PRINCIPLES OF COLLECTING PHYSIOLOGICAL BIOMETRIC DATA FROM WEARABLE DEVICES FOR AUTHENTICATION SYSTEMS

The principles and protocols for collecting physiological biometric data from wearable devices, in particular the Apple Watch, are investigated for building continuous user authentication systems in information systems. A comparative analysis of existing approaches to collecting biometric signals – heart rate (HR), heart rate variability (HRV), blood oxygen saturation (SpO_2), and skin temperature – is conducted, with a focus on the Apple Watch platform and the HealthKit framework. The limitations and open issues specific to data collection from commercial smartwatches are systematized, including irregular sampling rates, motion artifacts, lack of direct access to raw PPG signals, and limitations of background data collection. An improved protocol for collecting multimodal biometric data is proposed, based on synchronized parallel recording of four physiological signals with a contextual labeling mechanism for the user's physiological state. A schematic diagram of the data collection process has been developed, which includes the stages of signal quality control, motion artifact filtering based on the accelerometer, and the formation of a biometric user matrix with periodic updating. The scientific novelty lies in the integrated approach to collecting four physiological parameters simultaneously, taking into account the context of activity, which ensures the formation of a more stable biometric profile compared to single-channel approaches.

Keywords: physiological biometric signals, mobile devices, authentication, blockchain, continuous authentication, information security, information protection, user identification.

Надійшла до редакції (Received): 26.04.2026
Прийнята до друку (Accepted): 12.06.2026
Опубліковано онлайн (Available online): 25.06.2026

http://creativecommons.org/licenses/by/4.0/
This work is licensed under Creative Commons Attribution-noncommercial-sharealike 4.0 International License.

UDC 004.94:378.091.212.2 DOI: 10.31673/2409-7292.2026.024711

Valentyna Makoiedova
PhD in Computer Science, Associate Professor of the Department of Digital Economics and Systems Analysis
State University of Trade and Economics, Kyiv, Ukraine
ORCID: 0000-0001-7518-894X
E-mail: v.makoedova@knute.edu.ua

Mykola Tsiutsiura
Doctor of Technical Sciences, Professor, Professor of the Department of Software Engineering and Cybersecurity
State University of Trade and Economics, Kyiv, Ukraine
ORCID: 0000-0003-4713-7568
E-mail: mitsiutsiura@gmail.com

INTELLECTUALIZATION OF SUPPORT FOR THE INTRODUCTORY CAMPAIGN OF HIGHER EDUCATION INSTITUTIONS USING INFORMATION TECHNOLOGY

The article examines the specifics of creating and modelling information technology to support the admissions campaign of a higher education institution in the context of increasing information flows, the growing complexity of interaction between the admissions committee and structural units, as well as constant changes in regulatory requirements for the organisation of the admissions campaign. The relevance of the topic stems from the need for effective data management, optimisation of information exchange, and improvement of the admissions committee's performance. The aim of the article is to analyse, model and implement information technology to support the admissions campaign of a higher education institution in the form of an admissions committee information system. The system is intended to optimise information exchange, automate core admissions processes and support adaptability to changes in admission requirements. The paper analyses modern approaches to the informatisation of the education sector, outlines the requirements for building an admissions committee information system, and defines the role of modelling information flows between the main entities of the admissions process. During the design of the database, logical and physical models were developed, covering approximately one hundred tables grouped by functional purpose. The central tables of the system were identified, which ensure the storage of applicants' personal data, contact information, documents, addresses, benefits, entrance examination results and other admission parameters. The feasibility of using triggers, stored procedures and functions to automate control over the creation, modification and deletion of records, ensure data integrity and support the system's operational logic has been justified. The possibilities of integrating Big Data technologies for the analytical

© Лісовський Б.В., Сколоздра М.М. Принципи збирання фізіологічних біометричних даних з носимих пристроїв для систем автентифікації. Сучасний захист інформації, 2(66), 116–126.
https://doi.org/10.31673/2409-7292.2026.026910

processing of large data sets have also been considered. The features of implementing the user interface in the Embarcadero RAD Studio Delphi environment are outlined. It is concluded that the proposed information technology contributes to improving the quality of management of the admissions campaign, expands the analytical capabilities of the higher education institution and ensures more efficient organisation of the admissions committee's work. The practical value of the development lies in the system's scalability, the implementation of fuzzy search for applications, data synchronisation with the Unified State Electronic Database for Education (USEDE), and improved user ergonomics thanks to a functionally grouped interface. The proposed solution creates prerequisites for reducing manual operations and operational risks through database-level control, automation of application status management, automatic assignment of personal file codes, fuzzy search tools, and synchronisation with USEDE.

Keywords: information technology, admissions campaign, higher education institution, admissions committee, modelling, database, Big Data.

Introduction

The larger the higher education institution in terms of scale of operations, the more intense the information flows associated with organising admissions become, and the more complex the interaction between the admissions committee and other structural units becomes. This is precisely why the research topic is relevant: there is a practical need to create and model information technology capable of ensuring effective support for the admissions process to higher education institutions. Its implementation will enable the streamlining of data management, the optimisation of information exchange, and an increase in the efficiency of both the admissions committee and the educational institution as a whole. It is now impossible to imagine the functioning of a modern higher education institution without the active use of information technologies, as it is these technologies that ensure the rapid and accurate processing of large data sets across various areas of activity. In the context of vast amounts of information and limited time for response and decision-making, digital tools have become an essential prerequisite for effective management.

Consequently, understanding the nature and structure of information technology within the higher education system is an essential component of the development of the modern educational landscape. The use of such technologies contributes to the improvement of management processes, the enhancement of the quality of educational services, and the strengthening of the institution's competitive position.

Statement of the problem

The rapid development of network and communication technologies has led to information becoming one of the key resources of scientific and technological progress. The spread of information and communication technologies has facilitated society's transition to a new mode of functioning – within the information space, where digital tools have quickly become indispensable in virtually all spheres of activity. General trends in social development and the active digitisation of various sectors are driving the expansion of methods and areas of application for information technologies, including in the field of education. Under such conditions, the absence of a flexible and adaptive model for supporting the admissions campaign, capable of taking into account rapid changes in the external and internal environment, makes the problem particularly relevant and requires scientific study.

Analysis of previous research

The paper [1] examines the process of digital transformation in the management of higher education institutions as the strategic integration of modern information technologies (in particular, artificial intelligence, Big Data, cloud computing and the IoT), aimed at increasing efficiency, automating processes and improving the quality of management decisions. The authors identified key digital transformation technologies, classified the main barriers to its implementation (organisational, strategic, human resources and technological), and identified critical success factors.

The informatisation of education should be viewed as a holistic set of organisational, scientific, technical, legal, socio-economic and operational processes aimed at creating conditions to meet the information needs of individuals, society and the state. This is achieved through the design, development and use of information systems, networks, resources and technologies based on modern computing and communications technology. At the same time, the informatisation of the education

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

sector should not be reduced merely to providing access to global computer networks, as its scope is considerably broader [2].

Particular attention should be paid to the ethical aspects of handling information. The ethical use of data entails appropriate and morally sound methods of collecting, storing, transmitting and using it. Some of the information processed as part of the admissions campaign may contain personal data; therefore, it is important to take into account the legal requirements regarding retention periods, procedures for use and subsequent destruction. Various approaches to the classification of information technologies are presented. At the same time, it is advisable to expand this classification to take into account the intended use of technologies in higher education institutions. Information technologies in higher education institutions can be geared not only towards supporting the educational process but also towards supporting administrative activities. In this context, they should be aimed at improving the institution's operational efficiency, increasing labour productivity, refining internal procedures and, in particular, ensuring high-quality support for the admissions campaign [3].

In the article [4], the authors summarise the results of previous studies covering the monitoring of the admissions campaign, the use of web resources for communication with applicants, and the application of mathematical models and neural networks for predicting admissions outcomes.

Significant attention in the research is devoted to the implementation of information technologies in the activities of higher education institutions, in particular the creation of an electronic educational environment as an integrated platform to support educational and management processes, the automation of admissions campaign monitoring and the analysis of applicant data, as well as the development of information interaction systems as the basis for effective management of higher education institutions. The strategic importance of digitalisation and the use of modern IT for improving the quality of management decisions, the transparency of processes and the competitiveness of educational institutions is emphasised separately. Researchers highlight the need for a comprehensive approach to the implementation of information systems that ensure the intellectualisation of key processes in the activities of higher education institutions [5-8].

Aim of the study

The aim of the article is to analyse, model and implement information technology to support the admissions campaign of a higher education institution in the form of an admissions committee information system. The proposed system is intended to optimise information exchange between the admissions committee and related structural units, automate core admissions processes support adaptability to changes in admission requirements, and enhance the organisational and analytical support of admissions campaign management.

Modelling and programming

Modelling information flows between the admissions committee's information system and other components supporting the admissions campaign enables the identification of the set of functional and structural requirements for such a system. Formalising these requirements is best achieved using UML diagrams, which facilitate the construction of models of actions, processes and interaction scenarios implemented during the admissions campaign [8].

One of the key components of the information system under development is the database, which ensures the collection, storage, structuring and processing of significant volumes of information necessary for the system's operation. The designed logical (fig. 1) and physical database models comprise approximately one hundred tables, which are conditionally grouped according to their functional purpose. These include: key tables containing the system's core data; system tables designed to store administrative information, in particular details about users and access rights; reference tables containing relatively stable regulatory and reference information; and CRM module tables designed to record and store data regarding communication with applicants.

Based on the logical database model, its physical implementation was developed in the Microsoft SQL Server environment using Microsoft SQL Server Management Studio. Relationships between tables are organised using primary and foreign key mechanisms, ensuring the integrity,

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

consistency and structure of data within the information system. The main tables containing data on applicants in the physical database model include Entrant**,** Contact**,** ContactType**,** Document, EntrantAddress, EntrantBenefit, EntrantCourse, Exam and Photo.

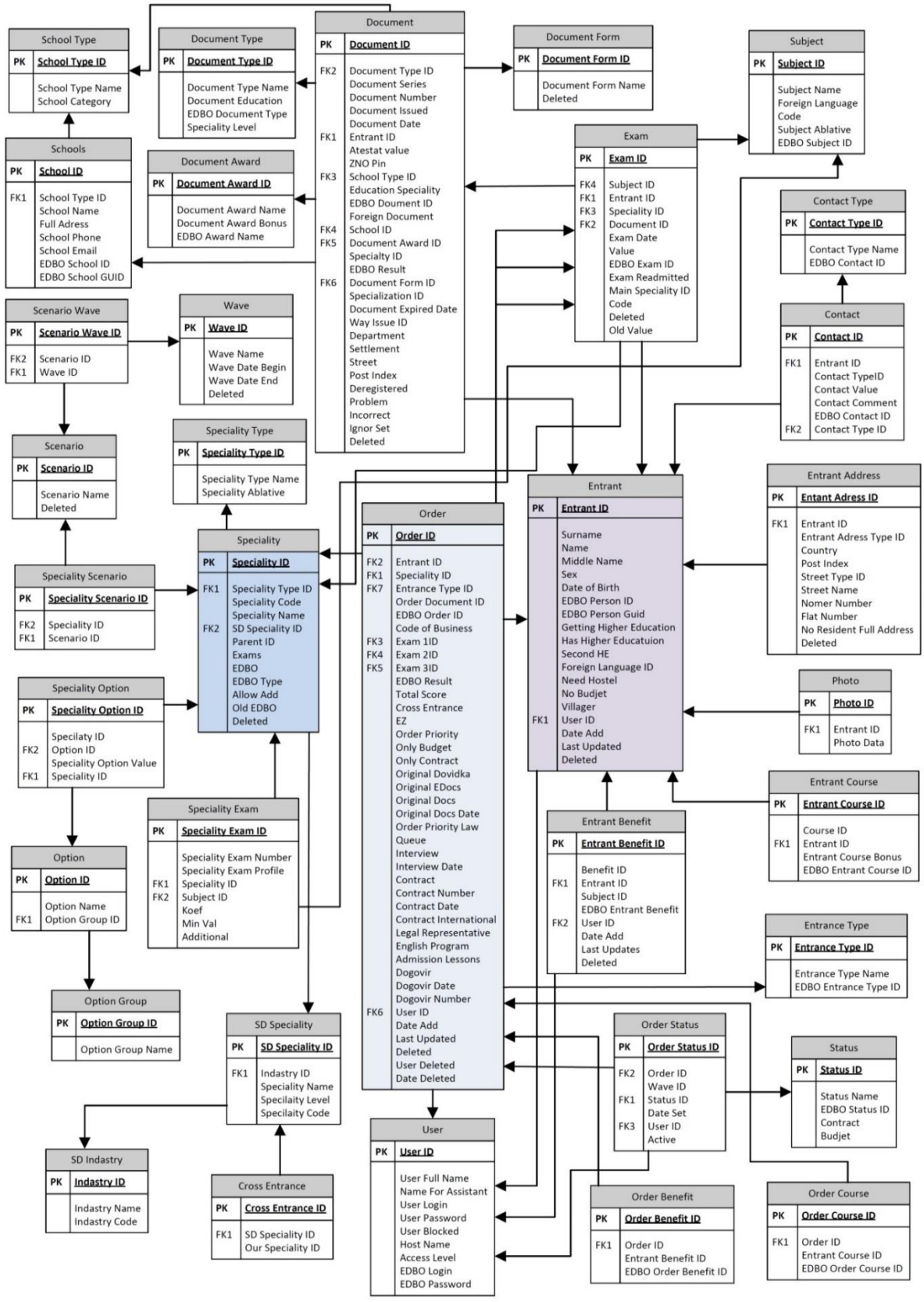

Fig. 1. Logical model of the database

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

The Entrant table is central to the database and contains key information about the applicant: personal details, date of birth, information regarding the need for accommodation, choice of foreign language, details of previous education, participation in the competition for state-funded places, concurrent study, as well as administrative information for record-keeping within the system and integration with the Unified State Electronic Database for Education (USEDE).

The Contact table is designed to store the applicant's contact details, whilst ContactType is used as a reference for contact types. The Document table contains details of the applicant's documents: their type, series, number, date of issue, issuing authority, average mark on the educational qualification, data from the EIT/NMT certificates, as well as administrative notes regarding verification, accuracy and entry of information into the EDEBO.

The EntrantAddress table stores the applicant's address details, including address type, geographical location, postcode, street name, house and flat number, or the full address of a non-resident. The EntrantBenefit table contains information on admission benefits and special conditions, whilst the EntrantCourse table contains details regarding preparatory courses or participation in academic competitions, which may result in additional points.

The Exam table displays the results of entrance examinations: subject, date taken, mark obtained, associated document, specialisation and administrative details regarding the recording of results. The Photo table is designed for applicants' photographs and contains the photo ID, applicant ID and the applicant's photograph.

Tables related to specialisations and admission parameters contain information on the list of specialisations, their parameters, stages and scenarios of enrolment, fields of education, related areas of study, as well as entrance examinations for individual specialisations or groups thereof (fig. 2).

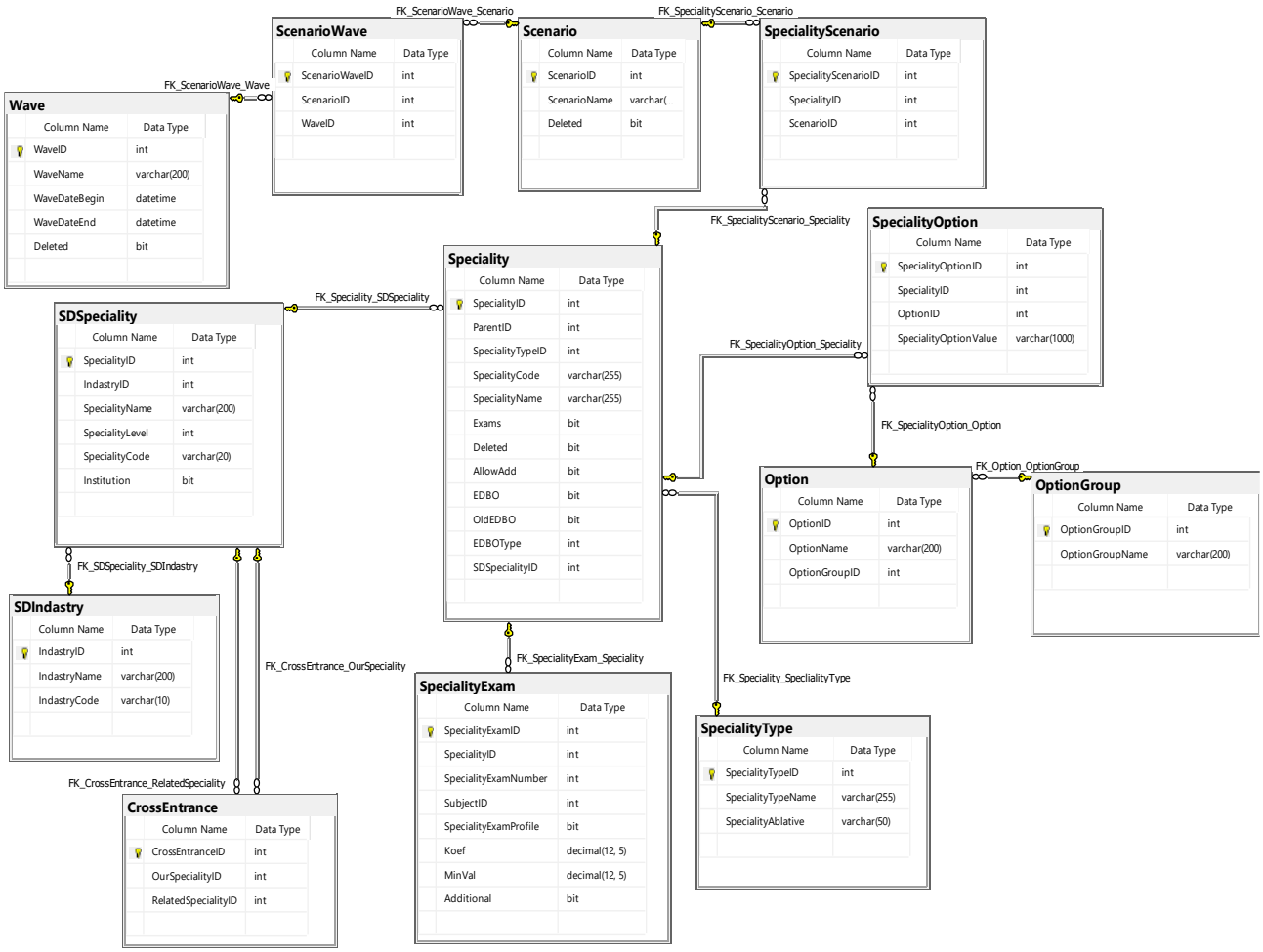

Fig. 2. Physical model of the database of specialisations and admission parameters

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

An important element of the database's operation is the use of triggers. For the OrderStatus table, the OrderStatusUserDateTime trigger has been implemented (fig. 3), which, upon the creation of a new record, automatically adds user details, as well as the date and time the new application status was set.

```
ALTER TRIGGER [dbo].[OrderStatusUserDateTime]
   ON  [dbo].[OrderStatus]
   AFTER INSERT,UPDATE
AS
BEGIN
    SET NOCOUNT ON;
    IF (SELECT COUNT(*) FROM inserted WHERE ISNULL(Active, 0)=0)<=0
        RETURN;
    DECLARE @UserID int;
    SELECT
        @UserID=UserID
    FROM [Session] WHERE HostName=HOST_NAME() AND DateEnd IS NULL
    IF @UserID IS NULL
    BEGIN
        ROLLBACK TRANSACTION
        RETURN
    END
    UPDATE OrderStatus SET Active=0
    WHERE OrderID IN (SELECT DISTINCT OrderID FROM inserted)
    UPDATE OrderStatus SET DateSet=GETDATE(), UserID=@UserID, Active=1
    WHERE OrderStatusID IN (SELECT OrderStatusID FROM inserted)
END
```

Fig. 3. The 'OrderStatusUserDateTime' trigger for the application status table

The second trigger – 'OrderStatusDelete' (fig. 4) – is executed after a status is deleted, and its task is to retrieve the previous status of the application and mark it as active.

```
ALTER TRIGGER [dbo].[OrderStatusDelete]
   ON  [dbo].[OrderStatus]
   AFTER DELETE
AS
BEGIN
    SET NOCOUNT ON;

    UPDATE OrderStatus SET Active=1 WHERE OrderStatusID IN
        (SELECT
            MAX(os.OrderStatusID)
        FROM OrderStatus os INNER JOIN deleted d ON d.OrderID=os.OrderID
        GROUP BY os.OrderID)
END
```

Fig. 4. The 'OrderStatusDelete' trigger for the table containing order statuses

The Order table includes the OrderUserDateTime trigger, which is activated when a new applicant's application is added (fig. 5). Its functions are not limited to recording the user, date and time of the record's addition. Additionally, this trigger performs the automatic calculation and assignment of a personal file code. Before the information is entered, a check is performed to verify the existence of an active user session: if no session is detected, the add operation is cancelled; if a session is present, the active user's identifier is entered into the system.

Similar operations can be implemented using procedures; however, the use of triggers is a more reliable approach, as they are executed automatically at the server level and provide additional control

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

over changes to the database. This enhances data integrity and reduces the risk of errors during data processing.

```
ALTER TRIGGER [dbo].[OrderUserDateTime]
   ON [dbo].[Order]
   AFTER INSERT
AS
BEGIN
    SET NOCOUNT ON;
    DECLARE @UserID int;

    SELECT
        @UserID=UserID
    FROM [Session] WHERE HostName=HOST_NAME() AND DateEnd IS NULL
    IF @UserID IS NULL
    BEGIN
        ROLLBACK TRANSACTION
        RETURN
    END

    DECLARE @Code int, @SpecialityID int, @EZ int;
    SELECT TOP 1 @SpecialityID=SpecialityID, @EZ=EZ FROM Inserted

    SELECT TOP 1
        @SpecialityID=s.SpecialityID
    FROM dbo.fn_GET_Speciality_Reverse(@SpecialityID) f LEFT JOIN Speciality s ON f.SpecialityID=s.SpecialityID
    WHERE s.AllowAdd=1
    ORDER BY s.SpecialityTypeID

    IF ISNULL(@EZ, 0)<>0
    BEGIN
        SELECT TOP 1 @Code=n-1 FROM
            (SELECT
                ROW_NUMBER() OVER (ORDER BY CodeOfBusiness) n,
                CodeOfBusiness
            FROM [Order] o INNER JOIN dbo.fn_GET_Speciality_Tree(@SpecialityID) f ON f.SpecialityID=o.SpecialityID
            WHERE Deleted IS NULL) a
        WHERE n<CodeOfBusiness
        ORDER BY n
    END

    IF @Code IS NULL
        SELECT
            @Code=ISNULL(MAX(CodeOfBusiness), 0)
        FROM [Order] o INNER JOIN dbo.fn_GET_Speciality_Tree(@SpecialityID) f ON f.SpecialityID=o.SpecialityID
        WHERE Deleted IS NULL

    DECLARE @t TABLE (OrderID int, Code int)
    INSERT @t SELECT OrderID, ROW_NUMBER () OVER (ORDER BY OrderID) FROM inserted

    IF @Code IS NULL SET @Code=0
    UPDATE [Order] SET
        CodeOfBusiness=@Code+t.Code,
        UserID=@UserID,
        [DateAdd]= GETDATE()
    FROM [Order] o INNER JOIN Inserted i ON i.OrderID=o.OrderID
    LEFT JOIN @t t ON t.OrderID=i.OrderID
    END
```

Fig. 5. The ‘OrderUserDateTime’ trigger for the table containing applicants’ applications

Storing information in a structured format ensures efficient interaction with data, simplifies access to the necessary information and creates the conditions for scaling the information system. This makes it possible to increase both the volume of data and the number of users without a significant reduction in performance.

Research results

The study also examines the possibility of performing analytical data processing using Spark SQL, which is a module of the Apache Spark framework designed to work with structured data sets. The integration of Spark SQL into the information system opens up opportunities for the application of Big Data technologies, which is particularly relevant given the constant growth in the volume of

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

data accumulated during the admissions campaign. The model for integrating Spark SQL into the information system is shown in Fig. 6.

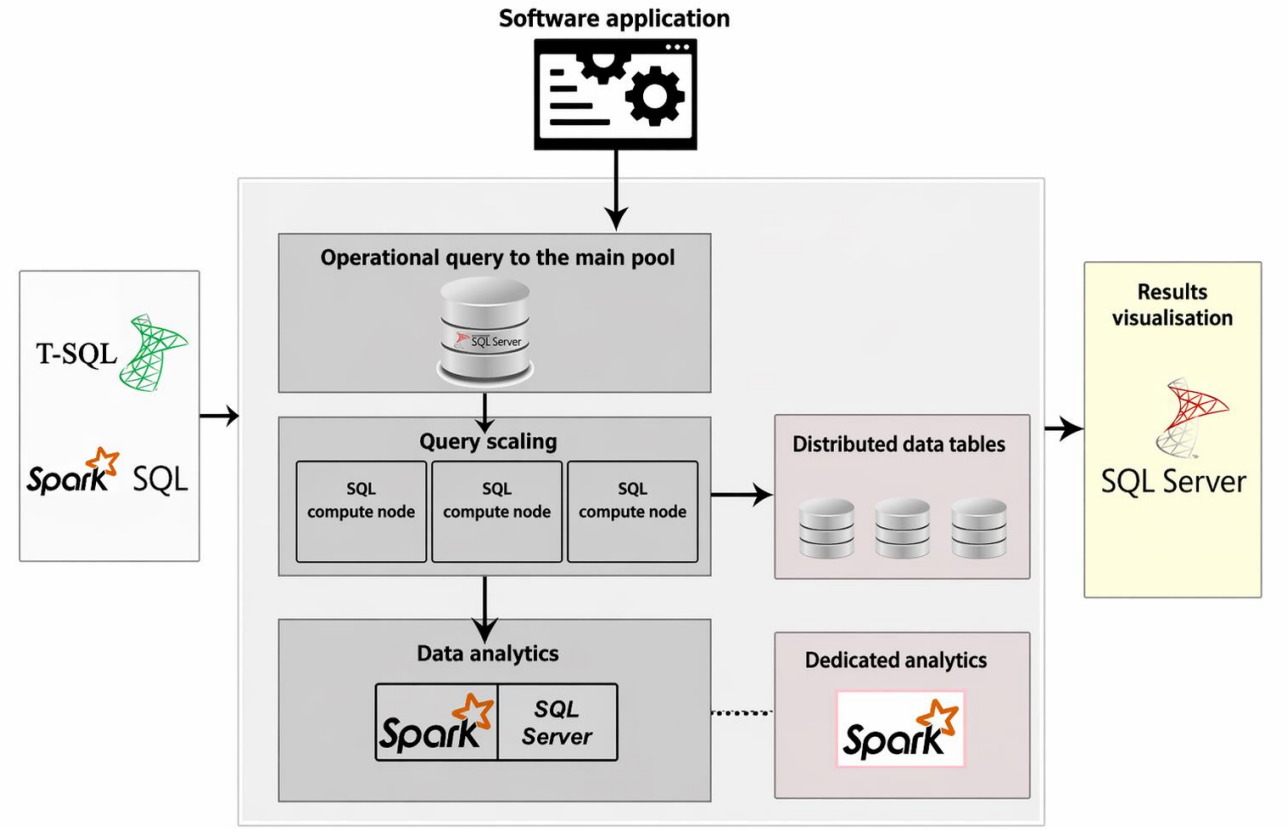

Fig. 6. Model of Spark SQL integration into the information system

The use of Big Data tools not only accelerates analytical processes but also enhances the quality of management decision-making, improves the structuring of information and ensures its more efficient storage. All core data operations, primarily record modification, are implemented at the database level via stored procedures, functions and triggers. At the user interface level, only the relevant procedures are called with the necessary parameters, whilst system logic and data integrity control are provided directly by the DBMS.

The user interface of the admissions committee's information system was developed in the Embarcadero RAD Studio Delphi environment. For the visual design, the AlphaControls and DevExpress VCL libraries were used, which provide a wide range of components for building a user-friendly and functional interface. To improve user ergonomics, the system's functional capabilities were grouped. For example, the 'Working Reports' panel is shown in Fig. 7.

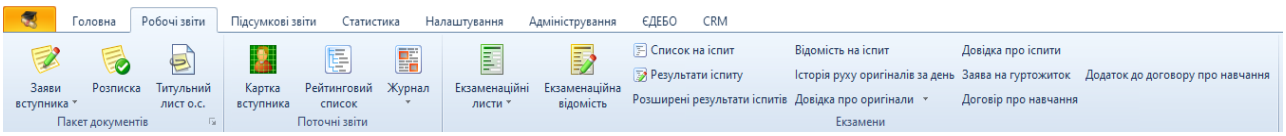

Fig. 7. 'Working Reports' panel

The main form for adding an applicant's application is shown in Fig. 8. The system form is designed for entering applicants' applications in cases where they apply in person to the admissions committee with paper documents. A committee member enters the applicant's personal details into the system, along with information regarding their identity document, previous education, test results, contact details, residential address, application characteristics and details of any special admission conditions.

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

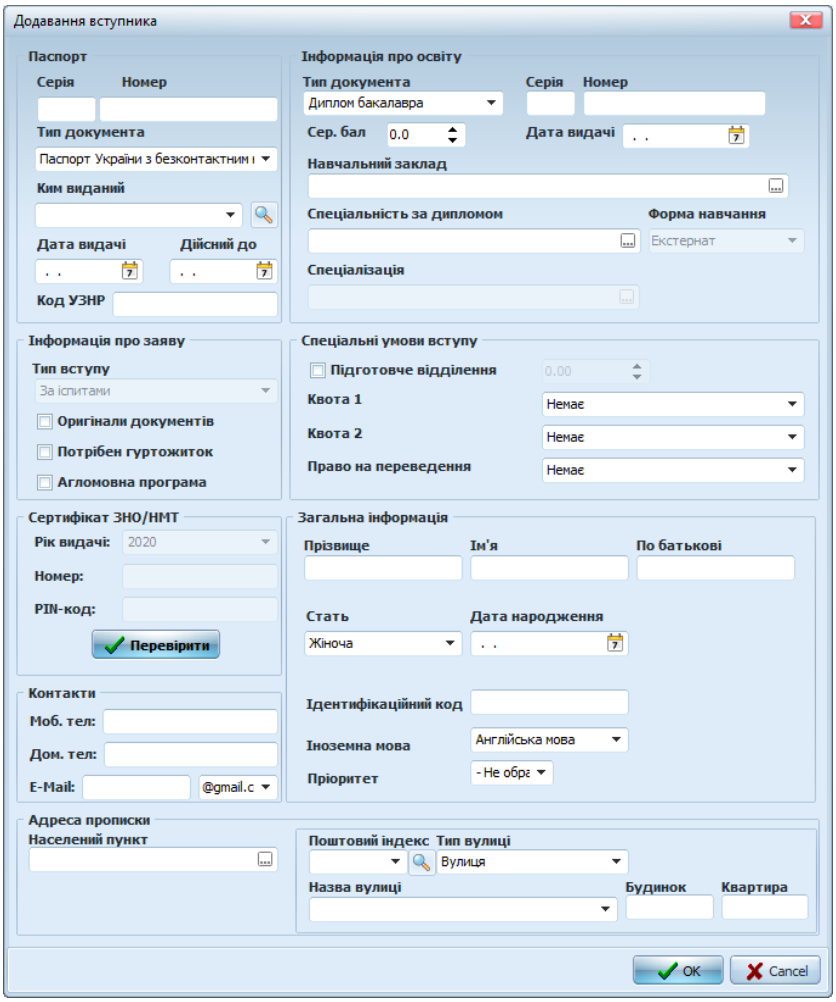

Fig. 8. ‘Add Applicant’ form

The system allows applications to be searched using various criteria, including the applicant’s surname, first name and patronymic, application submission date, contract number, document number or internal identifier in the database. Searches can be conducted across the entire system or within a specific branch of the specialism tree. An additional advantage is the implementation of fuzzy search by surname, which allows not only exact matches but also similar matches to be found. Once an application has been created in the information system, if it is submitted in paper format, it can be exported to the Unified State Electronic Database for Admission (USEDA).

Figure 9 presents an illustrative approximation of the functional outcomes achieved through the implementation of the admissions committee information system. The graph reflects four main areas of system impact: process automation, application search, status control, and reduction of manual operations. The increasing dynamics of the curves indicate the gradual strengthening of the system’s functional effect across the conditional stages of application processing.

The highest functional effect is associated with the automation of core operations, which is ensured through the use of database-level triggers, stored procedures, and functions. These mechanisms support the automatic recording of user actions, control over the creation and modification of records, and maintenance of data integrity. A similar positive trend is observed for application search, where the system provides search by applicant data, document number, submission date, internal identifier, and fuzzy surname matching.

The status control curve reflects the system’s ability to automatically record, update, and restore application statuses, thereby supporting the operational logic of the admissions process. The reduction of manual operations demonstrates the transfer of part of routine data-processing actions from the

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

user interface level to the database level, which creates prerequisites for reducing the risk of operational errors.

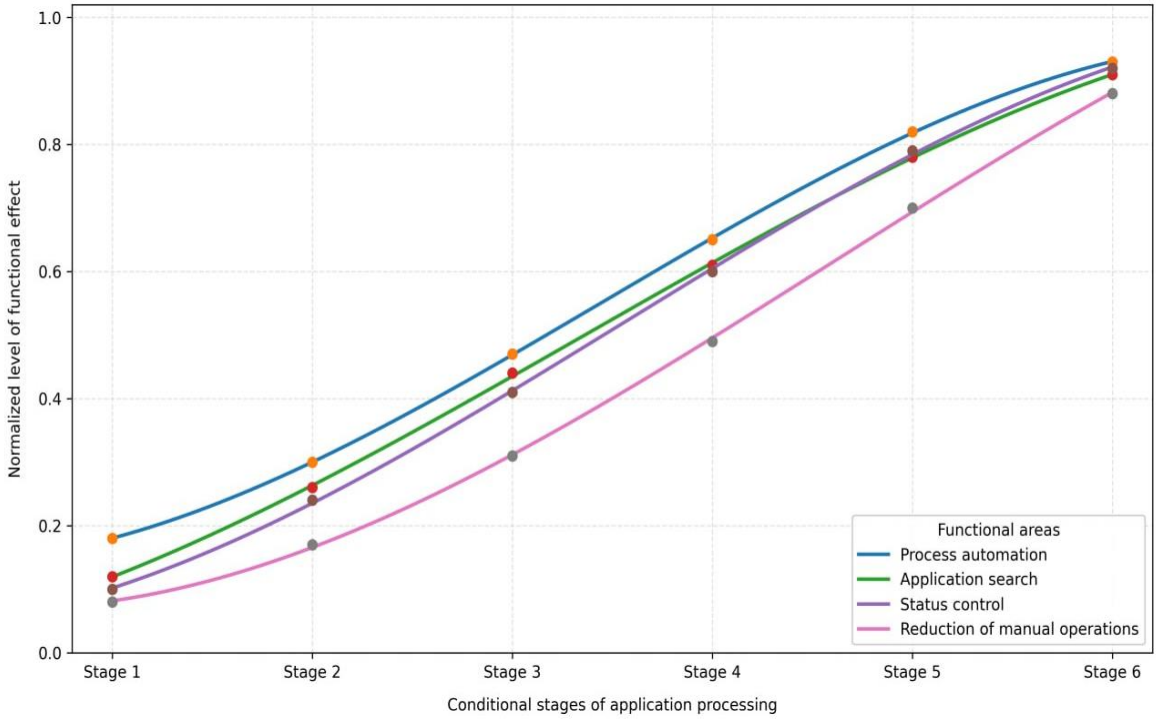

Fig. 9. Illustrative approximation of functional outcomes of the admissions committee information system implementation

Figure 10 illustrates the qualitative reduction in operational error risk achieved through the implementation of the admissions committee information system. The curve demonstrates a gradual downward trend across the conditional stages of application processing, indicating that the risk of operational errors decreases as the system functionality is consistently applied.

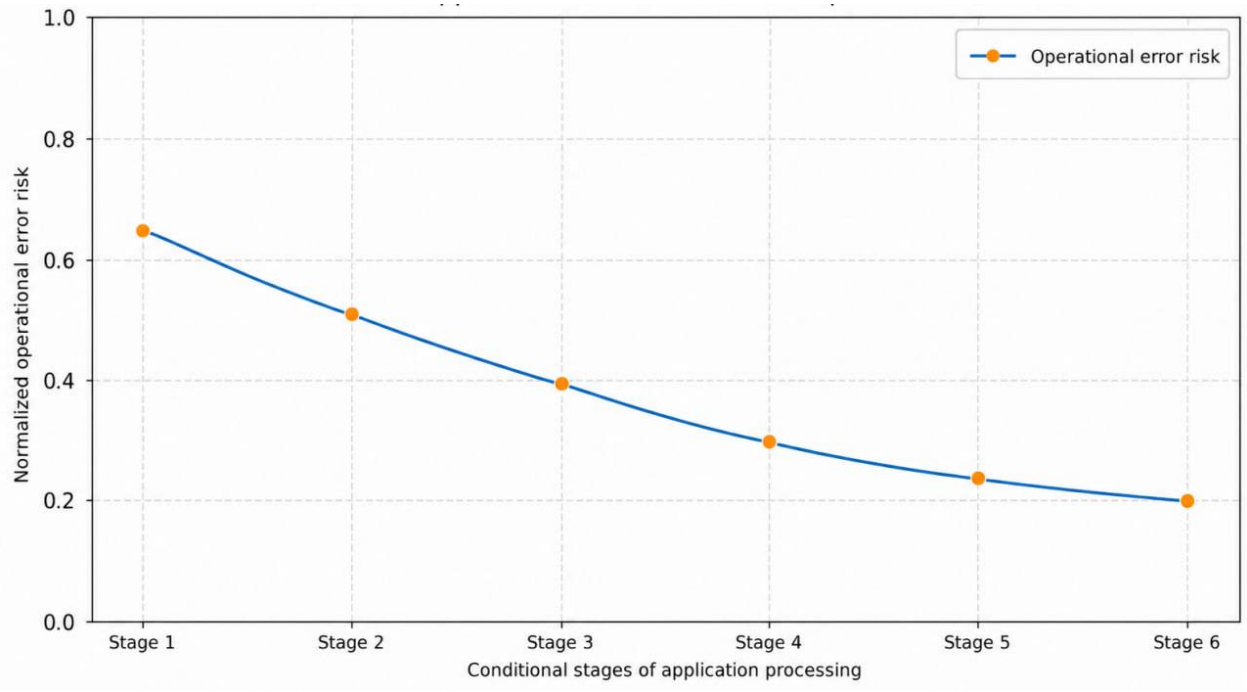

Fig. 10. Illustrative approximation of reduction in operational error risk

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

At the initial stages, the operational error risk remains relatively high due to the greater involvement of manual data entry and verification procedures. However, as the processing stages progress, the use of automated database-level mechanisms, including triggers, stored procedures, and built-in control functions, contributes to the reduction of routine manual actions and strengthens data integrity control.

The decreasing curve reflects the system's capability to minimise the probability of inconsistencies, duplicate entries, and status-handling errors during application processing. Thus, the figure confirms that the implementation of the proposed information technology creates functional prerequisites for reducing operational error risk in the admissions campaign.

The obtained practical results confirm the functional implementation of the proposed information technology at the level of database structure, server-side operational logic and user interface tools. In particular, the developed solution provides structured storage of applicant data, automated recording of users, dates and times of key operations, automatic assignment of personal file codes, restoration of the previous active application status after status deletion, search by multiple application attributes, fuzzy surname search. These results substantiate the reduction of manual operations and the mitigation of operational risks at the functional level.

Conclusions

1. The developed physical database model provides a structured basis for the operation of the admissions committee information system. Its architecture ensures the comprehensive storage of data on applicants, documents, contact information, addresses, benefits, examination results and other admission parameters. The use of logically grouped tables, primary and foreign keys create the conditions for maintaining data consistency, supporting the operational logic of the admissions process and scaling the system in accordance with the growing volume of information flows.

2. The implementation of triggers, stored procedures and functions at the database level makes it possible to automate key operations related to the creation, modification and deletion of records. In particular, the automatic recording of users, dates and times of changes, the assignment of personal file codes, the verification of active user sessions and the restoration of previous application statuses contribute to strengthening control over data processing. This approach reduces the dependence of the system on manual actions at the user interface level and creates functional prerequisites for decreasing the risk of operational errors.

3. The proposed information technology expands the functional and analytical capabilities of the admissions committee information system through the combination of database-level automation, a functionally grouped user interface, application search mechanisms, fuzzy surname search and the possibility of data export to the Unified State Electronic Database for Education. The integration of Spark SQL and Big Data technologies forms a basis for further analytical processing of large data sets accumulated during the admissions campaign. From a scientific perspective, the developed solution can be considered not only as a software tool for supporting routine admissions procedures, but also as an information model for improving the management of admissions processes under conditions of increasing data complexity, changing regulatory requirements and the need for timely decision-making.

4. The research results show that the developed admissions committee information system provides functional support for the main stages of application processing by combining applicant data management, document registration, contact information storage, admission benefits recording, entrance examination results processing and application status control within a single database-oriented environment. This confirms the practical applicability of the proposed information technology for organising the work of the admissions committee and for ensuring more coherent interaction between the main entities of the admissions process.

5. The implemented system functionality creates the basis for reducing the complexity of routine admissions procedures through the automation of data processing operations, structured storage of information, fuzzy search mechanisms and database-level control over changes. These

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

results demonstrate that the proposed approach can improve the organisational reliability of the admissions campaign and support more consistent decision-making.

References

1. Jacociunas, T., Verschoore, J. R., & Monticelli, J. M. (2025). Digital transformation of Higher Education Institutions. Revista Internacional de Educação Superior. 9,100692. https://doi.org/10.1016/j.sftr.2025.100692.

2. Makoiedova, V. O. (2023). Informatization of introductory campaign processes in higher education institutions. Technical sciences and technologies. 1 (31), 90-97. https://doi.org/10.25140/2411-5363-2023-1(31)-90-97.

3. Makoiedova, V. O. Information technology: approaches to definition, principles of construction. Electronic Professional Scientific Journal «Cybersecurity: Education, Science, Technique». 2 (18), 138-149. https://doi.org/ 10.28925/2663-4023.2022.18.138149.

4. Zub Kh. V., Zhezhnych P. I. (2022) Analysis of the Efficiency of the Ukrainian Higher Education Institutions Admission Campaign and the Ways to Improve it Through the Information Technology Implementation. Visnyk of Vinnytsia Politechnical Institute. 3 (156). 52–59. https://doi.org/10.31649/1997-9266-2022-162-3-52-59.

5. Morozov A. V., Vakaliuk T. A. (2021). An electronic environment of higher education institution (on the example of Zhytomyr Polytechnic State University). Journal of Physics : Conference Series. 1 (1840),012061. https://doi.org/10.1088/1742-6596/1840/1/012061.

6. Karashetsky V. P., Yarkun V. I. (2021). An automated system for monitoring the admission campaign of a higher education institution. Information technology and computer engineering. 2 (51), 12-16. https://doi.org/10.31649 /1999-9941-2021-51-2-12-16.

7. Рзаєва С. Л., Гамалій В.Ф. (2023). State and prospects of the use of information technologies in institutions of higher education. Science and Technology Today. 10 (24), 455-468 https://doi.org/10.52058/2786-6025-2023-10(24)-455-468.

8. Kozel V.M. (2019). The location and role of the information interaction system in the higher education management system. Scientific Notes of Taurida National V. I. Vernadsky University. Series: Technical Sciences. 6 (30), 71-76. https://doi.org/10.32838/2663-5941/2019.6-1/13.

9. Makoiedova, V. O. (2023). Engineering of the information system of the admission committee based on UML diagrams. Science and Technology Today. 9 (23), 634-642. https://doi.org/10.52058/2786-6025-2023-9(23)-634-642.

10. Big data options on the Microsoft SQL Server platform. https://learn.microsoft.com/uk-ua/sql/big-data-cluster/big-data-options?view=sqlserver-ver15.

Макоєдова Валентина Олександрівна
PhD з комп'ютерних наук, доцент кафедри цифрової економіки та системного аналізу
Державний торговельно-економічний університет, Київ, Україна
ORCID: 0000-0001-7518-894X
E-mail: v.makoedova@knute.edu.ua

Цюцюра Микола Ігорович
доктор технічних наук, професор, професор кафедри інженерії програмного забезпечення та кібербезпеки
Державний торговельно-економічний університет, Київ, Україна
ORCID: 0000-0003-4713-7568
E-mail: mitsiutsiura@gmail.com

ІНТЕЛЕКТУАЛІЗАЦІЯ ПІДТРИМКИ ВСТУПНОЇ КАМПАНІЇ ВИЩИХ НАВЧАЛЬНИХ ЗАКЛАДІВ, ЩО ВИКОРИСТОВУЮТЬ ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ

У статті розглядається специфіка створення та моделювання інформаційних технологій для підтримки вступної кампанії вищого навчального закладу в умовах зростання інформаційних потоків, зростаючої складності взаємодії між приймальною комісією та структурними підрозділами, а також постійних змін нормативних вимог до організації вступної кампанії. Актуальність теми випливає з необхідності ефективного управління даними, оптимізації обміну інформацією та покращення роботи приймальної комісії. Метою статті є аналіз, моделювання та впровадження інформаційних технологій для підтримки вступної кампанії вищого навчального закладу у вигляді інформаційної системи приймальної комісії. Система призначена для оптимізації обміну інформацією, автоматизації основних процесів вступу та підтримки адаптивності до змін вимог до вступу. У статті аналізуються сучасні підходи до інформатизації освітньої галузі, окреслюються вимоги до побудови інформаційної системи приймальної комісії, а також визначається роль моделювання інформаційних потоків між основними сутностями процесу вступу. Під час проектування бази даних було розроблено логічні та фізичні моделі, що охоплюють приблизно сто таблиць, згрупованих за функціональним призначенням. Було визначено центральні таблиці системи, які забезпечують зберігання персональних даних абітурієнтів, контактної інформації, документів, адрес,

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711

пільг, результатів вступних іспитів та інших параметрів вступу. Обґрунтовано доцільність використання тригерів, збережених процедур та функцій для автоматизації контролю за створенням, зміною та видаленням записів, забезпечення цілісності даних та підтримки операційної логіки системи. Також розглянуто можливості інтеграції технологій Big Data для аналітичної обробки великих наборів даних. Окреслено особливості реалізації інтерфейсу користувача в середовищі Embarcadero RAD Studio Delphi. Зроблено висновок, що запропонована інформаційна технологія сприяє підвищенню якості управління вступною кампанією, розширює аналітичні можливості вищого навчального закладу та забезпечує ефективнішу організацію роботи приймальної комісії. Практична цінність розробки полягає в масштабованості системи, реалізації нечіткого пошуку заявок, синхронізації даних з Єдиною державною електронною базою даних з питань освіти (ЄДЕО) та покращенні ергономіки користувача завдяки функціонально згрупованому інтерфейсу. Запропоноване рішення створює передумови для зменшення ручних операцій та операційних ризиків завдяки контролю на рівні бази даних, автоматизації управління статусом додатків, автоматичному призначенню кодів особистих файлів, інструментам нечіткого пошуку та синхронізації з USEDE.

Ключові слова: інформаційні технології, вступна кампанія, вищий навчальний заклад, приймальна комісія, моделювання, база даних, великі дані.

Надійшла до редакції (Received): 01.05.2026
Прийнята до друку (Accepted): 12.06.2026
Опубліковано онлайн (Available online): 25.06.2026

http://creativecommons.org/licenses/by/4.0/
This work is licensed under Creative Commons Attribution-noncommercial-sharealike 4.0 International License.

УДК 004.056.53:004.732 DOI: 10.31673/2409-7292.2026.023312

Прокопович-Ткаченко Дмитро Ігорович
кандидат технічних наук, доцент, завідувач кафедри кібербезпеки та інформаційних технологій
Університет митної справи та фінансів, Дніпро, Україна
ORCID: 0000-0002-6590-3898
E-mail: omega2417@umsf.edu.ua

Звєрєв Володимир Павлович
кандидат технічних наук, доцент, доцент кафедри інженерії програмного забезпечення та кібербезпеки
Державний торговельно-економічний університет, Київ, Україна
ORCID: 0000-0002-0907-0705
E-mail: zvieriev_vp@knute.edu.ua

Галущенко Олександр Михайлович
аспірант
Вінницький національний технічний університет, Вінниця, Україна
ORCID: 0009-0002-5597-8818
E-mail: ogalus5212@gmail.com

Торстенссон Ольга
викладач
Halmstad University, Гальмстат, Швеція
ORCID: 0009-0007-2169-6851
E-mail: olga.torstensson@hh.se

Черкаський Давид Олександрович
аспірант кафедри безпеки інформації та телекомунікацій
Національний технічний університет «Дніпровська політехніка», Дніпро, Україна
ORCID: 0009-0003-8516-6252
E-mail: asherjoseph.c@gmail.com

© Makoiedova V.O., Tsiutsiura M.I. Intellectualization of support for the introductory campaign of higher education institutions using information technology. Сучасний захист інформації, 2(66), 126–138. https://doi.org/10.31673/2409-7292.2026.024711