Analysis of modern LMS platforms in Kazakhstan: Structure, functionality, cybersecurity

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Abstract

Today, higher education institutions actively use information platforms (Learning Management System, LMS). The LMS platforms cover many functions in the educational process: organization of the learning process, content management, assessment and feedback, monitoring and reporting, communication and interaction, personalization of learning, administration, and user management. There are many up-to-date approaches to provide effective structure, wide functionality, and cybersecurity issues of LMS platforms. The main objective of this study is to analyze the modern and most popular LMS systems in Kazakhstan (Platonus, Univer, Canvas). The analysis has shown that the most effective system used by Kazakh universities is Canvas LMS. It provides several benefits that make it attractive to educational institutions and corporate users. But the cybersecurity issues should be studied deeply in future works, as it will provide anomaly detection in the information flows.

Keywords

cybersecurity, functionality, structure, LMS, education, academic information, AI, data leakage

1. Introduction

In the modern world, information technologies play a key role in the functioning of educational institutions. Higher education institutions actively use information platforms (Learning Management Systems, LMS) to manage the educational process, and store and process large amounts of data on students, teachers, and research. However, as the volume and importance of data grows, the risk of unintentional or malicious modification increases. This raises the need to develop a secure LMS that can withstand internal and external threats.

Another key challenge is the processing and analysis of large amounts of data generated in higher education institutions. Information about students, study programs, lecturers, and learning processes is continuously accumulated in LMS. Innovative methods and tools need to be developed and applied to efficiently process and analyze this volume of information.

The up-to-date LSM should include an optimal set of security features, utilizing the latest advances in cybersecurity and AI to detect and prevent anomalies and threats to data security. This will ensure not only protection from external and internal cyberattacks but also improve the efficiency of managing academic and administrative processes, guaranteeing the integrity and confidentiality of academic information.

The challenges of digital transformation facing higher education require the formation of new models of "digital" organizations with new approaches to the implementation of all types of activities, basic and auxiliary processes, new principles of interaction between participants in the educational process, and new digital services. Under these conditions, the growing need for secure information systems for educational institutions is extremely important and relevant, especially in the context of the increasing number of cyberattacks and stricter requirements for the protection of personal data. Preliminary studies have shown that the existing LMS of educational institutions in Kazakhstan is not always able to provide an adequate level of protection against modern threats, which is confirmed by regular incidents of data leakage.

2. Review of the modern approaches

Solving specific problems related to cybersecurity in Kazakhstan's educational institutions involves integrating procedures and tools with used LMS.

First, research in the application of AI to detect anomalies in LMS and other information systems shows the significant potential of AI in detecting and preventing cyberattacks [1]. However, many of these approaches do not consider the specifics of LMS, which opens the door for our study.

Second, many of the project managers' works mentioned above stand out by developing decision support systems based on different mathematical apparatus for analyzing anomaly and cyberattack trait data. These approaches can be adapted and extended in our project to create more efficient and specialized anomaly detection tools.

The third area is related to the integration of teacherless ML to analyze information from LMS databases. Techniques such as ML can detect abnormal behavior patterns without first identifying the parameters of normal behavior. Current research emphasizes the importance of adapting these methods to the specificity of data in educational environments [2].

The fourth direction of the research includes the development of mechanisms to ensure the security of the LMS, using genetic algorithms to determine the most effective set of security features. Genetic algorithms allow for optimization of the process of selecting protection means adapted to specific conditions and threats, which is confirmed by studies in the field of cybersecurity [3].

The fifth unique feature is the integration of the anomaly detection system with the Power BI platform to provide the results of data processing in the form of digital analytics and visualizations [4]. This will allow university administrations to effectively monitor and analyze the security of information flows.

The sixth direction of the research includes a comprehensive study of the level of personal data cybersecurity in the developed prototype of the LMS [5]. This will make it possible to assess the effectiveness of the implemented security features and anomaly detection mechanisms.

The seventh direction is related to the assessment of the effectiveness and potential of the application of the developed prototype in the real conditions of Kazakhstani

universities [6]. This will make it possible to determine the real value and applicability of the proposed solutions.

The eighth direction includes the formation of recommendations based on the results obtained to improve the degree of information security and cybersecurity of universities in Kazakhstan [7].

3. Statement of a research problem

The global goal of the project is to develop and implement a prototype of a secure LMS for a higher education institution, incorporating AI techniques to detect anomalies in data, improve cybersecurity optimize educational processes, and increase their efficiency.

To achieve the global goal, it is necessary to start with the study and analysis of the existing information flows of the university and the formation of terms of reference, including requirements for functionality, security, and interface of the system. Also, it is important to define the indicators collected in LMS of Kazakhstan universities (Platonus, Univer, Canvas).

From this viewpoint, the main objective of this study is to analyze the modern and most popular LMS systems in Kazakhstan by criteria of structure, functionality, and cybersecurity.

4. Main part of the research study

4.1. Analysis of the main tasks of up-to-date LMS platforms

The LMS are key tools for organizing, managing, and supporting the learning process in educational institutions and businesses. The main tasks of LMS systems include a variety of functions that contribute to the effective training and development of users. Below are the examples of architecture as well as the main tasks of LMS systems:
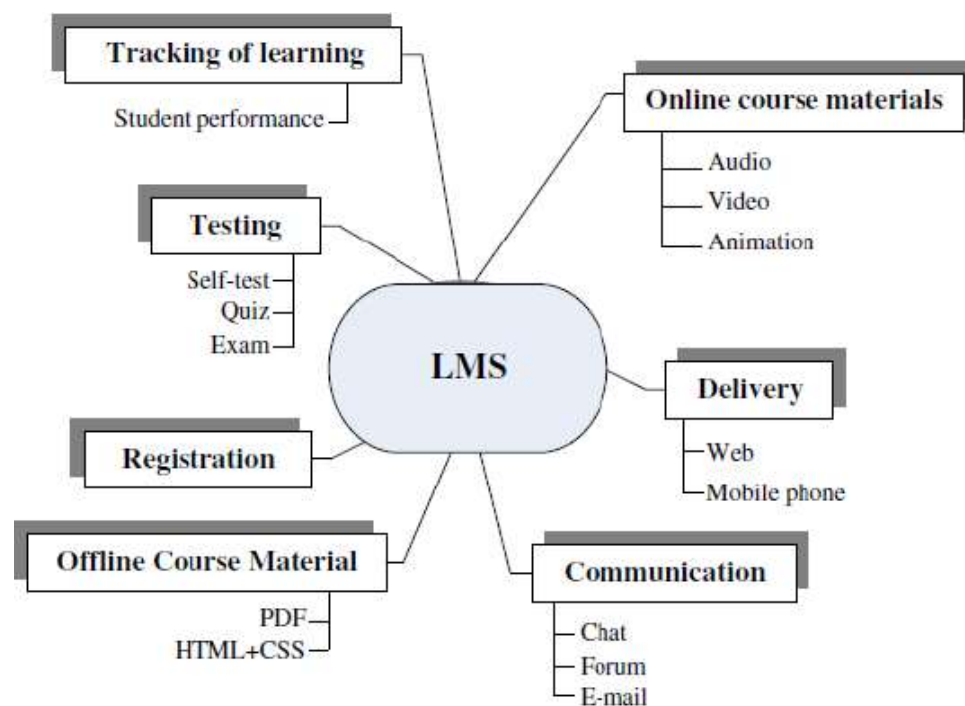

Figure 1: Example of the LMS architecture [7]

The main tasks of LMS systems are the following:

1. *Organization of the learning process:*
   – Structuring of training courses: LMSs allow you to create, organize, and structure training courses, including modules, lectures, assignments, and other learning materials.
   – Learning planning: Provide the ability to schedule training sessions, including class schedules, and deadlines for assignments and assessments.
2. *Content management:*
   – Uploading and storing materials: LMSs provide the ability to upload and store a variety of learning materials, such as videos, audio, texts, presentations, and more.
   – Content organization: Cataloging and organizing content to provide easy access and navigation for users.
3. *Assessment and feedback:*
   – Testing and assessment: LMSs provide tools for creating tests, quizzes, and other methods of assessing knowledge.
   – Automatic grading: Automating the process of grading tests and assignments, allowing you to quickly and efficiently assess user knowledge.
   – Feedback: Provide feedback to students on their performance and progress.
4. *Monitoring and reporting:*
   – Progress tracking: LMSs allow you to track users' progress in training courses, including module completion, test scores, and assignment completion.
   – Analytics and reporting: Generate reports on user activity, course performance, and other metrics to analyze the learning process.
5. *Communication and interaction:*
   – Forums and discussions: LMSs provide tools for organizing forums, discussion panels, and group discussions.
   – Notifications and alerts: Notification systems to inform users about new materials, schedule changes, and other important events.
   – Webinars and online meetings: Integration with webinar and online meeting tools.
6. *Personalization of learning:*
   – Individualized learning trajectories: LMSs can customize individualized learning paths for users based on their needs and knowledge level.
   – Adaptive learning: The use of adaptive technologies to customize the learning process to the individual needs and progress of the user.
7. *Administration and user management:*
   – User management: Registering, managing roles, and access of users in different parts of the system.
   – User support: Providing technical support and assistance to LMS users.

The main tasks of LMS systems cover a wide range of functions aimed at supporting and improving the learning process. From content organization and management to assessment, monitoring, personalization, and communication, LMSs provide a comprehensive approach to learning that allows for efficient use of resources and high learning outcomes.

4.2. Cybersecurity of LMS systems

The main aspects of cybersecurity of LMS systems include the following issues:

1. *Authentication and authorization*
   – Multi-factor authentication (MFA): The use of multiple factors to verify a user's identity (password, biometrics, tokens).
   – Role-based access control (RBAC): Role-based access control that allows you to control who has access to what resources.
2. *Data encryption*
   – Data at Rest Encryption: Use encryption algorithms to protect data stored on servers.
   – Data in Transit Encryption: Ensures the security of data transmitted over the network by using TLS/SSL protocols.
3. *Protection against malicious software*
   – Anti-virus software: Using antivirus solutions to protect servers and endpoints from malware.
   – Intrusion detection and prevention systems (IDS/IPS): Monitoring network activity to detect and prevent unauthorized activity.
4. *Code and development security*
   – Regular security testing: Conducting penetration tests and code analysis to identify and fix vulnerabilities.
   – Secure software development: Utilizing security best practices during software development, including code reviews and static code analysis.
5. *Access and identity management*
   – Access control: Ensure that only authorized users have access to sensitive data and functions.

Logging and monitoring: Maintaining detailed event logs and continuous monitoring to detect anomalous activity.

4.3. LMS in Kazakh Universities

1) Univer

The LMS Univer [8] is an important part of the educational infrastructure of some universities in Kazakhstan. This system (Fig. 2) is used to organize distance learning and provides a wide range of tools for students and teachers.
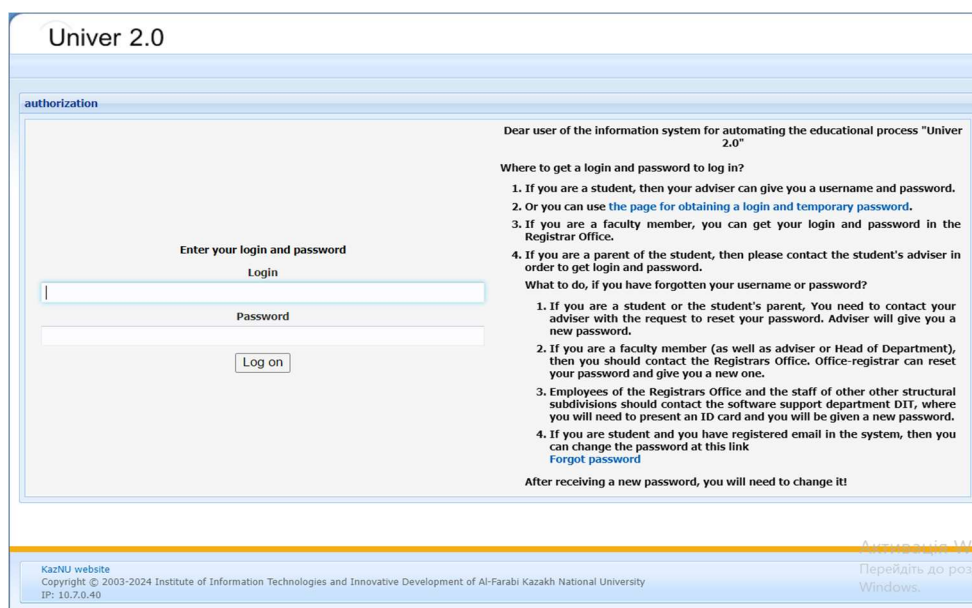
Figure 2: Authorization screen in Univer LMS

The main functions of the LMS Univer are the following:

1) Course management:
   – Creating and administering training courses, including uploading materials, organizing modules, and testing.
   – Integration with other platforms, such as Moodle, which allows you to effectively use both systems.

2) Monitoring and evaluation:
   – Track student progress, record grades, and analyze results.
   – Automatic grading of tests and assignments, which simplifies the work of teachers and increases the accuracy of grades.

3) Communication and interaction:
   – Tools for communication between students and teachers, including forums, chats, and video conferencing.
   – Possibility to organize webinars and online classes.

4) Administrative functions:
   – Manage student records, class schedules, and other administrative tasks.
   – Support for the work of the Admissions Office, including managing applications and registration of new students.

5) Integration with other systems:
   – Supports integration with platforms such as Microsoft Teams, Google Meet, and other tools to ensure an integrated approach to learning.
   – This system ensures high efficiency in organizing the educational process, allowing teachers to focus on course content and students to learn.

The LMS Univer combines the following structural modules:

- Rector
- Vice-Rector
- Dean
- Deputy Dean
- Education Department
- Method Office
- Distance learning
- Exams. Issues
- Accounting Department
- Testing Department
- Management
- Registrar's office
- Methodist
- Admissions Office
- Human Resources
- Student Affairs
- Academic department
- Methodical department
- Head of Department
- Teacher
- Schedule
- Faculty rating
- Bachelor
- Master
- Doctoral student
- Monitoring
- Support Department
- Additional semester
- Mentor—Advisor
- Administrator
- Commandant
- Reports
- Handbooks.

2) Platonus

The Platonus LMS [9] is one of the leading educational platforms in Kazakhstan (Fig. 3). It is widely used in universities and colleges to automate and optimize the learning process.
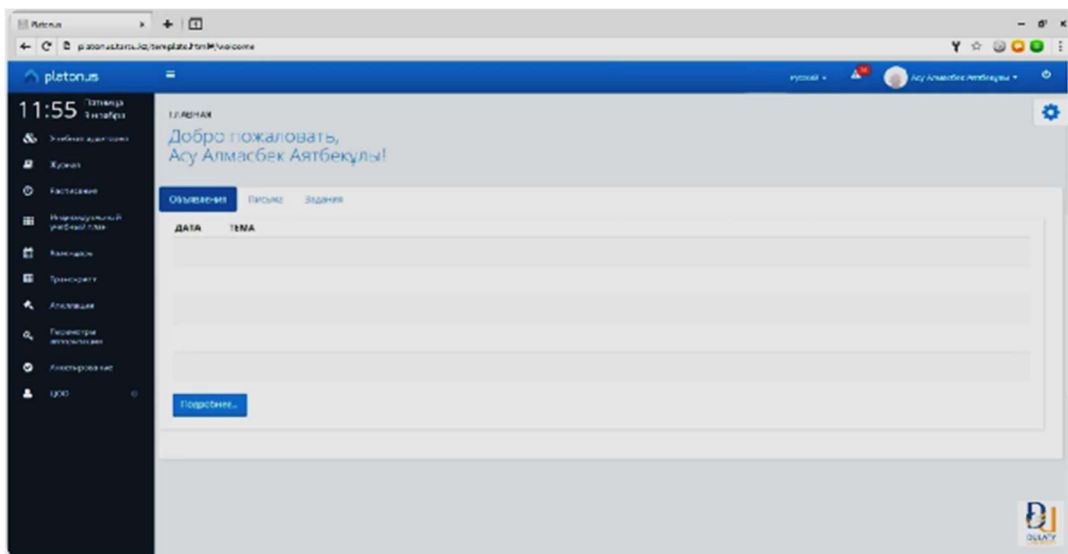

Figure 3: Workspace screen in Platonus LMS

The main features and benefits of the Platonus LMS are the following:

1) Automation of the educational process:
   – Platonus allows you to automate the planning and management of academic calendars, class schedules, exams, and state certifications.
   – The system supports credit-based learning technology, which ensures efficient distribution of academic disciplines and teacher workload.
2) Course and content management:
   – The platform provides the ability to create and administer training courses, upload training materials, and conduct tests.
   – Integration with other systems, such as Moodle, provides a wide range of learning opportunities.
3) Transparency and control:
   – Maintaining electronic journals and information on grades increases the transparency of the learning process and reduces the risk of corruption.
   – The system supports appeals after exams and tests, ensuring the fairness of assessment.
4) Monitoring and reporting:
   – Platonus allows you to track students' progress, and generate reports on their performance and other statistical information.
   – Integration with a unified higher education management system for centralized data accounting.
5) Communication and learning support:
   – The system provides tools for communication between students and teachers, including electronic messaging and document exchange.
   – It supports distance learning, allowing you to reach a wide audience and provide flexibility in the learning process.
   – Platonus is also actively used in medical schools, where it is adapted to the specifics of medical education, including the management of research activities and clinical practices.

The LMS Platonus combines the following structural modules:

- Information about the university
- Faculties
- Specialties/GOP
- Teachers
- University staff
- Students
- Applicants
- Parents
- Orders+Extracts from orders
- Transcript
- Graduates
- Discipline catalogs
- Training cases
- Calendar
- Curricula
- Learning streams
- Journal of grades and attendance
- State certification
- Records
- Summary sheets
- Summary sheets for the whole period
- Schedule
- Testing
- GPA calculator
- Preparatory Department
- Card file of trainees
- Military department
- Questionnaire for user
- Reports
- Publications of university teachers
- Messages
- Announcements

- Library
- Online registration for disciplines
- Composition of appeal commissions of examination sessions
- Employment of graduates
- Distribution of graduates
- File storage
- Military records
- Electronic bulletins (online signing of bulletins in the system)
- Intermediate certification online
- Distribution of academic load
- Online registration of applicants
- Practical training of students
- Control over the fulfillment of graduation works
- Integration with the system of checking for borrowings
- Antiplagiarism/StrikePlagiarism/Turnitin
- Online proctoring. Integration with AeroExam
- Online Proctoring. Integration with Examus
- Dormitory
- Dormitory. Autodistribution of places
- Service center for students/dropouts/ graduates

- SMS notification of system users
- Integration with MS Active Directory
- Integration with MS Teams
- Integration with Power BI
- Generating reports (analytics) in Business intelligence format
- Checking written works (for borrowings)
- Minor
- Settings
- Distribution of faculty disciplines
- Education documents constructor
- Integration with 1C: Accounting Office
- Online registration for applicants
- Testing for applicants
- Reading data from ID card
- Tasks.

3) Canvas LMS

The Canvas LMS [10] was developed by Instructure company, it's a powerful LMS (Fig. 4) that is actively used in many countries around the world, including Kazakhstan. Canvas LMS offers a wide range of tools and features that help educational institutions effectively organize and manage the learning process.

Figure 4: Workspace screen in Canvas LMS

Canvas LMS is actively used in various educational institutions in Kazakhstan to organize distance learning, ensure the continuity of the educational process, and support modern teaching methods. It helps universities and schools in Kazakhstan to implement innovative approaches to teaching, providing students and teachers with all the necessary tools for effective interaction and learning.

The main features of Canvas LMS are the following:

1) Integration with other systems:
   – Canvas integrates seamlessly with student management systems (SIS) and hundreds of external educational applications, making it a versatile solution for any type of educational institution.
2) Mobile access:
   – The platform supports mobile applications for students, teachers, and parents, allowing users to interact with the system from any device at any time.
3) Personalization of learning:
   – Canvas provides the ability to create individual learning paths using adaptive learning features and personalized recommendations.
4) Interactive content:
   – The system supports the creation of interactive video content through Canvas Studio, which allows you to turn passive learning into active interaction.
5) Analytics and reporting:
   – Canvas provides advanced analytics and reporting capabilities to help track student performance and course effectiveness.
6) Security and accessibility:
   – The platform provides a high level of data security and meets international accessibility standards, making it reliable and convenient for all users.

The LMS Canvas combines the following structural modules:

- Integration with SIS, LTI, and other systems
- Home page
- Dashboard
- Reporting and analytics modules
- Course creation tools
- Modules for student management
- Survey tools
- Modules for interacting with faculty
- Assessment tools
- Modules for organizing distance learning
- Integration with various external systems
- Competency-Based Learning module
- Tools for tracking students' progress
- Calendar
- Modules for conducting tests and exams
- Assessment module
- Tools for providing feedback
- Integration with video conferencing tools
- Publish course materials
- User access and role management
- File Storage
- Notifications and reminders
- Collaboration tools
- Module for organizing group projects
- Tools for creating and managing quizzes
- Analytics and reports on learning outcomes
- Tools for communicating with students
- TurnItIn support
- Support for StrikePlagiarism (LTI 1.3).

Comparative analysis of LMS platforms

Table 1 provides a comparative analysis of the LMS systems under consideration by the main characteristics that are important for Kazakh and other universities. For the comparison the following features were used: Flexibility (possibility to change by needs of the university), Free access (availability of the free version of the platform), Wide use (use in various universities in Kazakhstan and other states), Scalability (possibility to increase number of users and databases), Remote study (support of the distant learning), Mobile version (availability of the iOS-based, Android-based and other mobile platforms), Integration (possibility to integration with other educational and research platforms as well as instrumental tools like Google Drive, Microsoft Office 365), Cloud storage (data saving in cloud storage), Cybersecurity (support the tools and procedures for data confidentiality, integrity, and availability), Update (constantly being updated to integrate the latest technologies and features to improve the learning process).

Table 1
Comparison of LMS in Kazakhstan

LMS/Features	Univer	Platonus	Canvas
Flexibility	+/-	+/-	+
Free access	-	-	+/-
Wide use	-	+	+
Scalability	-	+/-	+
Remote study	-	-	+
Mobile version	+	+	+
Integration	+/-	+/-	+
Cloud storage	-	-	+
Cybersecurity	+/-	+/-	+
Update	+	+	+

5. Conclusions

A study of LMS systems most commonly used by universities in Kazakhstan has shown that the most effective system is Canvas LMS. It provides several benefits that make it attractive to educational institutions and corporate users. Here are some of the key benefits of Canvas LMS:

- It is known for its simple and intuitive interface that makes it easy to use for both teachers and students. The interface is easily adaptable to different types of courses and teaching methods.
- It has powerful mobile applications for Android and iOS that allow users to access their courses from anywhere. This ensures continuous access to learning materials and communication with instructors and students.
- Canvas LMS integrates seamlessly with a variety of external applications and tools through the LTI (Learning Tools Interoperability) standard. This includes integration with tools from Google, Microsoft, and many others, allowing you to create comprehensive learning solutions.
- Provides teachers with a variety of tools for creating and editing learning materials. This includes video lectures, interactive exercises, quizzes, discussion forums, and other types of learning content.
- Provides advanced analytics and reporting capabilities that allow you to track student progress, course performance, and assignment completion. This data can be used to improve curricula and increase student success.
- Supports a variety of learning formats, including blended learning, fully online courses, and traditional classroom learning. This allows institutions to easily adapt the system to their specific needs.
- Provides a variety of tools for communication between students and teachers, such as messages, discussion forums, video conferencing, and group projects. This promotes active interaction and collaboration within the learning process.
- Meets high standards of data security and privacy, ensuring the protection of users' personal information. The system also meets various

regulatory requirements, making it a reliable choice for educational institutions in different countries.

Further research will be devoted to a thorough analysis of Canvas LMS information flows, as well as cybersecurity issues of the platform (threats, vulnerabilities, risks, etc.).

Acknowledgments

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