Topic subjects

Lesson objectives

6.1 DIGITALIZATION IN KAZAKHSTAN

You will
• Learn about digitalization process in Kazakhstan

Which process would you like to digitalize from your daily life?

Driving questions motivating students interest

Facts ☆

Important stages in the development of the e-government of the Republic of Kazakhstan.

2006
eGov

2010
e-Government purchases

2011
e-Pay

2012
e-License

2013
e-Business Registration

2014
e-Judicial office

2015
e-Healthcare

2016
Open government

2017
Digital Kazakhstan

Main text

DIGITAL KAZAKHSTAN

About the program

Digital Kazakhstan is a program designed to accelerate the development pace of the economy and improve the quality of our citizen's life.

The main goals of the program are to accelerate economic growth, upgrade the living standards, and create conditions for the new future digital economy.

1. Implementation and development of digital technologies in key sectors of the country's economy.

2. Providing Kazakhstan citizens with ubiquitous broadband Internet access and mobile communication 4G (in the future 5G).

3. Improving the quality and increase the number of public services provided online.

4. Creating new opportunities and conditions for entrepreneurs through the development of e-commerce.

5. Increasing the digital literacy of the population, which will contribute to the development of the domestic IT sector, improve the quality of education and healthcare.

Interesting facts

FIVE KEY DIRECTIONS OF PROGRAM IMPLEMENTATION

Will be carried out in the period of 2018-2022

1. Digitization of the economy branches

Reorganization of the RK economy traditional branches using innovative technologies and possibilities, which increase productivity and lead to capitalization growth.

2. Transition to the digital state

State infrastructure transformation to provide services for population and business.

3. Implementation of the digital Silk Way

Development of high speed and security infrastructure of the transfer, storage, and processing of data.

4. Evolution of the human capital assets

Transformational changes, comprising creative society formation and transition to the new realities – knowledge-based economy.

5. Innovative ecosystem formation

Creation of the conditions for technological entrepreneurship development with stable relations between business, academic domain, and state, as well as the introduction of innovations into industry.

All the projects, realized within the framework of the "Digital Kazakhstan" program will facilitate the efficiency and transparency of the government control, ensure local employment, improve the quality of education and healthcare service, as well as increase labor efficiency and the growth of the small and medium business.

☆ Facts

Kazakhstan ranks the 33rd place in the world rating of the United Nations on the index of e-government development.

It consists of indicators of human capital development, telecommunications infrastructure, and online services.

Practice

1. Analyze the program «Digital Kazakhstan» and its main directions.
2. Which directions are most digitalized and which ones are least digitized in this period?

🔒 Literacy

1. What is digitalization?
2. What are the main aims of digitizing government services?
3. At which stage of digital transformation is Kazakhstan now?

Questions to consolidate the topic

Activity 1

1. Which public services provided online do you use often in your everyday life?
2. Discuss the problems you faced.

Activity 2

1. Make small research about the difference in the quality of any public service in your city before and after digitizing.
2. Create an infographic poster.

Mini practice projects releated to the topic of the lesson

9

C O N T E N T S

1 CHAPTER

ARTIFICIAL INTELLIGENCE

- explain the principles of machine learning, neural networks (neurons and synapses);

- describe the scope of artificial intelligence in industry, education, gaming industry, society.

Why we need Artificial intelligence? Is it going to dominate over human being?

INTRODUCTION TO AI

Artificial intelligence (AI) will change our future more fundamental than any other innovation next decades. We are going to wake up in a new world full of technology that feels more and more like a marvel.
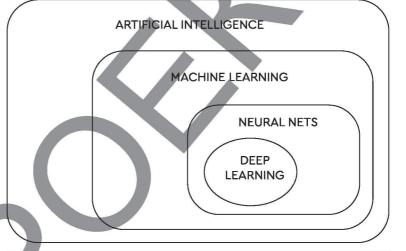
The acceleration of change is really fantastic. There was some historical periods (ex. forty years ago) when people disbelieved in AI, that time called AI winters and but now rapid advances in data storage and computer processing power have changed the game in the last decades.

Keep in mind ✤

Most tasks of machine learning (and AI) is to predict results based on incoming data.

Artificial intelligence is a set of technologies that allows us to extract knowledge from data. So it's any kind of system that learns or understands patterns within that data, and can identify them, and then reproduce them on new information.

Artificial intelligence is about teaching the machines to learn, and act, and think as humans would.

Figure 1.1.1.

Artificial intelligence is the name of a whole knowledge field, similar to biology or chemistry.

Machine Learning is a part of artificial intelligence. An important part, but not the only one.

Neural Networks are one of machine learning types. A popular one, but there are other good guys in the class.

Deep Learning is a modern method of building, training, and using neural networks. Basically, it's a new architecture. Nowadays in practice, no one separates deep learning from the "ordinary networks". The greater variety in the samples you have, the easier it is to find relevant patterns and predict the result. Therefore, we need three components to teach the machine figure 1.1.1.
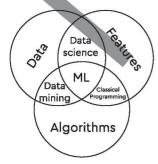
Data

Need to identify spam? Get tests of spam messages. Need to discover out client inclinations? See at their activities on Facebook. The more differing the information, the superior the result. There are two fundamental ways to get the information — manual and programmed. Programmed approach — you're gathering everything you'll be able discover. A few companies like Google use their own clients to label data for them without charge. Keep in mind ReCaptcha which strengths you to "Select all street signs"? That's precisely what they're doing. We are making ! (Figure 1.1.2)

It's extremely tough to collect a good collection of data (usually called a dataset). They are so important that companies may even reveal their algorithms, but rarely datasets.

Figure 1.1.2.

Features

Also known as parameters or variables. Those could be user's gender, stock price, word frequency in the text. In other words, these are the factors for a machine to look at.

When information put away in tables it's straightforward — features are column names. But what are they in the event that you've got 100 Gb of cat pictures? We cannot consider each pixel as a feature. That's why selecting the proper highlights more often than not takes way longer than all the other ML parts. That's moreover the main source of mistakes.

Algorithms

Any problem can be solved differently. The method you choose affects the precision, performance, and size of the final model. There is one important nuance though: if the data is crappy, even the best algorithm won't help.

Machine can	Machine cannot
Forecast	Create something new
Memorize	Get smart really fast
Reproduce	Go beyond their task
Choose best item	Kill all humans

Activity

In 2015, Google trained a conversational agent (AI) that could not only convincingly interact with humans as a tech support helpdesk, but also discuss morality, express opinions, and answer general facts-based questions. (Figure 1.1.3)
Look at information how AI interact with user and try to guess
1. Where data is taken from?
2. What features used Google?
3. Search for algorithms for natural language processing

Figure 1.1.3.

9

You will

- explain the principles of machine learning, neural networks (neurons and synapses);

- describe the scope of artificial intelligence in industry, education, gaming industry, society.

Why do we want machines to learn?

You're unteachable

Figure 1.2.1.

Jaksylyk wants to buy a car. He tries to calculate how much he needs to save monthly for that. He understands from internet that new cars are around 20 millions tenge, used year-old ones are 18 millions tenge, 2-year old are 16 millions tenge and so on.

Jaksylyk, as a good analytic, starts seeing a pattern: so, the car price depends on its age and drops to 2 millions every year, but won't get lower than 5 millions of tenge.

In machine learning terms, Jaksylyk invented regression – he predicted a value based on data. People do it all the time, when trying to estimate a reasonable cost for a used phone or figure out how many meat he should buy for each person.
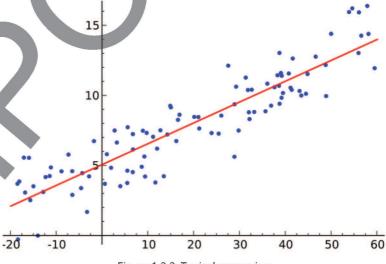
Figure 1.2.2. Typical regression

Facts ☆

Two last sentence of this paragraph is written by AI. talktotransformer.com

Follow the link to do it.

Unfortunately, not every problem in the world could be solved by regression.

The problem, for example for cars, they have different manufacturing dates, dozens of options, technical condition,

seasonal demand spikes, and there are many more hidden factors. An average person can't keep all that data in his head while calculating the price.

To solve people's problem – we need robots to do the maths for them. So, let's go the computational way here. Let's provide the machine some data and ask it to find all hidden patterns related to price. The most exciting thing is that the machine copes with this task much better than a real person does when carefully analyzing all the dependencies in their mind. *And that's where AI comes in. Machines are programmed to recognize patterns of behavior and then, by comparing them with a set of rules that have been written, they will automatically solve a problem* (written by AI, see facts).

That's why we need machine learning.

AI IN PRACTICE

In March 2017, OpenAI created agents that invented their own language to cooperate and more effectively achieve their goal. Soon after, Facebook reportedly successfully training agents to negotiate and even lie.

On August 11, 2017, OpenAI reached yet another incredible milestone by defeating the world's top professionals in 1v1 matches of the online multiplayer game Dota 2 (Figure 1.2.3).

Much of our day-to-day technology is powered by artificial intelligence. For example you can translate your informatics book via the Google Translate app (Figure 1.2.4).

Figure 1.2.3.   Figure 1.2.4.

Practice

https://experiments.withgoogle.com/collection/ai
Open google experiments with AI and try to play with some of AI tools

Literacy

1. Make a research on games that AI also defeated human being? How do you think why it happened?
2. How do you think Instagram and Youtube are using AI? and why? Is it possible for humans to do that?
3. Find what technologies are also use a power of artificial intelligence. How you can simplify yor life with AI?
4. Divide into groups and make discussion about regression. Give examples to teacher.

Terminology

demand spikes
- сұраныс шапшаңдығы - пики спроса
complexity
- күрделілігі - сложность
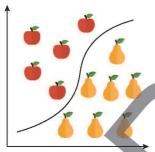
- explain the principles of machine learning, neural networks (neurons and synapses)

How you can teach machine?

Nowadays there are four main directions in machine learning.
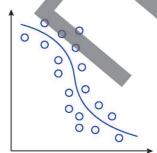
CLASSICAL MACHINE LEARNING

Data is pre-categorized or numerical — Data is not labeled in any way

SUPERVISED — **UNSUPERVISED**

Predict a category — Predict a number

Divide by similarity — Identify sequences

CLUSTERING
«Split up similar clothing into stacks»

Find hidden dependencies

CLASSIFICATION
«Divide the socks by color»

ASSOCIATION
«Find what clothes I often wear together»

REGRESSION
«Divide the ties by lenght»

DIMENSION REDUCTION (generalisation)
«Make the best outfits from the given clothes»

> Classical machine learning is often divided into two categories – **Supervised** and **Unsupervised Learning.**

In the first case, the machine has a "supervisor" or a "teacher" who gives the machine all the answers, like whether it's a cat in the picture or a dog. The teacher has already divided (labeled) the data into cats and dogs, and the machine is using these examples to learn. One by one.

Unsupervised learning means the machine is left on its claim with a numerous animal photographs and a errand to discover out who's who. Information isn't labeled, there's no teacher, the machine is attempting to discover any patterns on its possess.

Clearly, the machine will learn quicker with a teacher, so it's more commonly used in real-life assignments. There are two types of such tasks: **classification – an object's category prediction, and regression – prediction of a specific point on a numeric axis.**

CLASSIFICATION
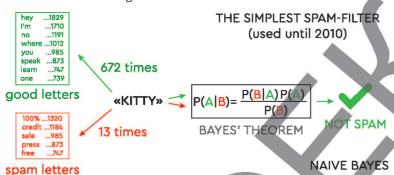
Splits objects based at one of the attributes known beforehand. Separate socks by based on color, documents based on language, music by genre. Figure 1.3.1 Today used for:
- Language detection, Sentiment analysis
- Spam filter, Fraud detection
- A search of similar documents
- Recognition of handwritten characters and numbers

> **Popular algorithms:** Naive Bayes, Decision Tree, Logistic Regression, K-Nearest Neighbours, Support Vector Machine

Classification

Figure 1.3.1.

Regression

Figure 1.3.2.

Machine learning is about classifying things, mostly. The machine here is like a baby learning to sort toys: here's a robot, here's a car.

In classification, you always need a teacher. The data should be labeled with features so the machine could assign the classes based on them. Everything could be classified — users based on interests (as algorithmic feeds do), articles based on language and topic (that's important for search engines), music based on genre (Spotify playlists), and even your emails.

In spam filtering the Naive Bayes algorithm was widely used. The machine counts the number of "bad" mentions in spam and normal mail, then it multiplies both probabilities using the Bayes equation, sums the results and got the answer.

```
hey     ...1829
I'm     ...1710
no      ...1191
where  ...1012
you     ...985
speak  ...873
learn  ...747
one     ...739
```
good letters

672 times

«KITTY»

13 times

```
100% ...1320
credit ...1184
sale    ...985
press  ...873
free    ...747
```
spam letters

THE SIMPLEST SPAM-FILTER
(used until 2010)

$$P(A|B)= \frac{P(B|A)\,P(A)}{P(B)}$$

BAYES' THEOREM

NOT SPAM

NAIVE BAYES

Later, spammers learned how to deal with Bayesian filters by adding lots of "good" words at the end of the email. The method was called Bayesian poisoning. Naive Bayes went down in history as the most elegant and first practically useful one, but now other algorithms are used for spam filtering.

Using this data, we can teach the machine to find the patterns and get the answer.

REGRESSION

"Draw a line through dots. That's the machine learning".
Figure 1.3.2 Today this is used for:
• Stock price forecasts
• Demand and sales volume analysis
• Medical diagnosis
• Any number-time correlations
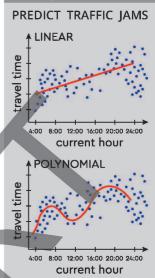
Popular algorithms are Linear and Polynomial regressions.

Regression is basically classification where we forecast a number instead of category. Examples are car price by its mileage, traffic by time of the day, demand volume by growth of the company etc. Regression is perfect when something depends on time.

Finance and analysis often uses regression. You may have seen it onto Excel. Unlike a person with a pen and a whiteboard, machine does so with mathematical accuracy, calculating the average interval to every dot.

Keep in mind

PREDICT TRAFFIC JAMS

LINEAR

travel time

4:00 8:00 12:00 16:00 20:00 24:00
current hour

POLYNOMIAL

travel time

4:00 8:00 12:00 16:00 20:00 24:00
current hour

When the line is straight — it's a linear regression, when it's curved – polynomial. These are two major types of regression. The other ones are more exotic.

Many classifiers turn into regression after some tuning. We can not only define the class of the object but memorize how close it is.

Activity

1. Make a research on Decision Tree method.

Literacy

1. Search for algorithms that represented above. Try to implement one of them into your own code.

How do advertisement "knows" what do you want to buy?

UNSUPERVISED LEARNING

Unsupervised was invented in the 1990s. It is used less often, in a situation where sometimes we simply have no choice.

Labeled data is hard to find. Should we manually take photos of million buses on the streets and label each of them? That will take a lifetime. We could use millions of workers and services.

Or you can try to use unsupervised learning. It's usually useful for exploratory data analysis but not as the main algorithm.

CLUSTERING

> **"Divides objects based on unknown features. Machine chooses the best way" Figure 1.4.1**
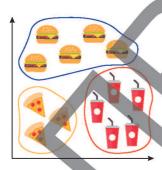
Nowadays used:
- To detect abnormal behavior
- To merge close points on a map
- For image compression
- To analyze and label new data
- For market segmentation (types of customers, loyalty)

> **Popular algorithms:** K-means_clustering, Mean-Shift, DBSCAN

Clustering

Figure 1.4.1.

Clustering is a classification with no predefined classes. Clustering algorithm trying to find similar (by some features) objects and merge them in a cluster. Those who have lots of similar features are joined in one class. With some algorithms, you can specify the exact number of clusters you want.

Apple Photos and Google Photos use more complex clustering. They're looking for faces in photos to create albums of your friends. The app doesn't know how many friends you have and how they look, but it's trying to find the common facial features. It's clustering.

DIMENSIONALITY REDUCTION (GENERALIZATION)

"Assembles specific features into more high-level ones". Figure 1.4.2.

Nowadays is used for:
- Recommender systems, Risk management
- Beautiful visualizations, Fake image analysis
- Topic modeling and similar document search

> **Popular algorithms:** Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Latent Dirichlet allocation (LDA), Latent Semantic Analysis (LSA, pLSA, GLSA), t-SNE (for visualization)

Dimension Reduction

Figure 1.4.2.

Already these algorithms were utilized by proficient information researchers, who had to discover "something interesting" in gigantic heaps of numbers. When Excel charts didn't help, they constrained machines to do the pattern-finding. That's how they got used Measurement Reduction or Feature Learning methods.

Recommender Systems and Collaborative Filtering is popular use of dimensionality reduction method. Seems like if you use it to abstract user ratings, you get a great system to recommend movies, music, games and whatever you want.

Figure 1.4.3.

ASSOCIATION RULE LEARNING

"Look for patterns in the orders' stream"

Nowadays is used:
- To forecast sales and discounts
- To analyze goods bought together
- To place the products on the shelves
- To analyze web surfing patterns

> **Popular algorithms:** Apriori, Euclat, FP-growth

This includes all the methods to analyze shopping carts, automate marketing strategy, and other event-related tasks. When have a sequence of something and want to find patterns in it — try these things. Say, a customer takes a bread and goes to the checkout. Should we place butter on the way? How often do people buy them together? Yes, it probably works for them, but what other sequences can we predict? Can a small change in the arrangement of goods lead to a significant increase in profits?

Same goes for e-commerce. The task is even more interesting there — what is the customer going to buy next time? Algorithms can only search for patterns, but cannot generalize or reproduce those on new examples.

In the real world, every big retailer builds their own proprietary solution. The highest level of tech here — recommender systems.

15

- explain the principles of machine learning, neural networks (neurons and synapses);
- describe the scope of artificial intelligence in industry, education, gaming industry, society.

How do you think how machines learn?

REINFORCEMENT LEARNING

"Throw a robot into a maze and let it find an exit". Figure 1.5.1.

Nowadays used for:
- Games
- Automating trading
- Enterprise resource management
- Self-driving cars, Robot vacuums

Popular algorithms: Q-Learning, SARSA, DQN, A3C, Genetic algorithm
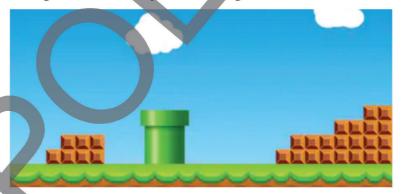
These kind of methods looks like real artificial intelligence. In lots of articles reinforcement learning is placed somewhere in between of supervised and unsupervised learning. They have nothing in common.

Reinforcement learning is used in cases when your problem is not related to data at all, but you have an environment to live in. Like a video game world or a city for self-driving car.

Action
Reward

Reinforcement Learning

Figure 1.5.1.
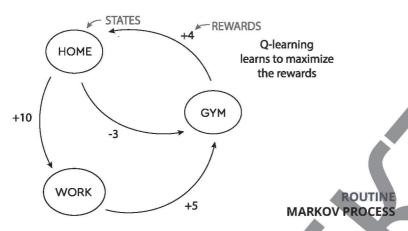
Knowledge of all the road rules in the world will not teach the autopilot how to drive on the roads. Regardless of how much data we collect, we still can't foresee all the possible situations. This is why its goal is to minimize error, not to predict all the moves.

Surviving in an environment may be a center thought of reinforcement learning. Throw small robot into real life, punish it for mistakes and reward it for right deeds. (Same way we educate our kids.)

More effective way here — to construct a virtual city and let self-driving car to learn all its tricks there first. That's precisely how we prepare auto-pilots right presently.

This approach is a core concept behind Q-learning and its derivatives . 'Q' in the name stands for "Quality" as a robot learns to perform the most "qualitative" action in each situation and all the situations are memorized and called simple markov process.

Reinforcement Learning for an average person would look like a real artificial intelligence. Because you teach this machine is making decisions in real life situations!

STATES — REWARDS

Q-learning learns to maximize the rewards

ROUTINE MARKOV PROCESS

Activity

Such machine can test billions of situations in a virtual environment, remembering which solutions led to greater reward. But how can it distinguish previously seen situations from a completely new one? Try to find answer.

ENSEMBLE METHODS

"Programming trees learning to correct errors of each other". Figure 1.5.2.

Nowadays used for:
• Everything that fits classical algorithm approaches (but works better)
• Computer vision, Object detection
• Search systems

Ensemble Methods

Figure 1.5.2.

Popular algorithms: Random Forest, Gradient Boosting

Ensembles and neural networks are two main fighters paving our path to a future. Today they are producing the most accurate results and are widely used in production.

Despite all the effectiveness the idea behind these is overly simple. If you take not very efficient algorithms and force them to correct each other's mistakes, the overall quality of a system will be higher than even the best individual algorithms.
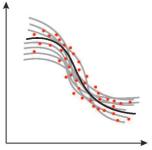
You'll get even better results if you take the most unstable algorithms that are predicting completely different results on small noise in input data. Like Regression and Decision Trees.

We can use any algorithm we know to create an ensemble. Use classifiers, and use it with regression.

🔒 Literacy

1. Genetic algorithms are considered as part of reinforcement learning. Make a research about this topic. Is this method useful?
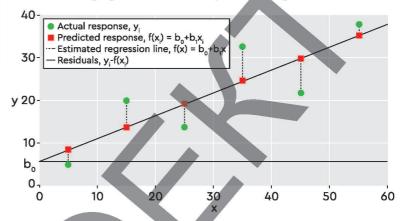
PROBLEM CLASSICAL SUPERVISED REGRESSION

Regression searches for relationships among variables.

In other words, you need to find a function that maps some features or variables to others sufficiently well.

Simple Linear Regression

The following figure illustrates simple linear regression:

The estimated regression function (black line) has the equation $f(x)=b_0+b_1x$. Your goal is to calculate the optimal values of the predicted weights b_0 and b_1 that minimize error and determine the estimated regression function.

Step 1: Import packages and classes

The first step is to import the package `numpy` and the class `LinearRegression` from `sklearn.linear_model`:

```
import numpy as np
from sklearn.linear_model import LinearRegression
```

Step 2: Provide data

The second step is defining data to work with. The inputs (regressors, x) and output (predictor, y) should be arrays (the instances of the class `numpy.ndarray`) or similar objects. This is the simplest way of providing data for regression:

```
x=np.array([5,15,25,35,45,55]).reshape((-1,1))
y=np.array([5,20,14,32,22,38])
```

Step 3: Create a model and fit it

The next step is to create a linear regression model and fit it using the existing data.

Let's create an instance of the class `LinearRegression`, which will represent the regression model:

```
model = LinearRegression()
```

It's time to start using the model. First, you need to call `.fit()` on `model`:

```
model.fit(x, y)
model = LinearRegression().fit(x, y)
```

Step 4: Get results

Once you have your model fitted, you can get the results to check whether the model works satisfactorily and interpret it.

You can obtain the coefficient of determination (R^2) with `.score()` called on `model`:

```
>>> r_sq = model.score(x, y)
>>> print('coefficient of determination:', r_sq)
coefficient of determination: 0.715875613747954
```

When you're applying `.score()`, the arguments are also the predictor `x` and regressor `y`, and the return value is R^2.

The attributes of model are .intercept_, which represents the coefficient, b_0 and `.coef_`, which represents b_1:

```
>>> print('intercept:', model.intercept_)
intercept: 5.633333333333329
>>> print('slope:', model.coef_)
slope: [0.54]
```

The value b_0 = 5.63 (approximately) illustrates that your model predicts the response 5.63 when x is zero. The value b_1 = 0.54 means that the predicted response rises by 0.54 when x is increased by one.

You should notice that you can provide y as a two-dimensional array as well. In this case, you'll get a similar result. This is how it might look:

```
>>>    new_model    =    LinearRegression().fit(x,
y.reshape((-1, 1)))
>>> print('intercept:', new_model.intercept_)
intercept: [5.63333333]
>>> print('slope:', new_model.coef_)
slope: [[0.54]]
```

As you can see, this example is very similar to the previous one, but in this case, `.intercept_` is a one-dimensional array with the single element b_0, and `.coef_` is a two-dimensional array with the single element b_1.

Step 5: Predict response

Once there is a satisfactory model, you can use it for predictions with either existing or new data.

To obtain the predicted response, use `.predict()`:
```
>>> y_pred = model.predict(x)
>>> print('predicted response:', y_pred, sep='\n')
predicted response:
[  8.33333333  13.73333333  19.13333333  24.53333333
29.93333333 35.33333333]
```

You will

- explain the principles of machine learning, neural networks (neurons and synapses);
- describe the scope of artificial intelligence in industry, education, gaming industry, society.
- design a neural network in spreadsheets / programs of mathematical modeling using a ready-made algorithm;
- sescribe the scope of the "learning with the teacher" method in the development of artificial intelligence.

How human brain work? Could we implement an analogy of human brains to computer?

NEURAL NETWORKS

"We have a thousand-layer network, dozens of video cards"

Used today for:
- Replacement of all algorithms of other machine learning
- Object identification on photos and videos
- Speech recognition and synthesis
- Image processing, style transfer
- Machine translation

Neural Networks

Popular architectures: Perceptron, Convolutional Network(CNN), Recurrent Networks (RNN), Autoencoders.
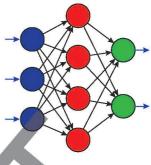
Any neural network is basically a collection of neurons and connections between them. Neuron is a function with several inputs and one output. Its task is to take all numbers from its input, perform a function on them and send the result to the output.

The structure of the neural network came into the world of programming straight from biology. The machine acquires the ability to analyze and even memorize various information. Neural networks are also able not only to analyze incoming information, but also to reproduce it from its memory. In other words, the neural network is a machine interpretation of the human brain, in which there are millions of neurons transmitting information in the form of electrical impulses.

input	output
[0,1]	[0,1]
[-1,1]	[-1,1]

A neuron is a computational unit that receives information, performs simple calculations on it, and passes it on. They are divided into three main types: input (blue), hidden (red) and output (green).. In the case when the neural network consists of a large number of neurons, the term layer is introduced. Accordingly, there is an input layer that receives information, n hidden layers (usually no more than 3 of them) that process it and an output layer that displays the result.
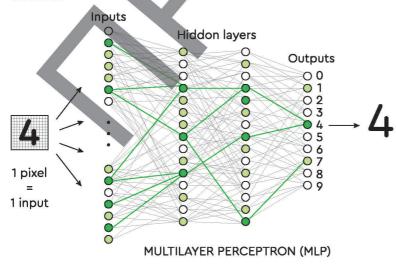
BACKPROPAGATION

If you throw in a sufficient number of layers and change the weights correctly, you will get the following: by applying to the input, say, the image of handwritten digit 4, black pixels activate the associated neurons, they activate the next layers, and so on and on, until it finally lights up the exit in charge of the four. The result is achieved.

MULTILAYER PERCEPTRON (MLP)

- explain the principles of machine learning, neural networks (neurons and synapses);

- describe the scope of artificial intelligence in industry, education, gaming industry, society.

- design a neural network in spreadsheets / programs of mathematical modeling using a ready-made algorithm;

- sescribe the scope of the "learning with the teacher" method in the development of artificial intelligence.

Convolutional neural networks are popular now. They are used to search for objects on photos and in videos, face recognition, style transfer, generating and enhancing images, creating effects like slow-motion and improving image quality. Nowadays CNNs are used in all the cases that involve pictures and videos.

Figure 1.8.1. Image above is a result produced by Detectron

A problem with images was always the difficulty of extracting features out of them. You can split text by sentences, lookup words' attributes in specialized vocabularies, etc. But images had to be labeled manually to teach the machine where cat ears or tails were in this specific image. This approach got the name 'handcrafting features' and used to be used almost by everyone.

| Original image | Preliminary processing | Hand-crafted features | Neural Network | Result |

There are lots of issues with the handcrafting.

First of all, if a cat had its ears down or turned away from the camera - the neural network won't see a thing.
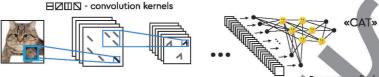
Secondly, try naming on the spot 10 different features that distinguish cats from other animals. People don't look only at ear form or leg count and account lots of different features they don't even think about. And thus cannot explain it to the machine.

So it means the machine needs to learn such features on its own, building on top of basic lines. We'll do the following: first, we divide the whole image into 8x8 pixel blocks and assign to each a type

of dominant line – either horizontal [-], vertical [|] or one of the diagonals [/]. It can also be that several would be highly visible — this happens and we are not always absolutely confident.

Output would be several tables of sticks that are in fact the simplest features representing objects edges on the image. They are images on their own but built out of sticks. So we can once again take a block of 8x8 and see how they match together. And again and again...

This operation is called convolution, which gave the name for the method. Convolution can be represented as a layer of a neural network, because each neuron can act as any function.

⊟⊠⊞⊠ - convolution kernels

«CAT»

Perceptron finds important features specific to a cat
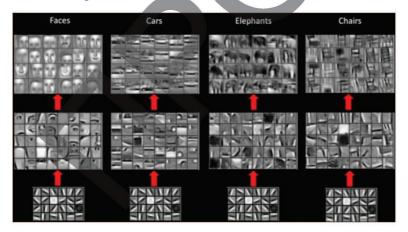
The neural network itself learns how to build important features from the simple lines

Convolutional Neural Network (CNN)

When we feed our neural network with lots of photos of cats it automatically assigns bigger weights to those combinations of sticks it saw the most frequently. It doesn't care whether it was a straight line of a cat's back or a geometrically complicated object like a cat's face, something will be highly activating.

As the output, we would put a simple perceptron which will look at the most activated combinations and based on that differentiate cats from dogs.

The beauty of this idea is that we have a neural net that searches for the most distinctive features of the objects on its own. We don't need to pick them manually. We can feed it any amount of images of any object just by googling billions of images with it and our net will create feature maps from sticks and learn to differentiate any object on its own.

Terminology

convolutional
- жинақталған - сверточный
face recognition
- тұлғаны тану - распознавание лиц
perceptron
- перцептрон - перцептрон

23

The second most popular architecture today. Recurrent networks gave us useful things like neural machine translation, speech recognition and voice synthesis in smart assistants. RNNs are the best for sequential data like voice, text or music.

One decade ago there was attempts to build automatic Microsoft Sam, the old-school speech synthesizer from Windows XP. That programm builds words letter by letter, trying to glue them up together. Now, look at Amazon Alexa or Assistant from Google. They don't only say the words clearly, they even place the right accents!

NEURAL NET IS TRYING TO SPEAK

All because modern voice assistants are trained to speak not letter by letter, but on whole phrases at once. We can take a bunch of voiced texts and train a neural network to generate an audio-sequence closest to the original speech.

In other words, we use text as input and its audio as the desired output. We ask a neural network to generate some audio for the given text, then compare it with the original, correct errors and try to get as close as possible to ideal.

Sounds like a classical learning process. Even a perceptron is suitable for this. But how should we define its outputs? Firing one particular output for each possible phrase is not an option — obviously.

Here we'll be helped by the fact that text, speech or music are sequences. They consist of consecutive units like syllables. They all sound unique but depend on previous ones.

We can train the perceptron to generate these unique sounds, but how will it remember previous answers? So the idea is to add memory to each neuron and use it as an additional input on the next run. A neuron could make a note for itself - hey, we had a vowel here, the next sound should sound higher (it's a very simplified example).

That's how recurrent networks appeared.
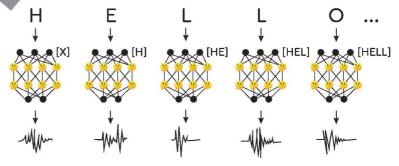
Figure 1.9.1. Recurrent Neural Network (CNN)

This approach had one huge problem - when all neurons remembered their past results, the number of connections in the network became so huge that it was technically impossible to adjust all the weights.
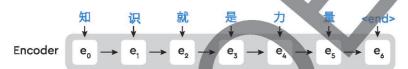
When a neural network can't forget, it can't learn new things (people have the same flaw).
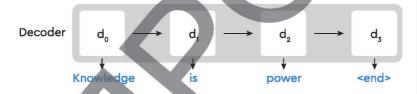
The first decision was simple: limit the neuron memory. Let's say, to memorize no more than 5 recent results. But it broke the whole idea.

A much better approach came later: to use special cells, similar to computer memory. Each cell can record a number, read it or reset it. They were called long and short-term memory (LSTM) cells.

Now, when a neuron needs to set a reminder, it puts a flag in that cell. Like "it was a consonant in a word, next time use different pronunciation rules". When the flag is no longer needed, the cells are reset, leaving only the "long-term" connections of the classical perceptron. In other words, the network is trained not only to learn weights but also to set these reminders.

Simple, but it works! You can take speech samples from anywhere.

There are many other types of neural nets.

Activity

1. Open https://experiments.withgoogle.com/collection/ai
2. Select Teachible machines
3. Launch experiment
4. Train neural net following instructions.
5. How do you think where input neurons are placed? Could we say that green, purple and orange are hidden neurons?
6. Play on other experiments on https://experiments.withgoogle.com
7. Try to explain them.

Why there is a button called training?
In button fulfillment you may see a code of dialogue on JS language, could you make a chat bot on python or other languages?
Try to make own dialogflow by python.
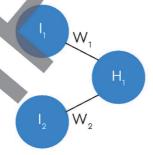
Terminology

recurrent networks - қайталанатын желілер - рекуррентные сети
speech recognition - сөйлеуді тану - распознавание речи
sequential data - дәйекті мәліметтер - последовательные данные

- explain the principles of machine learning, neural networks (neurons and synapses);

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$$W_1 = 0.1$$
$$W_2 = 0.3$$
$$W_3 = 0.2$$

It is important to remember that neurons operate with numbers in the range [0,1] or [-1,1]. And what, you ask, then handle the numbers that fall outside this range? At this stage, the easiest answer is to divide 1 by this number. This process is called normalization, and it is very often used in neural networks.

A synapse is the connection between two neurons. Synapses have 1 parameter - weight. The input information changes when it is transmitted from one neuron to another. Suppose there are 3 neurons that transmit information to the following. Then we have 3 weights corresponding to each of these neurons. In that neuron, whose weight will be greater, that information will be dominant in the next neuron (for example, color mixing). In fact, a set of weights of a neural network or a matrix of weights is a kind of brain of the whole system. Because of this weights, the input information is processed and turned into a result.

t is important to remember that during the initialization of the neural network, the weights are placed randomly.
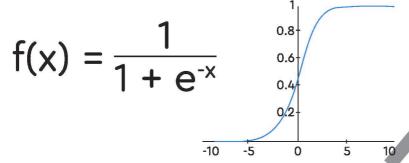
$$1)\ H_{1\ input} = (I_1 * w_1) + (I_2 * w_2)$$

$$2)\ H_{1\ output} = f_{activation}(H_{1input})$$

ACTIVATION FUNCTION

The activation function is a way to normalize the input data . That is, if you have a large number at the entrance, by passing it through the activation function, you will get an exit in the range you need. There are a lot of activation functions, so we will consider the most basic ones: Linear, Sigmoid (Logistic) and Hyperbolic tangent. Their main differences are the range of values.

SIGMOID

$$f(x) = \frac{1}{1 + e^{-x}}$$

This is the most common activation function, its range of values is [0,1]. It shows the majority of examples in the network. Accordingly, if in your case there are negative values (for example, stocks can go not only up, but also down), then you need a function that captures negative values.

TRAINING SET

A training set is a sequence of data with which a neural network operates. In our case of exclusive or (xor) we have only 4 different outcomes, that is, we will have 4 training sets:

0xor0=0, 0xor1=1, 1xor0=1,1xor1=0.

ITERATION
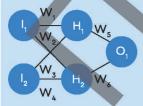
This is a kind of counter that increases each time a neural network passes one training set. In other words, this is the total number of training sets passed by the neural network.

Example

Calculate the result of the given neural network using sigmoid and its error using MSE.

Given:

I_1=1, I_2=0, w_1=0.45, w_2=0.78 ,w_3=-0.12 ,w_4=0.13 ,w_5=1.5 ,w_6=-2.3.

H_{1input}=1*0.45+0*-0.12=0.45 $H_{1output}$=sigmoid(0.45)=0.61

H_{2input}=1*0.78+0*0.13=0.78 $H_{2output}$=sigmoid(0.78)=0.69

O_{1input}=0.61*1.5+0.69*-2.3=-0.672 $O_{1output}$=sigmoid(-0.672)=0.33

O_{1ideal}=1 (0xor1=1)   Error=$((1-0.33)^2)/1$=0.45

result-0.33, error-45%.

THE EPOCH

When the neural network is initialized, this value is set to 0 and has a ceiling that is set manually. The greater the era, the better the network is trained and, accordingly, its result. The era increases each time we go through the entire set of training sets, in our case, 4 sets or 4 iterations.

✅ for (int i=0;i<maxEpoch;i++)
     for (int j=0;j<trainSet;j++)

🚫 for (int j=0;j<trainSet;j++)
     for (int i=0;i<maxEpoch;i++)

MISTAKE

Error is a percentage value that reflects the discrepancy between the expected and received responses. A mistake is formed every era and should go into decline. If this does not happen, then you are doing something wrong. The error can be calculated in different ways, but we will consider only three main methods: Mean Squared Error (hereinafter MSE), Root MSE and Arctan. There is no restriction on use, as in the activation function, and you are free to choose any method that will bring you the best result.

🔤 Terminology

transmit - тарату - передат
discrepancy - сәйкессіздік - несоответствие
restriction - шектеу - ограничение

You will

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- design a neural network in spreadsheets / programs of mathematical modeling using a ready-made algorithm;

- sescribe the scope of the "learning with the teacher" method in the development of artificial intelligence.
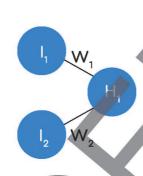
Practice 1

Given:
Here is simple perceptron construction, simulate one phase:
If inputs
$I_1=1$, $I_2=0.5$, $w_1=0.45$, $w_2=0.78$
What will be input in H1? What will be output, after activation function (sigmoid)? Change weights in order to get as output number near to 1.

I_1	1
I_2	0.5
W_1	0.45
W_2	0.78
H_1	?

Practice 2

Here is feed forward neural net.
Glven:
$I_1=0$, $I_2=1$, $w_1=0.5$, $w_2=0.4$, $w_3=-0.2$, $w_4=0.13$, $w_5=1.5$, $w_6=-2.3$.
Find:
1. What will be in H_1 and H_2 input and output digits.
2. What is O ideal according to table XOR
3. What is the error between O real and O ideal?
4. Change weights to get answer near to ideal on output neuron O1
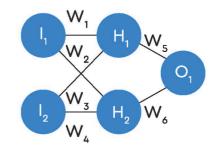
I_1	0
I_2	1
W_1	0.5
W_2	0.4
W_3	-0.2
W_4	0.13
W_5	1.5
W_6	-2.3
H_1	?
H_2	?

O_{real}	?
O_{ideal}	?

XOR TABLE

a	b	c
0	0	0
0	1	1
1	0	1
1	1	0

Activity
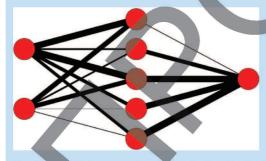
Go to http://www.emergentmind.com/neural-network

See how weights are changing during the training.
Train network on various logics: XOR, OR, NAND.

Terminology

image recognition - суретті тану - распознавание изображений
recurrent networks - қайталанатын желілер - рекуррентные сети
speech recognition - сөйлеуді тану - распознавание речи
sequential data - дәйекті мәліметтер - последовательные данные
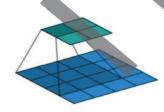
1.12 SIMPLE NEURAL NET MODELING.

NEURAL NET FROM SCRATCH

GIven logics:

	Input			Output
Example 1	0	0	1	0
Example 2	1	1	1	1
Example 3	1	0	1	1
Example 4	0	1	1	0
New situation	1	0	0	?

Example how to solve Neural net problems with code:
let's use numpy library which helps to solve simply math equations

```
from numpy import exp, array, random, dot
# XOR table we use as input to train neurons
training_set_inputs = array([[0, 0, 1], [1, 1, 1], [1, 0,
1], [0, 1, 1]])
# XOR table OUTPUT to complete logics
training_set_outputs = array([[0, 1, 1, 0]]).T
random.seed(1)
# Randomize initial weights.
# We assign random weights to a 3 x 1 matrix, with values
in the range -1 to 1 # and mean 0.
synaptic_weights = 2 * random.random((3, 1)) - 1
#Train neural net to Logic
for iteration in xrange(10000):
#sigmoid formula
output = 1 / (1 + exp(-(dot(training_set_inputs, synaptic_
weights))))
synaptic_weights += dot(training_set_inputs.T, (training_
set_outputs - output) * output * (1 - output))
print 1 / (1 + exp(-(dot(array([1, 0, 0]), synaptic_
weights))))
```

You should get result like this

```
Considering new situation [1, 0, 0] -> ?:
[0.99993704]
```

Computers see images using pixels. Pixels in images are usually related.Convolutions use this to help identify images.

CNN

Let's see the popular mnist dataset. This dataset consists of 70,000 images of handwritten digits from 0–9. We will attempt to identify them using a CNN.

LOADING THE DATASET

The mnist dataset 60,000 are given for training and 10,000 are given for testing.

When we load the dataset below, X_train and X_test will contain

the images, and y_train and y_test will contain the digits that those images represent. Let's use popular library - keras.

```
from keras.datasets import mnist
#download mnist data and split into train and test sets
(X_train, y_train), (X_test, y_test) = mnist.load_data()
```

EXPLORATORY DATA ANALYSIS

plot the first image in our dataset and check its size using the 'shape' function.

```
import matplotlib.pyplot as plt
#plot the first image in the dataset
plt.imshow(X_train[0])
```

```
<matplotlib.image.AxesImage at 0x7f83bcfbdc88>
```



```
#check image shape
X_train[0].shape
```

```
(28, 28)
```

By default, the shape of every image in the mnist dataset is 28 x 28, so we will not need to check the shape of all the images.

DATA PRE-PROCESSING

Next, we need to reshape our dataset inputs (X_train and X_test) to the shape that our model expects when we train the model. The first number is the number of images (60,000 for X_train and 10,000 for X_test). Then comes the shape of each image (28x28). The last number is 1, which signifies that the images are greyscale.

```
#reshape data to fit model
X_train = X_train.reshape(60000,28,28,1)
X_test = X_test.reshape(10000,28,28,1)
```

Let's make each output category and a binary variable is inputted for each category.

```
from keras.utils import to_categorical
y_train = to_categorical(y_train)
y_test = to_categorical(y_test)
y_train[0]
```

```
array([0., 0., 0., 0., 0., 1., 0., 0., 0., 0.], dtype=float32)
```

1.13 DATA ANALYSIS PYTHON - 1

Pandas is a Python library that provides extensive means for data analysis. Data scientists often work with data stored in table formats like .csv, .tsv, or .xlsx. Pandas makes it very convenient to load, process, and analyze such tabular data using SQL-like queries. In conjunction with Matplotlib and Seaborn, Pandas provides a wide range of opportunities for visual analysis of tabular data.

```
import numpy as np
import pandas as pd
pd.set_option("display.precision", 2)
```

We'll demonstrate the main methods in action by analyzing a dataset on the churn rate of telecom operator clients. Let's read the data (using the read_csv method), and take a look at the first 5 lines using the head method:

```
df = pd.read_csv('../../data/telecom_churn.csv')
df.head()
```

Let's have a look at data dimensionality, feature names, and feature types.

```
print(df.shape)
(3333, 20)
```

From the output, we can see that the table contains 3333 rows and 20 columns.

Printing out column names using columns:

```
print(df.columns)
```

We can use the info() method to output some general information about the dataframe:

```
print(df.info())
```

The describe method shows basic statistical characteristics of each numerical feature:

```
df.describe()
```

In order to see statistics on non-numerical features, one has to explicitly indicate data types of interest in the include parameter.

```
df.describe(include=['object', 'bool'])
```

For categorical (type object) and boolean (type bool) features we can use the value_counts method. Let's take a look at the distribution of Churn:

```
df['Churn'].value_counts()
0    2850
1     483
Name: Churn, dtype: int64
```

2850 users out of 3333 are loyal; their Churn value is 0. To calculate fractions, pass normalize=True to the value_counts function.

```
df['Churn'].value_counts(normalize=True)
Out[10]:
0    0.86
1    0.14
Name: Churn, dtype: float64
```

SORTING

A DataFrame can be sorted by the value of one of the variables (i.e columns). For example, we can sort by Total day charge (use ascending=False to sort in descending order):

```
df.sort_values(by='Total day charge', ascending=False).
head()
```

We can also sort by multiple columns:

```
df.sort_values(by=['Churn', 'Total day charge'],
ascending=[True, False]).head()
```

INDEXING AND RETRIEVING DATA

A DataFrame can be indexed in a few different ways.
To get a single column, you can use a DataFrame['Name'] construction. Let's use this to answer a question about that column alone: what is the proportion of churned users in our dataframe?

```
df['Churn'].mean()
0.14491449144914492
```

14.5% is actually quite bad for a company; such a churn rate can make the company go bankrupt.

Boolean indexing with one column is also very convenient. The syntax is df[P(df['Name'])], where P is some logical condition that is checked for each element of the Name column. The result of such indexing is the DataFrame consisting only of rows that satisfy the P condition on the Name column.
Let's use it to answer the question:

What are average values of numerical features for churned users?

```
df[df['Churn'] == 1].mean()
Account length        102.66
Area code             437.82
dtype: float64
```

How much time (on average) do churned users spend on the phone during daytime?

```
df[df['Churn'] == 1]['Total day minutes'].mean()
206.91407867494814
```

What is the maximum length of international calls among loyal users (Churn == 0) who do not have an international plan?

```
df[(df['Churn'] == 0) & (df['International plan'] == 'No')]
['Total intl minutes'].max()
18.9
```

DataFrames can be indexed by column name (label) or row name (index) or by the serial number of a row. The loc method is used for indexing by name, while iloc() is used for indexing by number.
In the first case below, we say "give us the values of the rows with index from 0 to 5 (inclusive) and columns labeled from State to Area code (inclusive)". In the second case, we say "give us the values of the first five rows in the first three columns" (as in a typical Python slice: the maximal value is not included).

```
df.loc[0:5, 'State':'Area code']
```

If we need the first or the last line of the data frame, we can use the df[:1] or df[-1:] construction:

```
df[-1:]
```

33

APPLYING FUNCTIONS TO CELLS, COLUMNS AND ROWS

To apply functions to each column, use apply():

```
df.apply(np.max)
State                                WY
Account length                      243
```

The apply method can also be used to apply a function to each row. To do this, specify axis=1. Lambda functions are very convenient in such scenarios. For example, if we need to select all states starting with 'W', we can do it like this:

```
df[df['State'].apply(lambda state: state[0] == 'W')].head()
```

The map method can be used to replace values in a column by passing a dictionary of the form {old_value: new_value} as its argument:

```
d = {'No' : False, 'Yes' : True}
df['International plan'] = df['International plan'].map(d)
df.head()
```

The same thing can be done with the replace method:

```
df = df.replace({'Voice mail plan': d})
df.head()
```

GROUPING

In general, grouping data in Pandas works as follows:

```
df.groupby(by=grouping_columns)[columns_to_show].function()
columns_to_show = ['Total day minutes',
                   'Total eve minutes',
                   'Total night minutes']

df.groupby(['Churn'])[columns_to_show].
describe(percentiles=[])
```

Let's do the same thing, but slightly differently by passing a list of functions to agg():

```
columns_to_show = ['Total day minutes',

                   'Total eve minutes',

                   'Total night minutes']

df.groupby(['Churn'])[columns_to_show].agg([np.mean,
np.std, np.min, np.max])
```

SUMMARY TABLES

Suppose we want to see how the observations in our dataset are distributed in the context of two variables - Churn and International plan. To do so, we can build a contingency table using the crosstab method:

```
pd.crosstab(df['Churn'], df['International plan'])
pd.crosstab(df['Churn'], df['Voice mail plan'],
normalize=True)
```

We can see that most of the users are loyal and do not use additional services (International Plan/Voice mail).

Let's take a look at the average number of day, evening, and night calls by area code:

```
df.pivot_table(['Total day calls', 'Total eve calls',
'Total night calls'],

               ['Area code'], aggfunc='mean')
```

DATAFRAME TRANSFORMATIONS

Like many other things in Pandas, adding columns to a DataFrame is doable in many ways.

For example, if we want to calculate the total number of calls for all users, let's create the total_calls Series and paste it into the DataFrame:

```
total_calls = df['Total day calls'] + df['Total eve calls'] + \
              df['Total night calls'] + df['Total intl
calls']
df.insert(loc=len(df.columns), column='Total calls',
value=total_calls)
# loc parameter is the number of columns after which to
insert the Series object
# we set it to len(df.columns) to paste it at the very end
of the dataframe
df.head()
```

5 rows × 21 columns

It is possible to add a column more easily without creating an intermediate Series instance:

```
df['Total charge'] = df['Total day charge'] + df['Total eve charge'] + \
                df['Total night charge'] + df['Total intl charge']
df.head()
```

5 rows × 22 columns

```
# get rid of just created columns
df.drop(['Total charge', 'Total calls'], axis=1, inplace=True)
# and here's how you can delete rows
df.drop([1, 2]).head()
```
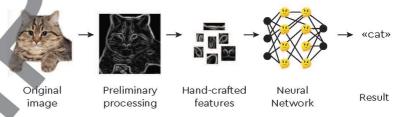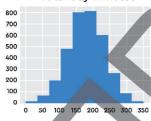
- explain the principles of machine learning, neural networks (neurons and synapses);

- describe the scope of artificial intelligence in industry, education, gaming industry, society.

- design a neural network in spreadsheets / programs of mathematical modeling using a ready-made algorithm;

- sescribe the scope of the "learning with the teacher" method in the development of artificial intelligence.

PREDICTING TELECOM CHURN

Let's see how churn rate is related to the International plan feature. We'll do this using a crosstab contingency table and also through visual analysis with Seaborn (however, visual analysis will be covered more thoroughly in the next article).

```
pd.crosstab(df['Churn'], df['International plan'], margins=True)

# some imports to set up plotting
import matplotlib.pyplot as plt
# !pip install seaborn
import seaborn as sns
# import some nice vis settings
sns.set()
# Graphics in SVG format are more sharp and legible
%config InlineBackend.figure_format = 'svg'

sns.countplot(x='International plan', hue='Churn', data=df);
```

We see that, with International Plan, the churn rate is much higher, which is an interesting observation! Perhaps large and poorly controlled expenses with international calls are very conflict-prone and lead to dissatisfaction among the telecom operator's customers.

Next, let's look at another important feature – Customer service calls. Let's also make a summary table and a picture.

```
pd.crosstab(df['Churn'], df['Customer service calls'], margins=True)
sns.countplot(x='Customer service calls', hue='Churn', data=df);
```

Although it's not so obvious from the summary table, it's easy to see from the above plot that the churn rate increases sharply from 4 customer service calls and above.

Now let's add a binary feature to our DataFrame – Customer service calls > 3. And once again, let's see how it relates to churn.

```
df['Many_service_calls']=(df['Customer service calls']>3).astype('int')
pd.crosstab(df['Many_service_calls'], df['Churn'], margins=True)
sns.countplot(x='Many_service_calls', hue='Churn', data=df);
```

Contingency table that relates Churn with both International plan and freshly created Many_service_calls.

```
pd.crosstab(df['Many_service_calls'] & df['International plan'],
df['Churn'])
```

Therefore, predicting that a customer is not loyal (Churn=1) in the case when the number of calls to the service center is greater than 3 and the International Plan is added (and predicting Churn=0 otherwise), we might expect an accuracy of 85.8% (we are mistaken only 464 + 9 times). This number, 85.8%, that we got through this very simple reasoning serves as a good starting point (baseline) for the further machine learning models that we will build.

The easiest way to take a look at the distribution of a numerical variable is to plot its histogram using the DataFrame's method hist().

```
features = ['Total day minutes', 'Total intl calls']
df[features].
hist(figsize=(12, 4));
```

Total day minutes

Total intl calls

There is also another, often clearer, way to grasp the distribution: density plots or, more formally, Kernel Density Plots. They can be considered a smoothed version of the histogram. Their main advantage over the latter is that they do not depend on the size of the bins. Let's create density plots for the same two variables:

```
df[features].plot(kind='density', subplots=True,
                layout=(1, 2), sharex=False, figsize=(12, 4));
```
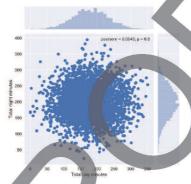
SCATTER PLOT

The scatter plot displays values of two numerical variables as Cartesian coordinates in 2D space. Scatter plots in 3D are also possible.

Let's try out the function scatter() from the matplotlib library:

```
plt.scatter(df['Total day minutes'], df['Total night minutes']);
```
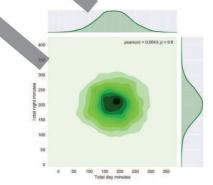
We get an uninteresting picture of two normally distributed variables. Also, it seems that these features are uncorrelated because the ellipse-like shape is aligned with the axes.
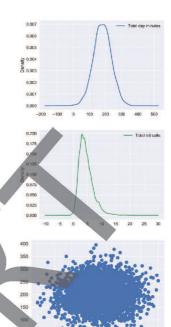
There is a slightly fancier option to create a scatter plot with the seaborn library:

```
sns.jointplot(x='Total day minutes', y='Total night minutes',
                data=df, kind='scatter');
```

The function jointplot() plots two histograms that may be useful in some cases. Using the same function, we can also get a smoothed version of our bivariate distribution:

```
sns.jointplot('Total day minutes', 'Total night minutes',
                data=df, kind="kde", color="g");
```

This is basically a bivariate version of the Kernel Density Plot discussed earlier.

DBSCAN
K-Means Agglomerative
Mean-Shift
Fuzzy C-Means **Clustering**
K-NN

Naive Bayes SVM Decision Trees
Classification Logistic Regression

Euclat
Apriori **Pattern search**
FP-Growth

UNSUPERVISED **SUPERVISED**

Linear Regression
Regression
Ridge/Lasso Polynomial
Regression Regression

**DIMENSION REDUCTION
(generalization)**

t-SNE PCA LSA SVD LDA

**CLASSICAL
LEARNING**

Random Forest

Stacking Bagging

**REINFORCEMENT
LEARNING**

**MACHINE
LEARNING**

**ENSEMBLE
METHODS**

Genetic SARSA Deep Q-Network
Algorithm Q-Learning DQN
ASC

AdaBoost Boosting XGBoost
LightGBM
CatBoost

**NEURAL
NETS AND
DEEP LEARNING**

Convolutional
Neural Networks
(CNN)

DCNN

Reccurent
Neural Networks
(RNN)

LSM

LSTM GRU

Generative
Adversarial
Networks (GAN)

Autoencoders

seq2seq

Perceptrons
(MLP)

THE MAIN TYPES OF MACHINE LEARNING

Simple data
Clear features
↓
**CLASSICAL
ML**

No data,
but We have
an environment
to interact with
↓
**REINFORCEMENT
LEARNING**

When quality is
a real problem
↓
ENSEMBLES

eternal
competitors

Complicated data
Unclear features
Belief in a miracle
↓
**NEURAL NETWORKS
AND
DEEP LEARNING**

The first methods of machine learning came from pure statistics in the '50s. They solved formal math tasks — searching for patterns in numbers, evaluating the proximity of data points, and calculating vectors' directions.

Nowadays, half of the Internet is working on these algorithms.

Big tech companies are more tend to use neural networks. Because sometimes 2% accuracy is an additional benefit in revenue. But for smaller ones could not be so important.

1. What is relationship between artificial intelligence Machine learning and neural network?

2. What machines can do?
   a. Forecast
   b. Memorize
   c. Take control all over humans

3. Why you should put button - i am not robot?

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4. For what reason this terms used in ML?
   a. Data
   b. Feature
   c. Algorithms

5. Make simple code that predicts number of students in your class. Use regression algorithm.

6. Classification is part of supervised learning or unsupervised learning? Give an example where this algorithm may be used in cybersecurity?

7. Why we need activation function in neuron? Try to write activation function in python.

8. Try to explain how google translator for photos work? Which neural net it uses?

9. Make research about GAN neural net? How to pit AI against each other.
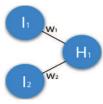
10. Give example about reinforcement learning.

11. What is similar between human neural nets and computer neural nets?

12. Try to guess how recognition of car works? (like sergek)

13. Tell a parts of neural net. Where Input neuron is placed?

14. How pictures recognized by neural net? Give example using mnist library - number pictures recognition.

15. Take data of car crushes in last years and try to make prediction on next years.

2 CHAPTER

3D MODELING

What would you create if you were a 3D artist?

3D MODELING

3D modeling is a technique in computer graphics for producing a 3D digital representation of any object or surface (Figure 2.1.1). It is used in many areas:
- professions: architecture, science, archeology, medicine, engineering industry
- entertainment: games, films
- services: 3D-printing, 3D-scanning

There are many 3d modeling programs on the market such as Maya, Autodesk 3ds Max, Solidworks, Sketchup, and Blender. They differ according to the usage goal. Moreover, there are also Computer-Aided Design programs with a big community. AutoCAD is one of the best known of them. The difference is, these programs allow users to draw a model in a 2d plain also.

Figure 2.1.1. 3D modeling
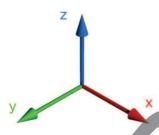
3D MODELING FEATURES

In real life we live in a 3-dimensional world, widht, height and depth. To represent these dimensions inside a computer we use the Cartesian coordinate system, where the 3 dimensions are respresented by X, Y and Z, laid out as intersecting planes (Figure 2.1.2). Where the 3 axis meet is called the origin. A single point in this space is represented by it's distance from the origin; point (2, 4, 8) is a point that is 2 units away from origin along the x-axis, 4 units away from the origin along the y-axis and 8 units away from the origin along the z-axis. So when using 3D you'll have to think and work using these 3 dimensions.

Figure 2.1.2. XYZ axis

We can define a single point or vertex (vertex is commonly used in computer graphics) using the Cartesian coordinate system XYZ. A point is not very useful, as you probably won't be able to see it. It's very small. But when joining vertices you can form a line or edge. By joining lines you can create a triangle or face. By joining multiple faces you create a shape or model, also called a mesh (Figure 2.1.3).

Vertex

Edge

Face

Figure 2.1.3. Mesh Structure

BLENDER

Blender is a professional, free and open-source 3D computer graphics software toolset used for creating animated films, visual effects, art, 3D printed models, interactive 3D applications and

video games. Blender can be downloaded from blender.org for free (Figure 2.1.4).

Blender's features include

- 3D modeling,
- UV unwrapping,
- texturing,
- raster graphics editing,
- rigging and skinning,
- fluid and smoke simulation,
- particle simulation,
- soft body simulation,
- sculpting,
- animating,
- match moving,
- camera tracking,
- rendering,
- video editing and compositing.

It further features an integrated game engine.

Figure 2.1.4. Logo of Blender

Activity 1

Draw images of your monitor or notebook from each side. (front, back, top, bottom, right and left).

🔒 Literacy

1. Where is 3d modelling used in?
2. What does it consist of one model?

Terminology

3D modelling - 3D модельдеу - 3D моделирование
cartesian coordinate system - картезияндық координата жүйесі - декартова система координат

2.2 BASIC MODELING

You will
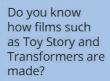
- learn using navigation tools;
- learn adding, moving and deleting objects;
- learn rendering.

Figure 2.2.1. Splash screen

Keep in mind

F3 key can be used to save the rendered image as a picture on your computer after rendering the scene by pressing F12.

Figure 2.2.3. Render view

Figure 2.2.4.

Do you know how films such as Toy Story and Transformers are made?

STEP 1: OPEN BLENDER

In this lesson we are going to create basic model(party monkey) in Blender. When you open Blender, Blender starts with a Splash screen (Figure 2.2.1). Click to the right of the Splash screen to make it disappear.

In the centre you'll see the 3D view. You have 3 different items in the 3D view: cube, lamp and camera (Figure 2.2.2).
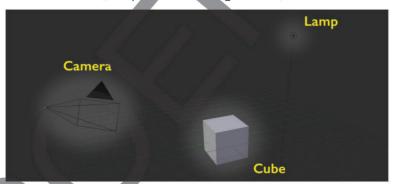
Figure 2.2.2.

STEP 2: NAVIGATE THE 3D VIEW

There are three types of navigational movements in Blender: an orbit, a pan, and a zoom. In the 3D view you can:

- zoom in and out using the mouse wheel;
  rotate the whole scene(orbit) by pressing the middle mouse button or the mouse wheel in and rotating around;
- pan by holding shift and middle mouse button.

STEP 3: RENDER

Rendering in this situation is the process of generating an image from a 3D model. Render the scene by pressing F12 (Figure 2.2.3). Press ESC to get out of the render view.

STEP 4: REMOVE THE CUBE

We won't be needing the cube, so let's remove it. Select the cube with the right mouse. An orange border should appear around the cube. Make sure your mouse is in the 3D view. Press X to delete the cube. You'll be asked whether it's OK to delete the object (Figure 2.2.4). Press ENTER

44

STEP 4: ADD A MONKEY

To add objects to the scene you can use the toolbox on the left. The toolbox contains a Create tab that has a selection of things that you can add.

From the toolbox on the left go to the Create tab and select Monkey (Figure 2.2.5).

A monkey appears in your scene (Figure 2.2.6). Position the monkey in front of the camera, so that we can see the monkey after rendering. In order to move monkey make sure it is selected. Otherwise select it with the right mouse. The blue handle, to go up and down on the z-axis, the green handle to go left and right on the y-axis and the red handle to go in and out on the x-axis. Then move monkey by using the blue, green and red handles.

STEP 5: ADD A HAT

We can also add a hat. For this we will use a cone. From the toolbox on the left go to the Create tab and select Cone. A cone appears in your scene. Now you have a monkey and a cone.

STEP 6: PUT THE HAT ON THE MONKEY

Now the cone needs to be positioned on top of the monkey. Select the cone using the right mouse. Use the blue, green and red handles to move the cone on top of the monkey.

You might have to rotate and zoom in or out to get a proper view. Now we need to see how it looks like by pressing F12. (Figure 2.2.7)

STEP 7: LIGHTEN THE MONKEY'S FACE

We need to move the light to shine upon the front of the monkey.

Select the lamp with the right mouse. Check for the orange border. Move the lamp using the blue, green and red handles to the side front of the monkey's face. Press F12 to check whether the monkey's face is well lit (Figure 2.2.8).

Figure 2.2.5.

Figure 2.2.6.

Keep in mind

If you are working on a Mac, wherever a function key is mentioned, use FN+FUNCTION KEY

Figure 2.2.7.

Figure 2.2.8.

Practice

1. Create a Christmas tree using cones (Figure 2.2.9)

Literacy

1. What kind of navigation tools are in Blender?
2. What is rendering?

Figure 2.2.9.

How can we make 3d models colourful?

COLOURING THE OBJECTS

In this lesson we will make a snowman out of objects and rotating a carrot to create the nose.

STEP 1: SNOWMAN'S BOTTOM

Figure 2.3.1. Translate, rotate and scale tools(from left to right)

To create a snowman we won't be needing a cube. Instead we need to add a ball or sphere. On the lefthand panel, go to the Toolbox. Select the Create tab. Then select UV Sphere.

The snowman's bottom looks a bit too small. So let's resize the uv sphere. Make sure the ball is selected.

Now let's use the blue, green and red handles to resize the uv sphere. For this we need to use the cube ends (the scale tool) instead of the arrow ends (the translate tool). So select this from the lower menu (Figure 2.3.1). Now resize the uv sphere using these handles.

However it is difficult to get the proper shape of snowman's bottom by using these handles. It might end up looking like a giant egg (Figure 2.3.2).

There is another way to resize.

Figure 2.3.2.

But firstly let's remove the uv sphere and add another one. Press S and you can uniformly resize the uv sphere by just dragging your mouse. If you've reached the appropriate size just left mouse click to confirm the size.
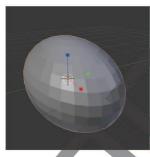
STEP 2: SNOWMAN'S HEAD

Now we need a head for the snowman. Let's add another uv sphere. Another uv sphere is added to your 3D scene. It might be that you don't see the uv sphere. That's because the uv sphere was added inside the other uv sphere. So we need to drag it out of the uv sphere.

Select the arrow ends, and translate tool from the menu below (Figure 2.3.1).

Figure 2.3.3.

Then drag the uv sphere out using the blue handle (z-axis) and place the uv sphere on top of the other. It might be that the head looks a bit big. Let's shrink it down. Use S to adjust the size and move the head onto the bottom using handle (z-axis) (Figure 2.3.3).

STEP 3: SNOWMAN'S NOSE

Usually the snowman's nose is made of a carrot. We'll be using a cone for this.

- From the Create tab select Cone.
- Use the blue handle to move it up.
- And press S to resize it.
- Select the rotate tool that will allow you to rotate in the proper direction, one at a time (Figure 2.3.1). Use that curve to rotate the nose.

Go back to the move tool. And position the nose properly using the blue, green and red handles (Figure 2.3.4).

Figure 2.3.4.

Figure 2.3.5.

Practice 1

Give the snowman some hat, eyes and buttons as shown in the picture left.

If you added the snowman all parts mentioned above, let's colour it. Now it looks entirely grey. To colour the snowman we need to add some materials to the model. In this case we want to colour the hat.

- Select the hat.
- Select the Material tab from the menu on the righthand panel (Figure 2.3.5).
- Give the material a name for example greenhat.
- Go to the Diffuse and click on it. A colour palette appears. Select a nice green colour (Figure 2.3.6). If you want to make it a bit darker green then you can drop the amount of intensity on it.
- Now you can see that the snowman has a green hat.

Figure 2.3.6.

Practice 2

Paint other parts of the snowman by the same way as we did with the hat. The result is shown in the picture left.

🔒 Literacy

1. What should be added to make models colourful in Blender?
2. What is the outliner panel?

📖 Terminology

navigation tools - навигация құралдары - навигационные инструменты
splash screen - бастапқы терезе - заставка
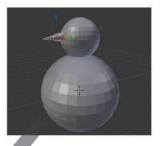
🧠 Keep in mind

Notice there is a small circle in the 3D view.

If you click with the left mouse somewhere in the 3D view the circle will be placed at that location. This is the 3D cursor. It means that when you add an object, the object will be placed at the location of the 3D cursor.

You will

- learn animating objects.
- learn render animations as a video file.

Should we do each frame to get an appropriate animation?

In this lesson we will animate a snowman to walk through the trees and render your animation as a movie that you can share on YouTube or with your friends.

STEP 1: PREPARE THE SCENE

We will continue the previous project with snowman. Let's Add a Plane. And paint it using Materials to white. Give the plane the size of the island that you want by Scaling it. Give the plane white colour looking like snow. Position the snowman to the far corner of the scene. The snowman will move close to the camera. Mention that you should check where the camera is. Go to render view by pressing F12 to see what the scene looks like. Adjust your camera position according to objects in the scene.
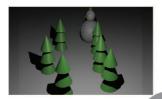
Figure 2.4.1.

Practice 1

1. Add 6 Christmas trees to the scene. Use cones for that reason.
2. You can copy and paste other 5 trees.
3. And don't forget to colour the trees. The final scene should look like the figure 2.4. 1.

STEP 2: KEYFRAMING

Keyframing looks at particular images at certain times in a movie and the computer works out all the other images in between. If we would say that the snowman starts at its current position and 4 seconds later it should be close to the camera the computer would work out a way of moving the snowman from the start position to the final scene. You don't have to do all the frames by yourself.

With a stop frame animation, you'll have to do all the frames by yourself. But with this animation the computer works it out for you.

At the bottom you have the timeline (with a green bar) (Figure 2.4.2).

Figure 2.4.2.

STEP 3: SET THE LENGTH OF THE ANIMATION

Set the End frame to 100 by typing 100 in the End frame.

STEP 4: KEYFRAME THE FIRST FRAME

Make sure that you are at frame 1. You can see the frame number at the bottom of the timeline. Go to the keys at the bottom of the timeline. Select LocRotScale to record the location, rotation and scale at the start frame (Figure 2.4.3). and click on the keys. So, the computer will work out where the snowman is, it's location, which way it's facing, rotation, and it's scale, if you want to make the snowman shrink or grow.

Figure 2.4.3.

STEP 5: KEYFRAME THE END FRAME

Move the green bar on the timeline to approximately frame 90. Then move the snowman close to the camera. Hit the key again. A yellow bar should appear on the timeline at frame 90. Move the green bar on the timeline to frame 0. Or type in 0 at the bottom. Then press play. And the snowman will move from the start position close to the camera. This looks pretty good (Figure 2.4.4).

Figure 2.4.5.

Figure 2.4.4.

STEP 6. RENDER SETTINGS

Now we'll be rendering the animation. On the right-hand panel make sure the camera tab is selected. There are some things that we need to change:

Go to Dimension. Here we need to change the Render Presets. The render presets define the resolution. Select TV PAL 16:9 (Figure 2.4.5).

Resolution: You can select a higher resolution or frame rate. This will give a really good quality but it will take a very long time to render.

For this lesson we'll be using the TV PAL, which is the old television format. If you select TV PAL you'll have a lower resolution. Select the File Format. Choose H2.64, a format that should run on most computers.

STEP 7: RENDER

Now we are ready to render. Go to the top. Click on animation. The computer is working out every single image that you need to stick together to make this movie. As you know from the bottom we have a hundred images in total.

You can see that the resolution is not high. If you zoom in you could see the pixels. If you would suppose something like HD or 4K renders, the resolution would be much better but the computer would need more time to render the images. So, if you are trying things out, try a lower resolution such as TV PAL.

If the render stops you can go to the location that you have set to store the file. And you should see the movie file, which is 4 seconds long. **Now play your movie!**

🧠 Keep in mind

The output location is where Blender will save your files. Go to Output. Change the location by clicking on the folder icon. So now we have PAL, 25 frames per second and we are saving to a location that you have access to. Make sure to set the file format to a video format.

🔒 Literacy

1. What is keyframe?
2. What is the role of dimension and resolution?

🔠 Terminology

frame - кадр(жақтау) - кадр
keyframe - бағыттаушы кадр - ключевой кадр

2.5 ADVANCED MODELING

- learn extruding objects;
- learn painting multicolour objects.

Figure 2.5.1. Kiiz ui

Facts ☆

Kiiz ui (from Kazakh language) is a portable, round tent covered with skins or felt and used as a dwelling by several distinct nomadic groups in the steppes of Kazakhstan and other Central Asian countries.

Is it possible to deform any shape to any other one?

ADVANCED MODELING

In this lesson we'll be editing an object. We'll be making a kiiz ui by editing a cylinder.

STEP 1: BASE OF THE KIIZ UI

Let's start with removing the cube. We'll be creating the kiiz ui from the cylinder. Let's start to reshape the cylinder. The cylinder will be the bottom of the kiiz ui. Then we'll build up the top of the cylinder.

Go to Edit mode (Figure 2.5.2).

Figure 2.5.3.

Now we'll be creating the upper side of the kiiz ui. Go to the face select (Figure 2.5.3).

Select the face on top of the cylinder. Extrude the face.

- Go to the Toolbox.
- Select the Tool tab.
- Select Extrude region (Figure 2.5.4).
- And pull it up.

STEP 2: THE SHANYRAK

Now we want the top to come into a point, to be more like a top cone. To do this we can use the scale tool. Select the top of the cylinder. Resize the face using the red and green handles of scale tool, turning it into more of a top cone (Figure 2.5.5).

STEP3: ADDING A DOOR

Select near 2 faces pressing Shift from any side of the cylinder. Use Extrude Region from Tool tab. Pull it aside to make a door.
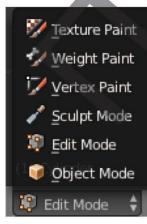
Figure 2.5.2.

STEP 4: COLOURING

First we will give the kiiz ui a yellow color using Material tab.

Now we will add a new material for the door.

- Go to the Material tab on the right menu panel.
- Add a new material by pressing on the + button.
- Click on New.
- Give the material a name for example green.
- And select a green color for the Diffuse.
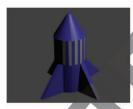
Now we add the color to the faces of the door.

- Select a door to color green. You can select the face with the right mouse button.
- Click on the green material.
- Now click on the Assign button to color the face green (Figure 2.5.6).

Figure 2.5.6.

Now select the shanyrak to be coloured and give it the black colour by performing above steps (Figure 2.5.7).

Practice

1. Make a rocket model.
2. Paint it with blue colour and white stripes as shown in the picture left.

Literacy

1. What is the function of Extrude Region tool in Blender?
2. How to make multicolour objects?

Terminology

advanced modelling - жоғары (дәрежеде) модельдеу - углубленное моделирование
base - негіз - основание, основа
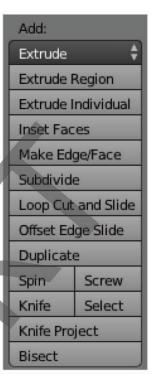
Figure 2.5.4.
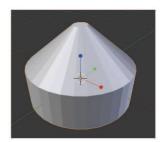
Figure 2.5.5.
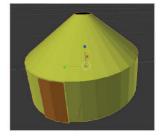
Figure 2.5.7.

You will

- learn proportional editing;
- learn to change object vertices.

Facts ☆

- Trees are the longest living organisms on Earth, and never die of old age.
- If a birdhouse is hung on a tree branch, it does not move up the tree as the tree grows.
- Trees improve water quality by slowing and filtering rainwater and protecting aquifers and watersheds.

▼ Add Cylinder

Vertices

◄ 6 ►

Radius

◄ 1.000 ►

Depth

◄ 2.000 ►
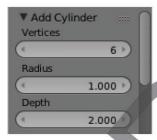
Figure 2.6.1.

Figure 2.6.2.

Figure 2.6.3.

Is it possible to make a ground in Blender as real in life?

In this lesson we will model a landscape with a tree. Let's start with the tree trunk.

STEP 1: MODEL THE TREE TRUNK

To model the tree trunk we will use a cylinder as the basic shape. Add a cylinder. Our cylinder has quite some vertices. We don't need all those vertices so let's reduce the amount of vertices.
- On the left hand panel you will see the number of vertices. If not press T to bring up the Tool Shelf. Lower this number to something like 6 (Figure 2.6.1).

Now we need to resize our cylinder to make it look a bit more like a tree trunk. If you are not in Edit mode, go to Edit Mode. Now resize the object by pressing S and using the mouse to resize the cylinder to a tree trunk. Now we need to make the tree trunk taller. We can do that by resizing upwards. Make sure the Resize tool is selected. Use the blue handle to stretch the cylinder (Figure 2.6.2).

Now we want to narrow the top of the tree.
- Select the Transformation tool. Deselect the faces by pressing A. Select vertices from the lower menu.
- Select the upper vertices using B. Select the first vertex and then press B to select the rest. It can be that you have to rotate a bit to have a proper view. Now press S to resize the top of the tree making it a bit narrow (Figure 2.6.3).

Now we want to narrow the top of the tree.

STEP 2: POSITION THE TREE TRUNK ON THE GROUND

Now that we have a basic shape of a tree trunk, let's make sure that the tree stands on the ground.
- As we need to position the tree, we need to go to Object mode. Make sure the tree trunk is selected.
- Then position the tree trunk properly on the terrain using the blue handle.

STEP 3: ADD SOME LEAVES

Let's zoom out and add a bunch of leaves. Press SHIFT + A or use the toolbox, to add an icosphere.

STEP 4: RESIZE LEAVES

The leaves might look a bit big compared to the tree trunk, so resize it.
- Now position the icosphere on top of the trunk using the blue, green and red handle. Rotate around to see from different angles and check whether the leaves are properly on top.

STEP 5. COLORING

Paint the tree trunk to dark brown color and leaves to green color. (Figure 2.6.4).

STEP 6: CREATE A GROUND

- Add a Plane. Give the plane the size of the island that you want by Scaling it.
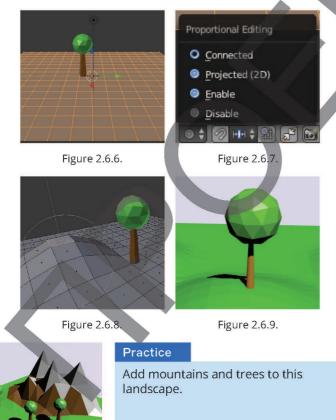
STEP 7: ADD SOME HILLS

- Go to Edit Mode. Select Tools -> Subdivide (Figure 2.6.5).
- Press SUBDIVIDE a couple of times creating multiple faces (Figure 2.6.6).
- Enable Proportional Editting (Figure 2.6.7).

Now we'll create some hills of sand by pulling up some faces. Using Proportional Editting we can set the area of influence. Select a face using Face tool.

- Grab the face and pull it up along the Z-axis (Figure 2.6.8). Press G + Z to grab a face and move along the Z-axis. Move the face up along the Z-axis.
- Use Proportional Editting to set the area of influence.

Create 3 or 4 hills. And paint the ground to green colour (Figure 2.6.9).

Figure 2.6.4.

Figure 2.6.6.

Figure 2.6.7.

Figure 2.6.5.

Figure 2.6.8.

Figure 2.6.9.

Practice

Add mountains and trees to this landscape.

Keep in mind

The output location is where Blender will save your files. Go to Output. Change the location by clicking on the folder icon. So now we have PAL, 25 frames per second and we are saving to a location that you have access to. Make sure to set the file format to a video format.

Literacy

1. How does it affect proportional editing in Edit Mode?
2. How to change area of influence in Proportional Editing?

How to do intro and outro to your YouTube videos?
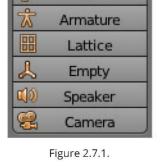
In this lesson you will add, edit, animate text and add light to the scene.

STEP 1: ADD TEXT TO YOUR SCENE

We start by adding text to the scene.
1. Open Blender.
2. Remove the cube.
3. Add text
   • On the left panel select Create -> Text (Figure 2.7.1).
   • or use SHIFT + A and select Text (Figure 2.7.2).

By default Blender displays the text "Text" in the scene. Let's change this text.

Figure 2.7.1.

STEP 2: CHANGE THE TEXT

To change the text we need to go to Edit Mode.
• Switch to Edit Mode (Figure 2.7.3).

A cursor appears at the text. Using the arrow keys you can move around the text. Now we can edit the text.
• Delete the text using BACKSPACE or DELETE keys.
• Type the text "Own text".
• Press ENTER to add another line.
• And enter the text "Another line" (Figure 2.7.4).
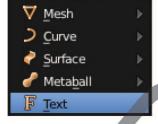
Figure 2.7.2.

STEP 3: CHANGE THE FONT OF THE TEXT

We can also change the font of the text.
• Go back to Object Mode (Figure 3).
• Go to the Data tab on the right panel.

Figure 2.7.3.

In this Data tab you can change different settings.
• Give the text a bit more depth by changing the Extrude.
• Change the Depth of the Bevel to round the edges slightly (Figure 2.7.5).

You can also import a font from your computer.
• Go to the Font section (Figure 2.7.6).
• Press on the map icon.
• Go to your Filesystem and select a font.

Figure 2.7.4.

You can also change the alignment of the text:
- Go the section Paragraph.
- You can adjust the Horizontal Alignment or Vertical Alignment (Figure 2.7.7).

STEP 4: ANIMATE THE SPACING

In Blender you can adjust the spacing between the letters or words or lines. Let's animate the text such that the letters start off apart and then come together.
- Go to the section Paragraph.
- Change the letter spacing, set the spacing to 10.

Now let's keyframe this position.
- On the timeline make sure you are at frame 1.
- Set the End of the Timeline to 50.

- Go to the Letter spacing.
- Right klick on the Letter spacing. A menu pops up.
- From the menu select Insert Keyframe (Figure 2.7.8).

Let's say that after 2 seconds, 48 frames later, we want the letters to come back together.
- Set the Timeline to frame 48.
- Set the Letter spacing to 1.
- And keyframe this position. Select Insert Keyframe from the menu.

STEP 5: RENDER YOUR ANIMATION AS A VIDEO FILE

Go to Render tab on the right panel. Select TV_PAL 16:9 as a preset and select AVI_JPEG or any other video format as an output file format. Don't forget to select output file location too.

Practice

Do intro or outro to your videos. Put background plane and other objects to make it look good.

🔒 **Literacy**

1. Where to right click to set a keyframe for text animation?

🔤 **Terminology**

proportional editing - пропорционалды өзгерту - пропорциональное редактирование
tree trunk - ағаш діңі - ствол дерева
text animation - текст анимациясы - текстовая анимация
render - рендерлеу - визуализация
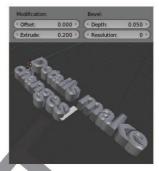
Figure 2.7.5.

Figure 2.7.6.

Figure 2.7.7.

Figure 2.7.8.

- identify AR;
- do your first AR.

How can AR impact our daily life?

Figure 2.8.1.

AUGMENTED REALITY AND VIRTUAL REALITY

Augmented reality(AR) is enhanced virtual objects overlaid on our physical world, whereas virtual reality separates us visually from the real world. Wearable glass device, head-mounted device, or smartphone applications are used to experience augmented reality. There are many smart glasses available on the market like Microsoft HoloLens, Google Glass and Epson Moverio BT-300. How is it used? You wear the AR smart glass and see the virtual objects in our real world registered to a special place (Figure 2.8.1).

There can be used tracker papers or cards to register it to a place. However, some apps allow users to register it to any place. Furthermore, AR can be delivered on hardware that we already own and use: smartphones or tablets (Figure 2.8.2).

Let's list some spheres where AR is used: Medical Training, Retail, Repair & Maintenance, Design & Modelling, Business Logistics, Tourism Industry, Classroom Education, Field Service, Entertainment Properties, Public Safety and etc. Augmented reality can be used in varying industries, and augmented reality companies are rapidly using augmented technology in innovative ways.

Figure 2.8.2.

HOW TO EXPORT YOUR 3D MODELS TO AR IN BLENDER

Now we are going to export 3d models for AR viewing applications in mobile phone. At the beginning open your previously done projects in Blender. It will be appropriate to use one or two objects rather than environments like landscape. Because we need to be able to see the real physical world too. More virtual objects on the screen mean more barriers that block our physical world.

1. In the viewport of Blender, go to the menu and select export Wavefront(.obj) (Figure 2.8.3).
2. When exporting, make sure you have the needed options ticked (bottom left panel). If your model has materials, please tick "Write Materials" that will generate a .mtl file (Figure 2.8.4).

Figure 2.8.3.
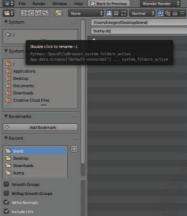
Figure 2.8.4.

The .mtl contains the settings of the materials used in the 3D model, you will need to zip it with the .obj file to upload your model into Augment. If your model uses textures, please also add them to the zip.

If you want to gather the textures used by your model in a folder, please do as follow :

1. Save your Blender file (.blend) in the same folder as your .obj file, if you didn't already.
2. Click on File/External Data/Pack All into .blend (Figure 2.8.5).
3. Click on File/External Data/Unpack All Into Files (Figure 2.8.6).
4. Choose "Use files in current directory (create when necessary)" Doing so will generate a folder "textures" that includes all the textures used in your 3D model in the same folder as your blender file and your .obj file, making it easier to compress in a zip archive file and upload into Augment. Just select your .obj, its .mtl and the folder textures when compressing.
5. There are many augmented reality apps. We are going to use "Augment" app, in our case. Download it from App Store or Play Market. Install it and upload 3d models to your phone or upload through browser of your computer. And enjoy the AR you did.

Figure 2.8.5.

Figure 2.8.6.

You will

- identify VR;
- do VR.
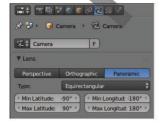
How to use VR for the betterment of human life?

HUMAN IN VIRTUAL REALITY

Virtual reality (VR) is a simulated world that immerses you to environments that are similar to or different from the real world. You wear a VR headset and feel like you are really there! All you can see is the virtual world. Physical world is hidden from your eyes completely. It enables you look around in virtual world by reacting your head movements. There is a 'stereo rendering' technology, which provides a slightly different image to each of your eyes. As a result, you dive into 3D world, instead of the 2D of a computer monitor (Figure 2.9.1).

Figure 2.9.1.

3D PANORAMA AND VIRTUAL TOUR

Virtual reality seems to be the next big thing after the advent of internet. This is because it has virtually changed the way business is done with its numerous applications. Thanks to this technology you are able to see the 3D panorama of any place.

Virtual reality was applied to following sphere: Pilot Training (Figure 2.9.2), Medicine, Movie industry, Military Training, Video Games, Museums.

Figure 2.9.2.

DOING YOUR FIRST 3D PANORAMA (VIRTUAL TOUR)

We will create virtual tour of your previous projects. I would be appropriate to use complex 3D environments rather than a model. Because your need to see 3d environment.

To do this we render an image (or film) that covers every single direction you can look - a panorama.

A VR viewer then shows you only the part of the image for the direction you are looking in, updating as you turn your head.

Figure 2.9.3.

CYCLES RENDERER

VR rendering is only available in Cycles, so use the drop down on the top bar to switch from Blender Render. Cycles is a more realistic renderer, that does a better job of matching the real world, but you may have to redo your materials.

Select Cycles from the top Engine menu (Figure 2.9.3).

CAMERA SETTINGS

Now select the camera, go to the Camera tab, and set the Lens to be Panoramic and the Type to be Equirectangular (Figure 2.9.4).

Figure 2.9.4.

RENDER OUTPUT RESOLUTION

You should set the output resolution to be 2048 x 1024 or 4096 x 2048 however, as this is what VR headsets expect.
- Go to the Render tab on the left menu panel.
- Set the Resolution to 4096 x 2048.
- And the Size to 100% (Figure 2.9 5).

Figure 2.9.5.

LEVEL THE CAMERA

You should rotate the camera so that it is level - if it is at a wonky angle anyone viewing your scene will feel dizzy.
- Level the camera.

3D STEREO (OPTIONAL)

To be more immersive we can enable 3D stereo rendering. To do that we need to adjust a few more settings:
- Go to the Render Layers tab (Figure 2.9.6).

Figure 2.9.8.

Figure 2.9.6.

Figure 2.9.7.

- Ticks the Views checkbox. The default settings are what we need (Figure 2.9.7).
- Now return to the first tab, the Render tab, and there will be new settings in the Output section.
- Switch the Views Format to Stereo 3D and the Stereo Mode to Top-Bottom.
- And set the Output to //stereo-<your name (Figure 2.9.8)

Cubes start at 2 meters across, so you may want to scale them down!

It is best to keep any camera motion gradual. Sudden changes of direction will make you feel ill, and you might even fall over!

Render your animation or image.
- If you are rendering a single image, you will need to save your image:
  - Select Image -> Save as Image from the lower menu (Figure 2.9.9).
Don't forget to save your .blend file. Upload it to your phone and install any VR viewer app. Google Cardboard, Youtube VR, Google Daydream are most known types. And enjoy your Virtual Reality.
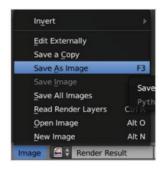
Figure 2.9.9

| 🔲 | Terminology |

virtual reality - виртуалды шынайылық - виртуальная реальность
cycles render - циклдар рендерері - циклы рендеринга

| 🔒 | Literacy |

1. What is VR?
2. Where is it used?

1.Which hotkey is used to grab?
A)G
B)H
C)Z
D)R

2.Which tab is used to color objects?
A) Materials
B) Render
C) Sun
D) Texture

3.Fill in the blanks
To extrude a selected face, we press the _____ key to extrude a selected face.
To scale selected 3d objects, we press the_____ key and move the mouse.

4. _____ is the extension of Blender source file?

5. Match the following commands and hotkeys.
1. to deselect all objects
2. to start the rendering from the active camera
3. To add tools
4. to view tools on the left hand side

a) Shift+A
b) A
c) T
d) F12

6. We select an object and press ___ to switch Edit mode.
A)Alt
B)F12
C)Tab
D)Ctrl

7. Which tool is used to extend and create a new section of your model?
A)Knife
B)Rotate
C)Scale
D)Extrude

8.Which tab is used to make a video in Blender?
A)Render
B)Materials
C)Texture
D)Sun

9.Which key is used to change of influence for grabbing proportionally?
A) Mouse Scroll Wheel
B) Arrows
C) F1 to F12
D) Right click

10. Which of them is not correct way of saving an image?
A)F3
B)Image->Save as Image
C)View->Render
D) None of them

11. ___ is a simulated world that immerses you to environments that are similar to or different from the real world.
A)Augmented Reality
B)Mixed Reality
C)Virtual Reality
D)Physical Reality

12. How do You Select A 3d Object?
_____

13. Which of them should be set on the top bar to make VR image?
A)Cycles Render
B)Blender Game
C)Blender Render
D)Engine

14. _____ is enhanced virtual objects overlaid on our physical world.
A)Augmented Reality
B)Mixed Reality
C)Virtual Reality
D)Physical Reality

15.Can you do video compositing with Blender?
YES   NO

16.What are Vertices?
_____

3

CHAPTER

PROCESSING HARDWARE

You will
- Learn about virtual machine;
- Describe the purpose of virtual machines.

How we can use several operating systems on one computer system?

VIRTUAL MACHINE

A virtual machine (Figure 3.1.1) is a program that acts as a virtual computer. It runs on your current operating system (the host operating system) and provides virtual hardware to guest operating systems. Virtual machines are separated into two major categories:

Figure 3.1.1. Virtual machine icon

PROCESS VIRTUAL MACHINE

SYSTEM VIRTUAL MACHINE

Process virtual machine runs as a normal application inside an OS and supports a single process.

Keep in mind

You can have several virtual machines installed on your system.

You're only limited by the amount of storage you have available for them.

System virtual machine allows the sharing of the underlying physical machine resources between different virtual machines, each running its own operating system. The software layer providing the virtualization is called a **virtual machine monitor** or **hypervisor.**

TYPES OF HYPERVISORS

Depending on where you want a hypervisor to run, we can make a distinction between two types of hypervisors:

Facts

Process VM has become popular with the Java programming language, which is implemented using the Java virtual machine.

Type 1 Hypervisor (Figure 3.1.2) is a hypervisor that installs directly onto a computer. There is no host OS and the hypervisor has direct access to all hardware and features.

Type 2 Hypervisor (Figure 3.1.2) requires a host OS and is often treated as installed software inside the host. That's why it hasn't got direct access to hardware.

Figure 3.1.2.The difference of Type1 and Type2 in graphical form.

Practice

Write at least three advantages and disadvantages of process and system virtual machines.

Activity

Students divide into two groups. The first group must write benefits of type 1 hypervisor in the first half of the desk, and the second group must write benefits of type 2 hypervisor in the second half of the desk. Before start writing groups have 5 minutes for preparation.

Literacy

1. What is a virtual machine?
2. What is the difference between the host OS and guest OS?
3. Name two main categories of virtual machines and explain their difference
4. Explain the difference between types of hypervisors

Terminology

virtual machine - виртуалды машина - виртуальная машина
hypervisor - гипервизор - гипервизор
native - жергілікті - родной
host - хост - хост

3.2 VIRTUAL MACHINE APPLICATIONS

You will

- Learn about virtual machine applications;
- Create your first virtual machine.

How we can create a virtual machine on the computer?

VIRTUAL MACHINE APPLICATIONS

Virtual Machine Application is a software designed to create virtual machines on the computer system. The most widely used VM Applications are shown below:

- **Oracle VM VirtualBox** (Figure 3.2.1) works on Windows (from XP or later versions), any Linux (level 2.4 or better), MacOS. In addition, it's free.
- **VMware offers Fusion** (Figure 3.2.2) for the MacOS which is a free trial and $79.99 to purchase, and Workstation (Figure 3.2.3) for Windows or Linux is free for personal use. These two products offer effectively the same solution.
- **Parallels Desktop** works only on MacOS as the host OS and the price starts from $79.99 (for the basic edition).
- **QEMU's** (Figure 3.2.4) main difference from other VM solutions is that it is both a VM host and also a machine emulator. But QEMU only able to host on Linux and it's free.
- **Microsoft Hyper-V** (Figure 3.2.5) comes as part of Windows 10 Pro and Windows Server (2012 and 2016), at no additional cost to the user.

Figure 3.2.1. Oracle VM VirtualBox icon.

Figure 3.2.4. QEMU icon.

Figure 3.2.5. Microsoft Hyper-V icon.

Figure 3.2.2. VMware Fusion icon.

Figure 3.2.3. VMware Workstation icon.

Practice

Fill the table shown below

№	Name of VM Application	Advantages (at least 2)	Disadvantages (at least 2)
1	Oracle VM VirtualBox		
2	VMware Fusion		
3	VMware Workstation		
4	Parallels Desktop		
5	QEMU		
6	Microsoft Hyper-V		

CREATING YOUR FIRST VIRTUAL MACHINE

1. Download suitable for your OS **VirtualBox** version from **www.virtualbox.org** and install it.
2. Download **Ubuntu** from **ubuntu.com**
3. Open **VirtualBox**, then on **Machine** tab press the **New** option (Figure 3.2.6)
4. On the opened window type **Name** as **Ubuntu**, choose **Type** as **Linux** and **Version** as **Ubuntu (64-bit)** (Figure 3.2.7)
5. Select the **amount of memory** (RAM) in MB to be allocated to the VM (Figure 3.2.8)
6. Select the **hard disk option** as **'Create a virtual hard disk now'**, and **hard disk file** type as **VDI (VirtualBox Disk Image)**, after indicate the **filling way of the hard disk** as **'Dynamically allocated'**
7. Choose the **VM file location** and **size** of it (Figure 3.2.9)
8. Select **Ubuntu VM**, press **Start** and point the location **Ubuntu OS** (Figure 3.2.10)
9. Press **Start**, and at the new window choose **Install Ubuntu** option
10. Follow steps of installation
11. Congratulations you have created your VM.

Figure 3.2.6. Creating the new VM
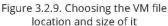
Figure 3.2.7. New VM options

Figure 3.2.8. Selecting amount of memory

Figure 3.2.9. Choosing the VM file location and size of it
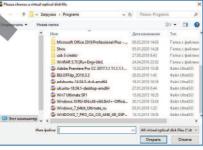
Figure 3.2.10. Pointing the location of Ubuntu OS

🔒 **Literacy**

1. What is VM application?
2. What are the advantages of using Oracle VM VirtualBox?
3. What is the main difference between VMware Fusion and Workstation?
4. What are the differences between Parallels Desktop, QEMU, and Microsoft Hyper-V?

📖 **Terminology**

workstation - жұмыс станциясы - рабочая станция
machine emulator - машина эмуляторы - эмулятор машины
allocated - бөлінген - выделенный

- Learn about characteristics of the main components of tablets;

- Compare tablets according to main components characteristics.

What are the main components of tablets?

TABLET MAIN COMPONENTS

Figure 3.3.1. Tablet components

A tablet is a wireless, portable personal computer with a touchscreen interface. Generally, the tablet consists of various components (Figure 3.3.1), we will list the main of them below:

TOUCHSCREEN

A touchscreen is the input device responding to fingertips that allow the user to communicate with the device in a user-friendly manner. There are two most common types of touchscreens:

Facts ☆

The idea of tablet computing is generally credited to Alan Kay of Xerox, who sketched out the idea in 1971. The first widely sold tablet computer was Apple Computer's Newton (Figure 3.3.2)

Figure 3.3.2. Apple Computer's Newton
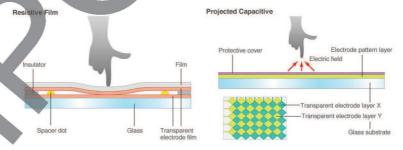
Figure 3.3.3. A resistive touchscreen   Figure 3.3.4. A capacitive touchscreen

- **a resistive touchscreen** (Figure 3.3.3) is pressure-sensitive, so it relies on the pressure you place on the screen
- **a capacitive touchscreen** (Figure 3.3.4) uses the electrical properties of the human body to change an electrostatic field on the screen

SCREEN

A screen uses graphic media to display information in a human-readable form. The **size** and **resolution** are two important characteristics of the screen.

MOTHERBOARD

The motherboard is a "skeleton" that connects all the tablet's components. It has two sites:

a. the inner side (Figure 3.3.5) hosts conducting circuits of the electric network, such as:
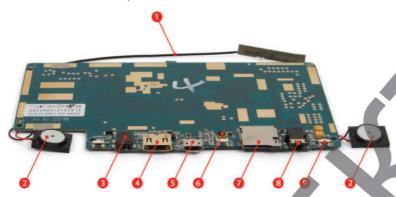
Figure 3.3.5. The inner side of the motherboard. 1. Coaxial cable 2. Speaker (buzzer) 3. Charge connector 4. Mini-HDMI connector 5. Micro-USB connector 6. Microphone 7. Memory card connector 8. Handsfree connector 9. Tablet power button

b. the outer side (Figure 3.3.6) hosts various electric elements, micro electric circuits, and connectors, such as:
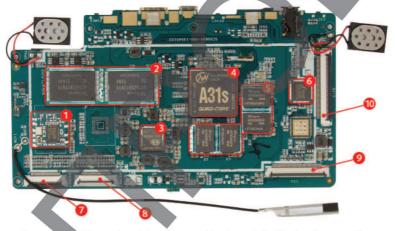
Figure 3.3.6. The outer side of the motherboard. 1. Bluetooth operation module, Wi-Fi and FM-radio units 2. ROM 3. Power management chip 4. CPU 5. RAM 6. Touchscreen controller 7. Primary camera connector 8. Front camera connector 9. Display connector 10. Touchscreen connector

BATTERY

Rechargeable batteries provide portability, and they are different in their **chemical makeup, voltage, capacity,** and **size**

CASE

Tablet casing, which, is usually composed of **two** parts – **the rear panel**, and **the front panel.**

- Learn about characteristics of the main components of smartphones;

- Compare smartphones according to main components characteristics.

What are the main components of smartphones?

SMARTPHONE MAIN COMPONENTS

A smartphone is a cellular telephone with an integrated computer. Generally, the smartphone consists of various components (Figure 3.4.1), we will list the main of them below:

DISPLAY

A **display** uses graphic media to show information in a human-readable form. Display technologies in smartphones of today come in two main types:

a. the **LCD display** (**IPS** technology and its variations) in which **backlight** is generating everything you see from behind the screen.

b. the **LED display** (**AMOLED** or **Super AMOLED** and its variations) in which **light-emitting diodes** are responsible for every pixel you see.

SYSTEM-ON-A-CHIP

A 'System-on-a-chip' or SoC (Figure 3.4.3) is a microchip or integrated circuit which contains:

Figure 3.4.1. Smartphone components

CPU	GPU
RAM	ROM
Modem	Northbridge/Southbridge

INTERNAL STORAGE

Internal storage - it exists as the flash memory, ranging from 16 GB, and can go all the way up to 1 TB on some smartphones.

BATTERY

Batteries provide portability, and they are different in their **chemical makeup, voltage, capacity,** and **size.**

The first smartphone was **IBM's Simon** (Figure 3.4.2), which was presented as a concept device at the **1992 COMDEX** computer trade show.

Figure 3.4.2. IBM's Simon
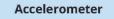
CAMERA

All smartphones come with a **rear-facing** and **front-shooting camera.** A smartphone camera comprises up of three main parts:
1. the **sensor** (which detects light)
2. the **lens** (the component in which light comes through)
3. The image processor

SENSORS

There are **five** main **sensors** in a smartphone:

Accelerometer	Gyroscope
Digital compas	**Ambient light sensor**
Proximity sensor	
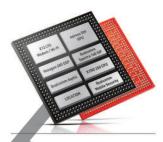
Figure 3.4.3. An example of SoC structure

Activity

Group work.
1. The first group must write a definition of components which which belongs to SoC.
2. The second group must write a definition of five main sensors.

Practice

Fill the table with the suitable information about the components of each smartphone model

#	Model of Tablet	OS	CPU	RAM	Storage	Rear camera	Front camera	Battery
1	Iphone XS							
2	Samsung S10							
3	Huawei P30							
4	Google Pixel 3							
5	OnePlus 7							

🔒 Literacy

1. What are the main components of a smartphone?
2. What is the main difference between display types?
3. Name and explain the function of components which are placed on the SoC
4. Name and explain the function of five main sensors on a smartphone

🔤 Terminology

lens - линза - объектив
proximity sensor - жақындық сенсоры - датчик приближения
ambient light sensor - қоршаған жарық сенсоры - датчик внешней освещенности

3.5 TRENDS IN THE DEVELOPMENT OF MOBILE HARDWARE

What are the differences between flagship and budget phone?

GROWTH OF THE FEATURE PHONE (1999-2002)

- **Motorola Timeport L7089** (1999) the first phone equipped with **an antenna** which works on **tri-band** (GSM 900/1800/1900 Mhz)
- **Kyocera VP210** (1999) the first phone with the **front camera** (Figure 3.5.1) for video calling
- **Benefon Esc!** (1999) the first phone equipped with **GPS** (Global Positioning System) **Navigator**.
- **Sharp J-SH04** (2000) the first phone with the **rear camera** (Figure 3.5.2)
- **Siemens SL45** (2001) the first phone with 32 MB **memory card**

MOBILE DATA REVOLUTION (2003-2006)

- **Calypso C1250i** (2003) the first phone which supports **Wi-Fi** for VoIP calls
- **Sprint PCS International Phone IP–A790** (2005) by Samsung the first **quad-band** antenna phone which works on both CDMA and GSM networks
- **Casio G'zOne** (2005) the first **waterproof** phone

GETTING SMARTER (2007-2010)

- **Nokia 6131 NFC** (2007) the first phone which supports **NFC** (Near Field Communication) technology
- **LG Prada** (2007) the first phone with **a capacitive touchscreen** (Figure 3.5.3)
- **Palm Pre** (2009) the first phone which supports **wireless charging**

LIFE COMPANION (2011-2014)

- **LG Optimus 3D** (2011) the first full **3D** phone with **dual lens** (Figure 3.5.4)
- **Motorola Atrix** (2011) the first phone with a **fingerprint scanner**
- **Oppo Find 5** (2012) the first phone with **Full HD Screen**

SIZE MATTERS (2015-2018)

- **Fujitsu Arrows NX F-04G** (2015) the first phone with an **iris scanner** for authentification
- **Xiaomi Mi Mix** (2016) the first phone with a **bezel-less screen** (Figure 3.5.5)
- **Sharp Aquos S2** (2017) the first phone with a **notch** (Figure 3.5.6)
- **Vivo X20 Plus UD** (2018) the first phone with an **on-screen fingerprint sensor**

Figure 3.5.1. Kyocera VP210

Figure 3.5.2. Sharp J-SH04

Figure 3.5.3. LG Prada

- **Huawei P20 Pro** (2018) the first phone with a **triple camera system**

- **Samsung Galaxy A9** (2018) the first phone with **four cameras** on the rear side

- **Vivo Nex** (2018) the first phone with the **pop-up front camera**

- **FlexPai by Royole** (2018) the first **foldable** smartphone (Figure 3.5.7)

THE BEGINNING OF 5G ERA (2019-2022)

- **Samsung Galaxy S10 5G** (2019) the first phone with **5G network** support

- **Samsung Galaxy S10** (2019) one the first phone with an **ultrasonic on-screen sensor**

- **Nokia 9** (2019) the first phone with **five cameras** (Figure 3.5.8) on the rear side

Figure 3.5.4. LG Optimus 3D

Figure 3.5.5. Xiaomi Mi Mix

Infinity-U   Infinity-V   Infinity-O   New Infinity

Figure 3.5.6. Evolution of the notch

Practice

Fill the table with the suitable information about the hardware components according to the period of time given.

#	Period of time	Developed hardware components
1	1999-2002	
2	2003-2006	
3	2007-2010	
4	2011-2014	
5	2015-2018	
6	2019-2022	

Figure 3.5.7. FlexPai

🔒 Literacy

1. List names of periods of developing of mobile devices hardware components
2. How much was the capacity of first memory card on the phone?
3. When the first waterproof phone was launched?
4. Name the first phone with a capacitive touchscreen

Figure 3.5.8. Nokia 9

71

- Learn about characteristics of the main components of smartphones;

- Compare smartphones according to main components characteristics.

Why we need to update out mobile device OS?

GROWTH OF THE FEATURE PHONE (1999-2002)

- **WAP** (Wireless Application Protocol) technology first time on phones was released on **Nokia 7110** in **1999**

- **Predictive Text** entering method was used firstly on **Nokia 7110** in **1999**

- **Polyphonic Ringtones** (2000) for the first time was available on **Sony CMD J5**

- **Symbian** (2000) becomes the **first** modern **Mobile OS**

- First **Mp3 Player** (2001) was released on **Samsung SPH-M1000**

- First **Bluetooth** (2001) connection was available on **Ericsson R520m**

- **MMS** (2002) for the first time was released on **Sony Ericsson T68i**

MOBILE DATA REVOLUTION (2003-2006)

- **Realtone Ringtones** (2003) for the first time was available on **Nokia 3300**

- First **Augmented Reality Game** (2003) on **Siemens SX1**

- **Full Web browsing** (2005) for phones on **Opera Mini (Figure 3.6.1)** browser

Figure 3.6.1. Opera Mini icon

GETTING SMARTER (2007-2010)

- **iPhone OS 1** released in 2007 (Figure 3.6.2)

- **Android 1.0** released in 2008 (Figure 3.6.3)

- **Android Market** was released in 2008

- **App Store** was released in 2008

- **Google Voice Control** (2010)

LIFE COMPANION (2011-2014)

- **Apple** introduces **Siri** (2011) to the world

- **iCloud** (2011) cloud storage

- First **Facial Recognition** (2011) software was on **Symbian 3 OS**

- **Google Drive** (2012)

- First **Heart Rate Monitor** (2014) application was available on **Samsung S5**

Figure 3.6.2. iPhone OS 1 home screen

SIZE MATTERS (2015-2018)

- **Android Pay** released in 2015 (Figure 3.6.4)
- **Apple Pay** released in 2015 (Figure 3.6.5)
- **Huawei Mate 10** first phone which used **AI** (2017)

THE BEGINNING OF 5G ERA (2019-2022)

- **AR navigation** (2019) in **Google Maps**
- **5G** (Figure 3.6.6) technology in mobile apps (2019)
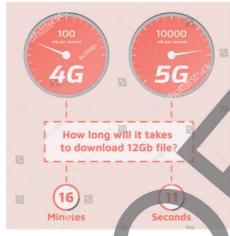
Figure 3.6.6. 4G and 5G comparison infographic

Figure 3.6.3. Android 1.0 home screen

Figure 3.6.4. Android Pay icon

Figure 3.6.5. Apple Pay icon

Practice

Fill the table with the suitable information about the software development according to the period of time given

#	Period of time	Developed software components
1	1999-2002	
2	2003-2006	
3	2007-2010	
4	2011-2014	
5	2015-2018	
6	2019-2022	

Literacy

1. List names of periods of development of mobile devices software components
2. Name the first phone with Mp3 Player
3. Name the first full web browsing browser
4. Name the most popular mobile payment systems

Terminology

augmented reality - еңейтілген шынайылық - дополненная реальность
facial recognition - бет тану - распознавание лиц
voice control - дауыстық басқару - голосовое управление

CHECK YOURSELF

1. Give a definition

Virtual machine
Host OS
Guest OS
Process VM
System VM
Hypervisor
Type 1 hypervisor
Type 2 hypervisor

2. Complete the table

#	Name of VM Application	Host OS	Price
1	Oracle VM VirtualBox		
2	VMware Fusion		
3	VMware Workstation		
4	Parallels Desktop		
5	QEMU		
6	Microsoft Hyper-V		

3. Fill in the blanks

A _____ is a _____, _____ personal computer with a _____ interface.
A _____ touchscreen is _____ - sensitive, so it relies on the _____ you place on the screen.
A _____ touchscreen works by using the _____ properties of the human _____ to change an _____ field on the screen.
The _____ and _____ are two important characteristics of the screen.
The _____ is a "_____" that connects all the tablet's components.
_____ are different in their chemical makeup, _____, _____, and size.

4. Answer the questions

What is the smartphone?
What is the main difference between display types?
What are the components of SoC?
What are the main components of the smartphone's camera?
What are the main five sensors in the smartphone?

5. Matching

1. Calypso C1250i   a. 1999
2. Fujitsu Arrows NX F-04G   b. 2001
3. Kyocera VP210   c. 2003
4. Vivo Nex   d. 2007
5. Motorola Atrix   e. 2011
6. Siemens SL45   f. 2015
7. Sharp Aquos S2   g. 2017
8. LG Prada   h. 2018

6. True or False
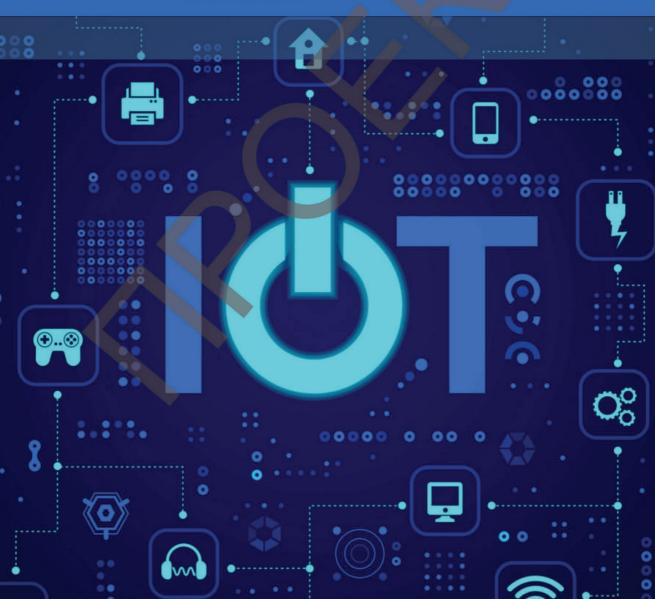
a. Predictive Text entering method was used firstly on Sony CMD J5 in 1999
b. First Mp3 Player (2001) was released on Samsung SPH-M1000
c. First Augmented Reality Game (2003) on Nokia 3300
d. iPhone OS 1 released in 2008
e. Android Market was released in 2008
f. Apple introduces Cortona (2011) to the world
g. Android Pay released in 2015
h. Apple Pay released in 2015

4 CHAPTER

INTERNET OF THINGS

- explain how the Internet of Things works;

- evaluate the possibilities of using the Internet of Things (at home, manufacturing).

Did you know that farmers can put sensors on their crops that tell them when to water, how much water is needed, and when to harvest?

In our world today, there are more smart devices than there are people. A growing number of people are connected to the Internet, in one way or another, 24 hours a day. An ever-increasing number of people have, and rely on, three, four, or more smart devices. These might include smartphones, exercise and health monitors, e-readers, and tablets. As shown in Figure 1, by 2020, it is forecast that each consumer will have an average of 6.58 smart devices.

How is it possible for so many devices to be connected?

Modern digital networks make all of this possible. The world is quickly being covered with networks that allow digital devices to interconnect and transmit. Think of the mesh of networks like a digital skin surrounding the planet, as illustrated in Figure 4.1.1. With this digital skin, mobile devices, electronic sensors, electronic measuring devices, medical devices, and gauges are all able to connect. They monitor, communicate, evaluate, and in some cases automatically adjust to the data that is being collected and transmitted.

Facts ☆

Smart Cities, such as Barcelona, Spain, use sensors to control many of their infrastructure systems such as traffic flow, parking, water utilization, and hydro.

Example 1: Weight sensors in parking spaces allow drivers to quickly know where there is an available parking spot. This reduces driving and idling time for the driver and lowers carbon emissions for the environment.

Figure 4.1.1. Smart city concept

HOW CONNECTED ARE YOU?

Practice

Survey 3 or 4 people: family, colleagues, and friends. Determine how many hours they are "connected" via any device during each day.

It is important to understand that most people born in the 1990s, will have grown up in a primarily digital world. Computers, the Internet, mobile phones, texting, social networking are all second nature to members of this group. This survey will help you to recognize how much of the day is actually spent "connected". This will help us to see the impact this generation will have on business and the economy.

Step 1: Create a spreadsheet similar to the one below (Figure 4.1.2).

a. Add extra rows for more information if needed.

	A	B	C	D	E	F
1	How Many Hours are You Connected during the Day?					
2						
3	Person 1	Age	Gender	Device	Task	Time in hours
4		43	M	Smartphone	Facebook	4
5					Talking	2
6					Texting	10
7					Twitter	3
8				Fitbit	Tracking exercise	14
9				Tablet	On-line banking	0.5
10						
11					Total	33.5
12	Person 2	Age	Gender	Device	Task	Time
13						
14						
15						
16						
17	Person 3	Age	Gender	Device	Task	Time

Figure 2.

Step 2: Summarize findings.

a. What was the average amount of time spent "connected" by all of your interviewees? _____

b. How many people were connected on more than one device at a time? _____

c. Did age make a difference to the amount of "connected" time during a day? If yes, what do you think is the reason? _____ _____

d. Did gender make a difference to the amount of "connected" time during the day? If yes, what do you think is the reason? _____ _____

e. How might this information affect the way businesses address their processes? _____

Keep in mind

All digital devices work based on computer programs and supplied data. Artificial Intelligence implies that these devices are able to think on their own. If programmed appropriately, smart devices are able to evaluate data that is provided to them and modify processes or settings "on the fly". If they are provided with sufficient data, they can "learn" and modify their own code based on the new parameters.

Activity 1

Determine your connected generation by taking this fun survey that was created by PriceWaterhouse Coopers:

http://surveys. strategyand.pwc.com/ DigitalGenerationTool/ index.php

Literacy

1. What is the main differance between smart device and electronic device?
2. What are the main aims of IOT?

Cisco Packet Tracer is an innovative network simulation and visualization tool. This free software helps you to practice your network configuration and troubleshooting skills. You can use your desktop computer, or an Android or iOS based mobile device. Packet Tracer is available for both the Linux and Windows desktop environments.

Practice 1

To obtain and install your copy of Cisco Packet Tracer follow these simple steps:
1. Log into your Cisco Networking Academy "I'm Learning" page.
2. Select Resources from the menu in the upper right portion of your screen.
3. Select Download Packet Tracer.
4. Select the version of Packet Tracer you require.
5. Save the file to your computer.
6. Launch the Packet Tracer install program.
7. After installation, close and restart your web browser.
8. Launch Cisco Packet Tracer by selecting the appropriate icon.
9. When prompted, use your Netacad login information to authenticate.
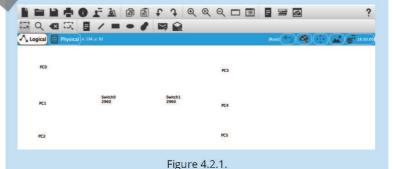
Since Packet Tracer simulates networks and network traffic, the physical aspects of these networks also need to be simulated. This includes actually finding and deploying physical devices, customizing those devices, and cabling those devices. After the physical deployment and cabling is done, then it is time for configuration of the interfaces used to connect the devices.

Practice 2

Deploying and Cabling Devices

Step 1: Open the Deploying and Cabling Devices Packet Tracer file. Download DeployingandCablingDevices.pkt file. Double click on the file to open it. You should be presented with a screen similar to that shown in the figure. If the file does not open, make sure you have properly installed the Packet Tracer application program.

Figure 4.2.1.

Step 2: Learn how to Deploy Devices and Cable them in Packet Tracer.

1.The first task in this activity is to practice using the Device-Type Selection Box.
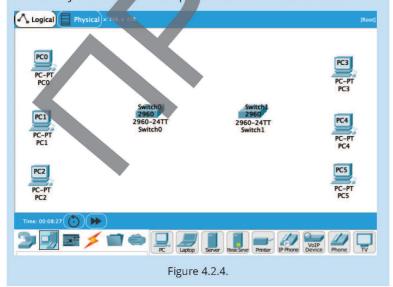
Figure 4.2.2.

The top row of icons represents categories of devices and the bottom row represents subcategories. Point at the top row of icons slowly and look at the Label box between the rows, the names of the categories will appear. Now point at the lower row icons and you will see their names appear. In this activity we will deploy Switches and PCs. Point at the lower row icons until you see one labeled Switches. Click on that icon and you will see the devices in the Device-Specific Selection Box change.

Figure 4.2.3.

It now shows the switches available in Packet Tracer. Please deploy two 2960 switches (if you don't remember how review the previous activity) over the Switch0 and Switch1 labels in the workspace. Now click on the End Device category in the Device-Type Selection Box, and deploy six PCs. If you are unsure of which device is the PC just point at the device in the Device-Specific Selection Box and look at the label area below the devices, it should say PC-PT. Your workspace should now look like this.

Figure 4.2.4.

Terminology

appropriate - қолайлы - соответствующий
deploying - орналастыру - развертывание
cabling - кабель жүргізу - прокладка кабеля
prompted - шақырылған - подсказано
sharpen - қайрау - точить
impact - әсер - воздействие

How are you connected to the global network?

Thirty billion things provide trillions of gigabytes of data. How can they work together to enhance our decision-making and improve our lives and our businesses? Enabling these connections are the networks that we use daily. These networks provide the foundation for the Internet and the digitized world.

Simple networks in homes enable connectivity to the Internet. They also enable the sharing of resources, such as printers, documents, pictures, and music, between a few local computers.

In businesses and large organizations, networks can provide products and services to customers through their connection to the Internet. Networks can also be used on an even broader scale to provide consolidation, storage, and access to information on network servers.

Modern networks can be a bit confusing. There are many types that are characterized by their geographic size, by the number of devices or networks that they connect, and by whether they support mobile devices or not. Networks can also be characterized by their function and purpose.

PERSONAL AREA NETWORK (PAN)

Personal area networks are small networks where connected wireless devices are within personal reach. Connecting your smartphone to your car using Bluetooth is an example of a PAN.

LOCAL AREA NETWORK (LAN)

LANs are typically networks in a small or local geographic area, such as a home, small business or department within a large corporation. LANs can connect two or more devices, including computers, printers, and wireless devices. LANs provide access to larger wide area networks (WANs) and the Internet.

WIDE AREA NETWORKS (WANS)

The term WAN typically refers to a collection of LANs that provides inter-LAN and Internet connectivity for businesses and governments.

INTERNET

The Internet is a multi-layer global network system that connects hundreds of millions of computers . The Internet is not owned by any one person or organization. This large system is comprised of multiple local and global networks serving private, public, business, academic, and government purposes.

1. Test Network Connectivity Using "ping" command.

```
MacBook-Pro-Yerzhan-4:~ shaniyev$ ping astanakitap.kz
PING astanakitap.kz (185.98.7.168): 56 data bytes
64 bytes from 185.98.7.168: icmp_seq=0 ttl=53 time=35.068 ms
64 bytes from 185.98.7.168: icmp_seq=1 ttl=53 time=35.334 ms
64 bytes from 185.98.7.168: icmp_seq=2 ttl=53 time=35.116 ms
64 bytes from 185.98.7.168: icmp_seq=3 ttl=53 time=34.984 ms
64 bytes from 185.98.7.168: icmp_seq=4 ttl=53 time=35.456 ms
^C
--- astanakitap.kz ping statistics ---
5 packets transmitted, 5 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 34.984/35.192/35.456/0.176 ms
```

Figure 4.3.1.

2. Trace a Route to a Remote Server Using Windows "tracert" ("traceroute" on Mac & Linux).

```
MacBook-Pro-Yerzhan-4:~ shaniyev$ traceroute astanakitap.kz
traceroute to astanakitap.kz (185.98.7.168), 64 hops max, 52 byte packets
 1  192.168.88.2 (192.168.88.2)  3.857 ms  0.976 ms  2.859 ms
 2  192.168.0.1 (192.168.0.1)  1.141 ms  1.181 ms  1.044 ms
 3  82.200.242.216 (82.200.242.216)  13.873 ms  14.701 ms  8.697 ms
 4  95.59.172.88.static.telecom.kz (95.59.172.88)  17.756 ms  18.209 ms  21.189 ms
 5  95.59.172.47.static.telecom.kz (95.59.172.47)  20.728 ms  18.341 ms  17.835 ms
 6  95.59.170.135 (95.59.170.135)  17.855 ms  25.207 ms  18.656 ms
 7  95.59.174.81 (95.59.174.81)  18.152 ms  19.338 ms  20.722 ms
 8  95.59.170.132 (95.59.170.132)  35.957 ms  31.950 ms
    92.47.145.100 (92.47.145.100)  33.967 ms
 9  92.47.150.197 (92.47.150.197)  32.094 ms
    92.47.151.205 (92.47.151.205)  32.812 ms
    92.47.150.197 (92.47.150.197)  31.887 ms
10  89.218.110.241 (89.218.110.241)  33.129 ms  31.944 ms  33.599 ms
11  filter.hoster.kz (89.218.102.1)  33.413 ms  34.557 ms  34.937 ms
12  pkz35.hoster.kz (185.98.7.168)  35.766 ms  32.521 ms  33.715 ms
```

Figure 4.3.2.

1. Which type of network is used to connect a company located in one area of a city to another location in a city far away?
2. What is the acronym for the network type that allows a personal fitness monitor to connect to a smartphone?
3. What is described as the network of networks and is the largest network in the world?
4. What is the acronym for a small business network that might connect 3 PCs and 4 wireless devices?

🔠 Terminology

broader scale - кең масштаб - широкий масштаб
consolidation - шоғырландыру - укрепление
ping - пинг - пинг
acronym - акроним - қысқарту

- learn how to create and manage your own network.

ADDRESSING TABLE

Device	Interface	IP Address	Subnet Mask	Default Gateway
PC	Ethernet0	DHCP		192.168.0.1
Wireless Router	LAN	192.168.0.1	255.255.255.0	
	Internet	DHCP		
Cisco.com Server	Ethernet0	208.67.220.220	255.255.255.0	
Laptop	Wireless0	DHCP		

Practice 1

Part 1.
Build a Simple Network in the Logical Topology Workspace
Step 1. Launch Packet Tracer
Step 2: Build the topology
a. Add network devices to the workspace.
   Using the device selection box, add the network devices to the workspace as shown in the topology diagram.To place a device onto the workspace, first choose a device type from the Device-Type Selection box. Then, click on the desired device model from the Device-Specific Selection box. Finally, click on a location in the workspace to put your device in that location. If you want to cancel your selection, click the Cancel icon for that device. Alternatively, you can click and drag a device from the Device-Specific Selection box onto the workspace.
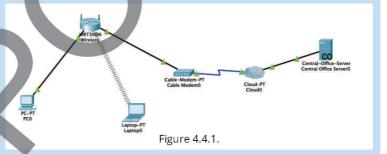
Figure 4.4.1.

b. Add the physical cabling between devices on the workspace
   Using the device selection box, add the physical cabling between devices on the workspace as shown in the topology diagram.The PC will need a copper straight-through cable to connect to the Wireless Router. Select the copper straight-through cable in the Device-Selection box and attach it to the FastEthernet0 interface of the PC and the Ethernet 1 interface of the Wireless Router.The Wireless Router will need a copper straight-through cable to connect to the Cable Modem. Select the copper straight-through cable in the Device-Selection box and attach it to the Internet interface of the Wireless Router and the Port 1 interface of the Cable Modem.The Cable Modem will need a coaxial cable to connect to the Internet cloud. Select the

coaxial cable in the Device-Selection box and attach it to the Port 0 interface of the Cable Modem and the coaxial interface of the Internet cloud.

The Internet cloud will need copper straight-through cable to connect to the Cisco.com server. Select the copper straight-through cable in the Device-Selection box and attach it to the Ethernet interface of the Internet cloud and the FastEthernet0 interface of the Cisco.com server.

Practice 2

Part 2:Configure the Network Devices
Step 1: Configure the Wireless Router

a. Create the wireless network on the Wireless RouterClick on the Wireless Router icon on the Packet Tracer Logicalworkspace to open the device configuration window.In the Wireless Router configuration window click on the GUI tab to view configuration options for the Wireless Router. Next, click on the Wireless tab in the GUI to view the wireless settings. The only setting that needs to be changed from the default is the Network Name (SSID). Here, type the name "HomeNetwork" as shown in the figure.

Figure 4.4.2.

b. Configure the Internet connection on the Wireless Router Click on the Setup tab in the Wireless Router GUI.In the DHCP Server settings verify that the Enabled button is selected and configure the static IP address of the DNS server as 208.67.220.220 as shown in the figure.

c. Click on the Save Settings tab.
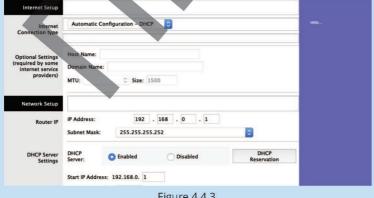
Figure 4.4.3.

STQ

THE INTERNET OF THINGS

The Internet of Things (IoT) is the connection of millions of smart devices and sensors connected to the Internet. These connected devices and sensors collect and share data for use and evaluation by many organizations. These organizations include businesses, cities, governments, hospitals and individuals. The IoT has been possible, in part, due to the advent of cheap processors and wireless networks. Previously inanimate objects such as doorknobs or light bulbs can now be equipped with an intelligent sensor that can collect and transfer data to a network.

Practice 1

Researchers estimate that over 3 million new devices are connected to the Internet each month. Researchers also estimate that in the next four years, there are going to be over 30 billion connected devices worldwide.

Perhaps a third of connected devices will be computers, smartphones, tablets, and smart TVs. The remaining two-thirds will be other kinds of "things": sensors, actuators, and newly invented intelligent devices that monitor, control, analyze, and optimize our world.

Some examples of intelligent connected sensors are: smart doorbells, garage doors, thermostats, sports wearables, pacemakers, traffic lights, parking spots, and many others. The limit of different objects that could become intelligent sensors is limited only by our imagination.

Facts

Businesses have more information about products that they sell and who is purchasing them. Armed with this type of data, they can streamline production and target their marketing and advertising to specific areas or audiences, promotes creation of new business opportunities and marketing ideas.

Practice 2

Imagine a new intelligent sensor
Many devices have sensors in them that affect the operation of processes or generate data to assist governments and businesses. Use your imagination to think of devices that could be made more useful if they contained intelligent sensors.

Think about your day in your home, school, or office. Are there any objects that you think could provide useful information to you or to others if they were equipped with sensors? As an example, if the toilet roll holder in your home had sensors to detect weight, it could turn red and beep when it needed a new roll.

a. Describe the object that you selected.
b. What kind of data would sensors in this object gather?
c. How could the gathered data be useful and to whom would it be useful?

Advantages and Disadvantages of IoT Devices
Many devices have sensors in them that affect the operation of processes or generate data to assist governments and businesses. Do their advantages outweigh any disadvantages?
Answer the following questions.
a. Describe some of the advantages for including sensors in parking spaces in a municipal parking garage?
b. What type of data could sensors pull from your smart TV? From your fitnesswearable?
c. What might the data, from your previous answer, be used for? Is the use a good thing or a bad thing?

Individuals can reap improved fitness and health benefits, better home and family security, and reduced costs for energy and heating systems. They can enjoy more varied entertainment, limit the speed a teenage driver can reach, or even monitor the health of an older family member at the wheel of their car.

Governments monitor environmental issues, target funding for social issues, and have informed control of power output.

Manufacturing saves money, improves efficiency, and improves productivity of manufacturing processes and operations. Manufacturers reduce downtime by predicting maintenance requirements and improving scheduling of field service employees.

Literacy

1. What is needed in a smart home to connect sensors and smart devices to a network?
2. What is comprised of millions of smart devices and sensors connected to the internet?
3. What type of device could allow a refrigerator to place a replacement order for an item contained within it?

Facts

Cities have the ability to control traffic patterns based on time of day or major events, monitor and control garbage and recycling, monitor health and housing needs, and evaluate future transportation requirements.

Terminology

evaluation - бағалау - оценка
inanimate - жансыз - неодушевленный
equipped - жабдықталған - оборудованный
actuators - қоздырғыштар - приводы
pacemaker - кардиостимулятор - кардиостимулятор
gathered - жиналған - собрано
manufacturer - өндіруші - производитель

- evaluates the possibilities of using the Internet of Things (at home, manufacturing).

HOW ARE IOT DEVICES CONNECTED TO THE NETWORK?

A sensor needs to be connected to a network so that the gathered data can be stored and shared. This requires either a wired Ethernet connection or a wireless connection to a controller. Controllers are responsible for collecting data from sensors and providing network or Internet connectivity. Controllers may have the ability to make immediate decisions, or they may send data to a more powerful computer for analysis. This more powerful computer might be in the same LAN as the controller or might only be accessible through an Internet connection.

Sensors often work together with a device called an actuator. Actuators take electrical input and transform the input into physical action. As an example, if a sensor detects excess heat in a room, the sensor sends the temperature reading to the microcontroller. The microcontroller can send the data to an actuator which would then turn on the air conditioner.

The majority of new devices such as fitness wearables, implanted pacemakers, air meters in a mine shaft, and water meters in a farm field all require wireless connectivity. Because many sensors are "out in the field" and are powered by batteries or solar panels, consideration must be given to power consumption. Low-powered connection options must be used to optimize and extend the availability of the sensor.

The image contains actuator and sensor representations with a line representing connection to the controller. All are contained in a gray cloud labelled fog computing.

EXPLORE A SMART HOME

Practice 1

Packet Tracer has a wide variety of sensors and smart devices that will allow you to design smart homes, smart cities, smart factories, and smart power grids.

To locate the available sensors and smart devices, select End Devices from the Device Selection box at the lower left-hand side of the screen. Next, select the subcategory Home. In this subcategory, you will see many IoT devices including an air conditioner, ceiling fan, coffee maker, and CO detector. These devices can be connected to your network wirelessly or with a physical cable.

To connect the devices to your network, you need a home gateway or registration server. To find a home gateway, select Network Devices from the Device Selection box and then select Wireless Devices from the subcategories.

To control the devices, you have two options:
1. You can interact directly with a device. Hold down the Alt key and at the same time click on the device to turn it on or off.
2. You can connect remotely over the network. Using a remote

PC, tablet or smart phone, use a web browser to connect to the home gateway or registration server. From here, you can turn the devices on or off using the features of the home gateway or registration server.

To configure devices, click on the device to open it. After it is opened, multiple tabs are displayed:

- Specifications – describes the features, usage, local and remote control of the device
- Physical – available modules and power connections
- Config – shows display name, serial number, network configuration, and IoT server
- Attributes – displays the device attributes such as MTBF, power consumption, and cost

To configure the home gateway, click on the device. Within the device multiple tabs are displayed:

- Physical – available modules, and power
- Config – shows display name, interfaces (Internet, LAN, and wireless) to be configured
- GUI – shows services to be turned on/off
- Attributes – shows features and values related to device such as mean time between failure (MTBF), cost, power sources, and wattage

Figure 4.6.1.

🔒 Literacy

1. What is the main factors that made up smart home?
2. What allows digital devices to interconnect and transmit data?

EXPLORE THE EXISTING SMART HOME NETWORK

In this lesson you will open a Packet Tracer file with an existing home network, explore the devices on the network and then add additional wired and wireless IoT devices.

Practice 1

Step 1: Download and open the Smart_Home_Network.pkt file from the link below.

https://github.com/astanakitap/iot

Step 2: Explore the Smart Home Network.

a. Explore IoT end devices.

At the bottom left corner of the Packet Tracer window, locate and click the [End Devices]icon in the top row,and the [Home] icon in the bottom row of the Device-Type Selection box.

Figure 4.7.1.

Across the bottom of the Packet Tracer window,the Device-Specific Selection box displays the many different Smart Home IoT devices available. Move the mouse pointer over each device and notice that the descriptive name of the device is displayed at the bottom of the Device-Specific Selection box. Take a moment to look at each device type.

Figure 4.7.2.

b. Explore the Smart Home network.

In the Logical workspace is a pre-built smart home network that consists of many wired and wireless IoT devices,and network infrastructure devices.When you place your cursor over a device, such as the Smart Fan, an informational window opens containing basic network information about that device.

Figure 4.7.3.

To turn on or activate a device, simply hold down the Alt key on the keyboard and then left-click the device.Try this on each of the smart devices to observe what they do.The smart home network also consists of infrastructure devices such as a home gateway. Click the Home Gateway icon to open the Home Gateway

Figure 4.7.4.

The Physical tab is selected by default and shows a picture of the Home Gateway.
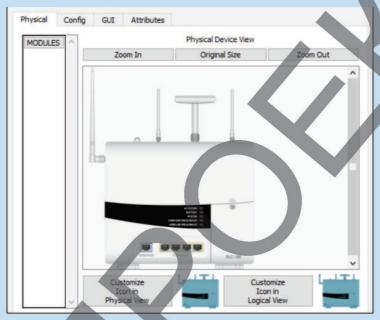
Figure 4.7.5.

Next, click the Config tab and then in the left pane click LANto view the LAN Settings of the Home Gateway.Write down the IP Address of the home network for future reference.
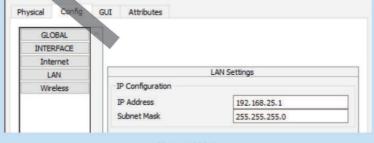
Figure 4.7.6.

- add wired IOT device to the smart home network.

EXPLORE THE EXISTING SMART HOME NETWORK

Practice 1

Step 1: Cable a device to the network

a. In the Device-Specific Selection box,click the Lawn Sprinkler icon and then click in the workspace where you would like to locate the Lawn Sprinkler.

b. Cable the Fire Sprinkler to the Home Gateway. In the Device-Type Selection box,click the [Connections]icon (this looks like a lightning bolt).Click the Copper Straight Through connector type icon in the Device-Specific Selection box. Then click the Sprinkler icon and connect one end of the cable to the Sprinkler's FastEthernet0 interface. Next,click the Home Gateway icon and connect the other end of the cable to an available Ethernet interface.

Figure 4.8.1.

Step 2: Configure the sprinkler for network connectivity

a. Click the Lawn Sprinkler device icon in the workspace to open the device window. Notice that right now the name of the Lawn Sprinkler is a generic IoT0.The device window will open to the Specification tab which gives information about the device which can be edited.

Figure 4.8.2.

b. Click the Config tab to edit the device configuration settings. In the Config tab,make the following changes to Settings:
- Set the Display Name to Sprinkler1 (notice the window name changes to Sprinkler1)
- Set the IoT Server to Home Gateway
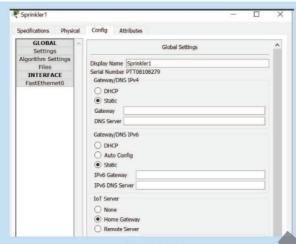
Figure 4.8.3.

Click FastEthernet0 and change the IP Configuration to DHCP.

Figure 4.8.4.

c. Verify that the sprinker is on the network. Log into the Home Gateway from the Tablet.

Figure 4.8.5.

The device Sprinkler 1 should now appear in the IoTServer – Devices list.
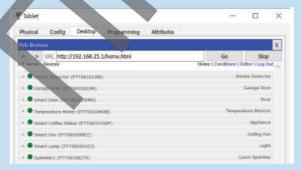
Figure 4.8.6.

Step 3: Experiment by adding other types of IoT devices to the smart home network.

📖 **Terminology**

lawn sprinkler - көгалдарға шашыратқыш - разбрызгиватель газонов
fire sprinkler - отқа су шашқыш - пожарный спринклер
compatible - үйлесімді - совместимый
configuration - конфигурациясы - конфигурация

ADD WIRELESS IOT DEVICES TO THE SMART HOME NETWORK

Practice 1

Step 1: Add a wireless device to the network

a. In the Device-Specific Selection box click the Wind Detector icon and then click in the workspace where you would like to locate the Wind Detector.

Figure 4.9.1.

b. Add wireless module to the Wind Detector.Click the Wind Detector icon in the workspace to open the IoT device window. In the bottom right corner of the IoT device window,click the Advanced button. Notice more tabs become visible at the top of the window. Click the I/O Config tab.

Figure 4.9.2.

- Change the Network Adapter drop down list to PT-IOT-NM-1W, which is a wireless adapter.
- c. Configure the Wind Detector for the wireless network.Click the Config tab. Change the Display Name to Wind_Detector and change the IoTServerto Home Gateway.
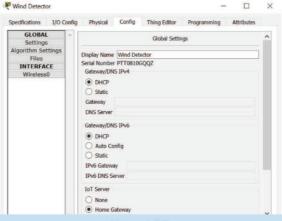
Figure 4.9.3.

Next click Wireless0 in the left pane. Change the Authentication type to WPA2-PSK and in the PSK Pass Phrase box type mySecretKey. These are the wireless settings from the Home Gateway.

A wireless connection should be formed between the Wind Detector and the Home Gateway.

d. Verify the Wind Detector is on the network.

Log into the Home Gateway from the Tablet.

Figure 4.9.4.

Figure 4.9.5.

The device Wind Detector should now appear in the IoT Server – Devices list
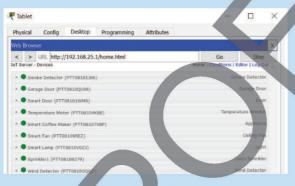
Figure 4.9.6.

Practice 1

Step 2: Experiment by adding other types of IoT devices to the smart home wireless network.

Terminology

wind detector - жел детекторы - детектор ветра
workspace - жұмыс кеңістігі - рабочее пространство
wireless module - сымсыз модуль - беспроводной модуль
power cycle device - қуат циклы - устройство цикла питания

Literacy
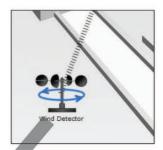
1. What is the differance adding wireless and wired devices for a smart home network?

- add Home Gateway to the Network;
- connect IoT Devices to the Wireless Network;
- add End User Device to the Network.

PART 1: CONNECT A HOME GATEWAY TO THE NETWORK

Practice 1

Step 1: Adding a home gateway

a. Select the Home Gateway device. Click the Wireless Devices icon in the Device-Type Selection box. Click the Home Gateway device icon and then click in the Logical workspace to add the device.

Figure 4.10.1.

b. Connect the Home Gateway to the Cable Modem.

Click the Copper Straight-Through connector icon in the Device-Type Selection box, then click the Home Gateway to add one end of the cable to the gateway. Next,click the Cable Modem icon to connect the other end of the cable to the Internet port.

Figure 4.10.2.

After a few seconds both ends of the cable should have green lights indicating that the link is up.

Figure 4.10.3.

PART 2: CONNECT IOT DEVICES TO THE WIRELESS NETWORK

Practice 2

Step 1: Select wireless devices

a. Click the Home Devices icon in the Device-Type Selection box and add the Fan, the Door, and the Lamp to the workspace.

Figure 4.10.4.

Step 2: Add devices to the home wireless network

a. Add a wireless adapter to the Fandevice. Click the Fan icon in the workspace to open the Config tab and then click the Advanced button in the bottom right corner of the window. Notice that the tabs at the top of the configuration window change. There are now more tabs. Click the I/O Config tab and change the Network Adapter type to the PT-IOT-NM-1W wireless adapter.

Figure 4.10.5.

b. Change the display name of the Fan device. Click the Config tab. In the Display Name box, type Ceiling Fan.
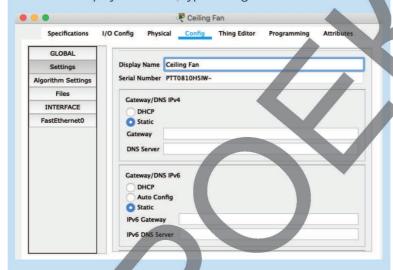
Figure 4.10.6.

c. Verify that the Fan device is connected to the wireless network. While still in the Config tab, click the Wireless0 interface in the left pane. In the configuration settings, the Home Gateway network should be listed in the SSID box. Verify that the DHCP is selected in the IP Configuration settings, the IP address is 192.168.25.100 and the default gateway is 192.168.25.1. This indicates that the fan is connected to the network and is receiving IP configuration information from the home gateway.

d. Connect the Door and the Lamp to the wireless network following the same steps used for the fan.

Literacy

1. Describe how to connect and monitor IOT devices?

- create a mobile application interface using application designer components.

How does mobile app are created?

MIT APP INVENTOR

MIT App Inventor (http://ai2.appinventor.mit.edu/) is a software development tool for OS Android, which requires the Java and Android SDK programming language to be easily understood by the elementary basics of algorithmization.

MIT App Inventor 2 is intuitive and simple to use. You don't have to be an expert in programming or design to build awesome apps that can do useful stuff. The code is done with drag and drop puzzle blocks.

Practice

1. Go to http://appinventor.mit.edu/explore/ and press Create Apps button.
2. Next, click on Start new project as shown in figure below.

Figure 4.11.1.

You'll be asked to give your project a name. As we're just exploring the MIT App Inventor 2 features, you can name it test.

Figure 4.11.2.

Click OK. Your project is automatically saved.

If you go to Projects > My Projects you can see all your saved projects.

Figure 4.11.3.

Click on the project name to open the app builder.

DESIGNER

You'll be presented with the Designer tab as shown in the following figure.

Figure 4.11.4.

At 1) you select whether you are on the Designer or in the Blocks Editor tab. With MIT App Inventor you have 2 main sections: Designer and Blocks. The designer gives you the ability to add buttons, add text, add screens and edit the overall app look.

The Blocks section allows you to create custom functionality for your app, so when you press the buttons it actually does something with that event.

2) The Palette contains the components to build the app design like buttons, sliders, images, labels, etc...

3) It's the Viewer. This is where you drag the components to build the app look.

4) Components. You can see all the components added to your app and how they are organized hierarchically.

5) Properties. This is where you select your components' properties like color, size and orientation.

BLOCKS EDITOR

Open the Blocks editor tab.

Figure 4.11.5.

You will

- edit the properties of components in the properties window and in the program code;
- create applications for mobile devices using conditional and cyclic structures.

ANDROID APP – RGB LED WITH ARDUINO AND BLUETOOTH

In this project you're going to build an Android app to control the color of an RGB LED with a smartphone via Bluetooth.

You're going to build the Android app using a free web based software called MIT App Inventor 2. This is a great project to learn how to interface the Arduino with a smartphone.

Here's a complete list of the parts required for this project:
- Arduino UNO – read Best Arduino Starter Kits
- Bluetooth module HC-04 or HC-05 or HC-06
- RGB LED (common anode)
- 3 x 220Ohm resistor
- Breadboard
- Jumper wires
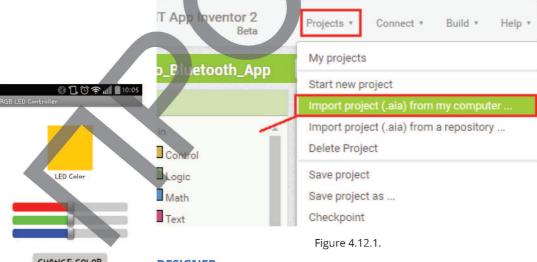
CREATING THE ANDROID APP

The Android App will be created using a free web application called MIT App Inventor. MIT App Inventor is a great place to get started with Android development, because it allows you to build simple apps with drag-n-drop.

You need a Google account to sign up for MIT App Inventor and here's the login page: http://ai2.appinventor.mit.edu.
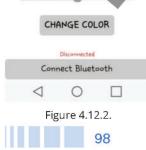
After login in go to Projects > Import project (.aia) from my computer and upload the .aia file.

Figure 4.12.1.

DESIGNER

With MIT App Inventor you have 2 main sections: designer and blocks.

The designer is what gives you the ability to add buttons, add text, add screens and edit the overall app look. Int the App Inventor software the app looks like this:

Figure 4.12.2.
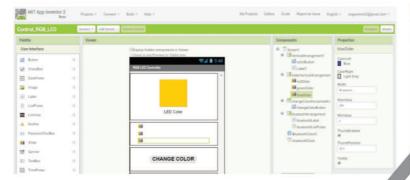
Figure 4.12.3.

The app looks different in the software and in your smartphone. This is the how the app looks in our smartphone:

BLOCKS

Then, you have the blocks section. The blocks sections is what allows to create custom functionality for your app, so when you press the buttons it actually does something with that information. You can download blocks for this app from the QR code in Figure 4.12.4.

INSTALLING THE APP

To install the app in your smartphone, go to the Build tab.

Figure 4.12.5.

- You can either generate a QR code that you can scan with your smartphone and automatically install the app in your smartphone.
- Or you can download the .apk file, connect your smartphone to your computer and move the .apk file to the phone.

Simply follow the installation wizard to install the App and it's done!

LAUNCHING THE APP

If you haven't generated the .apk file in a previous step, you can click here to download the .apk file (which is the Android App installation file). Move that file to your smartphone and open it. Follow the installation wizard to install the app.

Turn on your smartphone's Bluetooth.

Make sure you pair your smartphone with the bluetooth module – search for paired devices in your smartphone's bluetooth settings.
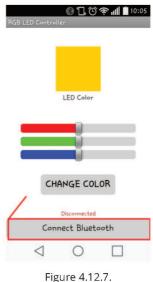
Then, open the newly installed app. Tap on the Connect bluetooth button to connect via bluetooth to the arduino bluetooth module.

Figure 4.12.6.

Figure 4.12.4.

Figure 4.12.7.

99

- transmits data from smart home sensors via the Internet.

Figure 4.13.1.

CONTROL 2 DC MOTORS VIA BLUETOOTH (PERFECT TO BUILD A ROBOT)

In this project I'll show you how to control 2 DC motors via bluetooth with an Android app created with MIT App Inventor 2. MIT App Inventor is a great platform to get you started with Android development.

To establish the bluetooth communication between your smartphone and your Arduino, you need a bluetooth module. This project uses the HC-05 bluetooth module

This bluetooth module works with serial data. This means that the Arduino sends information and the bluetooth module receives it via serial (and vice-versa).

By default the HC-05 bluetooth module operates at a baud rate of 9600. (Figure 4.13.1)

PARTS REQUIRED

- Arduino UNO – read Best Arduino Starter Kits
- Bluetooth module HC-04 or HC-05 or HC-06
- 1x L293D IC
- 2x DC motors
- Breadboard
- Jumper wires

CREATING YOUR ANDROID APP

The Android App will be created using a free web application called MIT App Inventor. MIT App Inventor is a great place to get started with Android development, because it allows you to build simple apps with drag-n-drop.

You need a Google account to sign up for MIT App Inventor and here's the login page: http://ai2.appinventor.mit.edu.

If you go to the Projects tab, you can upload the .aia file for this project
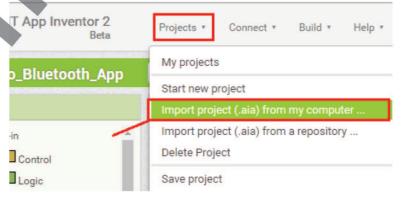
Figure 4.13.2.

With MIT App Inventor you have 2 main sections: designer and blocks. The designer is what gives you the ability to add buttons, add text, add screens and edit the overall app look.

The blocks sections is what allows to create custom functionality for your app, so when you press the buttons it actually does something with that information.

Figure 4.13.3.

Figure 4.13.5.

I recommend that you start by following this project and using the app without modifying it.

If want to make any changes to the app, when you're done and you want to install the app in your smartphone, go to the Build tab.
• You can either generate a QR code that you can scan with your smartphone and automatically install the app in your smartphone.
• Or you can download the .apk file, connect your smartphone to your computer and move the .apk file to the phone.

Figure 4.13.4.

Figure 4.13.6.
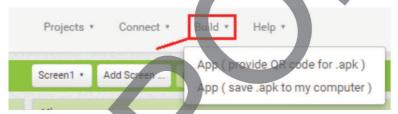
Simply follow the installation wizard to install the app and it's done!

SCHEMATICS

Follow the schematic diagram in the following figure to wire your circuit.

LAUNCHING YOUR APP

If you haven't generated the .apk file in a previous step, you can click here to download the .apk file (which is the Android app installation file). Move that file to your smartphone and open it. Follow the installation wizard to install the app.

Turn on your smartphone's Bluetooth.

Tap on the newly installed app. Press the "Connect" button to connect your application to your Arduino Bluetooth module.

Now you can easily control the 2 DC motors with your app:
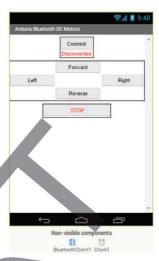
Figure 4.13.7.
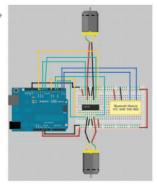
• writing a program for outputting data received from smart home sensors.

In this project we're going to learn how to build an app that connects to a microcontroller called Arduino 101 via Bluetooth. You can use this equipment to monitor various conditions (i.e., light, humidity, temperature, moisture) that can help you track the overall health of a plant. We will also learn how to graph this data.

Figure 4.14.1.   Figure 4.14.2.

Let's start by connecting all the sensors we're going to use to our Arduino. For this project, we are also using a Seeed Grove shield attached to the top of our Arduino. While the Grove board isn't necessary, it makes things much easier.We will also need the following components for this project:
• A moisture sensor
• A light sensor
• A humidity sensor (also works as a temperature sensor)
• An RGB LCD Display

We're going to attach 3 sensors (Light, Humidity, and Moisture) and an RGB LCD Display.
• Attach the Light Sensor to the A1 slot on the Grove board
• Attach the Moisture Sensor to the A2 slot on the Grove board.
• Attach the Humidity Sensor to the D4 slot on the Grove board
• Attach the RGB LCD Display to any of the I2C slots.

BUILDING THE APP IN APP INVENTOR

Start a new project in App Inventor and name it Healthy Plant Monitor. First, we need to set up some buttons to find and connect to our Arduino over Bluetooth.
• Drag a Horizontal Arrangement from the Layout drawer in the Palette and add 4 Buttons to it.
• Rename the buttons: ButtonScan, ButtonStopScan, Button Connect, and ButtonDisconnect
• Change their text to "Scan", "Stop Scan", "Connect", and "Disconnect"
• Below the Horizontal Arrangement add a Label. Rename it LabelStatus and change its text to "Status: "
• Below that add another Label. Rename it Label Data and change its text to "Data: "
• Below Label Data, add a ListView. Rename it List BLE. Next, we need to install the various extensions we need for our app.
• Download edu.mit.appinventor.iot.arduino101.aixand edu.mit. appinventor.ble.aix to your computer.
• For both files, in the Palette, click on Extension at the bottom and then on "Import extension" and then "Choose File".
• Find the extensions on your computer and upload them.

Figure 4.14.3. A moisture sensor

Figure 4.14.4. A light sensor

Figure 4.14.5. A humidity sensor

Next, we need to install the various extensions we need for our app.
- Download edu.mit.appinventor.iot.arduino101.aixand edu.mit. appinventor.ble.aix to your computer.
- For both files, in the Palette, click on Extension at the bottom and then on "Import extension" and then "Choose File".
- Find the extensions on your computer and upload them.

From the extensions list, add the following extensions to your app by dragging them onto the Viewer: BluetoothLE, Arduino101LightSensor, Arduino101Moisture, Arduino101Humidity, and Arduino101RgbLcd

Figure 4.14.7.
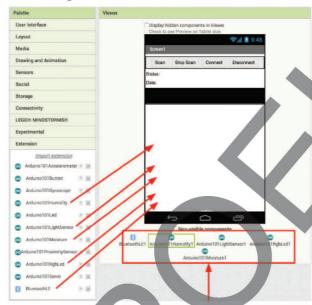
Figure 4.14.6.

After they are dragged onto the Viewer they will appear below the main screen.Don't worry if you see an error about integers, we'll fix that in a minute. Next, we need to let App Inventor know which pins on the Grove board the different sensors and the LCD screen are connected to.

First, let's set the pin for the Light Sensor
- Click on Arduino101LightSensor1 in the Components pane.
- In the Properties pane, click on BluetoothDevice and select BluetoothLE1. Under Pin, enter only the number that corresponds to the analog pin the light sensor is plugged into on the Grove board (in this case A1).
- Note: You only need to set the number (1) not the letter (A)
- Now, let's do the same thing for the rest of the sensors
- Click on Arduinio101Moisture1, set its BluetoothDevice to BluetoothLE1and set its Pin to 2
- Click on Arduino101Humidity1, set its BluetoothDevice to BluetoothLE1and set its pin to 4
- For the Ardunio101RgbLcd1 you only have to select the Bluetooth device (BlutetoothLE1); App Inventor will take care of the rest.
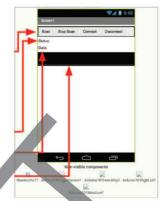
Figure 4.14.8.
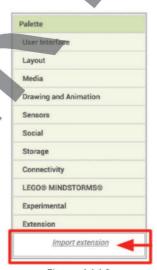
🔒 Literacy

1. Describe what is the purpose of each sensor used in this project?

🔤 Terminology

humidity - ауа ылғалдылығы - влажность воздуха
moisture - топрақ ылғалдылығы - влажность почвы
palette - бояғыш - палитра

- writing a program for outputting data received from smart home sensors.

SWITCH TO THE BLOCKS EDITOR VIEW

We want to set up the app to scan for available Bluetooth devices. To do this, we will use the ButtonScan button to set the Bluetooth component to start scanning, and change the status label.
- From ButtonScan in the Blocks pane drag out when ButtonScan. Click
  - ° from BluetoothLE1 add call BluetoothLE1.StartScanning
  - ° from LabelStatus add set LabelStatus.Text to
    - From the Text Drawer add a text block and type in "Status: Scanning"

Figure 1.

Next, we'll have the app stop scanning and change the status label when we press the ButtonStopScan
- From ButtonStopScan in the Blocks pane drag out when ButtonStopScan.Click
  - ° from BluetoothLE1 add call BluetoothLE1.StopScanning
  - ° from LabelStatus add set LabelStatus.Text to
    - From the Text Drawer add a text block and type in"Status: Stopped Scanning"

Figure 2.

We need to populate the device list with all the available Bluetooth devices
- From the BlueToothLE1 in the Blocks pane drag out when BluetoothLE1.DeviceFound
  - ° from ListBLE add set ListBLE.ElementsFromString to
    - From BluetoothLE1 drag out and snap in BluetoothLE1. Devicelist

Figure 3.

Now we need to have our App connect to the Arduino over Bluetooth, along with all of our sensor extensions.
- From ButtonConnect in the Blocks pane drag out when ButtonConnect.Click
  - ° From the BluetoothLE1 Drawer add call BluetoothLE1.Connect index
    - From BluetoothLE1 drag out and connect ListBLE. SelectionIndex(This sets the Bluetooth device to the one picked from the list.)

We also want to let the user know we are trying to connect to the device.
- ° From LabelStatus drag out set LabelStatus Text to
  - • From the Text Drawer add a text block and type in"Status: Connecting"

Figure 4.

Next we want to be able to disconnect from the Bluetooth device.
- • From the ButtonDisconnect in the Blocks pane drag out when ButtonDisconnect.Click
  - ° From the BluetoothLE1 Drawer add call BluetoothLE1. Disconnect

Figure 5.

We also want to know when the Bluetooth device successfully disconnects (to know pressing the button above worked)
- • From BluetoothLE1 in the Blocks pane drag out when BluetoothLE1.Disconnected
  - ° from LabelStatus add set LabelStatus.Text to
  - ° From the Text Drawer add a text block and type in "Status: Disconnected"

Figure 6.

Next we want to set it up to request data updates when the values for each of our sensors on the Arduino changes.
- • From the BluetoothLE1 in the Blocks pane drag out when BluetoothLE1.Connected
  - ° from Arduino101LightSensor1 add call Arduino101LightSensor1. RequestLightSensorUpdates
  - ° from Arduino101Humidity1 addcall Arduino101Humidity1. RequestHumidityUpdates
  - ° from Arduino101Humidity1 add call Arduino101Humidity1. RequestTemperatureUpdates
  - ° from Arduino101Moisture1 add
    - • call Arduino101Moisture1.RequestMoistureUpdates
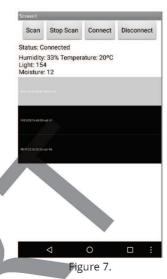
Let's also send a message to the Arduino's LCD to make sure it is working.
  - ° from Arduino101RGBLcd1 add call Arduino101RGBLcd1.SetText
- • From the Text Drawer add a text block and type in "Hello Plant"
  - ° from Arduino101RGBLcd1 add call Arduino101RGBLcd1.SetBackgroundColor color
- • From the Color drawer add the Green block
  - ° from LabelStatus add set LabelStatus.Text to
- • From the Text drawer add a text block and type in"Status: Connected"

Figure 7.

🔤 **Terminology**

blocks pane - блоктар тақтасы - панель блоков
populate - қоныстану - заселить
extensions - кеңейту - расширения
label status - белгі күйі - статус метки

105

1. According to Internet of Things match the following:

I. Individuals
II. Governments
III. Manufacturing

a. saves money, improves efficiency, and improves productivity of manufacturing processes and operations.
b. can reap improved fitness and health benefits, better home and family security, and reduced costs for energy and heating systems.
c. monitor environmental issues, target funding for social issues, and have informed control of power output.

2. Fix the following steps in correct order to obtain and install of Cisco Packet Tracer:
a. __ Save the file to your computer.
b. __ Launch the Packet Tracer install program. __ Select Download Packet Tracer.
c. __ After installation, close and restart your web browser.
d. __ Select the version of Packet Tracer you require.
e. __ Log into your Cisco Networking Academy "I'm Learning" page.
f. __ Select Resources from the menu in the upper right portion of your screen.
g. __ Launch Cisco Packet Tracer by selecting the appropriate icon.
h. __ When prompted, use your Netacad login information to authenticate.

3. Sort the following networks from biggest to smallest.
a. Local Area Network (LAN)
b. Wide Area Networks (WANs)
c. Personal Area Network (PAN)

4. What is used to provide IoT sensors with access to the network?
a. an actuator
b. a microcontroller c) fog computing
c. a laptop

5. What limits the types of different objects that can become intelligent sensors on the Internet of Things?
a. availability of power for consumption
b. the size of the internet c) the government
c. our imagination

6. Which two skills help with IoT prototyping? (Choose two.)
a. database administration b) design
b. programming
c. welding
d. Windows operating systems

7. What are two features of automation? (Choose two.)
a. a process that is self-driven
b. a process that always uses robots
c. a process that always uses sensors
d. a process that results in 12 hour shifts
e. a process that eventually eliminates the
f. need for human intervention

8. What are two requirements to connect a smart device to a home wireless network? (Choose two.)
a. IP addressing
b. home gateway name
c. URL
d. GUI
e. SSID

9. What is an open-source physical computing platform that can take input from a variety of switches or sensors to control physical objects?
a. Arduino
b. Raspberry Pi
c. Beaglebone

5
CHAPTER

IT STARTUP

• describe the concept of Startup.

Can you count how many hours per day you spend behind a computer or mobile phone on a popular app? How about your friends and family members?

Let's find out what IT startups are and how important they are today in our lives?

Figure 5.1.1. Startup

IT startup is a company producing and distributing software product initiated by one or more founders and designed to rapidly scale. IT startup offers a product or a service that provides a solution to the previously unresolved problem.

STARTUP LIFECYCLE

1. Formation

Startup begins with formation of a team with complementary skills around an idea that solves a particular problem. The team promptly builds minimum viable product, or a prototype, and offers it to initial users.

A minimum viable product (MVP) is a software or hardware with minimum amount of functionality to satisfy initial users, and to provide customer feedback for further product improvement.

Figure 5.1.2. Startup lifecycle

2. Validation

Founders try to achieve market validation by iterating through the loop of target audience discovery, product design, customer feedback and evaluation of traction.

Traction is a number of early customers that continuously use the startup product. It is a proof that people want your product.

3. Growth

After multiple iterations successful startup founders achieve traction. If users do not want to leave your app, it is time to start scaling the product to the wider audience. Startup growth is achieved by effective growth hack strategy and investor capital.

Growth hacking is a low cost marketing strategy to help startups attract massive amount of customers in the shortest time possible.

Founders are dreamers and innovators

Startups usually begin by a founder or co-founders who find a way to solve a problem. What kind of people are startup founders? Founders of successful startups live in the future:
- They play with cutting edge technologies and build amazingly creative products.
- They are not content with the present state of affairs and always looking to improve the world by trying to close the gap between their dreams and reality.
- They are problem solvers. Successful founders usually launch a startup that improves their personal life or their immediate environment. Successful founders don't try to solve problems that they don't understand enough.

Figure 5.1.3. How to start a start-up

🔒 Literacy

1. What is IT startup?
2. Explain 3 main startup lifecycle phases.
3. What qualities differentiate startup founders from the rest?

Activity

Divide the class into 4 groups. Each group needs to come up with the startup idea using one of the following technologies: artificial intelligence, blockchain, internet of things, virtual reality.

Practice

Analyze any 3 successful IT startups (popular apps or websites) according to the following criteria:
a. Who is the main target audience/users. How many users does it have?
b. Type of technology used (messaging, video sharing, streaming, ranking algorithm).
c. Who is the founder of the startup? How old is he/she? Is it his/her first startup?

🔠 Terminology

distribute - тарату - распространять
complementary skills - толықтырушы дағдылар - дополняющие навыки
validation - тексеру - проверка

109

- Describe the working principles of crowdfunding platforms

Have you ever asked your friends and family to help fund your amazing idea?

WHAT IS CROWDFUNDING?

In this lesson you will learn how crowdfunding works and what startup needs to crowdfund the product.

Crowdfunding is a method of funding a startup product completion by raising money from large amount of users online.

Figure 5.2.1. Crowdfunding

WHAT ARE CROWDFUNDING PLATFORMS

Crowdfunding platform serves as an intermediary between a startup and a network of online users willing to fund the project. Crowdfunding platforms select startup funding offerings and set up all the necessary organizational systems and conditions to properly raise capital on the internet.

Crowdfunding typically consists of the following stages:

Crowdfund campaign launch, promotion, reaching the funding goal, building the final product with raised money, and finally rewarding financial backers.

Figure 5.2.2. Crowdfunding platform

WHY STARTUPS NEED CROWDFUNDING?

Crowdfunding has raised tens of billions of dollars so far and has added twice as much value for the world economy. Here are the main reasons why startups need crowdfunding:

1. Marketing
   Startups don't need to spend resources on marketing as much.
2. Product validation and feedback
   The number one reason why startups fail is the lack of market need. If nobody cares about your product, it is very likely to fail. Crowdfunding platform helps to test the idea's worth by exposing it to the customers.
3. Low risk Income
   Crowdfunding is a type of pre-sale. With pre-sales, there is no need to buy and store large quantities of stock, or spend too much resources on building a software product that no one wants to get.

WHEN IS STARTUP PRODUCT READY FOR CROWDFUNDING?

1. Product should be clearly and instantly demonstrated
   Founders need to be able to clearly differentiate their product from the rest. It needs to stand out from the crowd.
2. Founders need to demonstrate their ability to complete the project
   Founders have to show that they have all the skills and creativity to complete the project and that they will do so within the funding limit.
3. Founders need to have a clear business plan
   Concise and to the point business plan with projected costs and revenues will build the trust in the project.

Practice

1. Write down all exceptional qualities that your potential startup product has.
2. Imagine your classmates are the first customers of your product. Why would they buy it?

🔒 Literacy

1. Name 3 reasons why startups need crowdfunding platforms?
2. What do founders need to worry about before launching crowdfunding campaign?

Terminology

crowdfunding - краудфандинг - краудфандинг
promotion - өнімді алға жылжыту - продвижение
founder - негізін қалаушы - основатель

☆ Facts

If the product is liked by the backers, usually the funding amount exceeds the goal by multiple times over.

Activity

Gather a team of potential startup founders in your class. Prepare a presentation for other classmates about your product. Distribute 100 points worth of papers that will function as money for the activity.

Present your product to the classmates and calculate the amount of papers you were able to accumulate. The team with the most papers in hand will win the activity.

Think about how you found out about most popular apps that you are currently using? Why have you kept the app and have not deleted it?

Let's find out how to promote IT startup product to the market

PRODUCT MARKET FIT

Product implementation into the market consists of 2 major phases: product-market fit and scaling.

Product promotion starts with founders trying to find product-market fit after they build minimal viable product (MVP). Product-market fit is a continuous process of improving the product or service based on the initial customers' feedback and suggestions.

Product-market fit is a process of matching the product, customers and the business model together in a sustainable way.

Before scaling, founders have to ensure they are ready to scale:

Initially, the startup needs to dominate very small niche market, not try to challenge established markets. Founders need to personally work with the small number of interested early users.

Figure 5.3.1. Sales funnel

STARTUP SCALING

At the scaling stage of the startup, founders employ what is known as the sales funnel.

Definition: **sales funnel** is a marketing term for the journey of potential customers from mere interest to loyal following and payments.

The sales funnel stages of customer journey consist of awareness about product, interest in the product, evaluation of the product before buying, purchase, and at last, loyalty or continuous purchases.

The main goal of startup scaling is to create the user network effect.

Network effect is a startup phenomenon where the product gains additional value as more people use it.

Figure 5.3.2. Network effect

Facts ☆

The most successful tech companies employ network effects

ONLINE MARKETING CHANNELS

Startups implement the following marketing channels to draw customers into the sales funnel:

1. **Social Media Marketing or SMM**
   Social media offers unique community building opportunities for a startup. This makes it the best media channel for building brand and long term relationship with customers.

2. **Search engine optimization (SEO) or content marketing**
   Content marketing is a long term strategy to rank on top of search engine results for the most searched keywords related to your startup product.

3. **Pay per click (PPC)**
   Pay per click advertising involves paying big tech platforms to display your company's advertisement on top of search results or to target audience that fits you selected customer criteria. It is the most effective short term marketing method.

4. **Email marketing**
   Email marketing is the oldest form of online marketing but it is the most reliable. Email marketing is used for customers who subscribe to receive regular update emails from your company.

5. **Word of mouth marketing**
   Word of mouth marketing consists of referral programs and online reviews.
   The most successful startups spread through word of mouth.

Figure 5.3.3. Online marketing

- create marketing advertising (infographics, video)

When your social media friends share something with you, what type of information they share: video, infographic, meme, tweet, or a chart?

In this lesson we will learn how to advertise your product in the most effective way.

MAKE INFOGRAPHICS

Sharing infographics is one of the best ways to market your product or a service. It is a creative way to share data in simple to understand images. It is also easy to create infographics using a plethora of online infographics building tools. Generally, making infographics with online tools consists of 5 steps:

STEP 1.
Select a template related to your subject.
STEP 2.
Add textual information
STEP 3.
Add graphical and stylistic elements
STEP 4.
Insert data visualization elements. Those mostly include graphs, maps and videos.
STEP 5.
Save and share your infographic with the world.

MAKE MARKETING VIDEO

Making short to the point engaging video for social media is the way to rapidly share your product offer and to introduce yourself to thousands of people. Promotional social media video should not last long.

A good potentially viral social media video should be:
- Be designed for silent mode watch.
- Use large screen text that stimulates curiosity.
- Interest viewers in the first 5 seconds and be up to 1 minute long.
- Display compelling graphics
- Inspire immediate action. The viewer should click a button to find out more, or to make a purchase.

There are a number of online services that lets you build amazing short viral videos. Generally, you can make videos in 6 steps:
STEP 1.
Select a video template related to particular subject.
STEP 2.
Upload your photos and short clips to integrate them with the video template.
STEP 3.
Add your company logo and brand colors

Figure 5.4.1. Infographics

STEP 4.
Add messages and information to various video frames
STEP 5.
Add sound elements to particular video snippets
STEP 6.
Download and share your short video on social media.

PERSONAL BLOG

Personal blog on social media is proven to be one of the best ways to build long term trust with customers.

Mostly, social media blogs should have the following elements:

1. **It starts with sharing your story.**
   People love helping those who make their dreams come true. Share your story and aspirations.
2. **Build a movement around a cause**
   Discover the cause that keeps you up at night and build a community around it. Human beings are social creatures, they love uniting for a noble purpose.
3. **Be funny.**
   Entertainment attracts people of all ages. Make your followers enjoy the experience with you and your product.

Figure 5.4.2. Social media video

Activity

Divide the class into teams and each team should prepare video advertisement scenario and present your work to the class.

Practice

Use one of free online tools to make either a short engaging video or a infographic related to your potential startup product.

Figure 5.4.3. Blogging

🔒 Literacy

1. Why marketers use infographics?
2. What video would most likely generate more views on social media:
   a. 20 minute presentation
   b. 30 seconds news
   c. 1 minute life story with large text descriptions.

📖 Terminology

advertisement - жарнама - реклама
snippets - үзінділер - фрагменты
entertainment - ойын-сауық - развлечения
template - шаблон - шаблон

1. Which of the following is not the stage of startup lifecycle:

    a. Formation

    b. Education

    c. Growth

    d. Validation

2. What is a Minimum Viable Product?

    a. startup product ready for adoption by mass market

    b. any software product

    c. software product for a particular hardware

    d. a product with just enough features to satisfy early customers

3. Why startups need crowdfunding:

    a. For marketing

    b. For funding

    c. For product feedback

    d. All of the above

4. How is crowdfunding executed?

    a. As a bank loan

    b. As government subsidy

    c. As venture capital round

    d. As a campaign on crowdfunding platform

5. Find marketing method below which is not online:

    a. Social media marketing

    b. Pay per click

    c. Friends recommending each other a product in office

    d. Referral program

6. A good social media marketing video should:

    a. Engage viewers in the first seconds

    b. Be not very long

    c. Use large text

    d. All of the above

7. What is the best way to build a long term audience for your personal blog:

    a. Launch a crowdfunding campaign

    b. Launch a social media marketing campaign

    c. Be honest and share your story and aspirations

Answer the following questions:

8. Find 3 different startups (national or international) that are currently at one of 3 startup lifecycle stages.

9. Please identify features of a minimum viable product for a social media startup.

10. Find one startup that has currently launched a popular crowdfunding campaign. Determine what this startup needs funding for. List all the reasons why this startup's crowdfunding campaign is successful.

11. Come up with an online marketing strategy for a referral program of your startup product. Determine who and why should people on social media share your marketing post. Test the result by launching a real world marketing campaign for your hypothetical startup idea on a popular social network.

12. Create a short compelling video about your startup idea using your smartphone and share it with your friends on social media. Compare the results (likes, shares, comments) with your classmates. Find out why people engaged with one video more than with others.

13. Build a personal blog on any popular social network discussing your startup idea and what led you to discover the idea. Use online marketing strategies discussed in the chapter to promote your blog. Report results and why your blog was/was not successful.

6 CHAPTER

DIGITAL LITERACY

You will

- Learn about digita- lization process in Kazakhstan

Which process would you like to digitalize from your daily life?

DIGITAL KAZAKHSTAN

About the program

Digital Kazakhstan is a program designed to accelerate the development pace of the economy and improve the quality of our citizen's life.

Figure 6.1.1.

The main goals of the program are to accelerate economic growth, upgrade the living standards, and create conditions for the new future digital economy.

1. Implementation and development of digital technologies in key sectors of the country's economy.

2. Providing Kazakhstan citizens with ubiquitous broadband Internet access and mobile communication 4G (in the future 5G).

3. Improving the quality and increase the number of public services provided online.

4. Creating new opportunities and conditions for entrepreneurs through the development of e-commerce.

5. Increasing the digital literacy of the population, which will contribute to the development of the domestic IT sector, improve the quality of education and healthcare.

Facts ☆

Important stages in the development of the e-government of the Republic of Kazakhstan.

2006
eGov

2010
e-Government purchases

2011
e-Pay

2012
e-License

2013
e-Business Registration

2014
e-Judicial office

2015
e-Healthcare

2016
Open government

2017
Digital Kazakhstan

FIVE KEY DIRECTIONS OF PROGRAM IMPLEMENTATION

Will be carried out in the period of 2018-2022

1. Digitization of the economy branches

Reorganization of the RK economy traditional branches using innovative technologies and possibilities, which increase productivity and lead to capitalization growth.

2. Transition to the digital state

State infrastructure transformation to provide services for population and business.

3. Implementation of the digital Silk Way

Development of high speed and security infrastructure of the transfer, storage, and processing of data.

4. Evolution of the human capital assets

Transformational changes, comprising creative society formation and transition to the new realities – knowledge-based economy.

5. Innovative ecosystem formation

Creation of the conditions for technological entrepreneurship development with stable relations between business, academic domain, and state, as well as the introduction of innovations into industry.

All the projects, realized within the framework of the "Digital Kazakhstan" program will facilitate the efficiency and transparency of the government control, ensure local employment, improve the quality of education and healthcare service, as well as increase labor efficiency and the growth of the small and medium business.

Activity 2

Group work:
1. Make small research about the difference in the quality of any public service in your city before and after digitizing.
2. Create an infographic poster.

Terminology

digitalize - цифрландыру - оцифровывать
broadband - кең жолақты - широкополосный
entrepreneurs - кәсіпкерлер - предприниматели
implementation - іске асыру - реализация

☆ Facts

Kazakhstan ranks the 33rd place in the world rating of the United Nations on the index of e-government development.

It consists of indicators of human capital development, telecommunications infrastructure, and online services.

Activity 1

Work in pairs:
1. Which public services provided online do you use often in your everyday life?
2. Discuss the problems you faced.

Practice

1. Analyze the program «Digital Kazakhstan» and its main directions.
2. Which directions are most digitalized and which ones are least digitized in this period?

🔒 Literacy

1. What is digitalization?
2. What are the main aims of digitizing government services?
3. At which stage of digital transformation is Kazakhstan now?

You will

- Analyze current trends in the digitalization process in Kazakhstan

What are the latest trends in information technology?

FIVE TRENDS OF THE PROGRAM

Digitization of all the spheres of Kazakhstan life and economy is the opportunity to occupy the frontline on the world scene, as well as to enhance the quality of public life and to establish favorable conditions for entrepreneurial development. In this regard, a set of measures at five key directions has been elaborated by the program "Digital Kazakhstan".

5 KEY DIRECTIONS OF THE PROGRAM AND THEIR TASKS:

Practice 1

Work in pairs:
1. Discuss the digitization of economic branches.
2. Have you ever used e-commerce services?
3. Which non-cash payment technologies you have used? For which services?

1. Digitization of economic branches

Digital economy is the utility of the on-line possibilities and innovative digital technologies both for the large enterprises and for small and medium businesses.

- Digitalization of industry and **electric power industry**
- Digitalization of **transport** and **logistics**
- Digitalization of **agriculture**
- The development of **electronic commerce**
- Development of **financial technologies** and **non-cash payments**

2. Transition to the digital state

Digital state means open, transparent and convenient opportunities for citizens and business, accessible online and at any time.

- **Government-to-citizens**
- **Government-to-business**
- Digitization of internal activity of state bodies.
- **Smart cities**

Activity 1

Group work:
1. Discuss the smart cities and their advantages and disadvantages.

3. Realization of the Digital Silk Way

The Digital Silk Way provides **speed** and **secure** access to the **Internet**, as well as a good quality of the mobile communication coverage on the country's territory (Figure 1).

- Expansion of coverage of **communication networks** and **ICT infrastructure**
- **Information security** in the ICT field
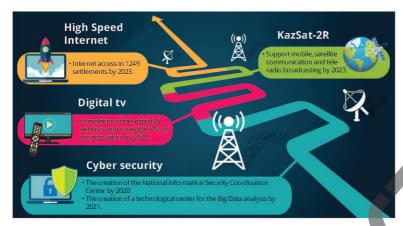
Figure 6.2.1. Digital Silk Way

4. Evolution of the human capital assets

Evolution of the new competence and digital literacy of the population will become possible due to the innovations in education.

- Increasing **digital literacy** in **secondary, technical and higher education**
- Increasing the **digital literacy** of the **population** (training, etc.)

5. Creation of an innovative ecosystem

It develops technology **entrepreneurship** and **innovations** with genuine links among business, academic domain, and state.

- Support for **innovative** development **sites**
- Development of **technological entrepreneurship** and s**tart-up** culture.
- Attracting venture financing
- Forming the **demand** for **innovation**

Activity 2

Group work:
1. Create a simple infographic poster that represents your dream smart school.
2. Compare your dream smart school with your current school.

Terminology

trends - тенденциялар - тренды
digitization - цифрландыру - оцифровка
non-cash payments - қолма-қол ақшасыз төлемдер - безналичные платежи
human capital assets - адами капиталы - человеческий капитал

Keep in mind

Useful IT-services in Kazakhstan

State and commercial services that you can get online:

State services E-government:
www.egov.kz
www.goszakup.gov.kz
www.elicense.kz
cabinet.salyk.kz
office.sud.kz

Startups:
most.com.kz
qaztech.vc
techgarden.kz
www.damu.kz

Education:
www.kundelik.kz
www.bilimland.kz
www.ustudy.kz
www.astanakitap.kz

Health care
www.i-teka.kz
www.zdrav.kz
www.idoctor.kz
www.polikliniki.kz
umc.org.kz

Literacy

1. What are the current trends in digitalization process in KZ?
2. What does Digital SlikWay mean?
3. Which opportunities, digitalization program opens for citizens and business?

121

⊘ You will

- Analyze digitalization process in education system

Which services would you digitize in education process?

EVOLUTION OF THE HUMAN CAPITAL ASSETS

"Digitalization is not an objective, but it is rather a means to achieve Kazakhstan absolute advantage."

Nursultan Nazarbayev

Evolution of the new competence and digital literacy of the population will become possible due to the innovations in education.

What will be changed by 2022:

The share of Internet users will grow to

82%

The level of digital literacy of the population will increase to

83%

The system of secondary, higher and additional education will meet the needs of the digital economy

DIGITALIZATION IN EDUCATION

To create a digital society it will be need to update the education system in accordance with the best world practices.

Emphasis will be placed on the development of creative and critical thinking, as well as the use of modern educational technologies in the learning process.

Facts ☆

Kazakhstan has the lowest rate of no school attendance for countries in eastern and central Europe.

The rate of primary attendance is 91% while the rate of secondary attendance is 92%.

Secondary education

- Introduction of **programming basics** in primary school classes.
- Updating the content of the subject "Informatics" through updating the programming languages **Java**, **C**, **Python**, etc.
- Introduction of the **foundations of entrepreneurship** and business (including technical entrepreneurship).
- Conducting **hackathons**, **olympiads**, and **competitions** in technical areas.
- Digitalization of the educational process.

Higher education

- Introduction of new specialties in higher educational institutions (**data science, artificial intelligence, cloud computing**, etc.).
- Increase in the number of state **grants for ICT specialties**.
- **Integration of ICT** in the disciplines of all specialties for **80% of universities**.
- Development of **distance education** through the creation of a national platform for **open education**.
- Opening of **ICT departments** of universities on the basis of productions.

Continuing education

Providing basic and professional **digital skills** training for:

- 100 thousand professionals
- SME representatives
- population

Development of **professional standards** of economic sectors taking into account the requirements of **ICT skills**.

Activity 1

Group work:
1. Discuss the highly valued competencies that are given at «Keep in mind».
2. Which skills would you add to these competencies?

Activity 2

Group work:
1. Discuss. Skills vs knowledge: which is more important?

Activity 3

1. Make small research and analyze the digitalization processes in education area in your school, city, region.
2. Which processes would you like to be digitized that are not digitized yet?
3. Create simple infographic poster.

Literacy

1. Which updates and transformations are expected in education system?
2. At which stage of digital transformation is our education system?

Terminology

digital literacy - сандық сауаттылық - цифровая грамотность
critical thinking - сыни ойлау - критическое мышление
entrepreneurship - кәсіпкерлік - предпринимательство
cloud computing - бұлтты есептеу - облачные вычисления
digital skills - сандық дағдылар - цифровые навыки
competencies - құзыреттілік - компетенции

WHAT WILL CHANGE BY 2022

- Quality and continuous coverage with a 4G cellular network.
- Country-wide broad bandwidth access to global data transfer networks
- The level of ICT development will reach the level of TOP-30 countries
- Innovative laboratories for Big Data, malicious code, and cyber incidents analysis will be created to reinforce cybersecurity

ICT INFRASTRUCTURE

Availability, stability, and security of data transfer is the technological basis of the development of all branches of economy as well as high quality of the population's life.

All this will be implemented with the help of the following digital and infrastructural solutions.

Broadband access

Broadband access to the internet that will be provided mostly via fiber-optical communication lines.

4G network (5G)

The most up-to-date generation of the cellular network allows transfer data at the speed higher than 100 Mbit/s. The 5G standard implementation is expected after 2020.

KazSat-2R

Kazakhstani communication satellite that will support mobile, satellite communication and television and radio broadcasting after 2023.

How the population will be provided with broadband Internet access, quality cellular communication, and digital television and radio broadcasting

2018 More than 100 thousand people from more than 55 rural settlements have BBA to the internet.

2019 More than 1.2 million people from more than 55 rural settlements have BBA to the internet.

2020 More than 800 thousand people from more than 741 rural settlements have BBA to the internet.

2023 The commissioning of "KazSat-2R" space communication system.

CYBER SECURITY

Enhancement of cybersecurity will be implemented using both technical means and the creation of safe behavior in the net of citizens and companies.

It will happen thanks to the following digital solutions.

Big Data analysis

This analysis and processing of important information represented by huge arrays of data.

Malicious code analysis

This is the analysis of computer programs, most often viruses, that harm users and their software.

Information security

Mandatory requirements or recommended standards of the safe usage of information systems.

🔒 **Literacy**

1. What are the main goals of Digital Silkway program?
2. What kind of changes in the IT sector is waiting for us in nearly future?
3. At which stage of realization Digital Silkway program is now?

What measures will be taken to provide cyber security in the country

2019 Development and approval of national standards onn information security.
The equipment of an information security means research laboratory.

2020 The creation of the National Information Security Coordination Center.
The equipment of a malicious code research laboratory.
The equipment of an information security testing laboratory.

2021 The creation of a technological center for the Big Data analysis.

Terminology

cellular network - ұялы желі - сотовая сеть
bandwidth - өткізу қабілеті - пропускная способность
cybersecurity - киберқауіпсіздік - кибербезопасность
fiber-optical - талшықты-оптикалық - оптоволокно
satellite - жерсерік - спутник

You will

- explain the purpose and principles of the Blockchain technology

Have you ever paid for a product online? How does online payment work?

WHAT IS BLOCKCHAIN?

Blockchain is a data structure that consists of the chain of blocks. Block is an object which typically consists of a header, timestamp, counter and transactional data. Blocks are connected sequentially by including an encrypted data of the previous block to the next block object. Thus, blockchain is a chronological linked list of cryptographically connected blocks with transaction data.

Figure 6.5.1. A chain of blocks

Transactions are records of change of a particular state. For payment blockchain, transaction signifies a change in the amount of tokens a wallet owner has. For smart contract blockchain, a transaction occurs when a small program is executed.

Transactions recorded inside chronological chain of blocks help to track the balance of all wallets using the blockchain.

BLOCKCHAIN NETWORK

A blockchain network is a decentralized network of computers called nodes. Each node stores a copy of blockchain acquired from the peer node. Nodes communicate with each other directly on a peer-to-peer basis without any intermediary. Each node tries to completely synchronize with peer nodes by verifying all transactions and block encryptions. The total synchronization among peer nodes is called decentralized consensus. Decentralized consensus allows transactions to be recognized universally by all nodes.

Facts ☆

Blockchain based cryptocurrency market is the fastest growing asset class of the last decade

Figure 6.5.2. Blockchain network

NEW INTERNET PROTOCOL

Since its emergence, the internet has been continuously evolving. The process of the evolution of the web can be described by 3 major stages.

Web 1.0 is an initial stage of internet development with open network protocols such as TCP/IP systems and World Wide Web introduced in 1990 by Tim Berners-Lee along with Hypertext Markup Language (HTML) web page representation. Web 1.0 allowed millions of computers to interact through open protocols.

Growth in communication network and web development capabilities had given rise to tech giants such as Google and Facebook in the mid 2000s. These new companies build fast, reliable and user-friendly closed commercial networks. This stage of internet development is known Web 2.0 era.

Figure 6.5.3. WEB 3.0 model

Web 3.0 is a new stage of the evolution of the internet characterized by decentralized blockchain networks. Blockchain network based on mutual consensus mechanism creates secure data transfer protocol and allows the exchange of not only information, but digital value. Web 3.0 is also known as the internet of value.

127

- explain the purpose and principles of the Blockchain technology

How is traditional database protected from tampering with information stored inside it? What are its weak points?

Let us discover step by step how blockchain actually works.

ASSYMMETRIC CRYPTOGRAPHY

What is cryptography? Cryptography is a branch of applied mathematics to study techniques of secure communication. Assymetric cryptography is based on different but mathematically related public-private key pair for encrypting and decrypting the message. Open public address is used for encrypting or verifying the ownership of the message, whereas secret private key is used for decrypting or signing the message. In the case of blockchain, public-private key pair is used for signing the message and verifying the ownership of the signature.

HASH FUNCTION

Hash function is based on cryptographic algorithm called secure hash algorithm. Secure hash algorithm takes a data input and produces an encrypted value known as hash value. A hash value consists of hexadecimal numbers (0-9, a-f). For example, the phrase "Alice gave Bob 5 coins" inserted into SHA-256 hash function produces the following hexadecimal value: 1dda87933b1f91dba0500eb93e83066d6244c172962aee6355a92ed71a61529c which consists of exactly 64 symbols.

Another property of SHA-256 algorithm is that it produces exactly 64 symbols regardless of the amount of the input data.

BLOCK

Block can be regarded as an object with key-value pairs, which consists of the following typical key data:

block index, hash value of the message, hash value of the previous block message, timestamp, counter.

Figure 6.6.1. The process of signing and verifying the message

Figure 6.6.2. Secure hash algorithm

Figure 6.6.3. Block

BLOCKCHAIN

Blockchain is a data structure comprised of the linked list of blocks. The present block contains a hash value of the previous block, thus chronologically linking two consecutive blocks. A previous block contains all messages or transactions that occurred before the present block.
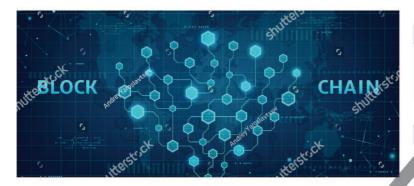
Figure 6.6.4. Blockchain

PROOF OF WORK AND NETWORK CONSENSUS

Proof of work is the process of discovering such a block hash value that produces a set number of zeros in front of the hash value. This is achieved by varying counter number inside the block. A particular counter number will yield the desired hash value.

Every node inside blockchain network needs to verify the following before accepting data from peers:
1. Nodes are incentivized to constantly execute proof of work and mine new blocks through token rewards.
2. Node authenticates the public address sending transaction
3. Node confirms whether public address sending transaction owns enough balance
4. Node verifies whether the present block data produces the hash value provided with the block
5. Node verifies whether the previous block's data produces the hash value provided within the present block
6. Node checks if proof of work has been established in producing block hash value

Consensus among nodes is automatically reached whenever nodes agree on a particular version of blockchain by verifying the above information.

Figure 6.6.5. Block with proof of work has 4 zeros in front of its hash value. 4 zeros are achieved by varying a counter until number 35298 yield the needed result.

- discover main applications of blockchain technology

Name any popular blockchain project you know of. Why does it use blockchain technology?

Figure 6.7.1.

Figure 6.7.2.

Practice

Deploy a 5 block blockchain with "4 zeros" PoW requirement. Then try to alter it by using 1 computer (node) that remine the information inside the blockchain starting from block number 1.

At the same time, use 2 computers (nodes) to mine 6th, 7th and other consecutive blocks.

Find out, which group of nodes (2 nodes vs 1 node) can mine 15 blocks first. Explain reasons why the blockchain is tamper-proof.

WHY DO WE NEED BLOCKCHAIN?

Blockchain is also known as Distributed Ledger Technology (DLT). DLT is a database innovation. Just like relational databases that impacted the organization of enterprises, DLT can fundamentally transform organizations toward scalable networks.

All blockchain applications are based on its key differentiating properties:

- **Immutability**
  Information inside blockchain is stored in chronologically encrypted format, which makes it impossible to tamper with data.

- **Trust automation**
  DLT allows network participants to delegate trust to cryptographic algorithms, which eliminates the possibility of human error.

- **Fault tolerance**
  Corruption of some nodes will not affect the blockchain network's security. This makes blockchain robust and agile against cyber attacks.

- **Transparency**
  All blockchain data is inherently transparent. This makes blockchain attractive for any processes that require openness.

BLOCKCHAIN USE CASES

Here are some of the areas blockchain technology is currently being implemented in:

- **Cryptocurrency**
  Cryptocurrency is a cryptographically secure decentralized digital unit of account. Cryptocurrencies eliminate all intermediaries in transactions.

- **Smart contract**
  Data inside blockchain can be not only static, but also programmable. People use contracts to put conditions on exchange

of money. In the same way, in the digital world, trading parties can exchange digital money using cyber contracts executed on blockchain. These digital contracts are known as smart contracts. Smart contracts are executed automatically as required conditions are gradually met without the need of any intermediary.

- **Smart property**

Blockchain can extend the concept of personal property by embedding cryptographic digital lock into the physical item. The lock can only be opened by the owner of the private key. Such cryptographically secured property is called smart property. Information about the smart property and the public address that it belongs to can be stored inside blockchain, thus securing its ownership.

- **Internet of things**

As the number of sensors and smart connected devices exponentially increases every year, the world is about to see the full potential of the internet of things realized. However, the security of IoT networks still is an open question. DLT secures data storage and data exchange, which makes it very promising security solution for IoT networks.

- **Supply-chain**

Modern supply-chain industry still uses outdated verification mechanisms and paper records. Blockchain can make supply-chain networks more transparent and immutable, strengthening the customer confidence in the product integrity.

- **Identity verification**

Anywhere we go, and anything we do, we always need to prove our identity: from logging in to websites to receiving government services. Blockchain allows one to make his or her identity personal, eliminating the need to store the ID in third party databases. This is especially relevant for personal data protection on the internet.

Figure 6.7.3.

Activity

Divide the class into groups. Each group needs to come up with a new startup based on one of listed blockchain applications. This startup needs to solve a particular local problem in your city or country.

Terminology

enterprise - кәсіпорын - предприятие
immutability - өзгермейтін - неизменность
fault tolerance - қателіктерге төзімділік - отказоустойчивость
cryptocurrency - криптовалюта - криптовалюта
supply-chain - логистикалық тізбек - цепочка поставок
confidence - сенім - уверенность

🔒 | Literacy

1. List 4 properties of blockchain technology

131

You will

- justify the need to protect information and intellectual property (laws on copyright)

"Each product of human thought and activity has its value. Every citizen has a legal right to protect their own inventions, works of science, literature and art, the other results of intellectual activities."

(Article 14 of the Civil Code of the Republic of Kazakhstan).

What would you do if you invented a brand new product?
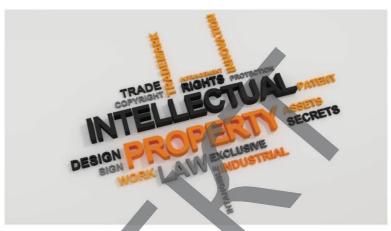
Figure 6.8.1.

INTELLECTUAL PROPERTY

Intellectual Property (IP) is defined as any "original creative work manifested in a tangible form that can be legally protected".

When we speak of Intellectual Property rights, we refer to controlling the way Intellectual Property is used, accessed or distributed. The **World Intellectual Property Organization** (WIPO), an organ of the United Nations, suggests laws to enforce Intellectual Property rights worldwide. The convention establishing the WIPO concluded on July 14, 1967 that:

Intellectual property shall include rights relating to:

1. literary, artistic and scientific works,
2. performances of performing artists, phonograms and broadcasts,
3. inventions in all fields of human endeavor,
4. scientific discoveries,
5. industrial designs,
6. trademarks, service marks and commercial names and designation,
7. protection against unfair competition, and all other rights relating to intellectual activity in the industrial, scientific, literary or artistic fields.

Figure 6.8.2. Copyright symbol

Facts ☆

The First Patent of the Republic of Kazakhstan was issued to the name of A.B.Bekturov Institute of chemical sciences.

WHY INTELLECTUAL PROPERTY RIGHTS SHOULD BE PROTECTED?

One reason for Intellectual Property laws is to allow Intellectual Property creators to benefit from their work. If artists create paintings after months of labor, then they deserve credit for

painting them and the income from selling or exhibiting them. If a business comes up with an attractive marketing logo, then no other businesses should be allowed to use that logo to promote their own products without permission.

Protecting IP is also seen as a method of promoting creativity. If no one is allowed to copy another person's work without permission then creativity is encouraged for everybody.

INTELLECTUAL PROPERTY IS DIVIDED INTO TWO CATEGORIES:

Industrial Property - patents, trademarks and industrial designs.	**Copyright - includes works of art, literature, music and more recently computer programs**

COPYRIGHT

The **copyright** – is the personal non-property and property rights of the author. Copyright (Figure 6.8.2) offers protection for original works of authorship.

An **author** – is an individual, who created the works of science, literature, or art.

INDUSTRIAL PROPERTY

Industrial property is one of two subsets of intellectual property (the other being copyright). The object of the industrial property consists of signs conveying information, in particular to consumers, regarding products and services offered on the market. Protection is directed against unauthorized use of such signs that could mislead consumers, and against misleading practices in general.

PATENT

A patent is a form of intellectual property that gives its owner the legal right to exclude others from making, using, selling, and importing an invention for a limited period of years, in exchange for publishing an enabling public disclosure of the invention.

☰ Activity

1. Make small research on how Intellectual Property protection law works in Kazakhstan and in other countries.
2. Compare them.
3. Give examples.

🔒 Literacy

1. What is Intellectual Property protection?
2. Why do we need to protect our information or intellectual properties?

☆ Facts

Copyleft (Figure 6.8.3) is a type of copyright license that allows redistributing the work (with or without changes) on condition that recipients are also granted these rights.

Figure 6.8.3. Copyleft symbol

🔤 Terminology

intellectual property - зияткерлік меншік - интеллектуальная собственность
human endeavor - адамның талпынысы - человеческие усилия
unfair competition - жосықсыз бәсекелестік - недобросовестная конкуренция
invention - өнертабыс - изобретение
convey - жеткізілім - передать
consumers - тұтынушылар - потребители
issued - шығарылды - выпущен

133

Figure 6.9.1.

In this lesson, we will learn what relates to intellectual property rights and how to protect it.

TYPES OF INTELLECTUAL PROPERTY RIGHTS

If you are the author of the product of creative or intellectual property, you initially have the **moral** and **economic rights**. This means that even if you pass in the future your work to anyone, moral rights remain yours. **The authorship is inalienable and non-transferable.**

The author also has the exclusive right - property law - intellectual property, which allows the results to dispose of at his discretion: to sell, in whole or in part allowed to use or dispose of it.

PROCEDURE FOR REGISTRATION OF RIGHTS TO WORKS OF INTELLECTUAL AND CREATIVE ACTIVITIES

Intellectual Property Committee of the Department of Intellectual Property of the Ministry of Justice of the Republic of Kazakhstan provides . These works include:
- literary, scientific, dramatic scenario;
- musical compositions, and musical-dramatic works;
- choreographic works, pantomimes, audiovisual works;
- works of architecture, urban planning, landscape architecture;
- paintings, sculptures, drawings, fine and applied arts;
- photographic works, as well as maps, plans, sketches, illustrations and three-dimensional works relative to geography, topography and other sciences;
- programs for the computer or databases.

In order to register the rights to these objects, you must provide a completed application, a copy of the identity document, and a copy of the work or pre-recorded media audiovisual works, sketches, drawings or other materials, depending on the type of the activity.

Keep in mind

In order to patent the invention, it is necessary to submit an application to the RSE "National Institute of Intellectual Property" of the Ministry of Justice of the Republic of Kazakhstan or the web portal of "electronic government".

NOT RECOGNIZED AS INVENTIONS

According to Article 6 of the Patent Law of the Republic of Kazakhstan, followings are not recognized as inventions:
- discoveries, scientific theories, and mathematical methods;
- methods of organization and management;
- symbols, schedules, and rules;
- rules and methods for performing mental acts, the games;
- computer programs and algorithms;
- projects and plans for structures, buildings, and territories;
- proposals only the appearance of products;
- proposals that are contrary to public order and the principles of humanity and morality.

INTELLECTUAL PROPERTY CRIME

Figure 6.9.2.

Intellectual Property crime is committed when someone uses an intellectual property right without the authorization of its owner. Counterfeiting and piracy are terms used to describe a range of illicit activities related to Intellectual Property Rights infringement. Most **counterfeit goods** infringe a trademark, which means that a good is produced without the authorization of its rights holder. **Piracy** refers to the illegal use of literary and artistic works protected by copyrights.

Activity

1. Make research and find examples of registered intellectual property from Kazakhstan.
2. Intellectual property rights related to which fields are most registered in Kazakhstan?
3. Find examples of intellectual property crime.
4. In which field most intellectual property crimes are done?

Literacy

1. How to register intellectual property?
2. What is intellectual property crime?

Terminology

inalienable - ажыратылмайтын - неотчуждаемый
exclusive right - айрықша құқық - эксклюзивное право
infringement - құқық бұзушылық - нарушение
illicit activities - заңсыз қызмет - незаконные действия
counterfeit goods - контрафактілік тауарлар - контрафактная продукция
piracy - қарақшылық - пиратство

WHAT IS AN ELECTRONIC SIGNATURE?

Electronic signatures (or e-signatures) are an "electronic sound, symbol, or process, attached to or logically associated with a contract or other record and executed or adopted by a person with the intent to sign the record."

In other words, an e-signature is a digitized version of your handwritten signature. It can be used to indicate the intent to approve or accept the contents of a document.

What makes electronic signatures popular?

E-signatures' greatest advantage is that they are easy to use. They allow users to sign documents online with the click of a mouse, or trace their handwritten signature using a finger or a stylus.

WHAT IS A DIGITAL SIGNATURE?

A digital signature is a specific technical implementation of some electronic signatures by applying cryptographic algorithms. Therefore, they refer to the coded/decoded technology in which some electronic signatures.

Keep in mind

Encryption – Process of converting electronic data into another form, called cipher text, which cannot be easily understood by anyone except the authorized parties.This assures data security.

Decryption – Process of translating code to data.

Figure 6.10.1.

The digital signature is like a lock on a document. It requires the existence of an official certificate issued by a body or institution that validates the signature and the identity of the person performing it.

What makes digital signatures popular?

Digital signatures leverage cryptography to provide proof of the integrity and origin of each signature, thus providing for non-repudiation.

FOR AN OVERVIEW OF THE COMPARISON BETWEEN THESE TWO SIGNATURES, PLEASE SEE THE TABLE BELOW.

Electronic Signatures	Digital Signatures
It uses a wide array of methods such as email, enterprise ID or phone verification, to authenticate signer identity.	It leverages certificate-based ID to authenticate signer identity.
It leverages an audit trail to demonstrate the proof of signing a document.	It binds each signature to the document via encryption, to demonstrate the proof of signing.

All digital signatures are electronic, but not all electronic signatures are digital

Electronic Signature   Digital Signature

Figure 6.10.2.

Activity

Group work:
1. Integrate Digital Electronic signature to your Smart school concept.
2. Create simple poster presentation.

Terminology

electronic signature - электрондық қолтаңба - электронная подпись
handwritten signature - қолтаңба - рукописная подпись
encryption - шифрлау - шифрование
decryption - шифрын ашу - дешифрование
non-repudiation - қабылдамау - безотказность
verification - тексеру - проверка
authentication - аутентификация - аутентификация

Literacy

1. What is the difference between Digital and Electronic signature?
2. Where do we usually use a digital electronic signature?

Digital Signature Certificate

ALGORITHM FOR USING DIGITAL SIGNATURES

Digital signatures are based on public key **cryptography**, also known as asymmetric cryptography. Using a public key algorithm, such as RSA, one can generate two keys that are mathematically linked: one **private** and one **public**.

When a signer electronically signs a document, the signature is created using the signer's private key, which is always securely kept by the signer.

The mathematical algorithm acts like a cipher, creating data matching the signed document, called a hash, and encrypting that data. The resulting encrypted data is the digital signature. The signature is also marked with the time that the document was signed. If the document changes after signing, the digital signature is invalidated.

WHAT IS PUBLIC KEY INFRASTRUCTURE (PKI)?

Public Key Infrastructure (PKI) is a set of requirements that allow (among other things) the creation of digital signatures. Through PKI, each digital signature transaction includes a pair of keys: a private key and a public key.

PKI enforces additional requirements, such as the **Certificate Authority (CA)**, a digital certificate, end-user enrollment software, and tools for managing, renewing, and revoking keys and certificates.

WHAT IS A CERTIFICATE AUTHORITY (CA)?

Digital signatures rely on public and private keys. Those keys have to be protected in order to ensure **safety** and to avoid forgery or malicious use. CAs, a type of Trust Service Provider, are third-party organizations that have been widely accepted as reliable for ensuring key security and that can provide the necessary digital certificates.

HOW DIGITAL SIGNATURES WORK
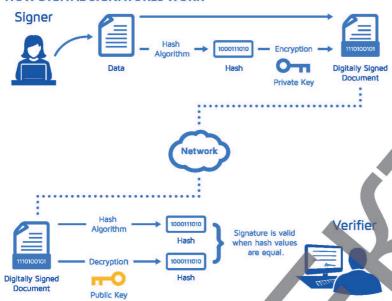
Figure 6.11.1.

To create a digital signature, signing software - such as an email program, creates a one-way hash of the electronic data to be signed. The private key is then used to encrypt the hash. The encrypted hash, along with other information, such as the hashing algorithm, is the digital signature.

The reason for encrypting the hash instead of the entire message or document is that a hash function can convert an arbitrary input into a fixed length value, which is usually much shorter. This saves time as hashing is much faster than signing.

If the decrypted hash matches a second computed hash of the same data, it proves that the data hasn't changed since it was signed. If the two hashes don't match, the data has either been tampered with in some way, integrity, or the signature was created with a private key that doesn't correspond to the public key presented by the signer, authentication.

Activity

1. Make small research about algorithms used in the digital signature.
2. Create your own simple encryption and decryption algorithm.
3. Encrypt your message and send to your friend.
4. Decrypt message using your algorithm

Literacy

1. What are Public and Private keys? What are they used for?
2. How does a digital signature work?
3. What are the functions of Certificate Authority?

Terminology

cipher - шифр - шифр
enrollment - тіркелу - зачисление
safety - қауіпсіздік - безопасность
malicious - зиянды - вредоносный
forgery - қолдан жасау - подделка
tampered - бүлінген - подделан
unique - ерекше - уникальный

139

How to simplify the interaction between the state and citizens?

Figure 6.12.1. E-Gov.kz

ELECTRONIC GOVERNMENT AND ITS PURPOSES

Just try to imagine a society close in your perspective to the ideal one. Healthy, with a good job, a good level of life, favorable living environment – the list can be continued endlessly according to personal priorities be completed with necessary additional aspects.

But an essential part of that society is the state itself. The state that takes care of the citizens, that guarantees integrity and compliance with the law, that oriented to the needs and demands of citizens, with easy and available interaction – a state for people.

Development of information communicational technologies in Kazakhstan may guarantee the implementation of as minimum two last statements. The concept of "electronic government" has been developed for comfort, clear without obstacles communication between the state and the people.

> "Electronic government" was created for more effective, transparent and accessible work of government agencies.

DEVELOPMENT OF THE ELECTRONIC GOVERNMENT IN THE REPUBLIC OF KAZAKHSTAN

The idea of creation of the electronic government belongs to the President of the country and was announced almost 9 years ago. During this period passed four global stages of establishment and development of the electronic government. Each stage assisted in interaction processes between each Kazakhstani citizen with the state.

The first stage is informational.

At that particular time was launched electronic government web-portal filled with information. It provided information about state agencies, their work, and the services which they deliver to citizens.

At this stage, each Kazakhstan citizen could get necessary information – the list of necessary documents, the sizes of state duties, the contact information of state agency.

The second stage is interactive.

It was marked with the start of electronic services provision. The users of the web-portal had got an opportunity to send requests to different state agencies just staying at home without any losses of time. Introduction of interactive services at the electronic government web-portal seriously saved time for the paperwork.

At this stage were launched informational systems, state databases, electronic licensing and gateway of the electronic government.

The third stage is a transactional.

At this stage, citizens got an opportunity to pay for state taxes and fees, fines and utility services. If earlier citizens needed to go to banks, now the services can be paid and obtained online.

For entrepreneurs, the transactional stage presented a truly valuable gift – Government procurement. The benefits are obvious - increased transparency and openness of competitions, tenders.

The fourth stage is transformational.

It is the current stage of development. The main aim now is provision of services to citizens with maximum efficiency. For the achievement of this target interactive and transaction, services were combined within complex services which are demanded by the citizens of Kazakhstan. Citizens may register legal entity within just 15 minutes, accept ID card, passport or driver's license, etc. All of them have been transformed into electronic format.

Activity

Make research on the egov portal and answer the following questions.
1. Which online services for citizenry are on the portal?
2. Which online services are taken by citizens most on the portal?

Literacy

1. What does electronic government mean and its purposes?
2. What are the main advantages of implementing e-government?
3. At which stage of development is e-government in Kazakhstan now?

Terminology

favorable - қолайлы - благоприятный
electronic government - электрондық үкімет - электронное правительство
utility services - коммуналдық қызметтер - коммунальные услуги
demand - сұраныс - спрос

• describe the functions of the e-government portal

DIGITAL KAZAKHSTAN

To apply for obtaining of registration certificates of National Identification Center of the Republic of Kazakhstan is possible on www.pki.gov.kz web site in the «Get EDS key» section.

NCA RK may not issue a certificate if an applicant does not have his/her private and public keys. Therefore, to generate them, NCA RK provides applicants with cryptographic information security facilities certified in the Republic of Kazakhstan (CISF, Cryptoprovider).

Once an applicant submits application for obtainment of certificate on the pki.gov.kz website, the generation of private and public keys takes place on his hardware.

KEYS AND CERTIFICATES STORAGE

An applicant, when submitting application for certificate may choose between the following hardware as a storage place:

Your computer

Keys and certificates will be stored on hard disc of PC's devices as files protected with PIN code.
Advantage: Files can be easily used.
Disadvantage: Possibility of unauthorized copying.

Kaztoken

Keys and certificates will be stored on external media protected by PIN code.
Advantage: Private keys cannot be copied.
Disadvantage: Media must be purchased for money.

ID card

Keys and certificates will be stored on ID cards of citizens of the RK with electronic media.
Advantage: Private keys cannot be copied.
Disadvantage: Need to purchase card-reader for money.

E-Token

Keys and certificates will be stored on external media protected by PIN- code.
Advantage: Private keys cannot be copied.
Disadvantage: Media must be purchased for money.

JaCarta

Keys and certificates will be stored on external media protected by PIN- code.
Advantage: Private keys cannot be copied.
Disadvantage: Need to purchase card-reader for money.

PERSONAL ACCOUNT ON EGOV

Personal Account is a section of the e-government portal, which contains personal information about the user, collected from various state databases.

It's allowed to log in to the portal using several ways. You can log in with the help of IIN/password, Electronic Digital Signature, Electronic Digital Signature in SIM, and One-time password (Figure 6.13.1).

But **Access** to the personal account is available only to the portal user, while authorization using an **electronic digital signature** is required to view the full dossier. There will be no access to personal information when you log in with the help of an IIN/password or via SMS code.
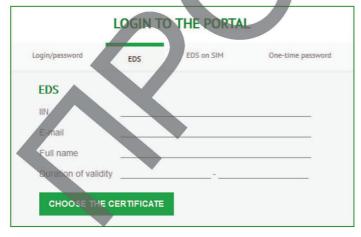
Figure 6.13.1. Log in to the personal cabinet

Activity

Compare the advantages and disadvantages of the ways of storing keys and certificates. Which way is more mobile and usable? Why?

🔤 **Terminology**

applicant - өтініш беруші - заявитель
advantage - артықшылығы - преимущество
disadvantage - кемшілігі - недостаток
cryptoprovider - криптопровайдер - криптопровайдер
dossier - құжаттама - досье

SERVICES ON PORTAL

As we said before, "Electronic government" was created for more effective, transparent and accessible work of government agencies.

The main function of e-government is to make available interaction between government and citizens. Today eGov portal the online services below are available for citizens (Figure 1):

Figure 6.14.1. Available online services for citizens

INFORMATION IS CONTAINED IN THE PERSONAL ACCOUNT

• Information on identity documents: their numbers and expiry dates;
• Address of residence and place of birth;
• Number and category of the driving license, if any, as well as its validity period;
• Information on the conclusion of marriage: date and place of registration, full name and IIN of the spouse, maiden name of the spouse;
• Status of the recipient of social payments and benefits (if any);
• Information about the availability of property, real estate (if available): its address and cadastral number;
• Information on participation in legal entities, if any;
• Information about the car;
• Availability of licenses by type of activity;

Figure 6.14.2. Mobile e-Gov.kz

- Presence or absence of the debtor's registry;
- Information about registration to a medical organization: name of the polyclinic, name of the local doctor, date of registration and number of the registration area;
- The status of an individual entrepreneur (if any);
- Information about children: names, IINs, dates of birth (to add the IIN of your child to the information system of the registry office, parents' IINs must be present in the record of the child);
- Information on contributions to compulsory social health insurance;
- Number of the queue of children in the kindergarten;
- Information about the queue for housing;
- Presence or absence of outstanding administrative fines;
- Information on the status of the state service from the IS "E-Kyzmet".

MOBILE APPLICATION

Within the framework of the "mobile government" project was generated the mGov mobile application (app) (Figure 2).

Mobile app may be used by the citizen of the Republic of Kazakhstan, registered in the Mobile government. Registration in mobile government is possible to get through the:
- Electronic government web-portal (EGP).
- Public Service Centers of the Republic of Kazakhstan (PSC).

In mobile e-gov the wide variety of services is available for user.

Personal Mobile Cabinet is established for user's personal data viewing. In personal mobile cabinet a user can see the information of user's registration and real estate address, automobile, registered penalties for traffic code violation, and etc.

In **Service catalogue** more than 50 state services are available for user (Figure 3), e.g. address reference, reference on convictions record, real estate, reservation of the turn in the queue at Public Service center (PSC), payment for mobile services and many other useful services.

OBTAINING SERVICES THROUGH TELEGRAM-BOT

Since when in 2015 Telegram launched a platform for creating bots, the messenger has become a convenient channel for obtaining a wide variety of online services.

In May 2018 eGov.kz also launched the first version of the e-government portal bot - **@EgovKzBot**. Many services are available through the bot. To get started with the bot, you need to be registered on eGov.kz and bind your phone number to the portal profile. Registration and binding of the phone is carried out strictly using EDS.

The Telegram messenger needs to be installed on your smartphone, to which your number is attached, and to search through the bot search by the name of @EgovKzBot. To start the bot, you need to click on the **Start** command and send the phone number via the menu.

Figure 6.14.3. Service catalogue

You will

- learn about Involving citizens in the participation in government

"Kazakhstan needs intellectual revolution that would enable to arise and fulfill our nation's huge potential"

Nursultan Nazarbayev

Why is it important that citizens participate in the government processes?

WHAT IS THE OPEN GOVERNMENT?

The main goal of the Open Government is to create a transparent accountable state, empower citizens to manage the state, strengthen the fight against corruption, and use new technologies to improve the effectiveness of public administration.

RELATIONSHIP BETWEEN CITIZENS AND THE STATE

Open Government will allow achieving transparency of government agencies' activities and e-gov users' expressing their opinions and getting prompt response and clarifications from agencies.

The Open Government consists of such components as: Open Data, Open Legalacts, Open Dialogue, Open Budgets, as well as Assessment of the Effectiveness of Government Agencies.

OPEN DIALOGUE

Establishing an effective feedback between government agencies and civil society
- **Accessibility -** Open dialogue between citizens and government.
- **Development of interest -** Citizens' capability to have an impact on government authorities.
- **Taking into consideration each citizen's opinion -** Public polling, voting, questionnaires, and surveys.

Figure 6.15.1.

OPEN LEGALACTS

Participate in the legislative process state
- **Accessibility -** Ensuring accessibility of draft legal acts to users.
- **Taking into consideration each citizen's opinion -** Enabling user feedback: commenting, voting.
- **Involvement of citizens -** Enabling generation of public vision on innovations promoting in the field of laws and regulations.
- **Transparency -** Ensuring preparation and submission of final reports for further analysis.

Figure 6.15.2.

OPEN DATA

Purpose of the project is to ensure transparency of activity through publication of datasets in machine-readable forms in a free access for Kazakhstan citizens

- **Accessibility -** Ensuring accessibility of data sets provided by government agencies.
- **Timeliness -** Ensuring capturing up-to-date information in various areas of government activities: statistical data, topographic information, social information.
- **Development of interest -**Ensuring public interest in further popularization of data sets
- **Authenticity -** Ensuring the displayed data correctness and authenticity.
- **User-friendliness -** Ensuring the convenience for citizens to use the data.

Figure 6.15.3.

OPEN BUDGETS

Ensuring transparency of formation and distribution of budget funds through citizen participation in the budget process

- **The reliability and timeliness -** Of published documents.
- **Transparency** - Creating and budget allocation.
- **Civic engagement -** Public discussion of the draft budget programs and reports on the implementation of budget programs. Vote "for" or "against" on the draft budget programs..
- **Availability -** Single access window to the budget, the consolidated financial statements, as well as the results of the state audit and financial control.

Figure 6.15.4.

EVALUATION OF THE EFFECTIVENESS OF THE GOVERNMENT AGENCIES

Ensuring the availability of the information about the results and the system of the evaluation of the performance of government agencies.

- **Availability -** Ensure the availability of information on the evaluation of the effectiveness of state bodies.
- **Transparency** - To see the results of the evaluation of the effectiveness of state bodies, see the rating.
- **Civic engagement -** Take part in public discussions on the work of state bodies.

Figure 6.15.5.

Activity

Which services on open government portal are popular between citizens?

Literacy

1. What is Open Government?
2. What are the main functions of Open Government?

Terminology

corruption
- жемқорлық - коррупция
legalacts - құқықтық актілер - правовые акты
legislative - заңнамалық - законодательная
user-friendliness - қолданушыға ыңғайлы - удобство для пользователя
convenience - ыңғайлылық - удобство

Answer the questions

1. What are the strengths and weaknesses of digitalization?
2. What will be changed by 2022 in the education sphere? Write your own opinion.
3. What are the opportunities and threats of digitalization?
4. What is public key?
5. What is private key?
6. Build a blockchain demonstration web app using any programming language that contains SHA256 hash function and public key generator libraries. Record the process step by step to determine how to create chronologically immutable cryptographic linked list (blockchain).
7. Come up with a hypothetical digital asset that is stored inside a blockchain. Give it a name and find out conditions for which it can be created in the blockchain. Try to exchange this asset among yourselves and determine what cryptographic technology should be used to identify the owner of a particular digital asset.
8. Build a blockchain smart contract based app that tracks the delivery of goods from point A to point B. Determine where you would need IoT solutions to be present in the smart contract to ensure the tracking is accurate.

Choose one correct answer

9. How many key directions have Digital Kazakhstan program?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5
10. Which key direction of the state program provides the development of innovations in education?
    a. Digitization of economic branches
    b. Transition to the digital state
    c. Realization of the Digital Silk Way
    d. Evolution of the human capital assets
    e. Creation of an innovative ecosystem
11. What is Digital Silkway?
    a. Name of the next generation internet
    b. Digital network of trade routes
    c. Development of a high speed and security infrastructure of the transfer, storage and processing of data.
    d. Creation of the conditions for technological entrepreneurship development
12. How do we call blockchain enabled internet:
    a. web 1.0
    b. web 2.0
    c. web 3.0
    d. web 4.0
13. What data can be stored inside the blockchain block?
    a. transactions
    b. programs
    c. identity
    d. all of the above
14. What is smart contract?
    a. AI enabled contract
    b. programmable transaction
    c. international legal contract
    d. legal contract written by lawyers
15. What is Intellectual Property protection?
    a. Protecting your personal account
    b. Legally protecting original creative work
    c. Protecting your personal data
    d. Legally Protecting information
16. Digital signature is ...?
    a. A technical implementation of electronic signatures by cryptographic algorithms.
    b. Digital version of handwritten signature
    c. Encryption method of the digital document
    d. Decryption method of the digital document

Multiple answer question

17. Sellect the ways of logging in to the Personal cabinet on e-government portal.
    a. IIN/Password
    b. One-time password
    c. Email account
    d. EDS
    e. EDS on Sim
    f. Social Media account
    g. Phone number

A

Algorithm - a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

Artificial intelligence - simulation of human intelligence processes by machines, especially computer systems.

Activation function is the function in an artificial neuron that delivers an output based on inputs.

Assymetric cryptography - a branch of cryptography related to the different but mathematically linked cryptographic key pair used for encrypting and decrypting messages.

B

Block - an object which typically consists of a header, timestamp, counter and transactional data.

Blockchain - a chronological linked list of cryptographically connected blocks with transaction data.

Blockchain network - a decentralized network of computers called nodes.

C

Classification the action or process of classifying something.

Cryptocurrency - cryptographically secure decentralized digital unit of account.

Crowdfunding - a method of funding a startup product completion by raising money from large amount of users online.

D

Deep Learning - Deep learning is part of a broader family of machine learning methods based on artificial neural networks.

Data - facts and statistics collected together for reference or analysis.

Decision Tree - is a decision support tool that uses a tree-like model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility.

Decentralized consensus - a total data synchronization protocol among peer nodes.

E

Epoch a period of time, especially one in which there are new developments and great change

Ensemble Methods - meta-algorithms that combine several machine learning techniques into one predictive model in order to decrease variance (bagging), bias (boosting), or improve predictions (stacking).

F

Features - distinguishing characteristic of a software item.

Fault tolerance - the ability of the computer network to remain productive and efficient despite the corruption or failure of some of its nodes.

G

Growth hacking - a low cost marketing strategy to help startups attract massive amount of customers in the shortest time possible.

H

Hash function - a cryptographic algorithm called secure hash algorithm that takes a plaintext input and converts it to the ciphertext output.

I

IT Startup - a company producing and distributing software product initiated by one or more founders and designed to rapidly scale

Immutability - the attribute of data stored inside a database that prevents it from getting tampered.

Iteration - repetition of a mathematical or computational procedure applied to the result of a previous application, typically as a means of obtaining successively closer approximations to the solution of a problem.

M

Machine Learning - application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.

GLOSSARY

A minimum viable product (MVP) - a software or hardware with minimum amount of functionality to satisfy initial users, and to provide customer feedback for further product improvement.

N

Network effect - a startup phenomenon where the product gains additional value as more people use it.

Neural Network - series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.

P

Proof of work - process of discovering such a block hash value that produces a set number of zeros in front of the hash value.

Product-market fit - a process of matching the product, customers and the business model together in a sustainable way.

Patterns a model or design used as a guide.

R

Regression - is a powerful statistical method that allows you to examine the relationship between two or more variables of interest.

Recurrent network - is a class of artificial neural networks where connections between nodes form a directed graph along a temporal sequence.

S

Spam irrelevant or unsolicited messages sent over the Internet, typically to a large number of users, for the purposes of advertising, phishing, spreading malware, etc.

Supervised Learning - is the machine learning task of learning a function that maps an input to an output based on example input-output pairs. It infers a function from labeled training data consisting of a set of training examples.

Sigmoid - function is a type of activation function, and more specifically defined as a squashing function, which limits the output to a range between 0 and 1

Synapse - the point at which a nervous impulse passes from one neuron to another.

Smart contract - a computer program executed only when specific conditions are met.

Smart property - a cryptographically secure property that can be managed only by the owner of the digital cryptographic key.

Sales funnel - a marketing term for the journey of potential customers from mere interest to loyal following and payments.

T

Traction - a number of early customers that continuously use the startup product. It is a proof that people want your product.

Training set - is the data set on which your model is built.

Transactions - records of change of a particular state.

U

Unsupervised Learning - is the training of an artificial intelligence (AI) algorithm using information that is neither classified nor labeled and allowing the algorithm to act on that information without guidance.

W

Web 1.0 - an initial stage of internet development with open network protocols such as TCP/IP systems and World Wide Web.

Web 2.0 - the next stage of internet development where companies built fast, reliable and user-friendly commercial online networks.

Web 3.0 - a new stage of the evolution of the internet characterized by decentralized blockchain networks.

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