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Development of the mobile application "Fascinating Onomastics" based on semantic base of knowledge

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Abstract: - This research, funded under the BR11765535 "Development of Scientific and Linguistic Foundations and IT Resources to Expand the Functions and Improve the Culture of the Kazakh Language" project, is aimed at the need to develop the scientific and linguistic foundations of the Kazakh language with a special focus on anthroponymy. Through the use of descriptive and historical methods, the research creates a semantic knowledge base for Kazakh proper names. This extensive database forms the basis of the innovative mobile application "Fascinating Onomastics", developed using the Flutter 3.0 framework. The application serves as an innovative resource allowing users to study Kazakh anthroponymy with features such as name search, favorites and the ability to add new names. The study revealed about 100 properties that affect the structure of proper names, contributing to a deeper understanding of Kazakh onomastics. The technical and economic effectiveness of the application is highlighted by its potential to increase cultural awareness, promote cultural tourism and be used as an economically viable product. In addition, this study has a high scientific and technical status, offering an unprecedented contribution to the study of Kazakh onomastics and cultural heritage. The application "Fascinating Onomastics" with its rich semantic features and interface in the Kazakh language is becoming an important milestone in achieving scientific, cultural and educational goals.

Keywords: Anthroponymy, Kazakh language, Mobile application, Semantic knowledge base.

I. INTRODUCTION

This work was funded in the framework of the research project BR11765535 "Development of Scientific and Linguistic Foundations and IT Resources to Expand the Functions and Improve the Culture of the Kazakh Language". The goal of the project is to develop scientific and linguistic foundations and IT resources to expand the functions and improve the culture of the Kazakh language as a language of interethnic communication in a digital format, which is an urgent and important problem in the strategic direction of the development of our state. The solution to this problem will be carried out on the basis of: analysis of scientific, methodological and normative foundations of the Kazakh language grammar and computational linguistics; research of models and methods of speech synthesis; construction of a formal description of the Kazakh language grammar, artificial intelligence technology for the development of an intelligent synonymizer, an electronic reference book, a mobile application "Fascinating onomastics", an electronic dictionary of school textbooks terminology, a synthesizer of Kazakh speech and an intellectual system "Akhmettanu".

This paper presents the creating of mobile application "Fascinating onomastics". Proper names are integral to language, serving as vital markers in human communication. Onomastics, a linguistic branch, specializes in the study of these unique designations for individuals or entities. Currently, onomastics has expanded the field of research and includes many other names related to the names of objects and phenomena [1]**Error! Reference source not found.**, [2]. The research group "Fascinating Onomastics" has chosen to delve into anthroponymy, specifically focusing on Kazakh anthroponymy – a domain rich in diversity and cultural reflections. Personal names are an important element of any language and culture, because no language, no culture can do without them. Each nation has its own names, the volume and completeness of which depends on the degree of inclusion and differentiation of real and imaginary objects in the nomination process [2].

Kazakh anthroponymy is a set of personal names used to name people in the Kazakh language. Kazakh anthroponymy is rich and includes both traditional Kazakh names and names from other languages (mainly Arabic and Persian). Kazakh names clearly show the cultural and historical dynamics of the people between the past and the present [3**Error! Reference source not found.**].

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The semantic knowledge base on anthroponymy, one of the largest branches of onomastics, as a research direction, and proposed to develop a mobile application based on it. For this purpose, a semantic knowledge base was developed, the structure and principles of creating which are detailed in [4]. The development of the mobile application "Fascinating Onomastics" on Kazakh anthroponymy has enormous potential to strengthen the cultural heritage of Kazakhstan and increase interest in its rich cultural and linguistic history. The mobile application can be an important tool for education, research and intercultural exchange, contributing to the promotion of Kazakh culture and language.

II. MATERIALS AND METHODS

In the first part of this research work – in the process of creating a semantic knowledge base of Kazakh names, two methods were used: descriptive (descriptive) method and historical method.

The descriptive method includes a sequential description of individual names and various onomastic phenomena studied in a certain historical period. This method requires strict adherence to a number of principles: clear definition of the research topic (for example, anthroponyms or toponym system), gradual description, systematization, grouping or classification of the studied material and description taking into account the research goals. The application of this method is the collection of material, its cataloging and systematization, which allows distinguishing its various components (types), determining general relationships between them, and highlighting their important characteristics.

The historical method, in turn, involves determining the onomastic layers according to their linguistic composition, that is, determining the origin of the word and its language.

In the final stage of scientific research work, a cross-platform (hybrid) method was used to develop a mobile application. For the hybrid approach, the Flutter 3.0 framework is chosen, an open-source framework developed by Google that allows developers to build high-performance, high-fidelity, native mobile applications based on a single code base. Flutter allows developers to write code once and deploy it on iOS and Android platforms, making it easy to build cross-platform applications without the need for large-scale recoding [5**Error! Reference source not found.**].

One of the main advantages of using Flutter is its customizable widgets, which allow developers to create visually appealing and interactive user interfaces that improve the overall user experience. Flutter is also equipped with a rapid loading function that allows developers to make changes to the code in real-time, allowing them to test and improve the application quickly and efficiently. In addition, Flutter's performance is significantly higher than traditional app development platforms, making it a great tool for companies looking to build high-performance mobile apps.

The general methodology for conducting the study was chosen the methodology for studying scientific articles, conducting scientific seminars, participating in scientific conferences and other scientific events dedicated to the scientific direction on the topic of the project, as well as analyzing auxiliary sources. This method involves the process of studying, generalizing and detailed analysis of literary data.

The research methodology for the development of the "Fascinating Onomastics" mobile application includes the following: the methodology of developing the functionality of the mobile application, the methodology of designing the mobile application and the interface, the methodology of testing the mobile application, the methodology of correcting and improving the mobile application.

Study of examples and semantic structures of Kazakh proper names, as well as determining the designation of Kazakh proper names and reflecting their signs and properties on the basis of semantic knowledge, determining the requirements of the mobile application, developing a prototype, developing terms of reference, testing the application.

Research methods: In the course of the research, a way of organizing phenomena by dividing them into groups according to certain characteristics was used – the classification method, as well as the prototyping method [6**Error! Reference source not found.**]. The prototyping method involves prototyping a mobile application and determining the optimal user interface.

Calculation methods: it is not necessary to perform calculations at this stage of the study.

Justifying the necessity for experimental work: Experimental research is an integral part of the mobile application development process, which helps to create an application that is efficient, functional and satisfies the needs of users. Experimental work done by SRW - evaluation of functionality and performance. These experiments allow you to evaluate how effectively and functionally the application performs its tasks. During this experiment, tests were conducted to determine how fast and stable the application works under different conditions.

Analysis of methods and tools for development of mobile application are the main principles of action of developed objects, their characteristics.

Developing mobile applications requires knowledge of different programming languages, frameworks and tools depending on the platform and technology used.

Popular technologies used to develop mobile applications:

1. *Native application development*: includes application development for a specific platform, such as iOS or Android, using platform-specific languages and tools such as Swift and Objective-C [7] for iOS, Java and Kotlin [8] for Android. Native applications offer the best performance and user interface but require a separate code base for each platform.
2. *Development of cross-platform applications*: allows developers to create applications that can run on multiple platforms using a single code base. Popular platform development technologies include React Native, Flutter, Xamarin, and Ionic [9].
React Native is a popular open source framework developed by Facebook to create native mobile applications using JavaScript and React. This will allow developers to create high-performance cross-platform applications for iOS and Android with a single code base.
Flutter is an open source framework developed by Google to create native mobile, Web, and desktop applications using the Dart programming language.
Xamarin is a platform for development of cross-platform application owned by Microsoft. It allows developers to build native mobile apps for iOS, Android and Windows using C# and .Net frameworks.
Ionic is an open source framework that uses web technologies like HTML, CSS, and JavaScript to build cross-platform mobile apps. It offers a library of UI components and plugins, and also supports popular frameworks like Angular and React.
3. *Hybrid application development*: involves building an application that combines native and web components. Hybrid applications use web technologies such as HTML, CSS, and JavaScript embedded in their container. Popular hybrid application development platforms include Apache Cordova, PhoneGap, and Ionic [10], [11].
4. *Web Application Development*: Web applications are created using web technologies such as HTML, CSS, and JavaScript, and run on web browsers. Web applications do not need to be installed on the device and users can access them by URL [12].

Server-side development: involves creating the back-end components of the mobile application that manage data and provide communication between the application and the server. Popular server development technologies include Node.js, Ruby on Rails, and Python Django, as well as GoLang [13**Error! Reference source not found.**].

Node.js is a popular technology for building real-time web applications and network applications that require high concurrency and low latency. It is based on the Chrome V8 JavaScript engine and uses a non-locking event-driven I/O model, which allows it to be used to create scalable real-time applications.

Ruby on Rails is a full-featured web development platform that emphasizes rules rather than configuration, making it easy for developers to quickly build web applications. This is especially useful for building e-commerce websites, social media platforms, and management systems of content.

Python Django is a high-end web framework with an emphasis on rapid development, clean design, and a pragmatic philosophy. Django is a full-featured framework for rapidly building web applications and is especially useful for building websites with multiple content and social media platforms.

GoLang is a statically typed, composable, open-source language designed for simplicity, efficiency, and high scalability. GoLang is especially useful for building microservices and web applications that require high concurrency and low latency.

Determining the requirements of the mobile application for the onomastics of Kazakh names. The target audience of the supplement is Kazakhs, Kazakhs living abroad and foreigners who are interested in Kazakhstan, its culture and traditions. The application provides detailed information on names and their meanings, making it an indispensable tool for students of the Kazakh language and culture, as well as for those who want to learn about the traditions of Kazakhstan.

III. DEVELOPMENT OF A PROTOTYPE OF A MOBILE APPLICATION FOR THE ONOMASTICS OF KAZAKH NAMES

A prototype of a mobile application was done using the Figma program. Figma is a web design tool used to create user interfaces, icons, and other design elements for websites, web applications, and mobile applications [14]. It provides a collaborative platform that allows teams to create, share, and view projects in real-time, making it easier for designers to collaborate and get feedback from stakeholders.

Prototyping helps you develop a prototype of your application design, identify revised or new ideas, and make the design process more efficient. Prototypes are visual representations of the design of the application that give an idea of the general appearance of the product and how it will work.

One of the stages of mobile applocation development is data modeling. Data modeling is the process of designing how an application will store data in a given database. Data modeling differs from relational database modeling. With a relational database, you can easily model the queries you need. During the design of the database of the "Fascinating Onomastics" database, fields (components or attributes representing the table structure), their types and additional notes were compiled.**Error! Reference source not found.** The main part of the fields in the database (column) has a logical type; some labels are grouped, and some fields (columns) are dependent on others.

Work on converting the data in the knowledge base of the mobile application "Fascinating Onomastics" into a database has been completed. In the process of data transformation, the names of the columns were changed according to the requirements, the necessary changes were made to the structure of the columns and fields, and the primary keys were added. At the same time, the appropriate relationships between the tables were established (1:1, 1:M, M:N), and the database diagram was created. Figure 1 shows a fragment of the information conversion process from the knowledge base of the "Fascinating Onomastics" mobile application to the structured database. (**Error! Reference source not found.**Figure 1).
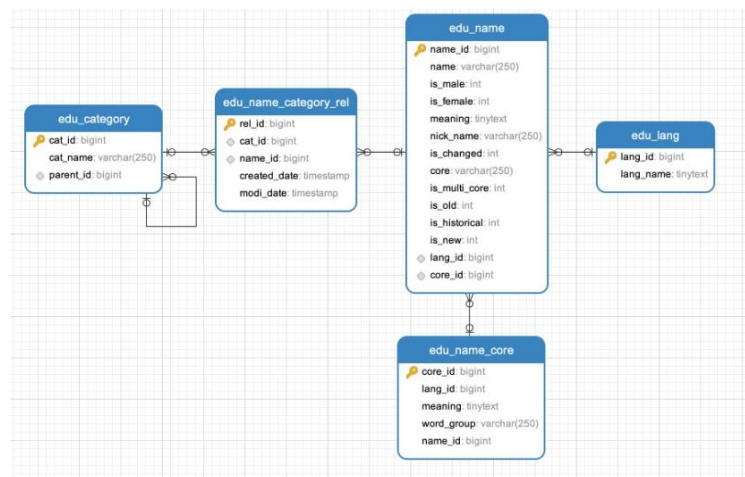

Figure 1 – Conversion progress of Database

The prototype of the mobile application "Fascinating Onomastics" allows you to test its design and generate new ideas, as well as find solutions to some difficult application design problems.

The mobile application created in a cross-platform way provides information about names and their meanings, semantic signs, and also allows searching by typing the letters of the name and searching by semantic signs. In turn, users can add desired names to the "Favorites" list. In addition, the user's browsing history is automatically saved. Another feature of the mobile application is that users can send a request to add a "New" name to the database, which allows to expand the knowledge base and improve the quality of the information provided. All the features of

the mobile application are displayed in the slider when you first install it (Figure 2**Error! Reference source not found.**).

The main screen consists of settings and functions (Figure 3). The functions include "Name search", "Favorites", "Browsing history", "Add new name" and "Similar names". At the bottom of each function is a brief description. There is also an information button next to it, which when clicked will open a description of the corresponding functionality from the function output screen.
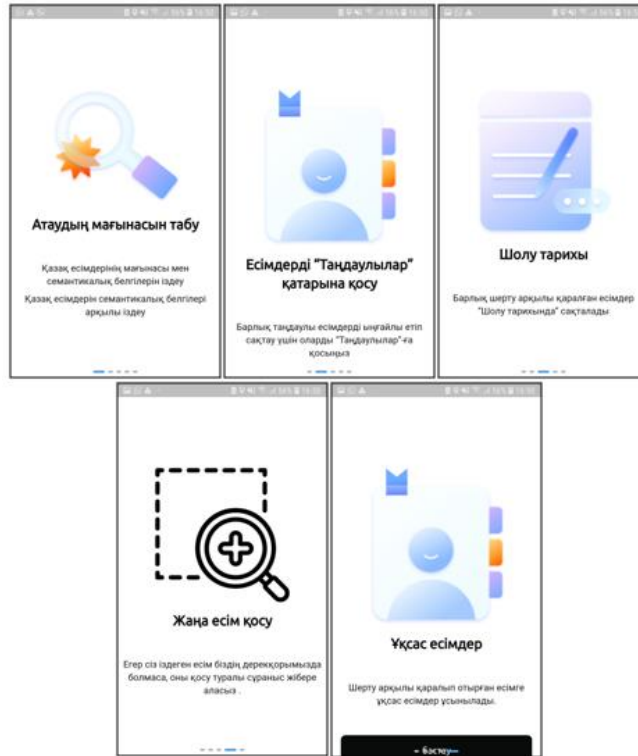

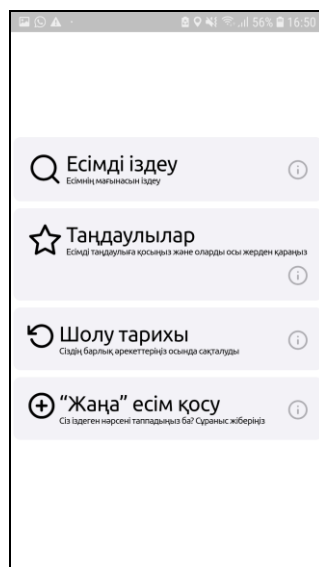Figure 2 - Features of the mobile application "Fascinating Onomastics"

Figure 3 - The main screen of the mobile application "Fascinating Onomastics"

IV. DEVELOPMENT OF A TECHNICAL TASK FOR A MOBILE APPLICATION FOR ONOMASTICS OF KAZAKH NAMES

In today's world based on mobile devices, businesses need to develop effective and convenient mobile applications to work with customers. With the development of technology, it has become easier than ever to create mobile applications, which are characterized by high responsiveness and customization, which makes it easier for businesses to connect more deeply with their customers.

The terms of a technical task for a mobile application is a document that specifies the requirements for the development and implementation of the application.

The first step in creating a mobile app is choosing an app platform. In this case, the chosen platform is iOS 8.0 and later or Android 4.4 and later. These are the minimum requirements for the functioning of the application in the two most popular mobile operating systems, which make up most of the global mobile device market. By developing an application that can run on IOS and Android, companies will be able to reach a wider audience, thereby increasing their popularity and potential income.

Another important aspect of mobile application development is the choice of a suitable Management System of Database (MSDB). A MSDB is a management software system of database that allows enterprises to efficiently store, organize, and access their data. In this case, MySQL 8 MSDB was chosen, a popular open source system that is widely used due to its reliability, scalability and ease of use. With MySQL, companies can store and extract data quickly and reliably, ensuring the smooth and efficient operation of the mobile application.

The next step in developing mobile applications is to choose a framework that will help developers create effective and convenient applications. In this case, Flutter 3.0 is chosen, an open source framework developed by Google that allows developers to create high-performance, high-precision, Nati e mobile applications based on a single code base. Flutter allows developers to write code once and deploy it on iOS and Android platforms, making it easy to create cross-platform applications without the need for scalable re-coding.

The back side of the mobile app is created using GoLang, a programming language known for its speed, efficiency, and scalability. In this context, the server refers to the part of the application that receives a request from the mobile application and processes it. After processing is complete, the system returns the response to the client. The speed and efficiency of Golang make it an ideal choice for creating reliable and high-performance server systems for modern mobile applications.

V. TESTING OF APPLICATION.

The mobile application has passed functional testing. Functional testing of mobile applications is an important part of the development process and assists ensure the quality of the application before launching it on the market.
Assessment of the reliability of the results obtained:
The results obtained are realistic, as they correspond to the real state of the Kazakh onomastics in question and are published in domestic and foreign scientific publications and presented at international scientific conferences.
Assessment of the technical and economic efficiency of the implementation of the results obtained: comparison with similar results of domestic and foreign work.
The semantic base of proper names in the Kazakh language, created at the previous stage of this study, was created for the first time [4], [15], so there are no similar works comparing them.
As for mobile applications that study proper names, the following foreign applications were found in the AppStore and Play Market mobile applications:
- Baby Names & Meanings – This app allows users to search for baby names and their meanings, as well as track and save favorite names [16].
- Name Generator – this application generates random names based on various criteria such as gender, nationality and popularity [17].
- The secret of the Name: Meaning - in this application, the characteristics of names tell about a person's character and its compatibility with other names [18].
- Namey is a mobile application for generating names for newborns, based on data from the global name database. Users can choose their surname, name style, first initial and more. can select different categories such as [19].
In addition, there are also domestic mobile applications such as " ESIMDER Znachenie imen kazakhi" [20], "Meaning of Kazakh Names" [21]. However, in these applications, names are classified according to only two or three categories (gender, origin, letters).

Compared with other foreign and domestic works, the mobile application "Fascinating Onomastics" is being developed for the first time, which includes proper nouns with such extensive semantic features, as well as a user interface in the Kazakh language with the functions of correcting and adding new examples of their examples.

Reasons for the necessity for additional studies: negative results that lead to the need to stop further studies:

At this stage, no further studies are needed, and no negative results have been obtained.

CONCLUSION

Based on the study of examples and structures of Kazakh proper names, to determine the designation of all concepts of anthroponyms and reflect their properties in the semantic base, to determine the relationship between Kazakh names and names in other languages and to study the way they are denoted in the semantic base, as well as to select technologies for developing mobile applications, the following results were obtained:

- the structure of the designation of proper names in the Kazakh language in the semantic base by about 100 properties;
- base of semantic knowledge of proper names in the Kazakh language;
- Mobile application "Fascinating Onomastics".

The results obtained here 1 and 2 are described in the interim report of this project with inventory number № 0222RK00514 (2022).

Assessment of the completeness of solving the obligations set:

All planned obligations are fully solved. All results were tested at international conferences and published in scientific publications (**Error! Reference source not found.**).

Recommendations and initial data on the actual use of research results:

Recommendations for users:

Application installation: start by installing the application "Fascinating Onomastics" from the official application store (for example, the Google Play) on your mobile device.

Registration and Login: if the application offers the ability to create a registration record, it is recommended to register to access additional features (such as saving favorite names).

Familiarization with the user manual: the application may provide the user manual with information about its functions and features. To get the most out of the application, check it out.

Search for names: use the search function to find English proper names that interest you. Enter the name or part of it to get information about it.

Research for names: the application can provide information about the origin, meaning and cultural significance of each name. Pay attention to this information for a deeper understanding of the names.

Save favorite names: save the names you are interested in in the "Favorites" section. This will help you find them more easily in the future.

Feedback: if you notice any bugs or have suggestions for improving the application, as well as want to add a new name, contact the developers through the Feedback section.

Initial data:

Source code of application: by accessing the source code of the application, it can be adapted and improved by other developers.

Name data: access to a database with information about Kazakh proper names, their Origin, history and cultural aspects. This data can be useful for research and educational purposes.

Assessment of technical and economic efficiency of implementation:

The technical and economic efficiency of the implementation of the mobile application "Fascinating Onomastics" is characterized by the following. First, it can contribute to increasing cultural awareness and knowledge in the field of proper names in the Kazakh language, which has the potential to strengthen national identity and cultural heritage. Secondly, such an application can contribute to the development of cultural tourism in the region, attracting additional tourist flows, gaining popularity among tourists and researchers. In addition, if properly monetized, the application will bring income to developers, turning it not only into an educational and cultural resource, but also into a valuable product from an economic point of view.

The implementation of the mobile application "Fascinating Onomastics" has significant technical and economic advantages compared to websites. For example, mobile applications provide more convenient and faster access to information, which makes them more attractive to users. Effective optimization for mobile applications, notifications and a user-friendly interface always allow you to increase the level of user interest. Mobile apps also provide a huge potential for monetization through paid services, ads, and subscriptions, which makes them more cost-effective. They also allow you to collect detailed statistics on user activity, which can be used to improve the application and develop marketing strategies.

Assessment of the scientific and technical level of research performed in comparison with the best achievements in this field:

The research carried out on the development of the mobile application " Fascinating Onomastics" has a high scientific and technical level and corresponds to the best achievements in the field of Kazakh onomastics, since a sample of a mobile application with such a large base of semantic knowledge was not found on the Internet.

The performed research is distinguished by its significance and innovation in the study of Kazakh proper names. The application provides users with high-quality information about the origin and meaning of names and provides in-depth linguistic and cultural analysis, making it an important resource for studying the cultural heritage and linguistic features of Kazakhstan. The mobile application "Fascinating Onomastics" makes a significant contribution to scientific and educational resources, contributes to understanding and respect for native Kazakh names and culture.

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Assel Omarbekova graduated with honors from the S. Toraighyrov Pavlodar State University. Kazakhstan in 2000 and postgraduate from L.N. Gumilyov Eurasian National University, Kazakhstan by specialty Mathematical and software of computers, complexes and computer networks in 2000. In 2008 she was received the degree of Candidate of Science.

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Her research interests related with intelligent tutoring systems, and distance learning technologies. She has more than 250 scientific and scientific-methodical works, of which 24 publications are indexed by Scopus (of which 3 are in peer-reviewed scientific publications with a CiteScore percentile in the Scopus database of at least 35) and 14 - Web of Science, 28 - in publications recommended by CQASES, 10 textbooks, 23 study guides.

She is the author of the following software: technology of automatic create electronic textbooks, system electronic questionnaire of teachers and etc. Also she was involved in projects related to the creation of multimedia learning systems for the Ministry of Education and Science, Ministry of Culture and Information, the Ministry of Finance of Kazakhstan and etc.