https://doi.org/10.30857/2786-5371.2023.2.6

УДК 004.4: 005.52

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SOFTWARE SOLUTIONS FOR EFFICIENT FINANCIAL MANAGEMENT AND BUSINESS METRICS TRACKING

Purpose. *This paper presents the development of a software system for business metrics tracking. The purpose of this research is to provide business owners with a tool to keep track of their business metrics, allowing them to make data-driven decisions.*

Methodology. *The methodology of this research includes an analysis of the problem area, identification of key business metrics, and examination of existing software solutions.*

Findings. *This research reveal the importance of defining key business metrics for marketing, business modeling, financial planning, and other aspects. Analysis of existing software solutions identified their advantages and disadvantages, which helped to define the requirements for the software system. The software system was designed to provide the user with the ability to track and manage business metrics, collaborate with partners, and work remotely.*

Originality. *This research lies in the development of a software system that provides clear instructions for use, data security, and online support. The practical value of the software system is that it provides a user-friendly interface for tracking business metrics, making data-driven decisions, and improving business performance.*

Practical value. *This research provides a comprehensive analysis of the development of a software system for business metrics tracking, with a focus on practicality and usefulness for business owners. The software system can be used in various fields and industries, providing an effective tool for managing business metrics.*

Keywords: *business metrics; software system; data-driven decisions; key performance indicators; existing software solutions; financial planning.*

Introduction. Top companies offer a number of metrics that help make business better and its advertising more successful. Constant control of these indicators determines the final success.

There are numerous research dedicated to the problem of tracking business metrics. One example in [1] is conducted by the Gartner Research Institute that compares various software systems for tracking business metrics. The research examined systems such as Tableau, QlikView, Microsoft Power BI, SAP Lumira, IBM Cognos Analytics, and others, and conducted a comparative analysis based on several parameters, including functionality, ease of use, data reliability, and security.

Another research [2] worth noting was conducted by Ohio State University, in which the authors proposed a methodology for evaluating the effectiveness of using business metrics to manage business operations. The study examined the use of business metrics in various industries such as retail, manufacturing, and financial services.

In general, the paper [3] provides an overview of predictive analytics methods and examines their application in the context of information systems research. In [4] authors analyze the functional capabilities, quality, and reliability of products, company strategies, as well as user reviews and experience. As a result, they create a chart known as the “Magic Quadrant”, where market-leading companies are placed in one of four quadrants depending on their ability to meet user needs and innovative strategy. This report helps organizations choose the most suitable platform for their analytics and business intelligence needs, as well as orient themselves in the current market situation and compare different products. It can also help platform developers and suppliers identify their strengths and weaknesses and improve their products for a competitive market. The paper [5] provides a comprehensive review of big data analytics in the context of business and government. The authors discuss the challenges and opportunities of big data analytics, the various techniques and tools used

in big data analytics, and the potential applications of big data analytics in different fields such as healthcare, transportation, and finance.

In addition to foreign researchers, there are many Ukrainian authors who also researched this problem. In [6] discusses the challenges and prospects of implementing business analytics systems in Ukraine, analyzes the state of the art of business analytics in the country and suggests ways to overcome the obstacles to its adoption. In [7] describes the development of a business analytics system that enables managers to make informed decisions based on real-time data from a production enterprise. In paper discusses the key features of the system and its benefits for the enterprise. The paper [8] presents methodological approaches to implementing a business analytics system in enterprises, describes the key components of the system and discusses the benefits of its implementation. Business analytics system that is based on open-source software is presented in [9]. In [10] provides an overview of the theoretical foundations of business analytics systems and discusses their practical application in trade and service enterprises and presents the key features of the systems and their benefits for the enterprises. In general, these papers provide insights into the challenges, prospects, and benefits of implementing business analytics systems in Ukrainian enterprises, as well as methodological approaches and practical applications of such systems.

However, despite the numerous studies in this field, there are still some unresolved issues that need to be addressed to improve software systems for tracking business metrics. For example, not all existing systems provide sufficient data security and user support. Additionally, many of them do not provide usage instructions and lack the necessary flexibility and scalability for managing businesses in different industries.

The aim of this paper is to create a software system for tracking business metrics for business owners, to assist in finding partners for business and simplifying decision-making for multiple business owners.

Business metrics. In order for a business to constantly grow and expand, experts in the field of business management have identified certain business metrics. It is important to know where you are going and to be able to forecast your trajectory.

Business metrics serve several functions:

– numerical representation of business processes. You know exactly how many people are interested in your product, what the conversion rate is at each stage, and how stable the situation is after n months;

– timely response to negative changes. Step-by-step analysis of indicators allows you to quickly identify a decrease in audience interest and identify the cause of such a situation;

– determining the peak seasonality. With the help of metrics, it is easy to determine the growth and decline of demand for a product in different periods;

– results of sales and marketing departments. The dynamics of changes in each period determines the effectiveness of advertising and the quality of the product itself.

Business metrics are calculated in a certain sequence. They can be represented in the form of a pyramid, where the top peak is the main indicator. At the second level are the indicators on which the main metric depends, at the third level are those on which the metrics of the second level depend, and so on.

Calculating all indicators provides a complete picture of the state of the business in a given period. Low conversion rates do not always mean poor results. On the other hand, high metrics do not always indicate positive dynamics. To identify the reasons for a decrease in demand or a decrease in profit, it is recommended to analyze the interrelation of different metrics.

There are many online business systems for managing general business, each with its own advantages and disadvantages, and the choice of a specific system depends on the company's needs

and specifics. However, the use of business metrics for business control is a necessary tool for effectively managing a company and achieving its goals. Below is an overview of some of them:

The “Balance Online” business control system [11] is one way for business owners to obtain accurate information about the financial state of their enterprise and monitor their business. Initially, the system creates a "financial snapshot" of all the company's business processes using zones of material responsibility. Automation of the system and implementation of the audit function then follow. The process of providing reliable information has been actively developing over the past three years, and now the consulting group Metrika offers turnkey control of “Balance Online” business. Market analysis has revealed that there are applications and websites that are used for finding people and communication with the goal of starting a business or seeking funding, as well as applications for tracking personal expenses and income. An example for a finance manager is the “Money Manager” [12]. When making purchases, a photo of the receipt can be attached to each item and its category can be determined. Statistics will then be generated by category. The software system allows for searching by month and exporting reports to Excel. There is also the ability to specify spending plans, and “Money Manager” will monitor them and notify about exceeding the limit, as well as including a calculator and calendar.

The main disadvantages of the “Money Manager” software system are:

– inconvenient and difficult to understand interface;

– to accurately calculate the financial flow, it is necessary to indicate insignificant, sometimes unnecessary details of expenses;

– presence of unnecessary fields to fill in;

– lack of synchronization between devices.

Additionally, there are websites for establishing business contacts. An example of a software system for searching for goods, services, suppliers, clients, and experts in narrow areas, renting and selling commercial real estate, transportation of goods, and seeking investments is “BYITSMART”. For the reliability of the software system and the accuracy of all data available on the site, the software system verifies the official documents of potential partners. The software system provides the ability to work without intermediaries and conduct business online.

The disadvantages of the “BYITSMART” software system are as follows:

– absence of localization;

– absence of the ability to authorize through social networks.

The reviewed software systems have a wide range of functions, but they do not combine both business contact establishment and direct control and project management at the same time. The uniqueness of the software system is the ability to conduct business and track all its indicators with partners.

Designing a software system to track business metrics. After conducting a market analysis of software systems for tracking business metrics, conclusions were drawn regarding the design of a software system to make it competitive and address the issues of existing software systems. The software system should allow owners and partners to collaborate on issues and participate in voting on the future direction of the business. The software system should ensure the accuracy, sensitivity, and precision of the information obtained from analyzing the indicators displayed on graphs and charts. To ensure full functionality, the software system should consist of several parts: a server and a client. The client part should provide a user-friendly and easy-to-use interface [14, 15]. The server part should interact with the client part of the project, providing up-to-date and complete information from the database. Since it is important to protect the data and prevent loss due to server crashes or other issues, the database will be hosted in cloud storage.

Architecture and software design.

The detailed user interaction capabilities with the system are described in the use case diagram in Fig. 1. A registered system user can register new projects, edit them, join existing ones, engage in discussions, and participate in voting on project-related issues (if the user is a member of the project).

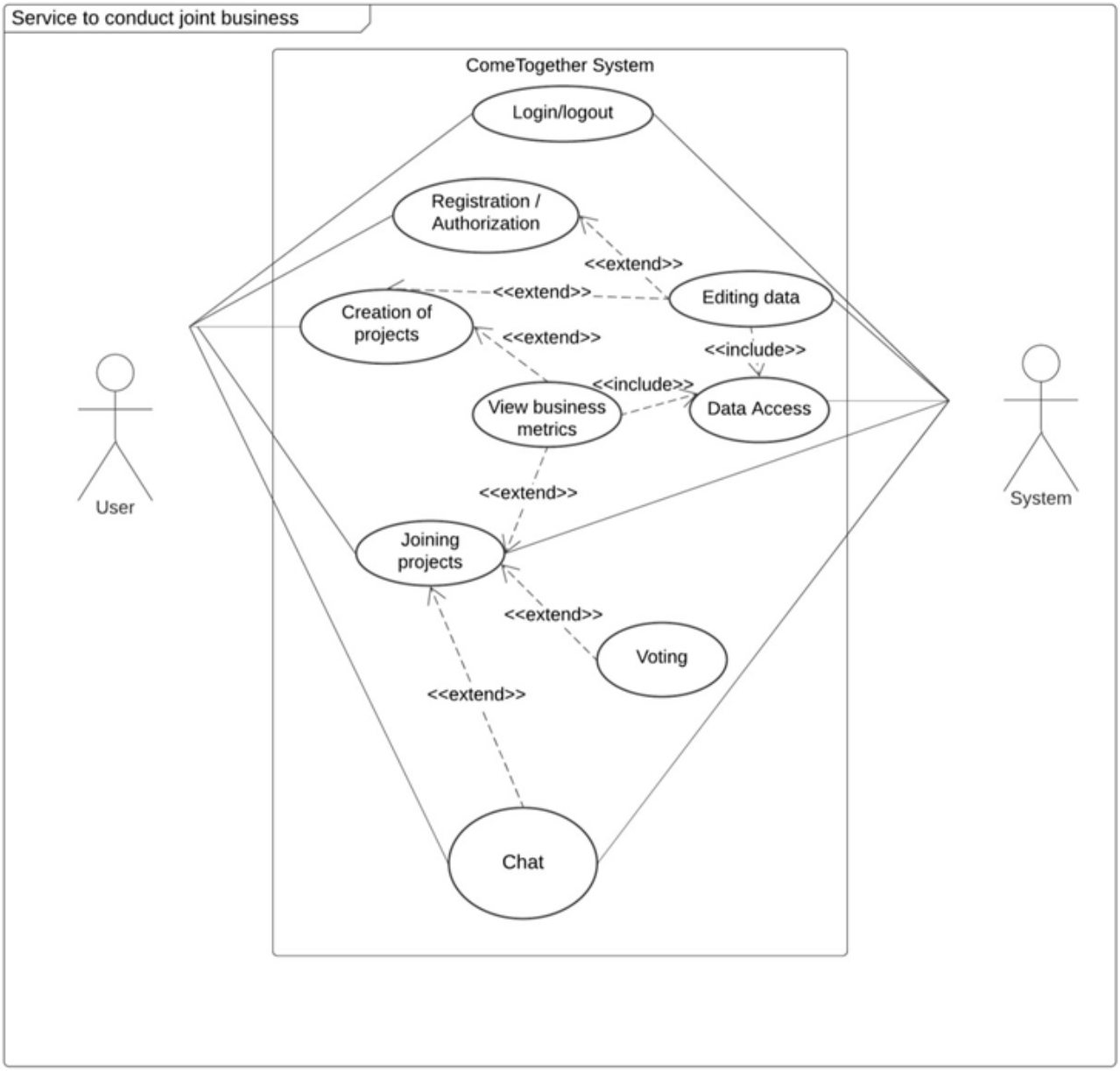

Fig. 1. **Use case diagram of service to conduct joint business**

The state diagram shown in Fig. 2 demonstrates the process of creating a project, making changes to it, participating in discussions, and voting on important issues. Only authorized users can create projects, while only members of the project can edit project information or view private data and metrics. Voting or creating surveys is also only available to project participants.

The project architecture is divided into three levels (presentation, business logic, and data access). The outermost levels cannot interact with each other directly, meaning the presentation layer cannot directly access the database or even the data access level, but only through the business logic

level. The components should be loosely coupled, so dependencies between components are implemented in the project.

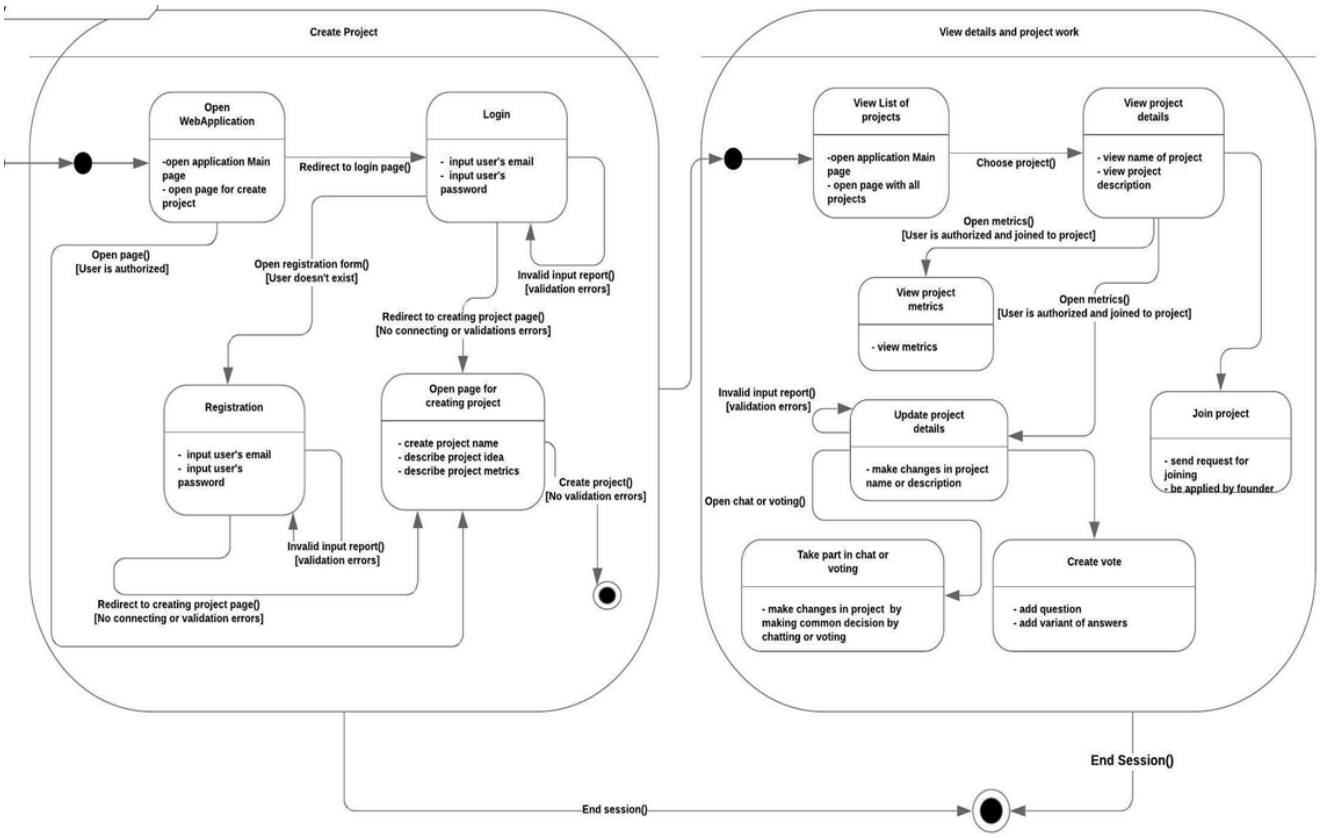

Fig. 2. **State diagram of service to conduct joint business**

The data access level is independent of the other levels, the business logic level depends on the data access level, and the presentation layer depends on the business logic level.

Presentation layer: This is the layer that directly interacts with the user. It includes components for the user interface, the mechanism for receiving input from the user. The presentation layer contains views and all the components that make up the user interface (styles, static HTML pages, JavaScript), as well as view models, controllers, and request context objects.

Business layer: It contains a set of components that handle the data received from the presentation layer, implements all the necessary application logic, all computations, interacts with the database, and passes the processing results to the presentation layer.

Data Access layer: It stores models that describe the entities used, and also houses specific classes for working with different data access technologies, such as the Entity Framework data context class. Repositories are also stored here, through which the business logic layer interacts with the database. Creating a storage class for each entity type can lead to a large amount of redundant code and partial updates.

Fig. 3. show the deployment diagram of the software system – the scheme of connections and dependencies between the project parts, the project infrastructure.

One of the ways to minimize redundant code is to use a shared repository, and one way to ensure that all repositories use the same database context (and therefore coordinate all updates) is to use a unit of work. To ensure this functionality and code cleanliness, the UnitOfWork pattern was used. The UnitOfWork class provides access to repositories through separate properties and defines a common context for both repositories.

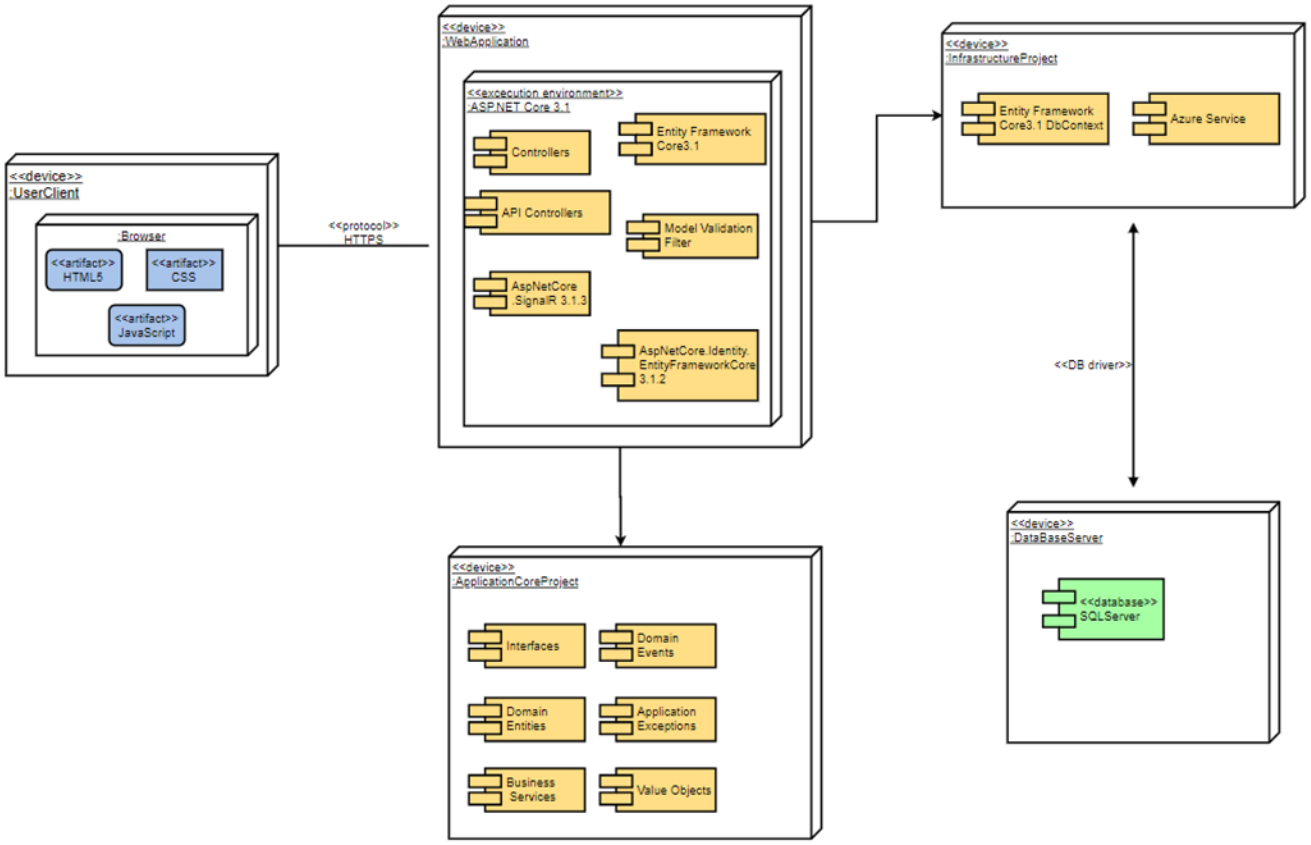

Fig. 3. **Diagram of the software system**

The business collaboration software system includes functionality for core scenarios for user roles such as regular users (businessmen, entrepreneurs, analysts, sponsors) and administrators or moderators. The administrator has the ability to make edits to articles published by users, check for plagiarism, and so on. Regular users are divided among themselves into owners, partners, and employees in order to provide proper access to information regarding a specific business, to differentiate access levels to business metrics for different positions in the business.

UI/UX Design. The client-side of the application is developed using HTML, CSS, JavaScript, Angular 7, and Bootstrap 4. To localize strings, the IViewLocalizer service is used, which works similarly to the IStringLocalizer service of the system. The built-in implementation of this interface is the ViewLocalizer class, which tries to find the required resource file depending on the path of the client page. SignalR Core is used for implementing chat between users. SignalR Core is a library that enables real-time communication in applications. SignalR uses bidirectional communication to exchange messages between the client and the server, allowing the server to send real-time data to all clients. The project includes the signalr.min.js file in the wwwroot folder for storing static files.

The server hub sends two values to the clients – the username and their message, so in the client-side function registered in the hubConnection method, we can obtain both values. Standard authentication and authorization mechanisms are used to create group chats where only the members of the chat can send and receive messages. The client-side of the software system is designed for use by both administrators and regular users. Upon logging into the portal, the user is presented with the main page of the software system. The software system has functionality for configuring the page themes (light and dark).

The user can view all projects registered on the website and find the one they want to join. The page for viewing all projects is shown in Fig. 4 (light theme). Entrepreneurs who have already

logged in to the website can register their own idea or project and post it on the website to find partners. The page for creating a project is shown in Fig. 5. When registering, it is desirable to provide as detailed and extensive information as possible to reduce the number of clarifying questions from other users and attract more attention from other entrepreneurs.

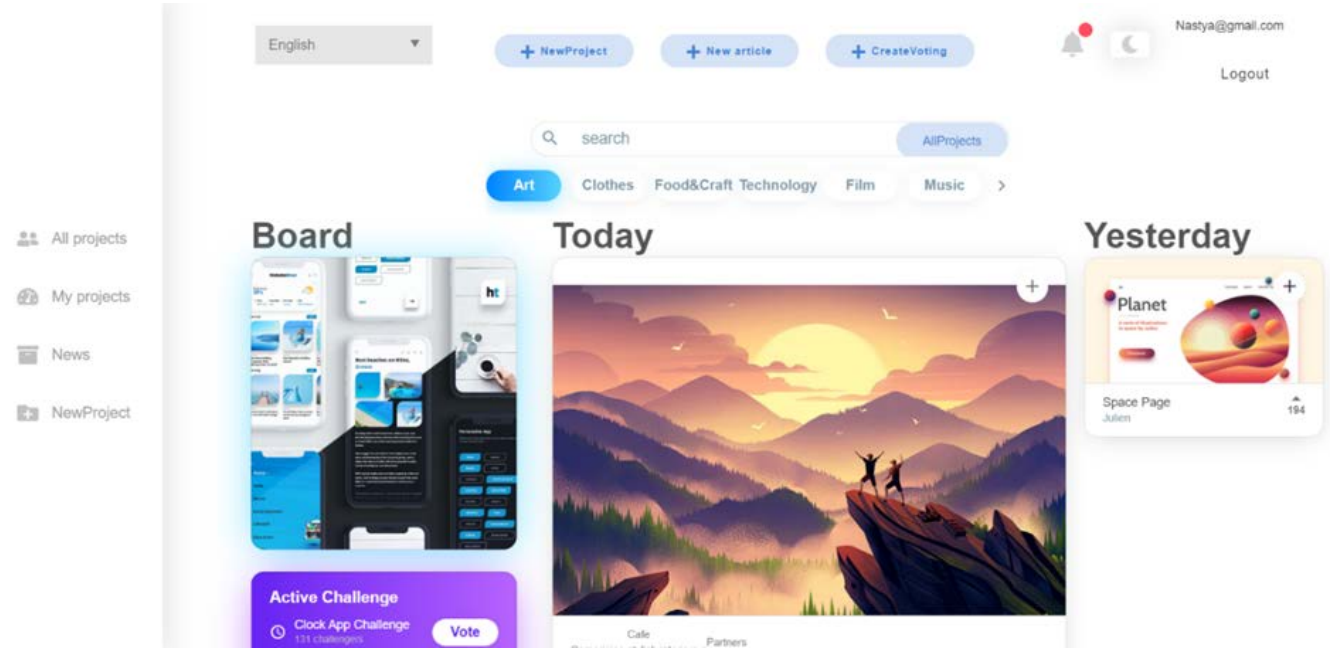

Fig. 4. **The page for viewing all projects**

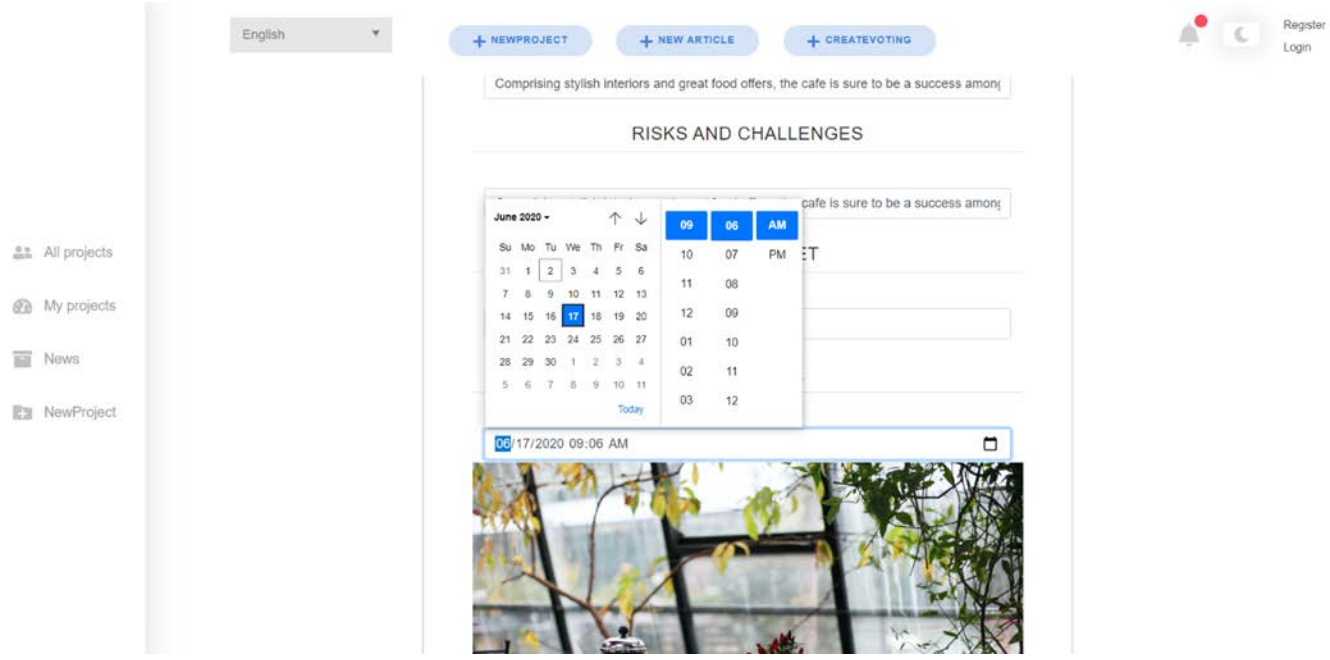

Fig. 5. **The page for viewing all projects The page for creating a project**

Users who already have projects or are partners in projects have access to creating and participating in votes regarding further actions related to the business. The process of creating a vote is shown in Fig. 6, 7. The poll creator can enable partners to add their own answer options (Fig. 7). It is assumed that questions can be put up for a vote in various ways. The first option is a single-choice,

the second is multiple-choice, the third is to react to each answer option, and the fourth is to rate each answer option on a scale set by the poll creator.

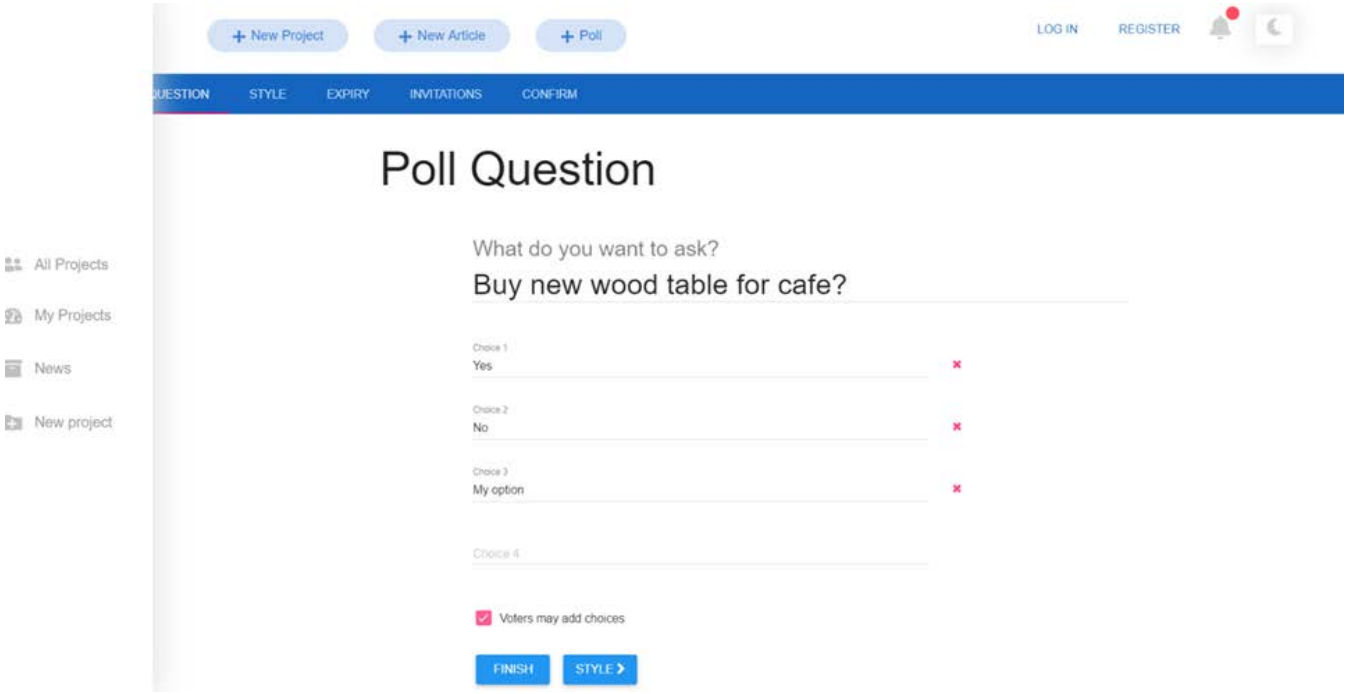

Fig. 6. **The poll creator**

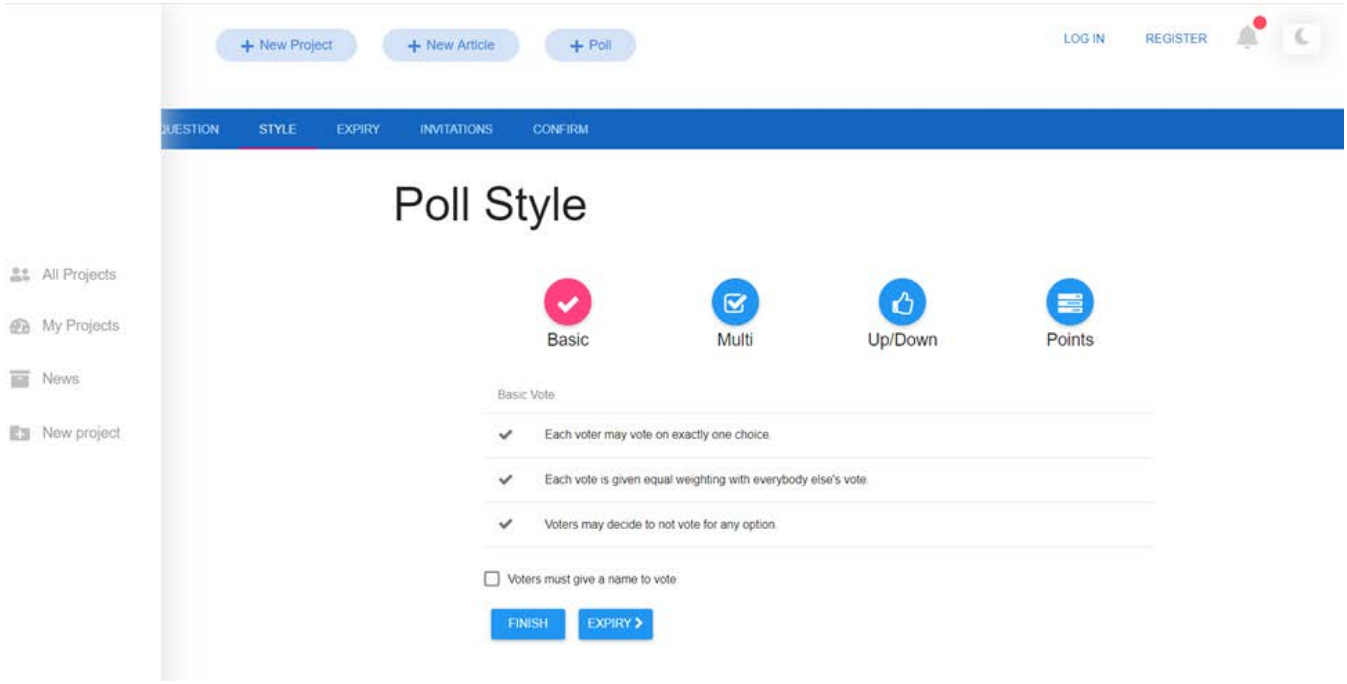

Fig. 7. **The creator of own answer options**

Experiment and results. To conduct research with specific software business metrics, the following steps were taken:

– Defined key performance indicators (KPI) related to the software. These include user acquisition, retention, conversion rate, number of active users, revenue and customer satisfaction.

– Collected data on selected KPIs for a certain period of time (one month).

– Analyzed data to identify trends and patterns in user behavior and software usage. This involves the use of tools such as data visualization or statistical analysis.

– Software performance is compared to industry benchmarks or previous performance to assess how well the software meets its objectives.

The information obtained from the analysis can be used to make informed decisions about how to improve the software and its performance. This may include changes to the user interface, marketing strategies or business processes. Overall, the goal of this research is to better understand how the software works and identify opportunities for improvement. By focusing on specific business metrics, research can provide actionable insights that can be used to optimize software and increase its value to users.

The final research proposed in Tab. 1 for the business metrics of the software system is as follows:

Table 1

Research result for the business metrics of the software system

Metric	Metric Description	Success Criteria	Current Value	Target	Delta
DAU	Number of new users per day	+10%	500	550	50
MAU	Number of new users per month	+15%	1.5	1.725	0.225
Retention rate	Percentage of users who continue to use the software system after the first visit	+5%	50%	52.5%	2.5
Session time	Average time spent by the user in the software system per session	+10%	5 minutes	5.5 minutes	0.5
Conversion	Percentage of users who became partners or created a new project	+3%	20%	23%	3
Churn rate	Percentage of users who stopped using the software system	+2%	15%	13%	2

Based on the results of the experiment, we can conclude that the software system met the users' needs by providing accurate information and protecting data. It also provided a platform for users to find partners for their projects or join existing ones, and enabled owners and partners to collaborate and make decisions through voting.

The analysis of business metrics showed that the software product was interesting to the target audience and the project was growing and developing. However, there were some areas for improvement, such as the need to increase the number of active users and to enhance data accuracy by encouraging users to provide complete and reliable information.

Overall, the software system has the potential to simplify and automate the decision-making process for the business and help in the search for partners. The data gathered from the research can be used to inform future development and marketing strategies.

Conclusions. Effective analytics provides information for making decisions about further steps. By tracking and analyzing business metrics, it is possible to understand that the product is interesting to the target audience and to determine that the project is growing and developing. It is necessary to monitor a number of important metrics and make decisions based on the data obtained to simplify this process and automate it.

The success of a business also depends on choosing the right business partner. Undoubtedly, a company can achieve success when a team of entrepreneurs and investors is created, where each participant has their own responsibilities and area of responsibility. Therefore, when considering the option of creating a joint business, it is necessary to carefully consider who to found it with, who to take into partnership, and to make decisions regarding business development.

Similar financial management and business metrics systems were analyzed in the paper. An introduced software system that provides the user with the ability to manage their business metrics can be used to remotely control the business according to the needs and conditions identified analytically for a new product, taking into account the requirements of different users. A set of requirements for the ownership, quality, and functions of the software system to be developed was formed. The detailed architectural design of the system and the individual architectural structure of each component were specified.

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ПРОГРАМНІ РІШЕННЯ ДЛЯ ЕФЕКТИВНОГО УПРАВЛІННЯ ФІНАНСАМИ ТА ВІДСТЕЖЕННЯ БІЗНЕС-ПОКАЗНИКІВ

Мета. *У цій статті представлено розробку програмної системи для відслідковування бізнес-метрик. Метою даного дослідження є надання власникам бізнесу інструменту для відстеження їх бізнес-метрик, що дозволяє приймати рішення на основі даних.*

Методика. *Методологія дослідження включає аналіз проблемної області, ідентифікацію ключових бізнес-метрик та дослідження існуючих програмних рішень.*

Результати. *Дослідження розкриває важливість визначення ключових бізнес-метрик для маркетингу, бізнес-моделювання, фінансового планування та інших аспектів. Аналіз існуючих програмних рішень визначив їх переваги та недоліки, що допомогли визначити вимоги до програмної системи. Програмна система була розроблена з метою надання користувачеві можливості відстежувати та керувати бізнес-метриками, співпрацювати з партнерами та працювати віддалено.*

Наукова новизна. *Новизна дослідження полягає у розробці програмної системи, яка надає чіткі інструкції щодо використання, захисту даних та онлайн-підтримки. Цінність програмної системи полягає в тому, що вона надає зручний інтерфейс для відстеження бізнес-метрик, прийняття рішень на основі даних та покращення результативності бізнесу.*

Практична значимість. *Дослідження надає комплексний аналіз розробки програмної системи для відстеження бізнес-метрик, з фокусом на практичність та корисність для власників бізнесу. Програмна система може використовуватися в різних галузях та галузях промисловості, забезпечуючи ефективний інструмент управління бізнес-метриками.*

Ключові слова: *бізнес-метрики; програмна система; прийняття рішень на основі даних; ключові показники ефективності; існуючі програмні рішення; фінансове планування.*