Mohammed Juned, 2025, 13:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology

An Open Access Journal

Laboratory Access Management System

Professor Mohammed Juned, Shaikh Umar Sajid, Shaikh Siraj Ahmed Akbar Ali, Muskan Shahnawaz Khan, Mohammed Salim Shaikh

Abstract- The Laboratory Access Management System (LAMS) features robust user authentication protocols, ensuring that only authorized personnel can access sensitive resources. With time-based access control, the system limits access to designated hours, while comprehensive logging provides a detailed record of user interactions. Administrator's benefit from real-time alerts for unauthorized access attempts. LAMS supports role-based access control, allowing customizable permissions that align with organizational policies. This flexibility not only improves security but also ensures compliance with regulatory standards. The user-friendly interface and efficient performance of LAMS, facilitate effortless maintenance and usability.

Keywords- Laboratory Access Management System (LAMS), Desktop Application, Access Control, User Authentication, Time-Based Access Control, Logging, Administrative Override, Role-Based Access Control, Laboratory Security, Compliance.

I. INTRODUCTION

LAMS leverages web technologies such as HTML, CSS, and JavaScript to deliver a cross-platform solution that addresses the need for enhanced security and efficient management of laboratory resources. The system introduces a multi-user framework where access roles are distinctly defined for students, teachers, and administrators, ensuring that the laboratory environment is managed effectively while maintaining strict security protocols.

The application allows administrators to oversee all aspects of the system, holding the highest level of control. They have the capability to create, update, or delete student and teacher profiles, adjust access permissions, and monitor laboratory activities. Administrators can manually unlock the system, override access restrictions for maintenance or emergencies, and configure session parameters such as time limits and access schedules to align with institutional policies. The comprehensive logging functionality also enables admins to track detailed records of user interactions, including login attempts, session durations, and administrative overrides, thus enhancing the overall security and transparency of the system.

Teachers play a critical role in managing lab sessions by initiating, monitoring, and concluding them. They can set specific time durations for lab access, start or end sessions according to the schedule, and manage the number of students allowed in the lab simultaneously. This flexibility enables teachers to ensure that lab resources are utilized efficiently during designated time slots, while also maintaining control over who has access. Teachers can also view logs related to their sessions, providing insights into student participation and lab usage.

Students can access LAMS by logging in with their username and password, after which they are allowed to use the system for a defined period set by the teacher. The system ensures that students adhere to scheduled access by automatically logging them out once the session expires. This time-based access control not only prevents unauthorized use of laboratory resources but also ensures that the lab is accessible to all students fairly and according to the established schedule.

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II. LITERATURE REVIEW

Laboratory access management systems reveal a growing emphasis on enhancing security, efficiency, and accountability in academic and research environments. Traditional manual systems, often reliant on logbooks and key-based access, have proven inadequate in preventing unauthorized entry and tracking user activity. Recent studies highlight the adoption of automated systems using technologies such as RFID, biometric authentication, and smart card readers, which offer real-time monitoring, access logging, and user-specific permissions. Additionally, integration with database management systems enables detailed reporting and audit trails, supporting administrative oversight and compliance with safety regulations. Emerging research also explores the use of IoT and cloud-based platforms to enable remote management and scalable deployment. Overall, the literature underscores the importance of a robust access control framework to ensure secure, efficient, and accountable laboratory operations.

Implementation

The Laboratory Access Management System is a Flask-based web application designed for institutional lab environments, offering role-based access for admins, teachers, and students through clean HTML/CSS (Bootstrap/Tailwind) and Jinja2-rendered dashboards. Admins manage users, teachers configure session limits and review recordings, while students access a countdown-based interface to submit real-time recordings via chunked AJAX uploads. The backend uses raw SQL with `mysql-connector-python`, avoids ORMs for performance transparency, and includes secure authentication (Flask-Login, Werkzeug hashing), session tracking, and file upload handling. Data is stored in a MySQL database (`experiment_db`), and session recordings are saved in the local filesystem (`static/recordings/`) with access control. Designed for simplicity, security, and scalability, the system maintains centralized control without blockchain, but allows for future cloud integration.

Testing and Evaluation

Test case	Input	Expected output	Result
Admin Login	Admin Password	Loged in and goes to admin dashboard	pass
Admin while adding new user	Student or teacher's mail, name And	Added successfully	pass
Teacher while creating session	Timing of session	Session created successfully	pass

III. RESULT

The system was developed using HTML, CSS for the frontend, Flask for backend, with student and teacher interactions managed via a web interface and maintained by admin.

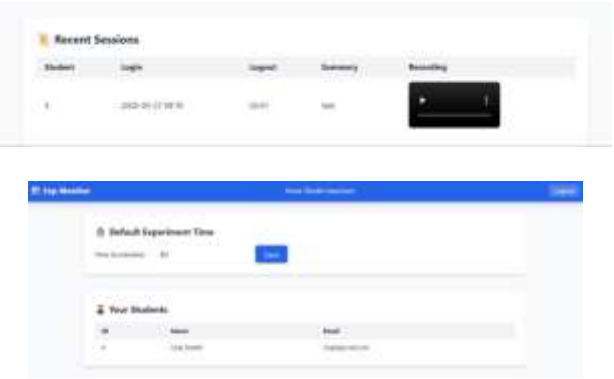

Figure 1 Teacher Dashboard

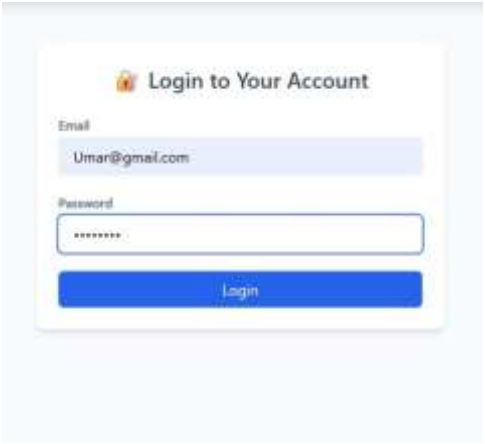

Figure 2 Admin login

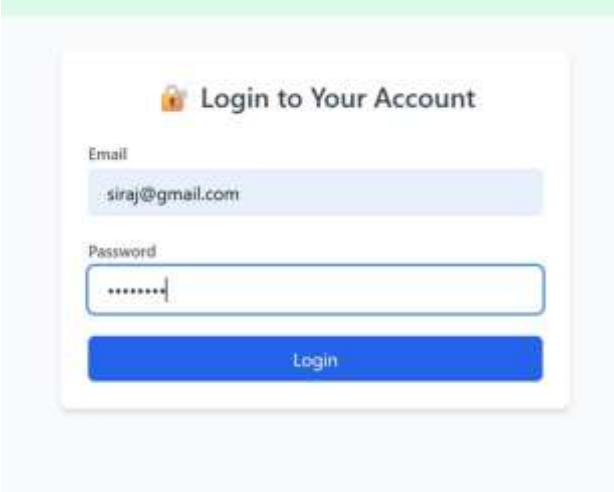

Figure 3 Student Login

Figure 4 Student Dashboard

IV. CONCLUSION

The Laboratory Access Management System (LAMS) presents a modern, effective solution for managing laboratory access in educational institutions. By leveraging for cross-platform compatibility, LAMS addresses key limitations of existing systems, such as the lack of robust user role management, inadequate session control, and insufficient logging capabilities. The system introduces a comprehensive framework that includes role-based access control (RBAC), time-based access restrictions, and detailed activity monitoring, ensuring that only authorized individuals have access to laboratory resources and that sessions are conducted efficiently.

Acknowledgements

We thank our guide, Prof. Mohammed Juned for his invaluable insights, and Rizvi College of Engineering for providing the infrastructure to conduct this research.

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