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АНОТАЦІЯ

В даній магістерській роботі розглянуто проблематику вивчення іноземних мов та проблематика поповнення словникового запасу у малюків. Проведено порівняння сучасних методів вивчення нових слів. Розглянуто проблематику впровадження сучасних технологій в процес навчання. Проаналізовано стан сучасних технологій для інтегрування в процес навчання. Проаналізовано сучасні рішення для вивчення іноземних мов.

Створено та протестовано веб додаток для поповнення словникового запасу малюків та вивчення іноземних мов. Результати роботи додатку порівняні з існуючими аналогами. Наведено висновки про доцільність розробки і впровадження подібної інформаційної системи в навчальний процес.

АННОТАЦИЯ

В данной магистерской работе рассмотрена проблематика изучения иностранных языков и проблематика пополнения словарного запаса у детей. Проведено сравнение современных методов изучения новых слов. Рассмотрена проблематика внедрения современных технологий в процесс обучения. Проанализировано состояние современных технологий для интеграции в процесс обучения. Проанализированы современные решения для изучения иностранных языков.

Создан и протестирован веб приложение для пополнения словарного запаса детей и изучения иностранных языков. Результаты работы приложения сравнению с существующими аналогами. Приведены выводы о целесообразности разработки и внедрения подобной информационной системы в учебный процесс.

ANNOTATION

This master's thesis deals with the problems of learning foreign languages and the problems of vocabulary replenishment in children. Modern methods of learning new words are compared. The problems of introduction of modern technologies into the learning process are considered. The state-of-the-art technologies for integration into the learning process are analyzed. Modern solutions for learning foreign languages are analyzed.

A web application was created and tested to supplement the baby's vocabulary and to learn foreign languages. The results of the application are compared with existing analogues. The conclusions about the feasibility of developing and implementing such an information system in the educational process.

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INTRODUCTION

The aim of the study is development of the new information system that uses new highly efficient learning tools received by analysis of the most effective learning tools.

To achieve this goal *next tasks* should be resolved:

1. To analyze modern state of the implementation information systems into the learning process;
2. To analyze modern information systems of the foreign language learning and methods of the vocabulary of kids replenishment, to make comparative analysis, find advantages and disadvantages;
3. To design universal information system designed for foreign language learning and vocabulary of kidsreplenishment based on analyses.
4. To inquire modern approaches and technologies that can be used in development of information system;
5. To develop information system using inquired technologies and instruments;
6. To test developed information system and analyze it effectiveness and expediency of implementation.

Object of the study – the process of the foreign language learning and vocabulary replenishment of kids.

Subject of the study – foreign language learning and vocabulary replenishment of kids methods and instruments.

Methods of the study that was used in the scientific work:

- comparison - to determine the advantages and disadvantages of existing methods and techniques that will be taken into account when developing an information system;
- generalization - to determine the general properties and characteristics of existing methods of learning foreign languages and replenish the vocabulary of children;

- modeling - to represent the logic of information system functioning in the form of diagrams and diagrams;
- formalization - for converting diagrams and diagrams into code of programming languages;
- analysis - to divide the object of study into components for the purpose of their independent study;
- experiment - to test and determine the effectiveness of the created software application, to analyze the feasibility of creating it.

The scientific novelty of the work is the design and development of a new information system for teaching children using new highly effective learning tools based on comparisons of the most modern methods.

The main scientific and technical result of the work - new information system was presented, which, unlike existing analogues, increases the efficiency of learning foreign languages and the vocabulary of children replenishment by using new highly effective means of learning, obtained by analyzing the most effective methods of language learning used nowadays.

Approbation. Master's qualification work and some aspects of it, the generalizations and conclusions were prepared for publication at the scientific conference "Youth in Science: Research, Problems, Prospects" (2020).

Publications. The results of the work were prepared for coverage in the scientific-technical conference "Youth in Science: Research, Problems, Prospects" (2020).

1 PROBLEM ANALYSIS AND LITERATURE REVIEW

1.1 Overview of the problem of vocabulary

On average in language has about 300,000 words (English as the most widely developed and recently celebrated the anniversary - millionth word).

But the average person uses in everyday speech 15-17 thousand words. Even holders of workshops words using a small margin. It is known that TG Shevchenko used in his works about 20 thousand words.

According to the language proficiency necessary to have a vocabulary of no more than 17,000 words. Therefore, we can construct methods of teaching a foreign language on a new basis. This technique offers not learn the maximum number of words, but only get the necessary vocabulary. After that, the student decides he does have enough vocabulary to his needs or not.

Studies show that properly selected only 400 words can replace 90% of the vocabulary to be used in the future[3].

In speech about forty words covering approximately 50% of the vocabulary speech. A 200 words are 80%, 400 as mentioned 90% and 95% of thousands. As can easily be seen, increasing the amount of vocabulary after a minimum only leads to a slight increase in the percentage used vocabulary.

From all the above we can conclude that properly selected basic vocabulary of 400 words will have any language at a basic level.

Take into 10 thousand words. Knowing 400 words, you will understand this text 9000 words, ie generally text you will understand. Of course, the number and percentage are quite conventional. You can run on any specific text, where these will be your 400 words is not enough. But these texts are very, very small.

1.2 Classification of vocabulary in foreign languages

Active stock of foreign words 400-500. This stock need to be able to explain to the other.

Baseline 800-1000 foreign words. This reserve is enough to understand virtually any text in a foreign language. As you understand, to explain, words takes less than to understand the reading. Because the source, so to speak, interactive. If he sees something that you do not understand, he can say the same, but in other words [4].

1500-2000 words, this reserve enough for everyday communication confident and sure reading foreign literature.

3000-4000 words. Such a vocabulary sufficient for reading and understanding literature.

8000 words. With this vocabulary you will be able to read any literature and communicate freely with any foreign interlocutor.

But even studied the necessary vocabulary of foreign words, does not automatically mean that you are free to communicate in a foreign language. It is necessary to know the rules for constructing sentences. Well, this is often not enough. In practice, for sure learning a foreign language can not do without close communication with native foreign language. And learning new foreign words when communicating with native speakers is much faster and more efficiently.

In the practice of Western countries defined three levels of vocabulary. These levels are used in teaching students foreign languages.

Thus 8000 words is a sufficient level to read and speak a foreign language. The first level or level A basic level (400-600 words) covers 90% of needs in the words of everyday language and about 70% of words in different texts.

The second level or level B. Minimum vocabulary (800-1000). This level is sufficient to meet the needs of 95% of words in everyday language and 80-85% in the texts.

Third level or level B, the average vocabulary (1500-2000 words), which is enough to fully cover the need of words in speech and 90% of the text.

By the way these levels are often oriented dictionary of foreign words. For example, German dictionary Grundwortschatz Deutsch (basic vocabulary of German fund) comprises 2000 words major languages: German, English, French, Spanish, Italian and Russian [5].

1.3 Analysis of existing methods

1.3.1 Zaitsev Method

“Zaitsev’s Cubes” is a manual for teaching reading from two years old and can be used in the family, kindergarten and school. The manual can be used in teaching children and adults for whom the language is not native.

The training is conducted on the basis of the analytical-synthetic method using warehouse blocks and takes place in the form of a fun and exciting game, during which preschoolers have time to start reading before the fun gets bored.

The letters on the cubes and tables are of such a size that they are clearly visible even from ten meters, it is important that from the very beginning the children do not experience any eye strain. Tables are located on the wall, their lower edge at a height of 165-170 cm from the floor - in order to avoid violations of posture, you often need to work standing up, with your head up. Under the tables there is a shelf in three boards to make words from cubes on it.

Cubes vary in color ("gold", "iron", "wooden", white with green punctuation marks), volume (large, small, double), weight (filled with glands and pieces of wood included in the kit), the sound of the filler being heard by shaking them. The goal is to provide involuntary, quick, reliable memorization.

Does a letter with a pointer over the cells of the tables also connect the “body memory”: are the letters located on the top, bottom, left, middle, or right?

Looking for books on the shelves, we remember not only their color, thickness, height, but also their location: the legs themselves go where you need to, the hand reaches out, the head turns. And only at the last second the gaze is focused.

In the audio recording, the columns and rows of tables, the alphabet, accompanied by the button accordion and balalaika, are sung in 35 popular, mostly folk tunes. Rhythmic pronunciation, or better yet, singing with music is a powerful means of influencing memory.

"Side" results that accompany the process of reading:

- Speech becomes cleaner and more distinct due to the constant pronunciation and chanting of warehouses;
- logopedic issues are corrected;
- literacy skills appear;
- developing the ability to work independently, the ability to obtain the necessary knowledge;
- logical thinking is formed;
- vocabulary is increasing rapidly.

The technique is nature-friendly and health-saving. Children not only do not lose health as a result of training, but also cases of correction of existing deficiencies (improvement of vision, correction of incipient scoliosis) have been recorded.

Long-term practice of teachers working according to Zaitsev's methods allows us to provide statistics on the duration of training for children of different ages (provided that classes are held for 30-60 minutes 2 times a week): The results are provided in the table 1.1.

1.3.2 Maria-Montessori method

Young children must first be taught to write, not read, says Maria Montessori. Watching the kids at her school, she came to the conclusion that it's

easier for a child to write a letter (in other words, draw it, because the letter is also a picture) than to perceive a certain abstract image of the letter in the book. Moreover, you need to start learning with capital letters, and not with printed letters, since circular movements are easier for children.

Review the reading learning stages

The first stage of the reading learning is “Stroke and circle”

Reading begins with writing, and writing begins with the preparation of the hand. For this, Montessori educators are advised to do hatching and stroke.

Table 1.1 - The results of Zaitsev method

Age	Duration of trainings
2-3 years old	6-9 month
4 years old	16 lesons
5 years old	5-10 lesons
6 years old	4-6 lesons

Adult foreigners who do not know a single language letter, in the first lesson in about 30-40 minutes, begin to make up the words spoken by the teacher from the cubes, and after a while already read them.

Stroking the drawing or tracing the frames, children draw lines of various lengths and in all directions, which produces freedom of movement of the hand and hardness of the fingers. When the prepared child finally takes a pencil or pen in order to write his first letter, he will do it with the same ease as a person who wrote a lot. For this work, children - both the smallest and the older ones - are given for a long time with the hottest passion.

The second stage of the reading learning is “Feeling the letters”

By touch, children remember better than by ear or even visually. Feeling soft, fluffy letters gives the kids great pleasure, and soon they will already know the whole alphabet.

The third stage of the reading learning is “We make words”.

When the children recognize several vowels (three, four) and the same number of consonants, they begin to compose words from the moving alphabet.

The fourth stage of the reading learning is “We write the words”

Kids start writing. All children do this in different ways: some of them feel letters for a long time, make up words, and begin to write only when these skills become an easy thing for them; then they immediately write words and whole sentences. Others for a long time draw letters of the entire alphabet, one after another, or they repeat the same letter, the same word. Typically, children who have begun to write write irresistibly and with enthusiasm. According to M. Montessori, a mania of writing is born for them.

The fifth stage of the reading learning is “We read”

Along with the letter is reading. A child who independently composes words from a movable font is already beginning to read. From words, as in writing, children move on to phrases and from handwritten to printed.

There are no boring exercises or tedious lessons in the Montessori system. All training is a game. Entertaining, with bright interesting toys. And the kid learns everything through reading, writing, and everyday skills.

But each game has its own rules. We will try to comply with them.

We play: where to start and how to end

Any exercise game begins with a presentation. You need to show and name all the items that participate in the game, and tell what you will do with them. For example: “These are rough letters. We will circle them and call them. ”

At the same time, you must show how this is done. Do not rush, do everything carefully, because the child will copy your actions.

After the presentation, give the baby the opportunity to play on his own. And here do not interfere, do not help, let him do everything himself.

And the game ends with cleaning. Show your child how to put letters in a box, put books and pictures in their place.

Count the game so that the baby is not tired when the time comes for cleaning. Remember: order is an essential element in the Montessori system, and you should not ignore it.

Review the composing fairy tales

Games with letters at first will captivate any baby.

But, like all toys, they can get bored if they are monotonous. Therefore, your task is not only to prepare all the necessary material, but also to think about how to diversify the game. We will tell you some moves when we talk about games, but you also need to work hard. Remember: turn any game into a fairy tale. Come up with small stories about the adventures of letters, or children, about magical pictures that help them overcome all obstacles.

For example, the baby traces the letter O with his finger, and you say: “Here is a lake on the way of our heroes. How can they swim through it? Let us call the magic letter M to help and make up the word “bridge” ”, etc.

Maria-Montesory methods is a complex solution with a lot of small exersices. This method is hard to be used as a base for automatic language learning process.

1.3.3 Olga Soboleva method

The technique is designed for natural immersion in the language environment. “In order to effectively teach a language, you need to distract from the idea that we are learning this language,” the author believes.

In the learning process, only internal motivation is used. To do this, material is carefully selected, there is no strict lesson planning and its dynamics are preserved. It is harmful to memorize words specially, because separate words and phrases do not make sense if they are without context. The child learns the language through ordinary intonations and without unnecessary fragmentation.

Olga Lvovna Soboleva is often confused with Olga Leonidovna Soboleva, a well-known linguist, author of her own method of studying a foreign language.

Review basic language learning techniques. For teaching reading and writing, Olga Soboleva suggests using colorization - the color study of rhyming endings. Children are taught to read aloud with expression, correctly structuring phrases and placing semantic stresses so that the picture of the correct and beautiful emotionally expressive speech remains in memory. Attention is not fixed on syllables or letters, but on the whole poem or song. The child watches the endings, painted in pairs depending on the sound. Gradually, he gradually gets used to all combinations of vowels and consonants.

Reception "Treasure Chest" allows you to enrich the vocabulary, accumulate a lot of useful expressions and train your speech. The text is worked out according to a certain algorithm: the student reads books with a pencil in his hand, emphasizes and writes out interesting expressions, and then uses them, describing real situations, making an integral "canvas" from the expressions.

When teaching writing, there is no stage of writing in block letters: Olga Soboleva calls it "Writing ahead of the curve". Children immediately learn to write together, they enter logically appropriate small elements in the text, complementing it to a single whole.

All homework is done without parental intervention. The child must perform audio suppression: the student listens to the material, and then he "voices" the text and records his speech on video. He may not keep up with the announcer and crush the phrase. Olga Soboleva claims that crushing is natural, moderation is not. It is very important to maintain a natural pace. In the classroom, teachers enthusiastically respond to all student videos, and discuss their comments with parents.

This technique helps to get used to speaking fluently, tighten grammar and improve pronunciation. The author calls this technique autonomous and claims that it can be successfully used by teachers and students who work using other methods.

Children quickly begin to read fluently and beautifully, speak expressively, learn acting skills.

According to Olga Soboleva, if a child at an early age gets acquainted with color, he will write very competently in the future.

The main methods proposed by Olga Soboleva can be used in training by other methods.

This method can be used to teach kids or adults with some developed independency as all tasks and homework should be done by student itself. This technique can be used to teach students from 8 years old and it's hard to adapt it to use with childrens 3-6 years old.

1.3.4 Doman Method

Glenn Doman (1920 - 2013) is an American neurophysiologist, author of methods for intensive intellectual and physical development of children from birth. He was the first to engage with newborn children.

The results were amazing: the children easily learned how to read, think, and were different in their wit and erudition. The development of Glenn Doman formed the basis of many techniques of the company "Umnitsa", "Wunderkind with diapers".

For training, Doman took the ancient Anglo-German system: showing and saying the whole word; he recommends showing cards with red words written on them on a white background.

He is convinced that it is necessary to begin to teach the child to read a year or even earlier. Such early learning will be an impetus for the further successful development of the baby.

Doman believes that "The human brain is a perfect computer that obeys the same pattern: the more facts it knows, the more conclusions it will be able to draw from them. At the same time, if we are going to hammer the heads of children with

any nonsense, it is unlikely to wait for them smart things and actions. Therefore, we must provide them with accurate, clear and unambiguous information. "

At an early age, the child still knows little about the names of the objects, in which case he recognizes them from the cards, and only knows the name, without the image of the object. If he has already formed a relationship between the image and the subject, then he still will not imagine the word object (because the words are too fast to show and often change and the baby does not have time to get used to them). Thus, it turns out that we, from a very young age, teach the child to think abstractly.

- It is necessary to deal with the baby from an early age;
- Classes should be short so that they do not bore the child;
- Fill cards with new words daily;
- You do not need to show the same card more than 3 times a day;
- It is necessary to deal only when the baby is in a good mood;
- Always rejoice in your child's success and praise him;
- Classes should be conducted systematically and regularly;
- Only work if you and your child like it.

Doman's technique is at the heart of early learning reading and math. Learning to read Doman comes down to the mechanical memorization of words - so the child will immediately learn to read whole words, bypassing the reading of letters and syllables. The child's eye sees the written word, though he does not understand its meaning. But, if the kid sees and at the same time hears the written word, then his brain interprets the received information - "understands" and mechanically remembers the written. Doman's cards are used as a guide: the child is shown several times a day words written in large red letters on the cards.

Doman also pays a lot of attention to mathematics teaching. He suggests replacing abstract numbers that are difficult for a child to understand with cards with a certain number of dots (circles). A child is shown a card with dots and is told how many points on it are depicted. As a result of regular screening, the child

will learn to determine the number of points without recalculation and perform arithmetic in the mind.

So, let's look at an example: if a child comes up to you and asks you about a cat you see, you can tell him:

1. Leave me alone;
2. It's "meow-meow";
3. It's a "cat";
4. This is "Maine Coon" (focusing on a specific breed);
5. Show him ten pictures with cats;

6. Teach him to establish the connection between the facts (show him ten cards with cats and say, "Look, all these pictures depict animals called" cats ": a Bengal cat, a British Shorthair, Devon Rex, the Sphinx, etc.).

Doman argues that if you choose the sixth option, the baby will be able to make his own conclusions: all cats have wool, tail, paws, etc., but differ in color, size, height, etc. Thus, in 30 seconds can significantly accelerate the development of the brain of the child.

1. For a better perception of the word the baby uses 3 ways at the same time:
 - a) picture (big picture),
 - b) inscription in big red letters and
 - c) clear pronunciation of the word;
2. the cards should be large so that the baby can easily distinguish between the drawing and the individual letters;
3. It is necessary to show them quickly (maximum 5-10 seconds), but it is necessary to repeat classes regularly, gradually increasing the load.

1.3.5 Conclusions

In our work we have compared 4 different methods of teaching children's new words. According to our comparison we will implement Doman's method with

some additional exercises in our work. This method was chosen as it has next advantages:

- The ability to teach reading almost from birth. All the training will be a game for him, an opportunity to chat with his mother, learn something new and interesting;

- The baby will develop a phenomenal memory. He will easily memorize and analyze a huge amount of information.

Also using this method as a program will allow to remove the main disadvantage of the method – time. In case of using program it's will not be necessary to spend a lot of time to master this method and spend a lot of time in learning available cards.

1.4 Analysis of existing solutions

1.4.1 LinguaLeo

This program is suitable for beginners and for those who have already achieved some success in learning English. Will it be useful for business people for whom there is a huge section dedicated to business English, where considered appropriate grammar, vocabulary, especially business correspondence, etc.

The application determines the level of knowledge of each user and propose appropriate for him exercises that are offered in a variety of form. It is also possible to pass the training tests DPA, IELTS, FCA, etc., are adequate vocabulary lists of the English and the opportunity to do offline. This is not a complete list of features of this application, which is now the leader among similar proposals. And start using it is free from any platform, but that within the program may need to pay for the expansion of functionality, and though she immediately may seem very high, but given the frequent promotions can be good save[6]. The interface is shown in Figure 1.1.

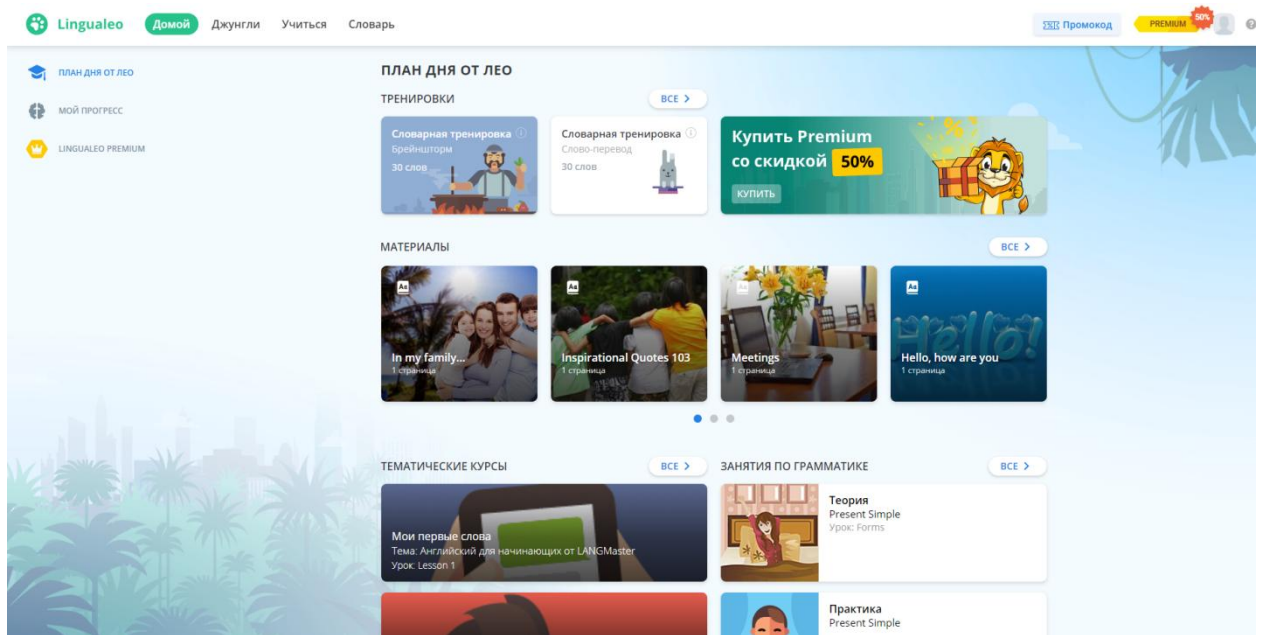


Figure 1.1 - Interface LinguaLeo

1.4.2 Duolingo

This is another very popular application that last year was the best in the field of educational programs and iOS, and Android. The application is free, and its Russified version provides only for studying English and German, but if as a primary language choose English, you can start learning even Spanish, Italian, French and Dutch languages.

Learning language is selected on the lessons that can effectively learn the words, grammar and pronunciation through the implementation of diverse exercises with two-way translation, listening comprehension, spelling, reading, etc. And if you were one lesson or the other you can not open, so the study is gradually and can achieve good results with more or less seriously. The interface is shown in Figure 1.2.

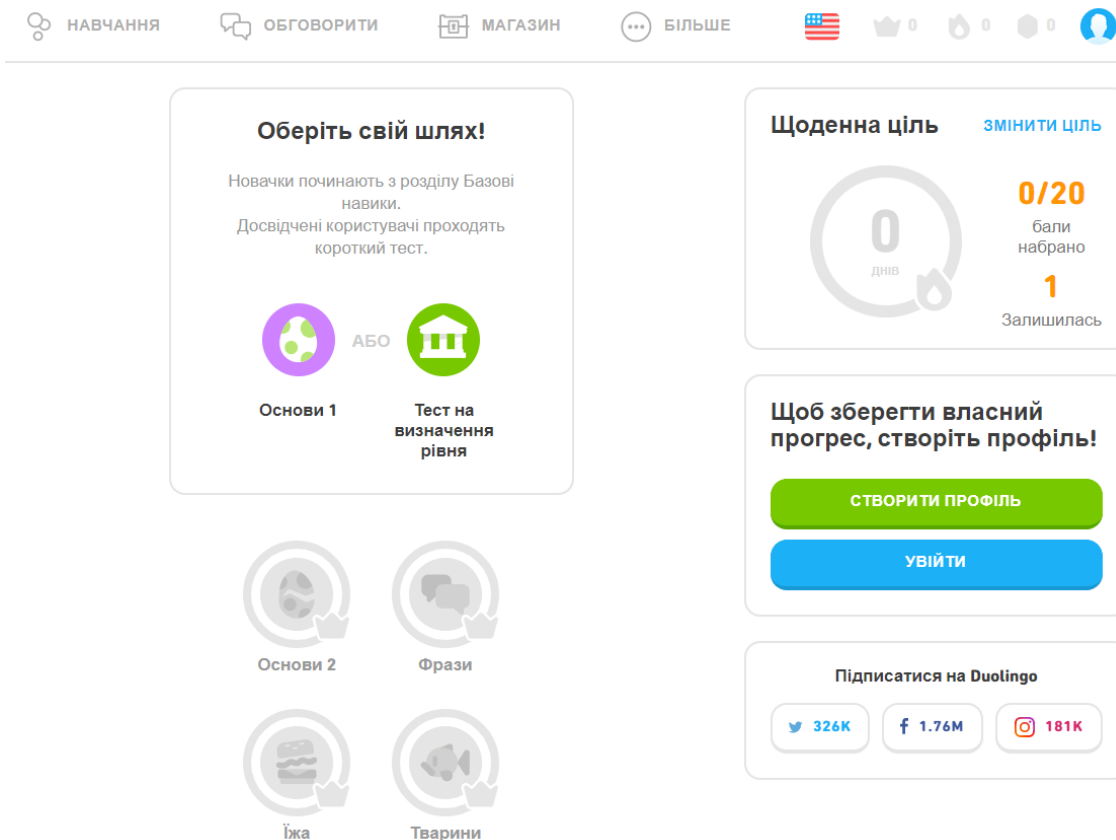


Figure 1.2 - Interface DuoLingo

1.4.3 Babbel

This application is already used by about 15 million. People worldwide, and maintains it had not much 14 languages. You can use the free, but that for some room still have to pay each month, and the amount will depend on the language and the selected package, but the average is 7-13 dollars. The application can be installed on both iOS and Android, and use a computer.

Learning a language is based on passing of lessons that focus on vocabulary and grammar often include dialogues, as they help quickly learn the words and designs. Courses are divided by level of knowledge, contain a lot of useful materials to help not only with vocabulary and grammar, but also with pronunciation and introduce the cultural traditions of the country. The only bad thing - the application has not yet Russified, so more suitable for those who already

know quite well a foreign language, to use it in the new study. The interface is shown in Figure 1.3.

Figure 1.3 - Interface Babel

1.4.4 Busuu

Busuu favorably with other applications that here you have the opportunity to train with native language study this language to communicate with people who like you also learn a foreign language. The number of possible languages are equal to 12 and can start learning for free, then you will have access to exercises in grammar, vocabulary, reading and some interactive tests. But if you pay for a premium subscription, which is from 170 to 500 rubles per month, access to mass grammar lessons, audio, video, interesting training on business and travel, etc.

Learning language is selected through the levels, each of which offers a set of exercises. And the knowledge gained you can immediately use to communicate

with native speakers, who will immediately correct errors and raise the level of your knowledge.

The interface is shown in Figure 1.4.

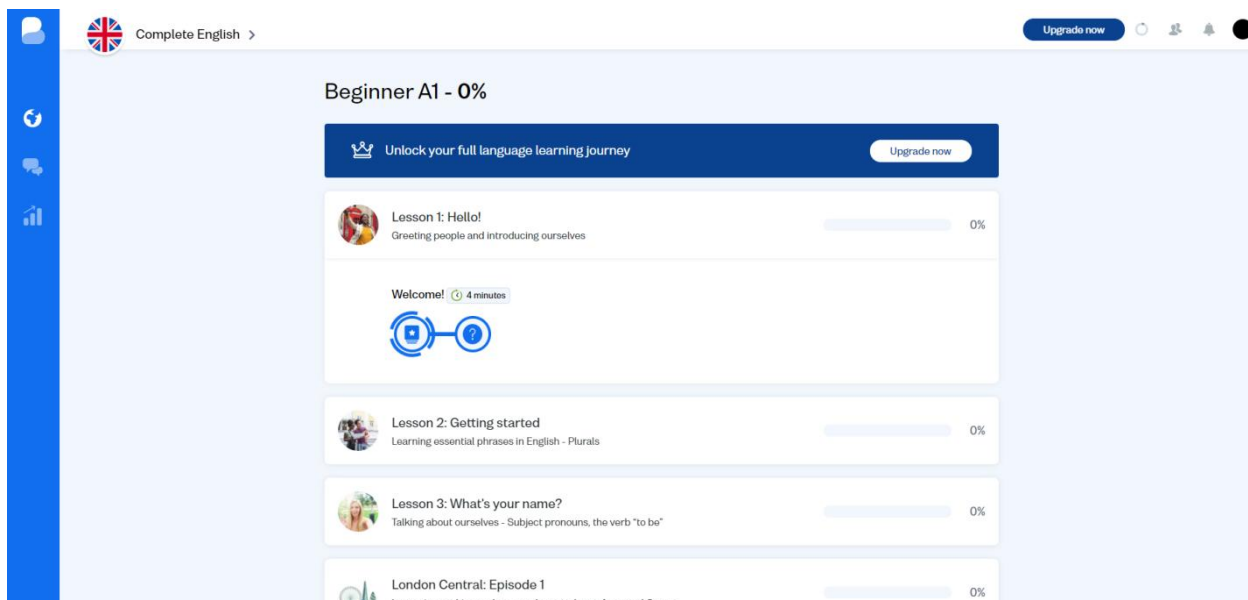


Figure 1.4 - Interface Busuu

1.4.5 British Council

Excellent suggestion, which allows us to study English without wasting time and money on training. It consists of 13 different applications that train foreign language from all sides. Thus, there is also an electronic textbook, which is designed for different levels of proficiency, and many test IELTS, great help prepare for the upcoming exam. There is an application for vocabulary through traditional card once, you can watch videos, coaching perception of English listening. Even a special section for football fans with traditional and specific vocabulary.

Overall, this app will be useful to all, without exception, the more distributed free and is suitable for any operating system.

Homepage shown in Figure 1.5.

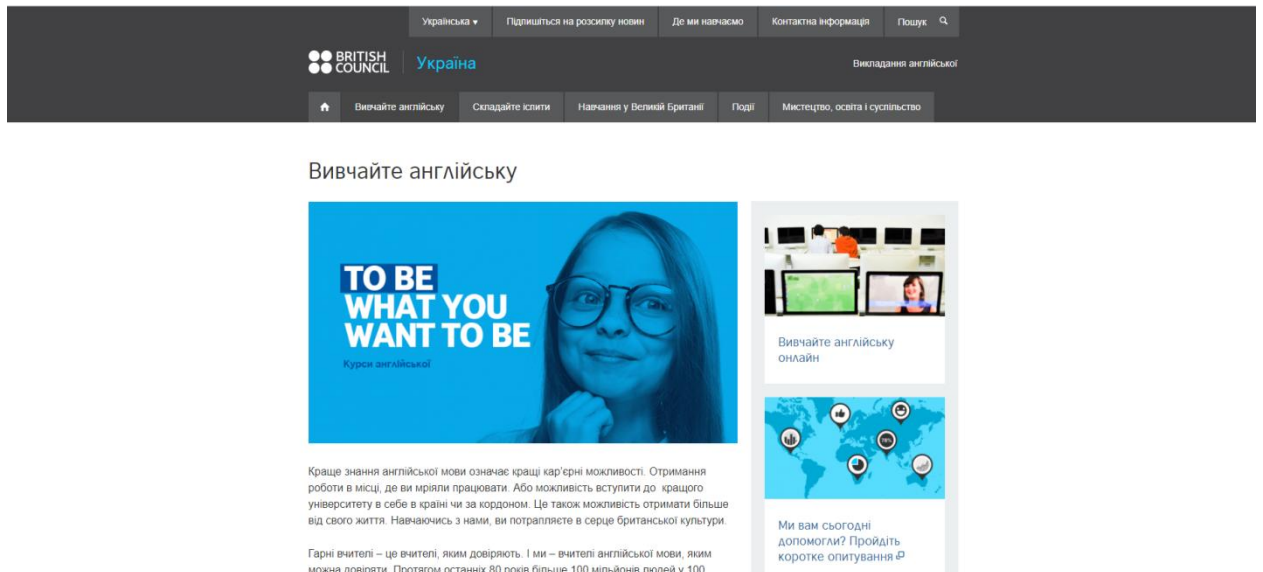


Figure 1.5 - Home British Council

1.4.6 Memrise

This is a very lengthy application-oriented language learning and linguistic culture. This weight exercises in grammar, spelling, translation, etc., there are many texts in the original, and is available until 36 languages and all for free. This application can hardly be called a classic application for language learning, which is divided into lessons - here you probably available a complete directory of irregular verbs, tests, texts, etc.

In order to learn new words were easier to use interesting images that will be impossible to forget. The process of learning and memorizing words application developers compared with the cultivation of flowers, where just throw the seed, that is to learn by heart the word is not enough, you should always water and care - regularly repeated studied vocabulary. And another benefit of application - its free distribution. The interface is shown in Figure 1.6.

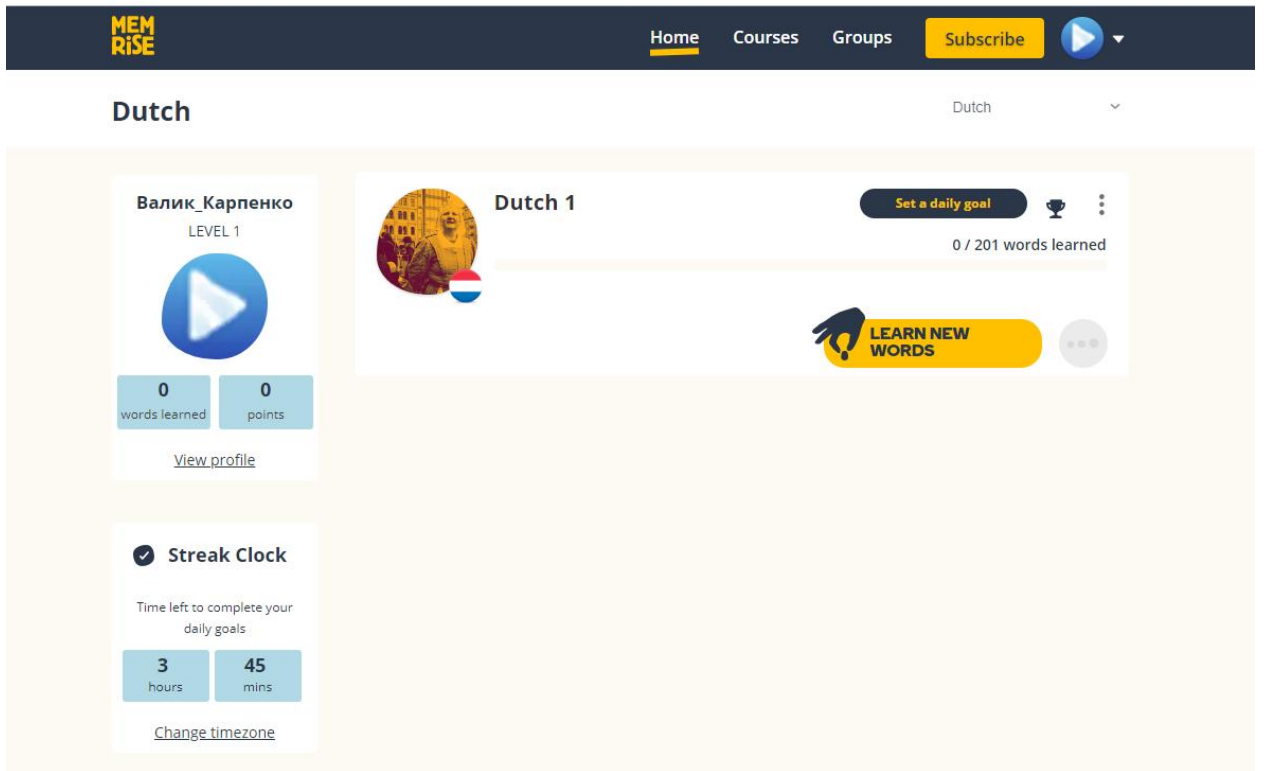


Figure 1.6 - Interface Memrise

2 RESEARCH OF TECHNICAL TOOLS FOR SOLVING THE TASK

2.1 Development of the server side

2.1.1 Microservices architecture

Microservices is the last word in server software development. Despite their novelty, more and more developers are choosing this architecture as the main one in software development.

In general, the architectural style of microservices is a software development approach whereby the entire application is developed as a set of small independent services. As a rule, such services communicate with each other using HTTP, which is currently the norm, but for the most part is considered anti-patterning, or usually today, via message delivery systems (like RabbitMQ). These services are developed independently and may, though rarely, be written in different programming languages.

To highlight the pros and cons of microservices, it is best to compare them with monolithic applications. Most systems are subdivided into the client side (HTML. JS. CSS), the server side, and the database. Any, even minor changes to these systems lead to a complete rebuild of such a server.

Monolith is the most common and obvious way to build a server. All logic is concentrated in one process. The monolith is easy to run and debug with the developer machine. Multiple servers are used for horizontal scaling.

Monolithic applications with their development are becoming more and more difficult to maintain. When changing one module, others are involved. If you need to scale one module, such as a text analysis module for learning, which can take up to 60% of server time, you need to scale the whole application.

All these inconveniences led to the emergence of microservices. In addition to independent development, we also get hardware independence. Each

microservice usually has its own server, or more likely its own container. With any errors in one service, the other system continues to work.

2.1.2 Architecture properties

There is currently no formal style of microservice development. This section will describe what are the common features of applications that use this style.

There have always been attempts in the industry to build systems through the use of various components. In recent years, most applications have used libraries as modules.

In our understanding, a component is a piece of software that can be independently updated or replaced.

The microservices architecture, like the monolith, uses libraries, but at the same time, the main way to modularize the server is to divide into services. Libraries connect to the application in the same process. Services are components that are started in a separate process. The main advantage of using services is their independence, both in development and deployment. When using libraries, any change causes the entire server to be redeployed. If your application is broken down into several services then changes to any of them lead to the deployment of this service only. Of course, some changes will be focused on interfaces, which requires coordination between different services, but when you set the correct boundaries between services, this need is minimal. Another advantage of using services is the explicit interface between them. In monolithic applications, usually only the documentation helps to keep the encapsulation of components, services help to avoid this through its explicit call mechanism.

However, the use of services has its drawbacks. Calls via HTTP, or the tire runs slower than the process.

At first glance, we can say that service and process are one and the same. In fact, a service can have several processes, usually at least two: the application process itself and the database process that uses only that service.

Separating the application into parts often results in the team being divided into parts depending on the technology. Usually these are the frontend, backend and db commands. With such development, any small changes take a long time, as they require cross-team interaction. This often results in logic being placed on a layer to which the command has access, to speed up development.

The microservice approach breaks the application into services depending on the business need. Such services have a complete set of technologies that includes both frontend and backend and database. This leads to the formation of small cross functional teams that minimally interact with each other.

Large monoliths can also be broken down into modules that are related to business needs, but this is rarely the case. Usually, due to the lack of good control, the boundaries between such modules are blurred over time. In microservices, it is clearly more difficult to break such boundaries and cost less time than to develop everything within one service.

2.1.3 The size of service

The most difficult question to answer was the size of the microservice. Service cannot include too much, because then the essence of microservice architecture is lost. For large services, the application is converted into several monoliths and includes only the disadvantages of both architectures. There are also antipaternalnanoservices when the services are too small. In this way, maintaining a swarm of small applications becomes unrealistic. The largest teams for microservices are teams of 12 people. Today it is considered that all business logic of service should fit in the head of the developer.

2.1.4 Services communication

During communication between processes, much of the logic is often incorporated into data transmission mechanisms. Often, products include extremely sophisticated information sharing capabilities as well as some business rules.

The microservices architecture uses an approach: smart receivers and simple data channels. Microservices try to be as independent as possible and focused on a specific business task. However, most microservices have no state. They receive data, apply some logic and send a response.

In this case, microservices usually use either HTTP, which, as noted earlier, is anti-patterning or light messaging. However, all requests do not change. With this approach, it is very common to use resource caches

In a monolithic application, the components work in one process and communicate a method call. The main problem is that you have no control over your modules, which can communicate as you like. To combat this, a pattern mediator is now commonly used, which is a lightweight analog of a monolith bus.

2.1.5 Decentralization

The central problem of centralized management is the tendency to standardize the platforms used. This approach greatly narrows the choice of tools. Not every solution can be applied to any problem. Monoliths are usually written in one language.

In the case of microservices, you can write all modules using different technologies. For example, Node.js for easy reports, C++ for real-time application, .Net for basic modules. At the same time, each of these services can use its own DBMS.

With code decentralization in services, it is possible to use open-source projects as your services. In doing so, you can write your own project and also make it open-source, which is a common practice, since services have abstract logic that may not be related to business logic.

A good example is Netflix, whose code can be found on github.

In the case of learning different languages, services that are not responsible for their own language learning may be reused. For example, a service for testing, because this service can be used not only in the case of learning a language and it contains absolutely no business logic.

Although Microservices is similar to Service Oriented Architecture (SOA), there is currently no clear definition of how the two standards relate to each other. Microservices are often separated from SOAs, though they are sometimes called the correct implementation of SOAs.

The .NET and JVM platforms are one example of the use of different languages within a single platform. The transition to higher-level languages and abstractions has been a common practice in recent decades. However, most applications do not require a high level of optimization. Monoliths usually have a very limited set of technologies from microservices because of the complexity of maintaining them within a monolith.

Decentralized data management makes a lot of sense. In general, this means that the data model for different systems and subsystems will be different. For example, the "Client" in terms of sellers and technical support are completely different. Some attributes in the context of different systems may be missing or have completely different values.

This problem is quite common when splitting an application into different components. Bounded Context with Domain Driven Design handles the problem quite well. This design method divides the heavy domain into contexts or domains and shows the relationship between them. The number of relationships between domains should be minimal. DDD is also important when blowing monolith. When building a microservice architecture, such a design is vital, because with poor

domain division, microservices have too many connections, which makes it difficult to develop that architecture.

In addition to decentralization by subject area, microservices also allow decentralization of how data is stored. In monolithic servers, using multiple databases is quite difficult and is usually not necessary. In microservices, using each service of its own database allows you to remove the bottleneck as a single database. It also allows each microservice to use its own kind of database. This allows us to use lightweight databases like CouchDb for services that store quite a bit of data and SQL databases for large services.

Using a single database in a monolith allows for data transactionality at the database level. When using many services, transactionality is difficult. Different technologies are used to ensure data integrity. Issues that arise are usually resolved by compensation operations.

This approach is usually a challenge for many teams. Most commands create processes that can undo user actions in the event of an error. This approach is useful as long as supporting such processes is less expensive than maintaining consistency.

Infrastructure automation has evolved greatly in recent years. Cloud technologies have evolved greatly in recent years. As a result, the complexity of building, deploying, and operating microservices has decreased.

Most applications built on a microservice architecture use Continuous Delivery and Continuous Integration. This approach allows you to automate product deployment quickly and efficiently.

There is no difference between automatic deployment of a monolith and services. The CI setting for services is generally the same as for a monolith.

Also, teams often use automated microservice management on a product in server. This stage, unlike the one described above, is very different in monolith and microservice applications.

2.1.6 Failure Design

Using services as components forces you to design them so that each service can work regardless of the inaccessibility of neighboring services. Although this approach is difficult, because the development must constantly process the inaccessibility of the services you refer to. Unlike the monolith, where the whole application is not available immediately. However, it also brings additional benefit, because if you make a mistake in the development of a server, your application will stop functioning and allow users to stop their work for several hours.

Microservice teams often have to automate system failure testing to understand how service unavailability affects the end user. An example is the Netflix team that artificially simulates service failures and data centers to monitor system stability.

An extremely important consequence of the fact that services can fail at any time is the importance of monitoring all problems. In microservice architecture, teams often use real-time monitoring, validation of technical elements, and business metrics. This approach allows you to prevent problems in advance.

Monolithic applications can also and often are built in the same transparent way. The difference is that in the case of microservices communicating with each other via messaging, this approach becomes critical. In the case of microservices, this approach is often the only way to deal with problems.

2.2 Design of frontend part

To date, Angular has taken the brunt of the UI frameworks. Although Angular is not growing as fast as the new Vue.js framework and is gradually giving way to React, it still has a large number of teams developing its products through this project.

Although Angular has many tools right out of the box, its module ecosystem is being replenished by the developer community. However, many of these projects are extremely high quality projects.

Along with Angular itself, you can find additional tools that have a positive effect on the core framework. Including:

- Integration with dynamic tools such as TypeScript and RxJS;
- libraries to manage the status of your application;
- linters and extensions for code analysis such as CodeAnalyzer;
- libraries for UI components;
- frameworks for testing the application;
- documentation that not only developers but the community itself work on.

2.2.1 Angular CLI

This tool makes heavy handling of Angular extremely fast. One of its advantages is the rapid transition to new versions of Angular. So going from version 7 to version 8 often takes just one day on big projects.

2.2.2 Differential load

Although this technology sounds extremely complex at first glance, it is extremely simple, but also extremely useful. The technology allows you to compile Angular code into two source scripts. One for the newest browsers and the other for the older ones. This makes it faster for new users and maintains old browsers at the same time.

3 SOFTWARE DEVELOPMENT

3.1 Variant analysis of architectural solutions of systems-analogues

The main analogues of our product are Anki, Lingualeo, Duolingo, Skyeng, Busuu, BBC languages and Livemocha. All of the above resources have been developed for learning foreign languages.

Their main difference is the absence of a wide variety of languages. Using the structure that is proposed in our solution, you can create a project in which it is easy to add a language to learn.

The user interface of most of the above analogues is written using static pages. We use technology that is useful when creating a one-page web application. Asynchronous requests to the server allow the user part to work faster and spend less resources on loading the duplicate parts of the pages.

It is also quite difficult to analyze the server part of web applications without access to it. We can only roughly imagine how it is organized. This has affected the fact that a backend architecture was conceived without the influence of opponents.

Based on the considered analog systems, we came to our own unique solution.

3.2 Description of the architecture of the system

An important stage in the development of any software is to choose the right tools and resources. This is primarily due to the specifics of the area in which the work is performed. The result of this phase depends on the successful implementation, as well as the execution time. Do not forget that an important characteristic of software products is its support. If the product has a non-

extensible architecture, then to meet the new needs of users, you will have to start all the work from scratch.

In this section, information related to the choice of technologies will be presented, and the reasons for choosing those or other tools for creating a full-fledged web application will be given.

The system being developed is based on the client-server architecture (Figure 3.1).

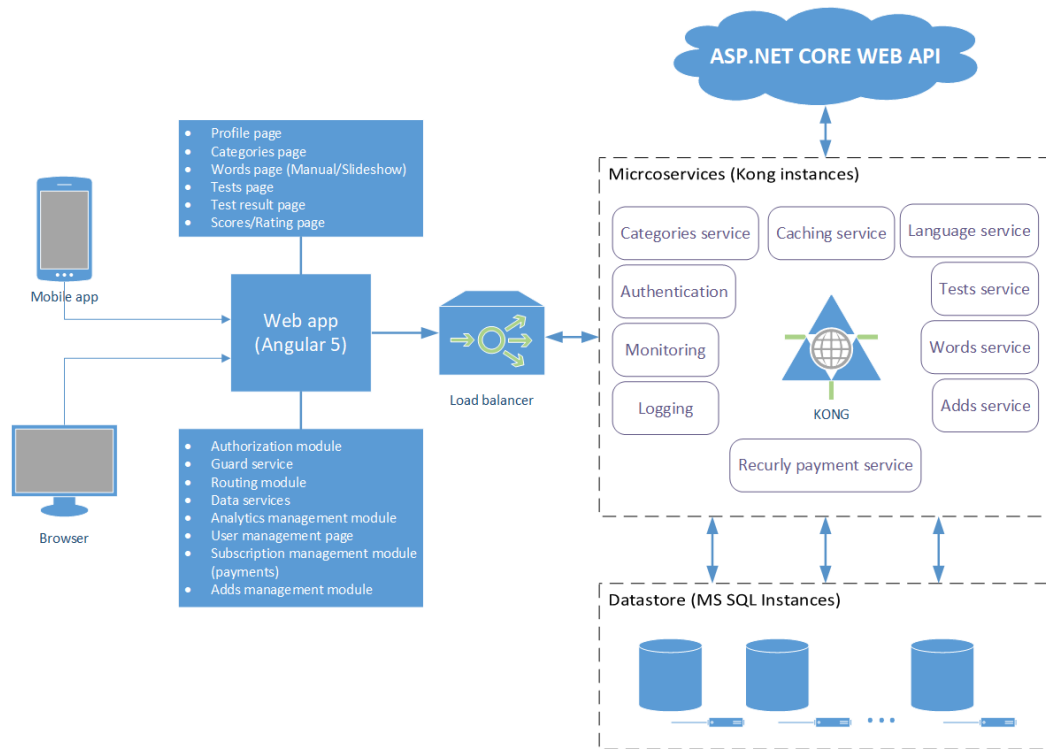


Figure 3.1 - client-server architecture

3.2.1 Database

One of the most important points in the development of an application is to consider the application domain with the subsequent construction of a relational data model. Since the modification of the database schema in a working web application is rather difficult, the inadequacy of the developed relational domain model will lead to significant difficulties in supporting the application.

MSSQL was used as a database for storing data. MSSQL is a relational database management system. Unlike NoSQL databases, which do not guarantee the integrity of data, relational DBMSs work with different tables and the relationships between them, allow you to save structured data. The main function of a DBMS is to maintain data integrity and consistency. This means that at any given time the data that is under the control of the DBMS does not contradict each other. To ensure the control of the DBMS impose restrictions on the stored data. Examples of such constraints are the primary key and the foreign key. This allows you to maintain the correct relationships between the tables. Figure 3.2 (page 41) shows the database structure underlying the web application.

3.2.2 Backend part

Typically, a server is a computer application, such as a web server, that runs on a remote server, reachable from a user's local computer, smartphone, or other device. Operations may be performed server-side because they require access to information or functionality that is not available on the client, or because performing such operations on the client side would be slow, unreliable, or insecure.

Client and server programs may be commonly available ones such as free or commercial web servers and web browsers, communicating with each other using standardized protocols. Or, programmers may write their own server, client, and communications protocol which can only be used with one another.

Server-side operations include both those that are carried out in response to client requests, and non-client-oriented operations such as maintenance tasks.

The backend part of the course work was written using ASP.NET MVC technology. ASP.NET MVC is a cross-platform, high-performance, open source environment for creating modern Internet-connected applications. It also easily

integrates with common client platforms and libraries, including Angular, React and Bootstrap.

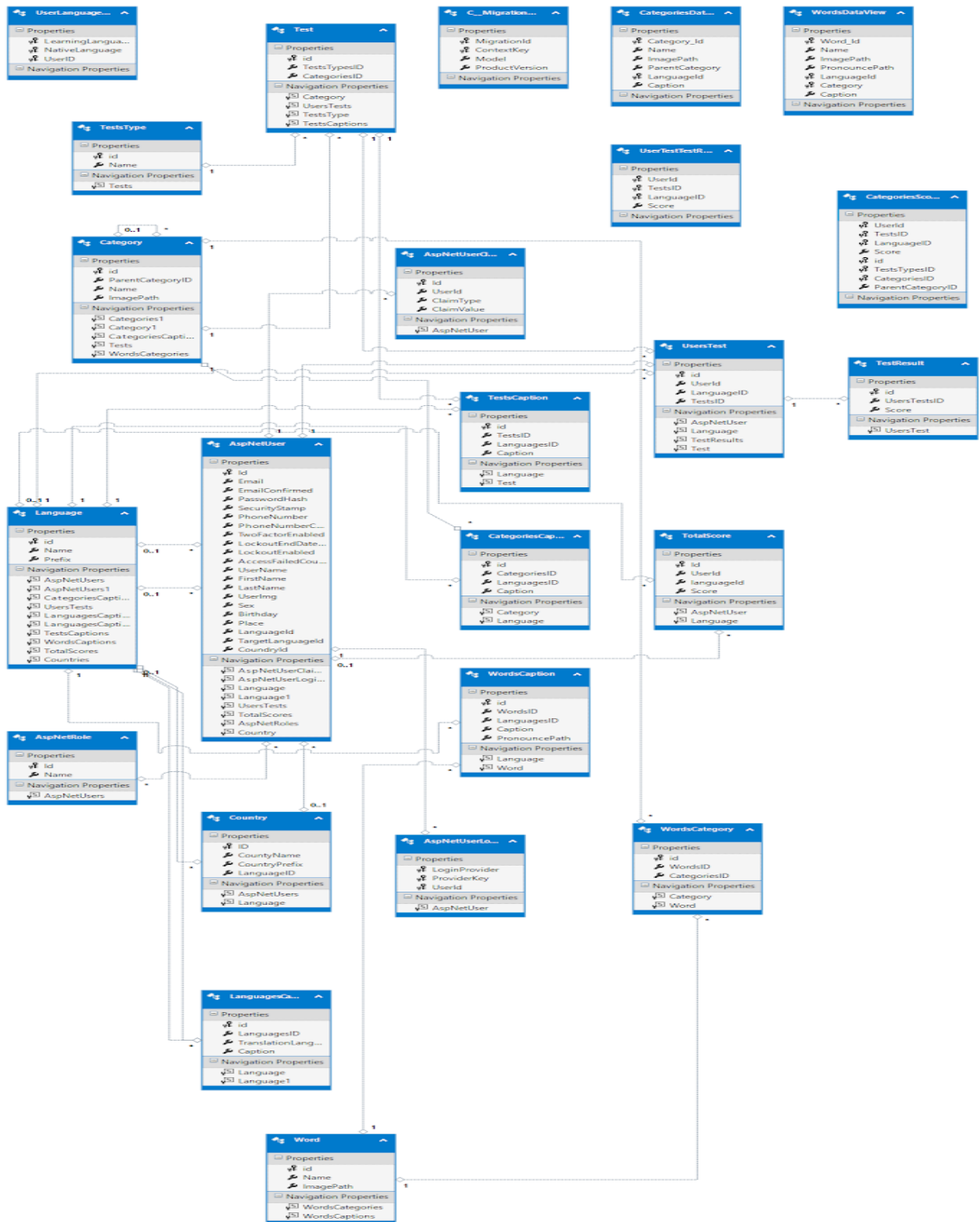


Figure 3.2 - Database Structure

3.2.3 Frontend part

The frontend part is the part of the application that is directly visible to the end user. It includes HTML (web page structure), CSS (styles for displaying structural elements), and JavaScript code for handling events that occur during user interaction with controls placed on the page.

To create the frontend part of the course work, the Angular 6 framework was used. Angular is an open source JavaScript framework for developing one-page applications. The framework works with HTML containing additional user attributes, which are described by directives, and associates the input or output of a page area with a model that represents regular JavaScript variables. The values of these variables are set manually or retrieved from static or dynamic JSON data.

The choice was made in favor of Angular 6 as the central entity in it is the component. The entire HTML page consists of various components that may contain other components inside themselves, thereby helping to structure the development process.

3.3 UML diagrams

3.3.1 Use-case UML Diagram

Use case diagrams describe the relationships and dependencies between the groups of use cases and the actors involved in the process. It is important to understand that the use case diagrams are not intended to display the project and can not describe the internal system of the system. Use case diagrams are designed to simplify interaction with future users of the system, with customers, and especially useful for determining the required characteristics of the system. In other words, the usage diagrams indicate what the system should do without specifying the methods themselves. Use case UML diagram is shown on figure 3.3.



Figure 3.3 – Use case UML diagram

3.3.2 Activity UML Diagram

Activity UML diagram is an UML diagram that shows the actions whose states are described in the state diagram. Activity refers to the specification of executable behavior in the form of coordinated sequential and parallel execution of subordinate elements - nested activities and individual actions of the English. action, interconnected flows that flow from the outputs of one node to the inputs of another.

Activity UML diagram is shown on figure 3.4.

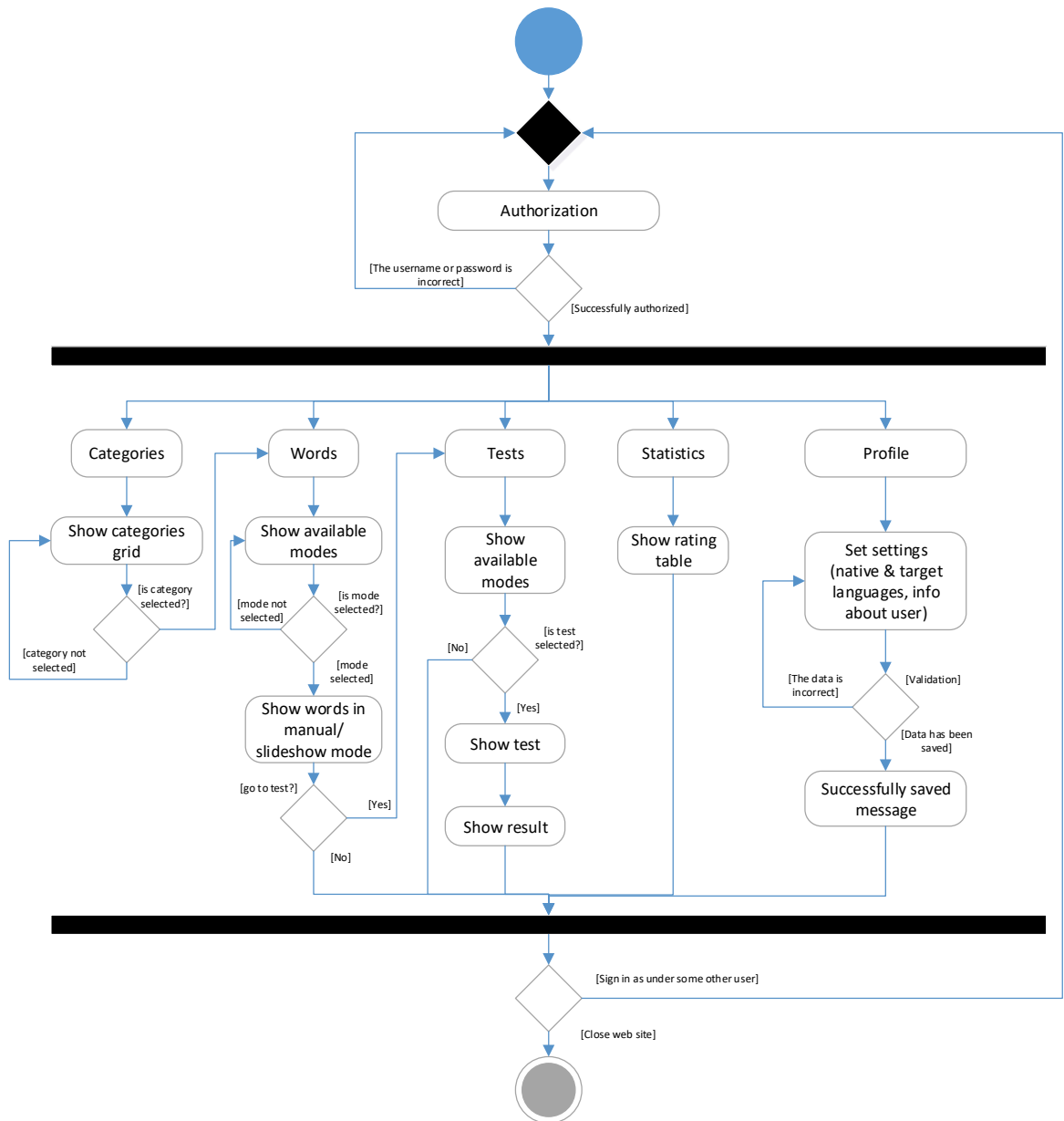


Figure 3.4 – Activity UML diagram

4 SOFTWARE DEPLOYMENT

4.1 Software environment description

The software for this system is developed in the Visual Studio Code environment, a tool for creating, editing and debugging modern web applications and applications for cloud systems. Visual Studio Code is distributed free of charge and is available in versions for Windows, Linux, and OS X platforms.

Microsoft introduced the Visual Studio Code in April 2015 at Build 2015. This development environment was the first cross-platform product in the Visual Studio series [13].

The basis for the Visual Studio Code is the use of the development of a free Atom project, developed by GitHub. In particular, Visual Studio Code is an add-on for Atom Shell that uses the browser engine Chromium and Node.js. It is noteworthy that the use of the work of the free Atom project on the site Visual Studio Code and in the press release and the official blog is not mentioned.

The editor includes a built-in debugger, tools for working with Git and refactoring tools, code navigation, autocompletion of typical designs and a context tooltip. The product supports development for ASP.NET and Node.js platforms and is positioned as a lightweight solution that allows you to do without a fully integrated development environment. Among supported languages and technologies: JavaScript, C ++, C #, TypeScript, jade, PHP, Python, XML, Batch, F #, DockerFile, Coffee Script, Java, HandleBars, R, Objective-C, PowerShell, Luna, Visual Basic, Markdown JSON, HTML, CSS, LESS and SASS [6]. The development environment interface is depicted in Figure 4.1.

The programming language, in the language that supports this design environment, is Javascript. To create dynamic content to the web system, the framework used by Google Angular 6 is the JavaScript framework for open source. Designed to develop one-page applications. Its purpose is to expand browser-based

applications based on the MVC template, as well as simplify testing and development [7].

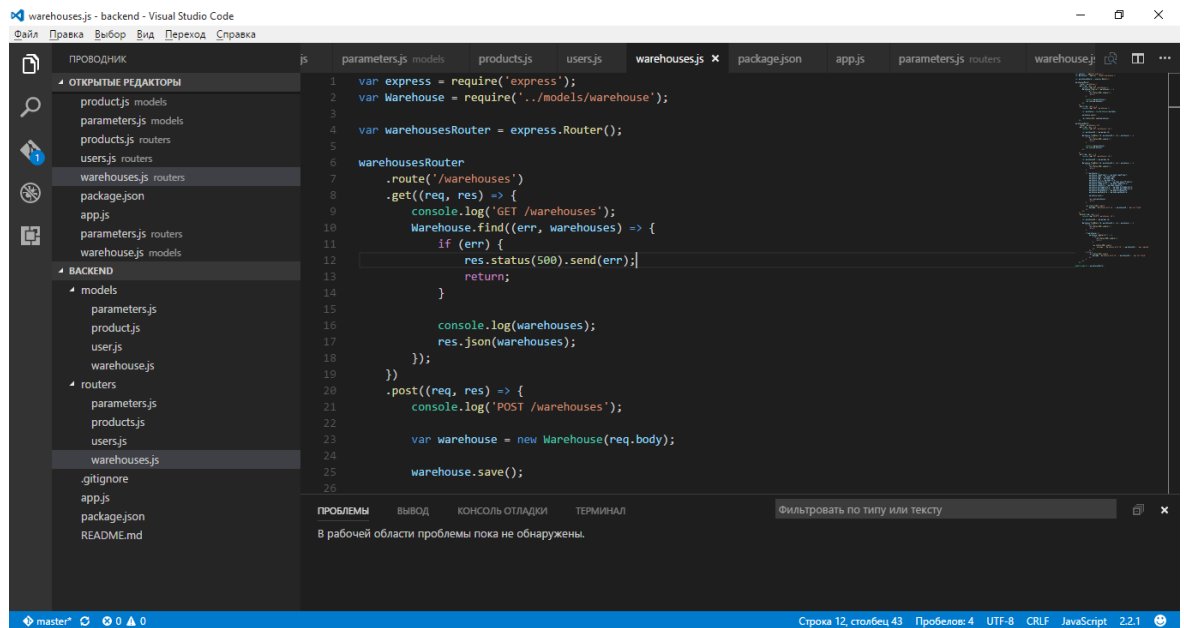


Figure 4.1 – Visual Studio Code environment interface

To manage the modules, the package manager npm (node package manager) was used [8].

The server side of the application was developed using a platform for performance of high-performance network applications ASP.NET MVC.

The developed web system follows the design of distributed REST APIs. REST (Reduced from Representational State Transfer) is an approach to the network protocol architecture that provides access to information resources. The central abstraction of REST is a resource. What happens when the address bar of the browser type the address of the web resource? Your browser (client) sends a GET request to the server. The server accepts the request and sends the response. The browser accepts and displays the received information.

In a client-server model, the server provides a service or resources that customers receive when they complete queries. In addition, the client can be anything: an Android application, a browser or an ATM.

Figure 4.2 depicts a graphical interpretation of a web application built on the REST API technology.



Figure 4.2 – REST API design technology

4.2 Deployment of an information system

4.2.1 Deployment of a front end part

When you are ready to deploy your Angular application to a remote server, you have various options for deployment.

For the simplest deployment, create a production build and copy the output directory to a web server.

1. Start with the production build using the next command: `npm run -prod;`
2. Copy everything within the output folder (`dist/` by default) to a folder on the server.
3. Configure the server to redirect requests for missing files to `index.html`.

This is the simplest production-ready deployment of your application. When you finished with the steps above your application will be ready to use for any end users [16].

4.2.2 Deployment of a back-end part

There are a lot of ways to deploy your backend part of an application written in .NET platform. But we have decided to containerize our application to make a deployment process easier every time when you facing it.

Firstly, you need to modify the project file to copy the output folder of Angular (In our scenario, we are using bundles folder) to the publish folder added a MSBuild steps to do as is shown on figure 4.3.

```
<PropertyGroup>
  <CopyAllFilesToSingleFolderForPackageDependsOn>
    CustomCollectFiles;
    $(CopyAllFilesToSingleFolderForPackageDependsOn);
  </CopyAllFilesToSingleFolderForPackageDependsOn>
</PropertyGroup>
<Target Name="CustomCollectFiles">
  <ItemGroup>
    <_CustomFiles Include=".\\Bundles\\**\\*" />
    <FilesForPackagingFromProject Include="%(_CustomFiles.Identity)">
      <DestinationRelativePath>Bundles\\%(RecursiveDir)\\%(Filename)\\%(Extension)</DestinationRelativePath>
    </FilesForPackagingFromProject>
  </ItemGroup>
</Target>
```

Figure 4.3 – ASP.NET MVC project file

In this build step, we should copy all the files from bundles folder to the publish folder. Also there may need one more build step to compile the angular project.

Next we need to create the Docker file to deploy the output folder to C:\inetpub\wwwroot in the container. WE can do it using the following commands:

```
FROM microsoft/aspnet
COPY ./inetpub/wwwroot
```

For database as it mentioned before we are using SQL Server. And to build SQL Database, we use Database.SetInitializer() method in DbContext class. Here is the code for DbContext class:

```
Database.SetInitializer(new DropCreateDatabaseModelChanges<WebAppContext>())[17].
```

Next, we need to build the container and run it. Once it is running, we can do a docker inspect command and identify the IP Address of the container as it shown on figure 4.4.

```
PS D:\Inetpub\wwwroot> docker build -t mvcngapp .
Sending build context to Docker daemon 28.65MB
Step 1/2 : FROM microsoft/aspnet
--> 816eb454dc15
Step 2/2 : COPY . /inetpub/wwwroot
--> 41a0c54da507
Successfully built 41a0c54da507
Successfully tagged mvcngapp:latest
PS D:\Inetpub\wwwroot> docker run -d --name mvcngapp mvcngapp
ea78887e4f7bd5636f6bd24f0ceaca212f48a6e34bb057b16ee2801feaf54a
PS D:\Inetpub\wwwroot> docker inspect -f "{{ .NetworkSettings.Networks.nat.IPAddress }}" mvcngapp
172.29.38.86
PS D:\Inetpub\wwwroot>
```

Figure 4.4 – Docker container building

Next, we are building a Dockerfile, in which we are building the project - both ASP.NET MVC and Angular.

In the Dockerfile first we download MSBuild, nuget and Node JS. Once downloaded extracting nodejs to C:\NodeJs folder. Then install MS Build with MSBuildTools and WebBuildTools. Once both installations is done set the tools to the PATH.

You can run npm install in the dockerfile, but it will take sometime. Also need to remove the ng build step from the project file, and run it outside. After building the Angular project we should restore the nuget packages with nuget.exe. And finally, we are building and deploying the solution with MSBuild.exe. For deploying we are using Visual Studio profile file. It is a simple pubxml file with FileSystem and deploying the output to C:\Inetpub\wwwroot directory [17].

4.3 Software description

When the user comes to the site he is seeing the main page that is showing main categories user are able to go to. Main categories page is shown in figure 4.5.

Responsive web design is a web page design that provides optimal display and interaction with the user regardless of the resolution and format of the device from which the page is viewed.

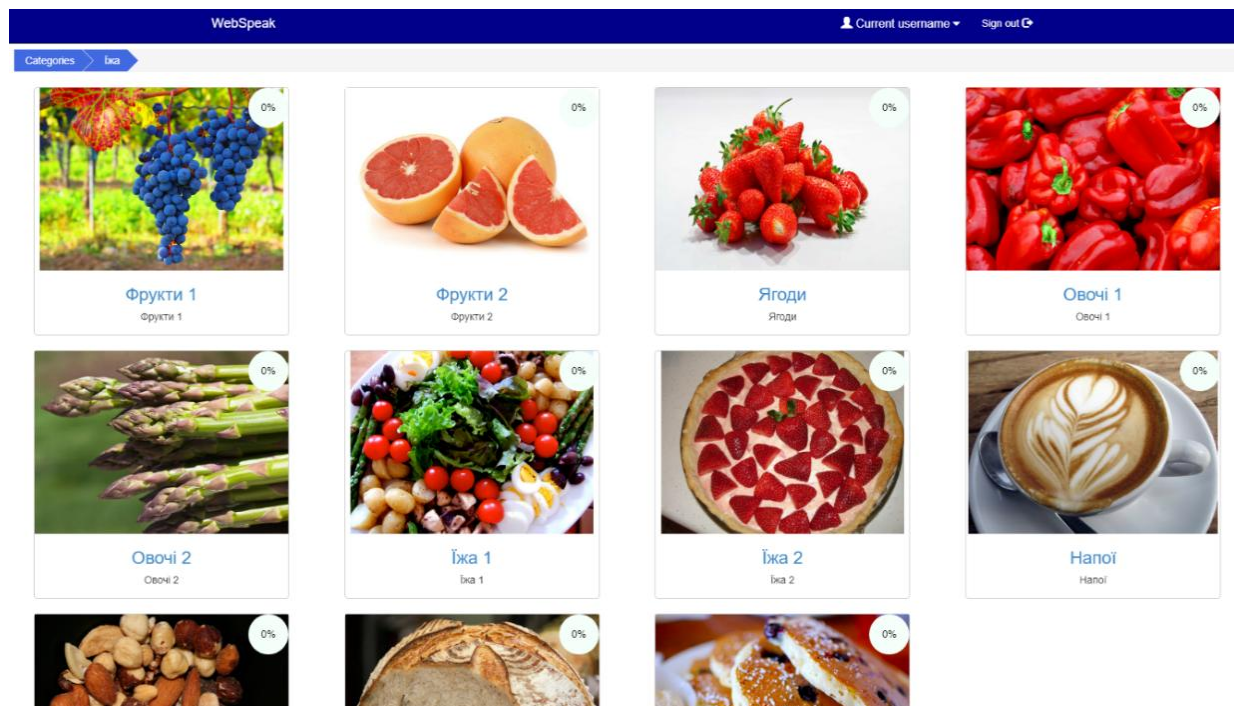


Figure 4.5 – Main categories page

The popularity of adaptive web design is growing day by day, as already now the amount of mobile traffic reaches more than half of all Internet traffic. This trend is so widespread that on April 21, 2015, Google launched an algorithm for site evaluation in its search engine to comply with the principles of "friendly" to mobile interface devices. This indicator depends on how high the page is presented in the results of the mobile search, and therefore this assessment partially acts as a penalty for sites that do not meet the standards for the mobile interface.

That is why we have decided to make our web application adaptive to all screen and devices. It can attract more users that will use our services. The adaptive layout of our site is shown in figure 4.6.

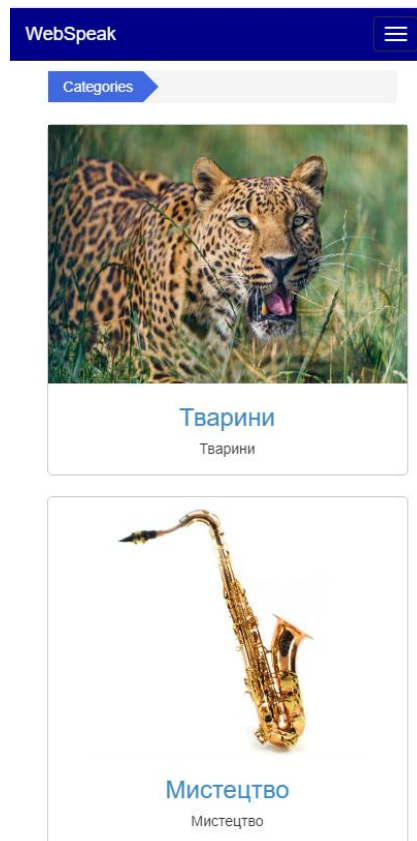


Figure 4.6 – Adaptive view on mobile device

When the user selected the category he wants to learn, the next step that should be chosen is what he/she is going to do. The page is shown in figure 4.7.

On this page, the user can go in 2 ways. The first one is to select manual or slideshow mode of viewing words. The second one way to go - tests. Our site provides 10 tests to pass which differ from each other and allow the user to consolidate knowledge about the selected category.

If the user decided to learn words in manual mode then he will see the page that is shown in figure 4.8. At the center of the screen is shown the picture that represents word below. It helps the user to remember easily the words even he does not know what is mean in the native language. Also, the page has a progress label and arrows right/left to navigate over the words.

WebSpeak Current username Sign out

Please select mode you want


Manual Slideshow

Testing

One from two ★★★★★	One from four ★★★★★
One from four: text ★★★★★	One from four: listening ★★★★★
True\False ★★★★★	Spell with picture ★★★★★
Spell with voice ★★★★★	Translation - text ★★★★★
Translation - pronunciation ★★★★★	Find pair - translation ★★★★★

Figure 4.7 – View, tests selecting modes page

WebSpeak Current username Sign out



цитрон
citron

2/19

Figure 4.8 – Manual mode of card showing

The next mode user is able to select is slideshow mode that is shown in figure 4.9. This mode does not require from the user to do any action because the words will pronounce and select to the next automatically. This page provides a navigate elements: slideshow slider, pause/start mode and etc.

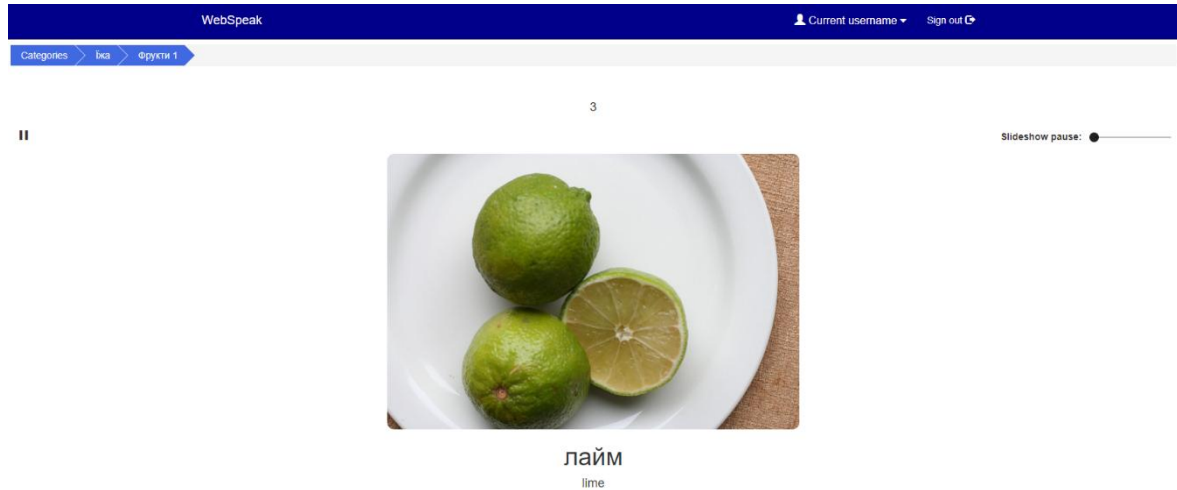


Figure 4.9 – Slideshow card showing mode

One of the main function of any app is a managing your information. This is a profile page that is shown in figure 4.10. This page provides user to set: first name, last name, email, gender, birthdate, native and target languages. This information can be used to grant user some bonuses or privileges of using our services.

To avoid user confusion when something went wrong or user navigated to the not existed page we developed a new page that shows the error and explains to the user what he did. The error page is shown in figure 4.11.

One of the main part of any application is authorization. Authorization is the function of specifying access rights/privileges to resources related to information security and computer security in general and to access control in particular. The login page and register pages are shown in figure 4.12, 4.13 respectively.

WebSpeak Current username ▼ Sign out 🔗

Vadim's Settings

First name
Vadim

Last name
Stetsiuk

Email
stesyuk.vadim@gmail.com

Gender
MALE ▼

Birthdate
12/07/1996

Native Language
Українська ▼

Target Language
English ▼

Cancel Save

Figure 4.10 – Profile page

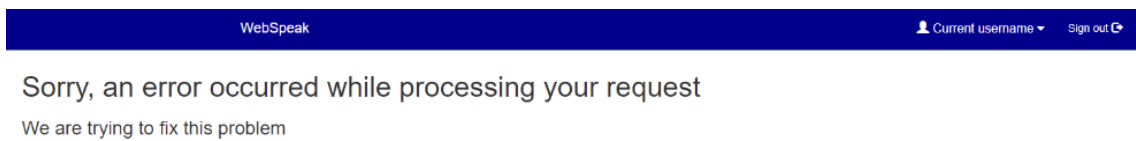


Figure 4.11 – Error page when page has not been found

WebSpeak Current username ▼ Sign out 🔗

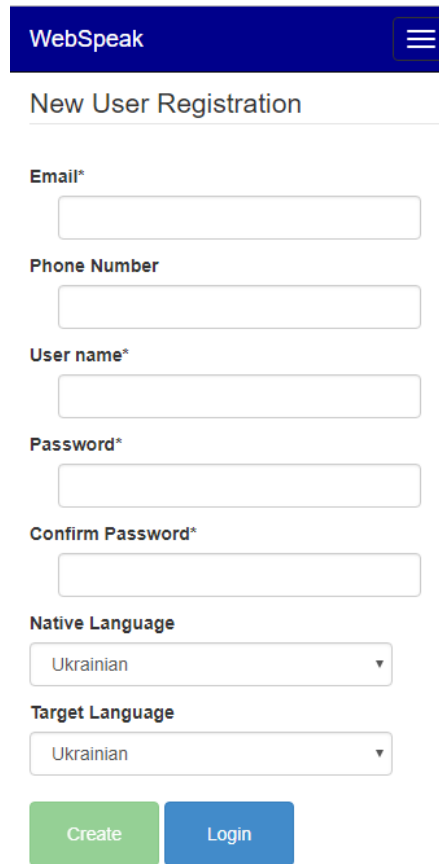
User name
guest

Password
.....

Remember on this computer

Log In

Figure 4.12 – Sign in page



WebSpeak

New User Registration

Email*

Phone Number

User name*

Password*

Confirm Password*

Native Language
Ukrainian

Target Language
Ukrainian

Create Login

Figure 4.13 – Sign up page

The next main part of developed application is tests. Our app application provides about 10 tests to pass and to consolidate all knowledge in some area.

Here they are:

– One from two. The test has one caption in the target language and 2 pictures (the first is correct that match to the caption below and the second is wrong). The goal is to find out the correct image. The test is shown in figure 4.14.



Figure 4.14 – Test 1

– One from four. The test is almost the same as the previous one but the task is a little bit complex because the user should find out which picture is correct from fourth cases. The test is shown in figure 4.15.



Figure 4.15 – Test 2

– One from four: text. The test has one image that represents some of the four captions below. The user should select the correct caption which matches to the picture. The test is shown in figure 4.16.

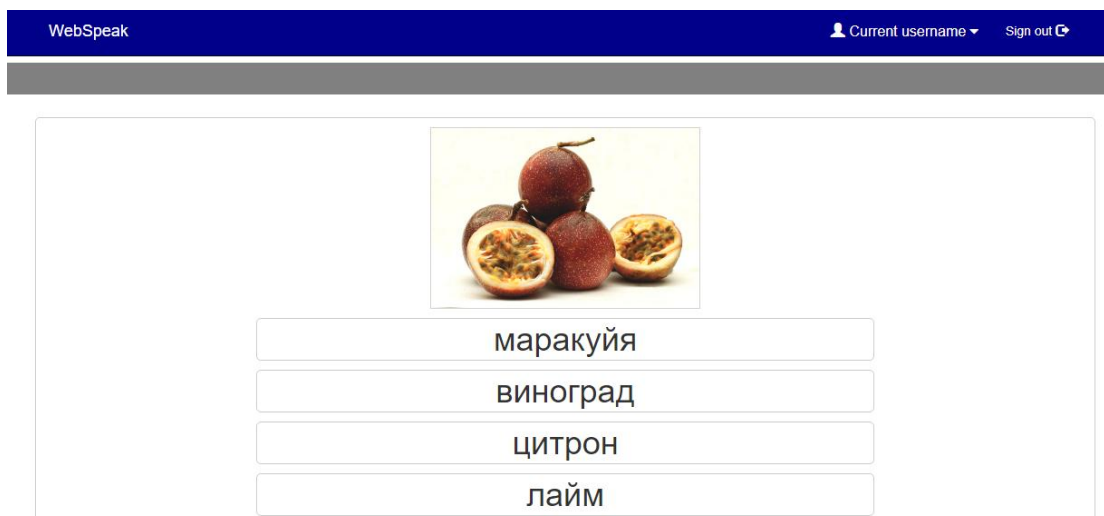


Figure 4.16 – Test 3

– One from four: listening. The test is an analog of Test 2 but in this case, he should listen the sound below in the target language and select the picture which name had been pronounced. The test is shown in figure 4.17.

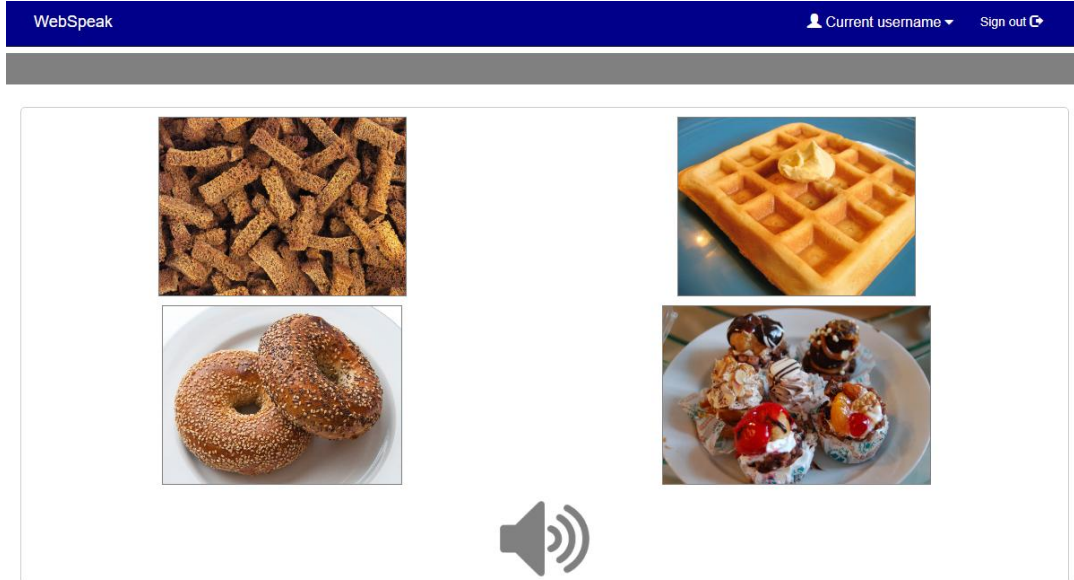


Figure 4.17 – Test 4

– True\False. The test has a picture and caption. The goal is to find out is it correct (the caption describes the picture) or not. The test is shown in figure 4.18.



Figure 4.18 – Test 5

– Spell with picture. The test has a picture and some letters are arranged in a random order. The purpose of the test is to arrange the letters in the correct order, so that the word is described by the image above. The test is shown in figure 4.19.

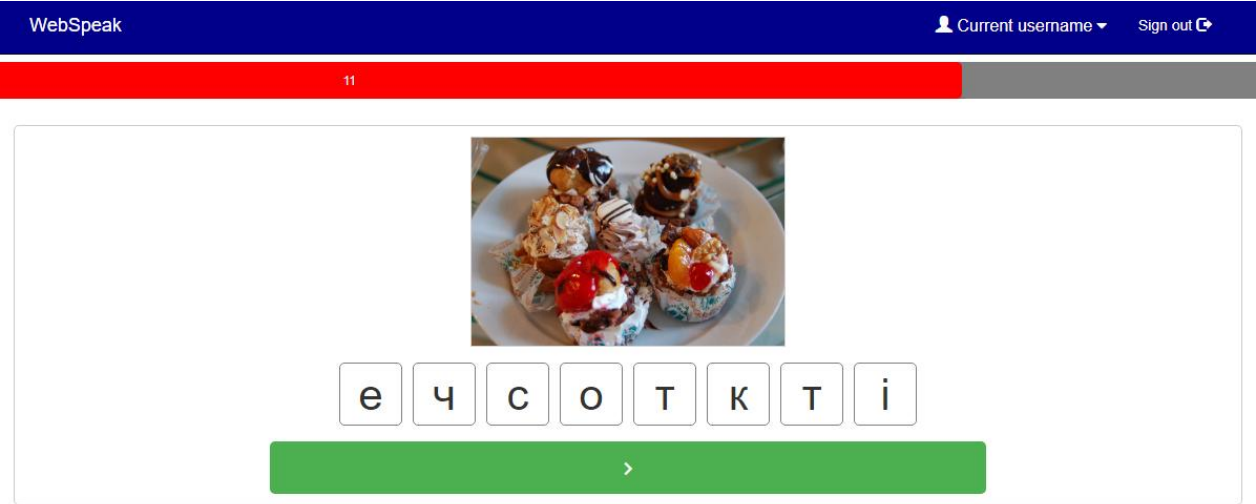


Figure 4.19 – Test 6

– Spell with voice. The test has some letters that arranged in a random order and pronounce of the word that should be compiled. The user should listen the pronounce and arrange the letters in a correct order. The test is shown in figure 4.20.

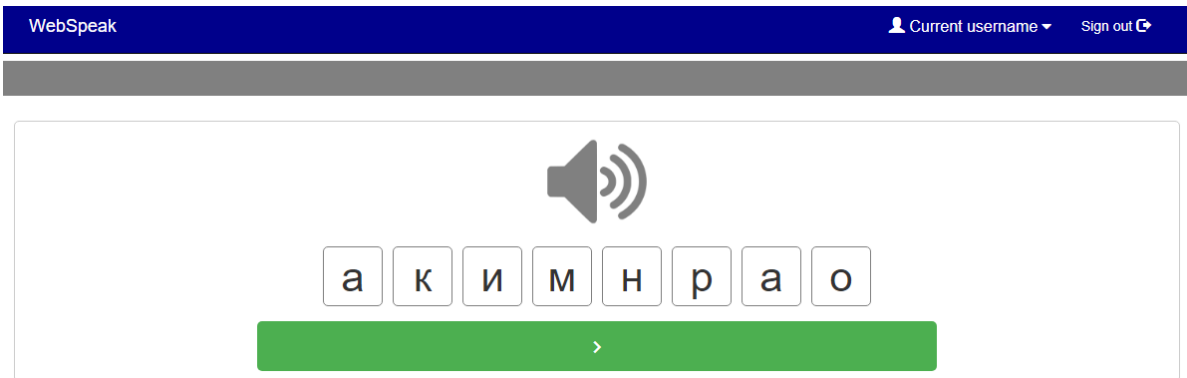


Figure 4.20 – Test 7

– Translation – text. The test has one highlighted label that contains word in a native language. Also four cases are below in a target language which user

should see and select one of them that matches to label above. The test is shown in figure 4.21.



Figure 4.21 – Test 8

– Translation – pronounce. The test has four options and one sound to listen. The goal is to select one of the caption above after listening the pronounce of the word in a target language. The test is shown in figure 4.22.

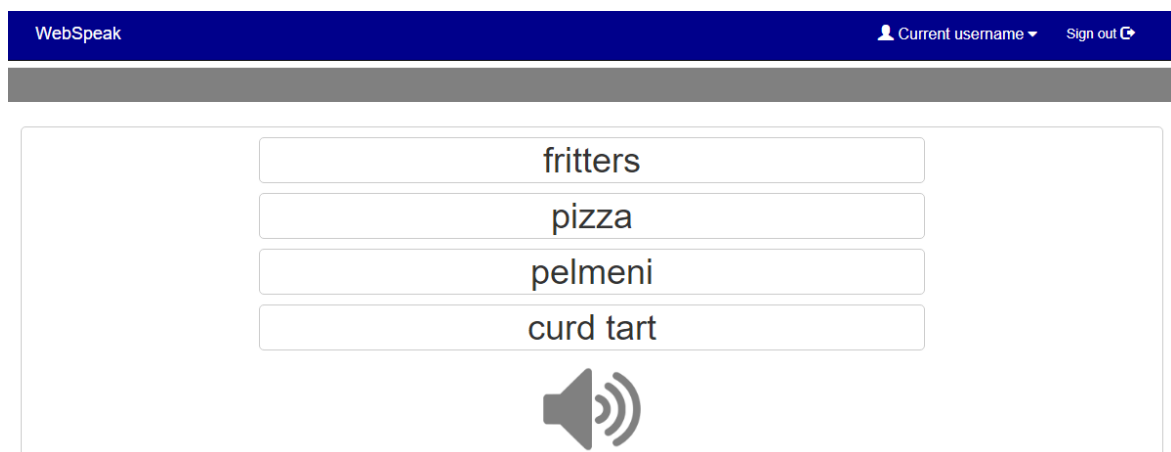


Figure 4.22 – Test 9

– Find pairs - Translation. The test has four words at the left side in a target language and four words at the right side in a native language. The goal is to connect correct translations. The test allows the user to undo the pair that had been connected.

The test is shown in figure 4.23.

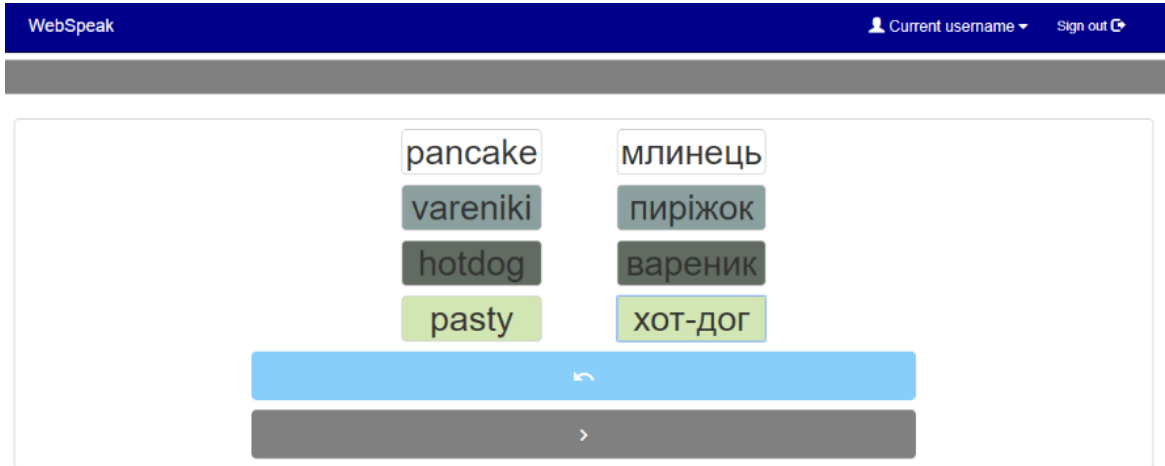


Figure 4.23 – Test 10

5 SYSTEM DISSEMINATION

5.1 Target market analysis

The most important in any task of system propagation is to shed potential buyers of this system. There are so many different methods to identify the group of people who can buy a developed system. The most popular are:

- interviewing potential buyer groups;
- social media marketing for small business;
- demographic information using census bureau information;
- past sales information;
- application analysis.

The main point of the target market research is to answer 6 main questions. The first question is “Who?”. This question is the easiest and the hardest at the same time. You need to answer You need to find out who can be your potential customer. You need to answer what are they genders, education level, age, occupation etc.

In our case the target user is childrens 3-6 years old. However, kids in this age can't buy our application so they can't be our target market. In the most cases parents want their children to learn foreign language or to improve their vocabulary. So, our target market is parents of kids 3-6 years old. In general target market is people 22-33 years old. We should target both genders but our distribution should be 70% of womens and 30% of mens. Such distribution should be used as womens in most cases are engaged in the education of children.

The second question is “When?”. Whe should find out what time is the best time to show our marketing materials to the target market. Also, we should found out when our customers will buy our product. They can buy it once, seasonally, subscription based or when something breaks. Our product will be used on the time based basis. Our system will be distributed using subscription model.

The third question is “Where?”. The location of our customers is important as well. We need to find where our customers live, where they work, what the size of the target area. Our customers are commonly located in the towns. In the most cases the users should be located in the region or state centers.

The fourth question is “Why?”. This question is the most important. We need to find out why target market should buy product. The answer on this question is covered in the section 1.

The last question is “How?”. In the research it’s needs to be considered what the customers behavior. This is the most common question for target advertising.

The results of the market target analysis are shown in the table 5.1.

Table 5.1 – target market analysis results

Age	22-33 years old
Gender	Male (30 %), Female(70%)
Distribution model	Subscription
Location	Citizen of the region, state centers

5.2 Marketing strategy

For implementing our marketing strategy, we should implement 10 steps. The first 2 steps were implemented in the section 5.1. We had researched our target market and researched what do they need from our application. This is the most important steps in any marketing strategy. Marketing strategy can’t be successful if your application can’t reach customers that need it.

The third step is the start of marketing itself. Marketing should start as early as possible. The marketing can start even on development stage. There can be released something like development video diaries. At the later stage some teasers can be released as well. The main goal there is to start building interest before the application is released.

The fourth step is preparing presskit. It's needed to be found all target bloggers, media groups, press etc. You need to provide as much information for the press as possible and cover all the possible silent points. The more people get more valuable information about application the more the more work will be done for you.

The fifth step is complex step. The app store pages should be optimized as much as possible, A lot of people get applications using store search. It's really important to think about title and description to optimize the search. Also, it's really important to find catchy icon. The screenshots of the app should cover as much as possible of the functionality. All these factors can be difference between buy application or move to the next one.

The six step is reviews. You need to ask your users to write the reviews to your app. If you can you can buy some professional reviews. Applications with a lot of reviews are credible for the new users.

The seventh step is social media. Application should have its own media accounts in the most popular social medias. Using this you can inform your customers about updates or about some changes and also provide some marketing information. Also, this will help you to get some advertising from people that already using your app by reposting information.

The eighth step is almost similar with step number 4. Even after the release you should use opinion makers to advertise your product. It's can be a YouTube, Instagram, Facebook or other bloggers. Such opinion makers can have a lot of subscribers. If the blogger is really close to your application, all this subscribers are potential customers.

The ninth step is feedback. It's important to listen to your customers, get their reviews and making your app always better for your customers. Also, it's important to monitor your marketing strategies and put more efforts in strategies that giving you more efforts than others.

The last step is one of the oldest but still one of the best. It's CEO optimization You should also apply SEO to your marketing efforts. Good SEO on

articles, videos, use of meta-descriptions, tags, and other identifiers will help both your app and your marketing to be more visible and easily found

CONCLUSIONS

This master's qualification work is devoted to the problem of introduction of modern information technologies into the process of learning foreign languages and replenishing the vocabulary of children. The use of information technologies in the process of learning, the process of learning foreign languages, the process of teaching children is analyzed.

Advantages and disadvantages of introduction of information technologies in the educational process are presented.

An overview of modern services and tools for learning foreign languages and replenishing the vocabulary of children is provided.

The approaches and tools most relevant to the development of the Android mobile platform for this topic are analyzed and selected.

The web application has been developed that allows you to learn foreign languages (Ukrainian, Russian, English, German, Spanish, Portuguese and Chinese) and supplement your children vocabulary. The developed application, unlike the existing ones, allows to increase the efficiency of mastering the material due to the successful formation of groups of words, as well as the use of associative approaches to language learning.

The developed software was tested. Comparison of the results of its work with existing analogs makes it possible to conclude that the set tasks are fulfilled in full.

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36. Set up prices & app distribution[Electronic resource]: [Website] – Electronic data. – Access mode: <https://support.google.com/googleplay/android-developer/answer/6334373>- Screen name.

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39. Pre-order on Google Play[Electronic resource]: [Website] – Electronic data. – Access mode: <https://support.google.com/googleplay/answer/4643892>- Screen name.

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42. Accepted payment methods on Google Play[Electronic resource]: [Website] – Electronic data. – Access mode: <https://support.google.com/googleplay/answer/2651410> - Screen name.

43. Types of featured app lists[Electronic resource]: [Website] – Electronic data. – Access mode: <https://support.google.com/googleplay/android-developer/answer/1295940> - Screen name.

44. View & analyze your app's ratings & reviews[Electronic resource]: [Website] – Electronic data. – Access mode: <https://support.google.com/googleplay/android-developer/answer/138230>Screen name.

45. Monetization and Ads[Electronic resource]: [Website] – Electronic data. – Access mode: <https://play.google.com/about/monetization-ads/> - Screen name.

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ATTACHMENTS

Attachment A (mandatory). Technical task

Vinnytsia National Technical University

APPROVED BY

Head of the department of the AIIT VNTU,

Dr.Sc., Prof

_____ R. Kvetny

“ ___ ” _____ 2019

TECHNICAL TASK

for the master's qualification work

«Software for increasing the vocabulary of children and learning foreign
languages. Part 1. Development of software for desktops»

08-02.MQW.012.00.000 TT

Supervisor of Masters qualification work

Associate Professor of

AIITdepartment

I. Bogach

“ ___ ” _____ 2019

Performer: st. of 3ACIT-18mgroup

V.Karpenko

“ ___ ” _____ 2019

1. Name and field of application

1.1. Title – «Software for increasing the vocabulary of children and learning foreign languages. Part 2. Development of software for mobile devices»

1.2. Field of application – Educational information systems.

2. The basis for the development.

Theme of master's qualification was approved by order VNTU № 238 from " _____ ”

3. Purpose and designation.

The purpose of master's thesis is to create a new information system for learning foreign languages and replenishing the vocabulary of children using new highly effective learning tools.

4. Initial data for development.

Master's qualification work is carried out for the first time. During the development, the following documents should be used:

1. Красовская Л.В., Исабекова Т.И. Использование информационных технологий в образовании. Научный результат. Педагогика и психология образования – Том 3, Выпуск №4 – 2017
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5. Requirements for development.

5.1. List of main features:

- User authorization;
- Support the following languages to learn: Chinese, English, German, Polish, Portuguese, Russian, Spanish, Ukrainian;
- Ability to group lessons into categories and subcategories;
- Ability to learn words using visual and auditory perception;
- Set of exercises to consolidate the learned words;

5.2. Basic technical requirements for development.

5.2.1. Requirements for the software platform: Android.

5.2.2. Operating system conditions:

- work on mobile devices based on Android 5.0 or higher;
- the possibility of a 24-hour system operation.

6. Stages and stages of development.

6.1 Explanatory note:

1	Analysis of the current state of the problem of introduction of information technologies into the learning process	
2	Analysis of methods of learning foreign languages and replenishing the vocabulary of children, conducting their comparative analysis, determining their advantages and disadvantages.	
3	Designing an information system for learning foreign languages and replenishing the vocabulary of children	
4	Researching modern approaches and technologies that can be used in the development of an information system	
5	Practical implementation and analysis of the results	
6	Approval of research results	
7	Publications	
8	Designing an explanatory note, graphic material and presentation	
9	Master's work defense	

7. The order of control and acceptance.

7.1. The progress of master's qualification work is supervised by the head of the work. The border control should be conducted until _____
_____.

7.2. The project certification is carried out on preliminary protection. Preliminary defense of master's qualification work is to be held until _____
_____.

7.3. The final decision on the assessment of the quality of the master's qualification work is taken at a meeting of the DEC. The defense of master's qualification work is to hold _____ .

Attachment B (mandatory).**The graphic part**

Head of the department of the AIIT	_____	<u>Dr.Sc., Prof</u> <u>R. Kvetny</u> (signature) (name, surname, degree, academic status)
Scientific supervisor	_____	<u>PhD.,As.Prof</u> <u>I. Bogach</u> (signature) (name, surname, degree, academic status)
Technical control	_____	<u>PhD.,As.Prof</u> <u>I. Bogach</u> (signature) (name, surname, degree, academic status)
Regulatory control	_____	<u>PhD.,As.Prof</u> <u>I. Bogach</u> (signature) (name, surname, degree, academic status)
Reviewer	_____	<u>PhD.,As.Prof</u> <u>O.Nikitenko</u> (signature) (name, surname, degree, academic status)
Student of the 3ACIT-18m group	_____	V. Karpenko

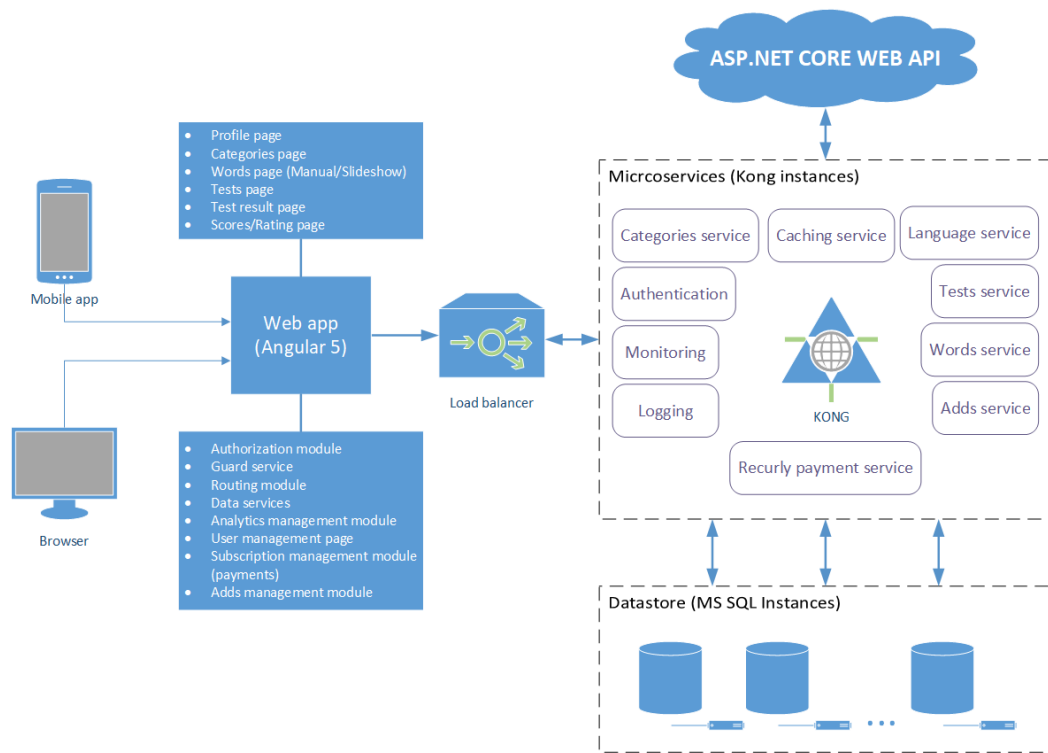


Figure B1 - Client-server architecture

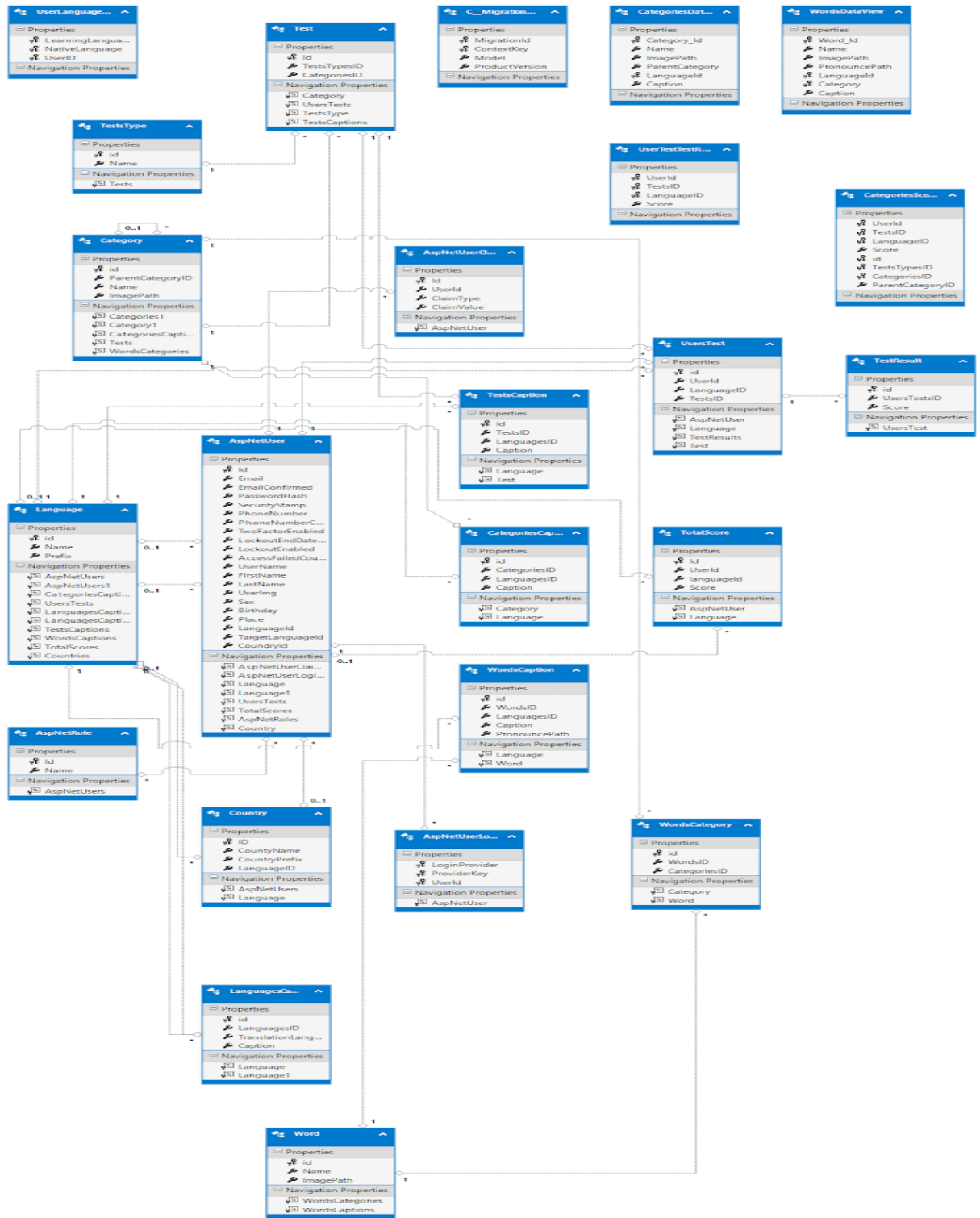


Figure B2 - Database Structure

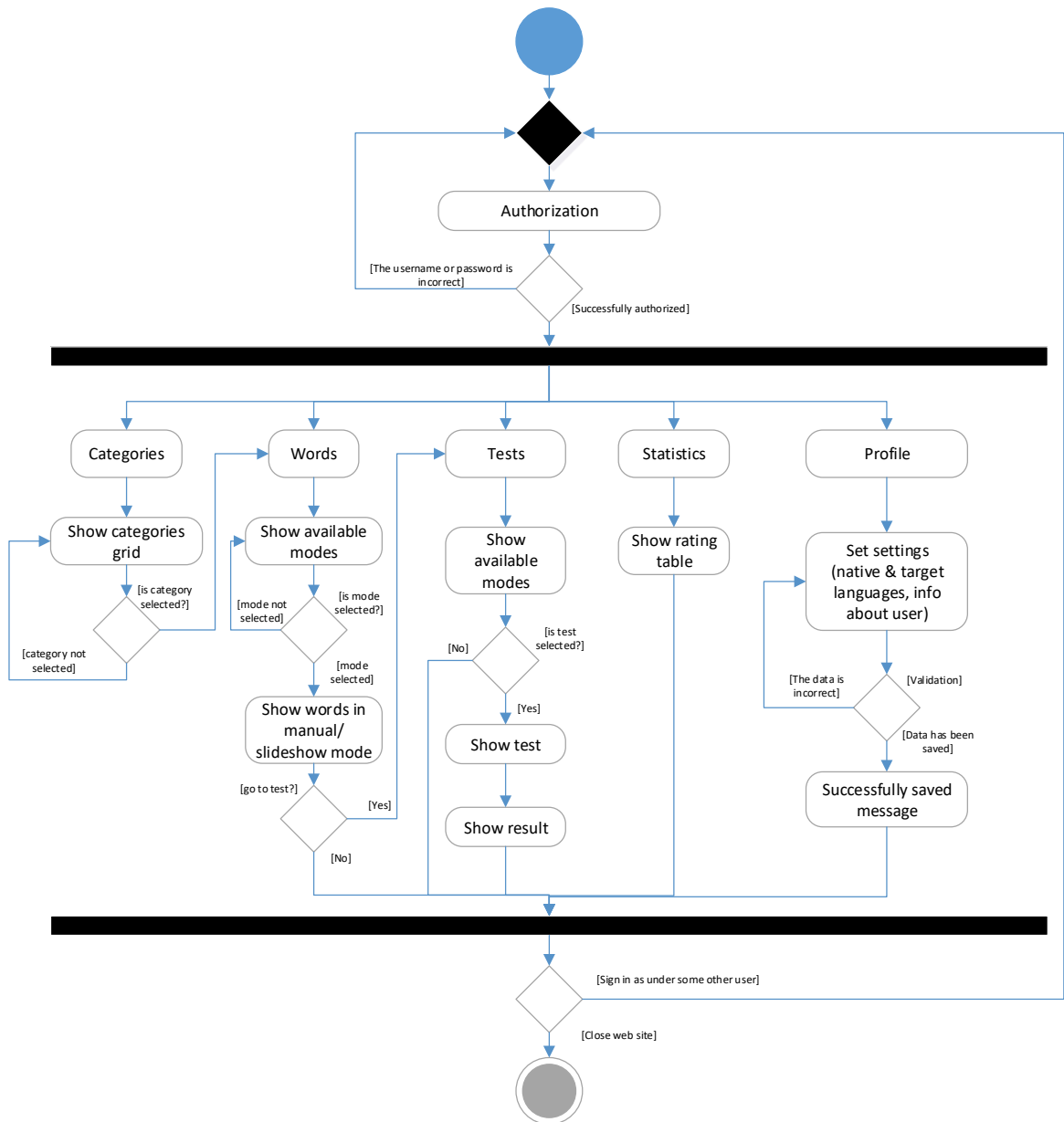


Figure B3 – Activity UML diagram



Figure B4 – REST API design technology

Attachment C (mandatory).

Listing of the software

```

using System;
using System.Collections.Generic;
using System.Diagnostics;
using System.Linq;
using Microsoft.AspNetCore.Mvc;
using DAL.Repositories;
using DAL;
using DAL.Models;
using Microsoft.AspNetCore.Mvc.Rendering;
using Microsoft.AspNetCore.Http;
using System.Threading.Tasks;
using Microsoft.AspNetCore.Identity;
using System.Security.Claims;
using Microsoft.EntityFrameworkCore;

namespace LearningLanguages.Controllers
{
    public class HomeController : Controller
    {
        IRepository<Categories> _categories = new CategoriesRepository();

        IRepository<Languages> _languages = new LanguagesRepository();

        IRepository<Words> _words = new WordsRepository();

        IRepository<Tests> _tests = new TestsRepository();

        IRepository<Users> _users = new UsersRepository();

        IRepository<TestResults> _testResults = new TestResultsRepository();

        IRepository<TotalScores> _totalScores = new TotalScoresRepository();

        [HttpGet("Home/Index")]
        public IActionResult Index()
        {
            int defaultLang = 3;
            string defaultEnableCheckBox = "true";

            if (HttpContext.Session.GetInt32("idLangNative") == null)
            {
                HttpContext.Session.SetInt32("idLangNative", defaultLang);
                HttpContext.Session.SetInt32("idLangLearn", defaultLang);
                HttpContext.Session.SetString("enableNativeLang", defaultEnableCheckBox);
                HttpContext.Session.SetString("enableSound", defaultEnableCheckBox);
                HttpContext.Session.SetString("enablePronounceNativeLang",
                defaultEnableCheckBox);
                HttpContext.Session.SetString("enablePronounceLearnLang",
                defaultEnableCheckBox);
            }

            return Ok();
        }

        [HttpGet("Home/Categories")]
        public async Task<IEnumerable<DTO>> Categories()
        {
            int idLangLearn = (int)HttpContext.Session.GetInt32("idLangLearn");
            int idLangNative = (int)HttpContext.Session.GetInt32("idLangNative");

```

```

        List<DTO> NativeLearnLangCat = await _categories.GetTranslations(idLangLearn,
idLangNative, null);

return NativeLearnLangCat;
    }

    [HttpGet("Home/Categories/SubCategories")]
publicasync Task<IEnumerable<DTO>> SubCategories(int id)
    {
    if (id != 0)
        {
            HttpContext.Session.SetInt32("category", id);
        }
    else
        {
            id = (int)HttpContext.Session.GetInt32("category");
        }

    int idLangLearn = (int)HttpContext.Session.GetInt32("idLangLearn");
    int idLangNative = (int)HttpContext.Session.GetInt32("idLangNative");

        List<DTO> NativeLearnLangSubCat = await
        _categories.GetTranslations(idLangLearn, idLangNative, id);

return NativeLearnLangSubCat;
    }

    [HttpGet("Home/Categories/SubCategories/Tests")]
publicasync Task<IEnumerable<DTO>> Tests(int id)
    {
    if (id != 0)
        {
            HttpContext.Session.SetInt32("subCategory", id);
        }
    else
        {
            id = (int)HttpContext.Session.GetInt32("subCategory");
        }

    int idLangLearn = (int)HttpContext.Session.GetInt32("idLangLearn");
    int idLangNative = (int)HttpContext.Session.GetInt32("idLangNative");

        List<DTO> NativeLearnLangTests = await _tests.GetTranslations(idLangLearn,
idLangNative, id);

return NativeLearnLangTests;
    }

    [HttpGet("Home/Categories/SubCategories/Tests/Manual")]
publicasync Task<IEnumerable<DTO>> Manual(int id)
    {
    if (id != 0)
        {
            HttpContext.Session.SetInt32("subCategory", id);
        }
    else
        {
            id = (int)HttpContext.Session.GetInt32("subCategory");
        }

    int idLangLearn = (int)HttpContext.Session.GetInt32("idLangLearn");
    int idLangNative = (int)HttpContext.Session.GetInt32("idLangNative");
    string enableNativeLang = HttpContext.Session.GetString("enableNativeLang");
    string enableSound = HttpContext.Session.GetString("enableSound");

```



```

string enablePronounceNativeLang =
HttpContext.Session.GetString("enablePronounceNativeLang");
string enablePronounceLearnLang =
HttpContext.Session.GetString("enablePronounceLearnLang");

        List<DTO> NativeLearnLangWords = await _words.GetTranslations(idLangLearn,
idLangNative, id);

        NativeLearnLangWords.First().EnableNativeLang = enableNativeLang;
        NativeLearnLangWords.First().EnableSound = enableSound;
        NativeLearnLangWords.First().EnablePronounceNativeLang =
enablePronounceNativeLang;
        NativeLearnLangWords.First().EnablePronounceLearnLang =
enablePronounceLearnLang;

return NativeLearnLangWords;
    }

    [HttpPost("Home/Categories/SubCategories/Tests/Test")]
public async Task<bool> Test([FromBody]DTOTestResultInfo resultInfo)
    {
var isUser = false;
string currentUserId = User?.FindFirst(ClaimTypes.NameIdentifier)?.Value;

if (String.IsNullOrEmpty(currentUserId))
    {
return isUser;
    }

int idLangLearn = (int)HttpContext.Session.GetInt32("idLangLearn");
DateTime testDate = DateTime.Now;

        TestResults testResult = new TestResults()
        {
            Result = resultInfo.TotalResult,
            UserId = currentUserId,
            LangId = idLangLearn,
            CategoryId = resultInfo.SubCategoryId,
            TestDate = testDate,
            TestId = resultInfo.TestNumber
        };

var testResultList = await _testResults.GetAll().Where(x => x.TestId ==
resultInfo.TestNumber && x.LangId == idLangLearn &&
                                                                    x.CategoryId ==
resultInfo.SubCategoryId).ToListAsync();
var totalScoresList = await _totalScores.GetAll().Where(x => x.UserId == currentUserId &&
                                                                    x.LangId ==
idLangLearn).ToListAsync();

int maxTestResultBefore = -1;

if (testResultList.Any())
    {
        maxTestResultBefore = testResultList.Max(x => x.Result);
    }

    _testResults.Create(testResult);

if (!totalScoresList.Any() && !testResultList.Any())
    {
        TotalScores totalScore = new TotalScores()
        {
            Total = resultInfo.TotalResult,
            UserId = currentUserId,

```

```
        LangId = idLangLearn
    };

    _totalScores.Create(totalScore);
}
elseif (!testResultList.Any())
{
    TotalScores totalScore = totalScoresList.First();
    totalScore.Total += testResult.Result;

    _totalScores.Update(totalScore);
}
else
{
    TotalScores totalScore = totalScoresList.First();

if (Math.Max(resultInfo.TotalResult, maxTestResultBefore) == resultInfo.TotalResult)
    {
        totalScore.Total += Math.Abs(resultInfo.TotalResult -
maxTestResultBefore);
    }

    _totalScores.Update(totalScore);
}

    _testResults.Save();
    _totalScores.Save();

    isUser = true;

return isUser;
}
}
```