JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DEVELOPMENT AND DEPLOYMENT OF LEARNING MANAGEMENT SYSTEM USING DEVOPS

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Abstract : The integration of Learning Management System (LMS) in educational institutions and corporate training environments has become increasingly essential for efficient and scalable knowledge dissemination. This project outlines the development and deployment of an LMS, emphasizing the utilization of DevOps practices to streamline the software development and deployment process. Our approach involves the automation of testing, deployment, and maintenance processes, which not only reduces manual effort but also enhances the overall system's reliability and agility. The LMS is built on a modular architecture, allowing for scalability and customization to meet the specific needs of different educational institutions and organizations. It includes features such as user management, content creation and management, assessment tools, and analytics for monitoring student progress and engagement. Throughout the project, we go into detail about the specific DevOps tools and techniques used, such as Jenkins for automated testing, Git for version control, Docker for containerization, and Kubernetes for coordination.

Index Terms - **Learning Management System,Computer Application, Course Enrollment.**

I. INTRODUCTION

In today's rapidly evolving educationallandscape, the role of Learning Management Systems (LMS) has transcended mere facilitation of online courses; it has become a cornerstone in modern education and corporatetraining. The seamless delivery of educational content coupled with the ability to monitor andenhance learning experiences, has made LMSa critical component of educational institutionsand organizations worldwide. The idea behind DevOps is to integrate developmentand has garnered a lot of attention because it can efficiently enhance and it includes features such as user management, content creation and management, assessment tools, and analytics for monitoring student progress and engagement.

II. PROBLEM STATEMENT

These challenges include lengthy development cycles, manual integration processes, lack of collaboration between development and operations teams, and difficulties in ensuring continuous integration and delivery. Additionally, there may be issues with scalability, reliability, and security in the deployment phase. The objective is to address these challenges by implementing DevOps practices, which emphasize automation, collaboration.

III. SCOPE OF THE PROJECT

It involves a multifaceted approach encompassing various stages of software development, deployment, and operationalization. Initially, thorough requirement analysis is conducted to understand the diverse needs of stakeholders, including educators, students, and administrators. Subsequently, an intricate system architecture is designed, delineating the technology stack, microservices structure, and containerization strategy.

IV. LITERATURE SURVEY

[1]. The benefits and drawbacks of utilizing LMS applications were the two main themes investigated in this qualitative study design using a descriptive methodology. 50 students and ten lecturersparticipated in written interviews as part of the data collection process, which was then subjectedto content analysis methods. This study was conducted at the flexibility of LMS applications to meet the demands of producing, disseminating, and overseeing educational materials at an time.

[2]. The sudden global outbreak of the Covid-19 pandemic in 2020 compelled higher education systems worldwide to move to online instruction, including online assessment. The purpose of the study was to find out what lecturer academic dishonesty (AD) among students during the first exam period of the Covid-19 pandemic, behaviors and the reasons behind their occurrence. Fifty-one

instructors and eighty-one students from various Israeli colleges and universities made the sample. The results add to the body of knowledge on compelled higher education systems worldwideto move to online instruction, including online assessment.

[3]. Public health expertsrecommended social distance as a way to slow down the spread of the COVID-19 pandemic and lower overall death rates. Thisrecommendation led to the closure of colleges and other institutions worldwide. However, theLMS (Learning Management System) is a greatway to encourage students' commitment to academic subjects like sustainability. Researchon integrated strategies in the context of learning management systems in developed nations has been scarce in the past.

[4]. The pandemic usersin a "new" normal where working and learningpractices are enforced by digitization. It pusheseducation even farther toward technologization, which is already well on its way thanks to commercialism and the dominant ideology of the market. According to Daniel, many institutions had plans to use technology in the classroom more, but changes that were supposed to take monthsor years had to be made in a matter of days. Keyfactors influencing the commercialization of learning are digital technologies and performance-based economic rationality. Whenlearning shifts from in-person interactions to virtual ones, the learning environment becomes disembodied and virtual rather than real, which affects student learning as well as how schools are run—they are no longer physical locations but rather websites. Users can absorb various components of systematic applications in a productive learning environment by using an LMS.

[5]. A common information technology applied in many Higher Education Institutes (HEI) to support instructionalinitiatives is called Learning ManagementSystems (LMS). Support for both on-campus and online courses—as well as a combination of these—can be provided by the system. The goal ofthis study is to comprehend how an LMS is implemented at a particular HEI. After a number of implementations over the previous six years, theHEI took the decision to launch a new LMS in 2018. The primary focus of the study is the instructors' perceptions of the implementation andthe role that a group of individuals known asAmbassadors played in it. Utilizing a social constructivist methodology, the study collected data from teachers and oversaw the HEI's implementation project by combining survey, observation, and interview techniques. The information gathered was examined by the study using theme analysis. Five themes served as the foundation for the analysis: pedagogy, system literacy, implementation.

[6]. In Traditional learning suffers from teachers' and students' lack of readiness for the learning process. Furthermore, the teaching material that has been presented cannot be duplicated, and the educator's explanations and the little notes have a limited capacity to transfer knowledge. This approach is not only inefficient, but it also has restricted time and space for learning that is not available anywhere, at any time. Students today tend to rely more on digital content, or ICT, than ever before. The availability, storage, and sharing of instructional materials via the internet makes the condition favorable.

[7]. The educators can lead and model conversations, organize virtual exercises, establish expectations for their students' learning, give them options, and help them solve problems by helping them make decisions. An engaging learning environment is created by an instructor's involvement within an LMS. Students can keep their individuality, zeal, and drive by using an LMS. Stakeholders in the educational community must find empirical research to support their LMS contributions. Education community stakeholders need to locate empirical research to support their involvement in learning management systems that aid in the study of computation as well as additional subjects by students. Users can absorb various components of systematic applications in a productive learning environment by using an LMS. In an educational setting, people who use computers can perform activities with unconventional phrases, and many educators might possess utilization of tasks in difficult-to-understand acronyms

V. PROPOSED METHODOLOGY

5.1 WORKING OF PROPOSED SYSTEM

Requirements serve as the foundation for the design, development, and testing phases of a project, and they help ensure that the end product aligns with the objectives and specifications set by the client, users, or other relevant parties. Clearly define the requirementsfor your LMS, including user needs, features, and performance expectations. Install a versioncontrol system, such as Git, to monitor changesmade to your configurations from the application and source code. For collaboration, use aplatform such as GitHub or GitLab. Ensure that security is a top priority by implementing security scanning tools and following best practices for securing your LMS and infrastructure. Set up a CD pipeline to automatically deploy your LMS to staging and production environments once it passes all tests in the CI pipeline.

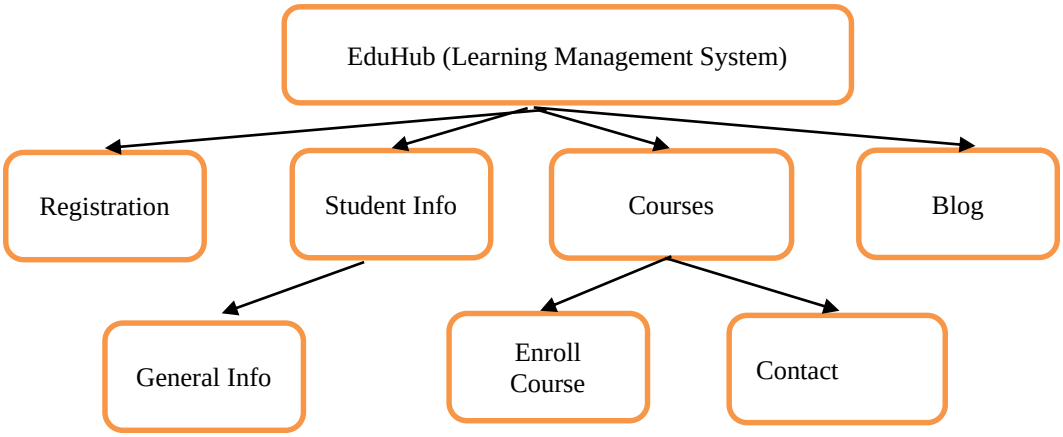

Figure 5.1 Methodology of LMS

5.2 SYSTEM ARCHITECTURE OF LMS

The system architecture for developing and deploying a Learning Management System (LMS) using DevOps typically involves a modular and scalable approach that leverages various components and technologies. At its core, the LMS architecture consists of frontend, backend, and database layers, each interacting with external services and components. The frontend layer encompasses the user interface and client-side functionalities of the LMS, often developed using modern web technologies such as HTML, CSS, and JavaScript frameworks like React or Angular. This layer is responsible for presenting the LMS content and facilitating user interactions. This is the user-facing component of your LMS,where students and instructors interact with thesystem. It's typically web-based application built using technologies like HTML, CSS, JavaScript, and server-side framework (e.g., Ruby on Rails, Django, Node.js). This improves scalability and reliability while streamlining the development and deployment process. Containers and orchestration tools facilitate efficient infrastructure management, while monitoring and analytics tools provide insightsfor it.

The backend layer serves as the central logic and data processing component of the LMS. It handles user authentication, authorization, course management, content delivery, and other core functionalities. Technologies like Node.js, Django, or Spring Boot may be used to develop the backend, providing RESTful APIs or GraphQL endpoints for communication with the frontend. The database layer stores and manages the LMS data, including user profiles, course materials, assessments, and progress tracking. Containerization technologies such as Docker are utilized to package each service and its dependencies into lightweight, portable containers. These containers are then orchestrated and managed using tools like Kubernetes, which automates deployment, scaling, and management of containerized applications. DevOps practices are integrated throughout the architecture, with automation playing a central role. Continuous integration (CI) and continuous delivery (CD) pipelines are established to automate the build, test, and deployment processes.

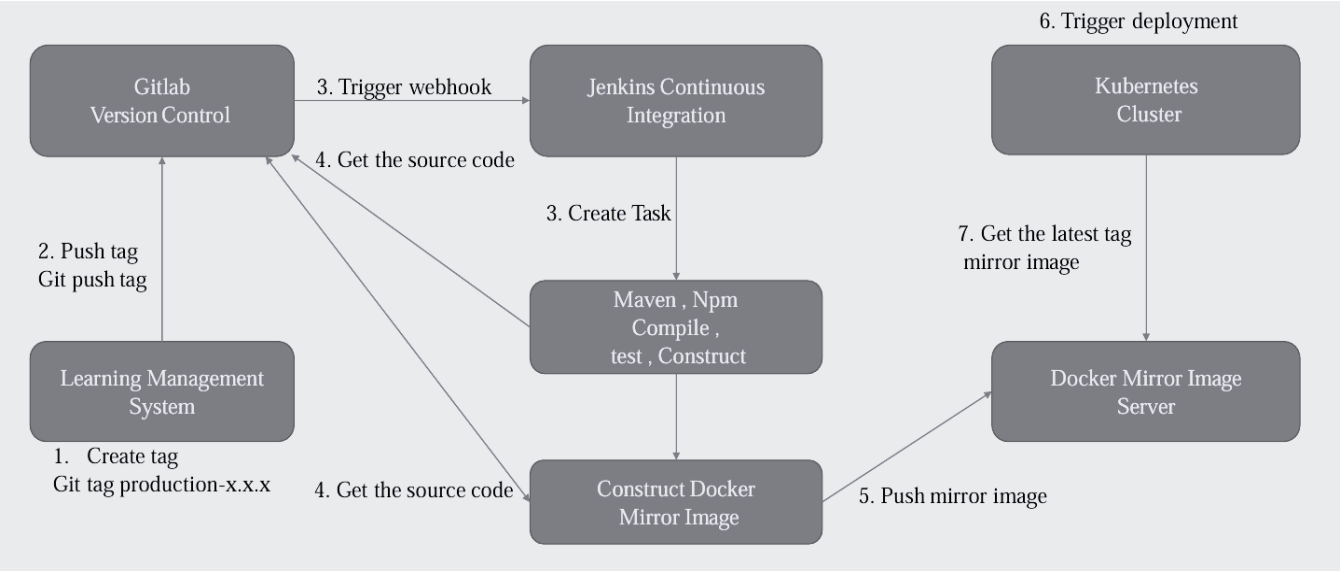

Figure 5.2 System Architecture of LMS

VI. SOFTWARE REQUIREMENTS

- Operating System: Windows 10 Home
- Front End Language: Html, Css, Java Script
- Back End Language: Java

VII. HARDWARE REQUIREMENTS

- Processor: 12th Gen Intel® Core ™ i5-12450H
- RAM :16 GB
- Hard Disk: 512 GB
- Input Device: Standard Keyboard and Mouse
- Output Device: VGA and High-Resolution Monitor.

VIII. RESULTS

The result and analysis details for the development and deployment of a Learning Management System (LMS) using DevOps involve several key aspects that contribute to the success and effectiveness of the system. Upon deployment, teams typically conduct thorough monitoring and analysis to assess various metrics and performance indicators. One crucial aspect of the analysis is the monitoring of system performance, including response times, resource utilization, and error rates. By leveraging monitoring tools such as Prometheus, Grafana, or ELK stack, teams can gain real-time insights into the health and performance of the LMS, identifying any bottlenecks or issues that may arise. Additionally, teams analyze user engagement and behavior within the LMS, tracking metrics such as active users, course completion rates, and user feedback. This provides valuable insights into the effectiveness of the LMS in delivering educational content and engaging learners, allowing teams to make data-driven decisions for future enhancements and improvements.

8.1 DATABASE OF H2 CONSOLE IN LMS

Figure 8.1 The H2 Console is a web-based database management tool primarily designed for the H2 Database, a lightweight and fast in-memory database often used during development and testing phases of a software project. Within the framework of the project for the LMS using DevOps, the H2 Console might not be the primary database tool, but it can still be useful for specific purposes, especially during development and testing phases.

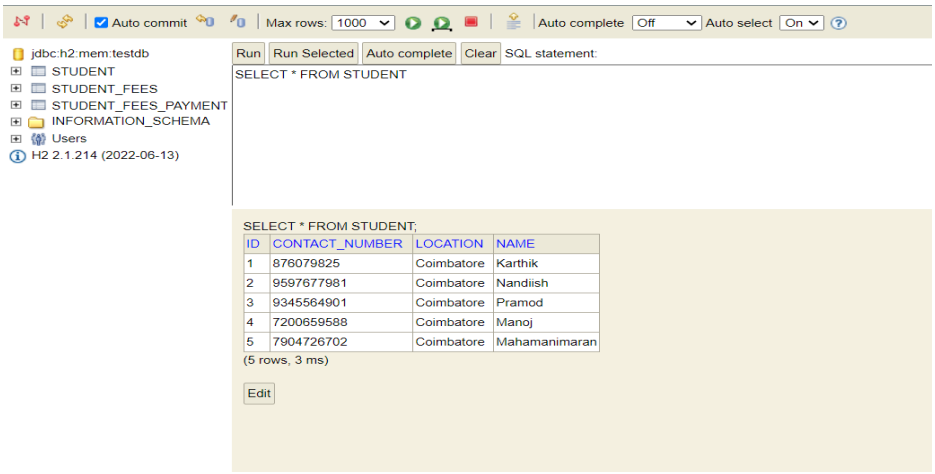

Figure 8.1 Database of H2 console in LMS

8.2 APPLICATION HOME PAGE OF LMS

Figure 8.2 Shows the home page for the Learning Management System Application and the application name was EduHub.

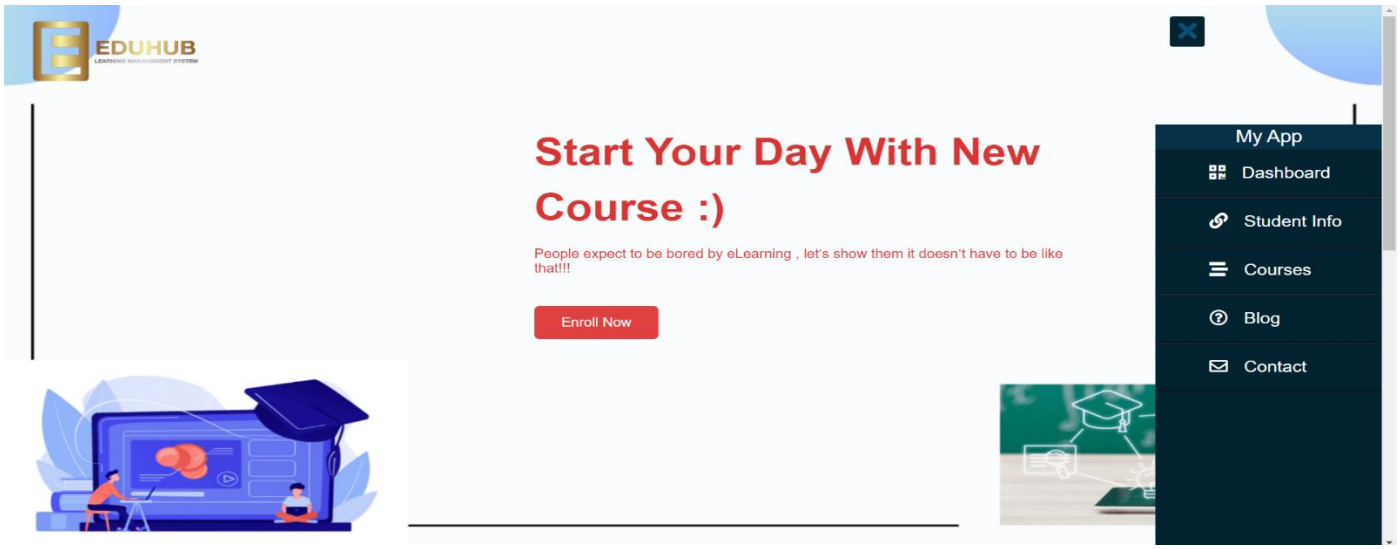

Figure 8.2 Application Home page of LMS

IX. ADVANTAGES

- Increased Dependability and quality.
- Excellent scalability and efficiency.
- The security level and feedback level are very high.

XI. CONCLUSION

In conclusion, by integrating DevOps into our learning management system, this project is assessed from two perspectives. Continuous Deployment (CDP) and Continuous Integration (CI). It provides an overview of the tools and technologies used in system practice, including Docker, Kubernetes, Jenkins, and Git. Our new learning management system has essentially been modernized by the idea of DevOps and related techniques by means of the application of relevant technologies and our ongoing practice. This has increased productivity and guaranteed the platform's scalability and availability. It has also made the development, testing, and release of information systems more convenient.

In this project, Learning Management System is a project tool which integrate educational environment to learners by provisioning the environment required to learn. The project is managed by DevOps methodology. By using DevOps to this Applications learners can use the LMS with more flexibility. It is a monolithic based application so our future work will be on Microservice based application.

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