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FKAAB Laboratory Booking System

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Abstract

The Faculty of Civil Engineering and Built Environment (FKAAB) faces inefficiencies and transparency issues in its manual reservation system. This project aims to develop a user-friendly, web-based system, revolutionizing resource management. Using a prototype, the contemporary system is designed, employing a data-driven methodology for informed judgments and improved resource allocation. Key objectives include simplifying reservations, increasing efficiency, and ensuring system stability. Anticipated benefits encompass enhanced efficiency, transparency, and reduced processing time for laboratory facilities. The initiative serves as a model for resource management, enhancing data-driven decision-making and FKAAB's competitiveness. The system's design prioritizes sustainability, offering a disruptive solution to recurrent resource management issues, potentially improving FKAAB's efficiency and academic reputation. Future work involves testing and adaptation to changing academic needs.

1. Introduction

The Faculty of Civil Engineering and Built Environment (FKAAB) currently faces inefficiencies in its manual laboratory reservation system, relying on paper-based forms for bookings. This outdated approach results in delays, administrative burdens, and a lack of transparency. The existing workflow involves manual processing, requiring multiple participants and leading to difficulties in tracking and managing bookings. The system's limitations hinder real-time access, data analysis, and informed decision-making. To overcome these challenges, the proposed system introduces a comprehensive transformation, offering a user-friendly online platform for laboratory booking. This digital system automates the entire process, ensuring speed, transparency, and accessibility for all stakeholders. It incorporates secure data storage, tailored software, and an intuitive interface to enhance productivity, resource allocation, and the overall user experience within the FKAAB community. The innovative approach addresses the current system's inefficiencies and aims to revolutionize laboratory booking administration at FKAAB. The problem that FKAAB faces is the procedure takes a long time, which burdens the administrative personnel and users alike. This tedious method requires people to manually fill out booking forms, which frequently calls for repeated data entry. Another problem is the Faculty of Civil Engineering and Built Environment (FKAAB) has several challenges as a result of the lack of an effective system for storing and retrieving data. The other problem is current system's restricted accessibility and transparency, which has a significant impact on FKAAB Laboratory Booking System's daily operations. The excessive dependence on paper-based paperwork in the existing manual booking method presents serious difficulties for FKAAB students, assistant lab, assistant engineers, supervisors, and lab managers. The objective for this system is to design a user-friendly system booking for FKAAB Laboratory Booking using a structured. This project will have four types of target user which are FKAAB student, student's supervisor, staff of fkaab which is science officer or assistant engineer and

administrator. These improvements will benefit not only the lecturers, students, and staff of FKAAB but will also have a favorable influence on the entire academic community.

2. Literature Review

The existing workflow of the FKAAB Laboratory depends mainly on manual paper-based forms for reserving laboratories. This outmoded approach requires students and staff members to physically fill out paper papers to obtain admission to the laboratories. Students and the staff responsible for handling lab bookings are also participating in this procedure. Students are entrusted with filling out booking forms, detailing their needs, and sending them to the appropriate department. In turn, the administrative staff handles these paper papers manually, validating availability and distributing resources. Students requesting admission to the laboratories, specifically the Environmental Lab needed to fill out Form A1, form A2, and the form A3 which is application for sample storage both kinds follow the same procedure. These forms are then signed by their academic supervisors and endorsed by the assistant engineer or science officer.

The information system method was chosen for this project. Web information systems are often made up of two major components: the front-end, or display layer, and the back-end. The front-end is made up of multiple resources (html templates, images, CSS and JavaScript files, etc.) that are accessed through the users' browsers and provide the main interface of the system; whereas the back-end provides various functionalities or services that are not directly accessed by the final users [1]. Website design is one of the most cost-effective and time-efficient for booking systems and can be quickly transmitted via the web [2].

There are several existing booking systems that are comparable to this project. All of the modules and features from the three existing systems will be included in the proposed system. The differences and similarities between these systems are shown in Table 1.

Table 1 System's comparison between existing systems with the proposed system.

Features/System	UTM Laboratory Application	Online Laboratory Reservation System Department of Mining Metallurgical and Materials Engineering	UCI Classroom Technologies	FKAAB Laboratory Booking
Registration and login module	√	√	√	√
Lab booking module	X	√	√	√
Approval workflow module	X	√	X	√
Notification and confirmation module	X	√	√	√
Booking report	X	√	X	√

In conclusion, the comparison of several systems in Table 4 reveals individual strengths and characteristics. The UTM Laboratory Application excels in user identification, menu creation, and lab booking features. UCI Classroom Technologies, Online Laboratory Reservation System Department of Mining Metallurgical and Materials Engineering and FKAAB Laboratory Booking systems demonstrate proficiency in calendar views, status updates, and notification modules.

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3. Methodology

Prototype Model focuses more on building the actual software than on creating lots of documents. This means the software can be made available sooner. In this approach, users are more involved and get to see and try out a prototype, which helps them give better feedback and specific requirements. This prevents misunderstandings between users and developers. The final product is more likely to meet the user's expectations in terms of how it looks, works, and performs[3]. The Prototype Model involves creating a test version of the software, testing and revising it until an acceptable prototype is achieved. This prototype serves as a foundation for the final system or software. It is particularly useful when the project's requirements are not well-defined, and it relies on an iterative, trial-and-error approach involving interactions between the developer and the client[4]. There were four steps in this model, which is planning, analysis, design, and implementation phases. This method involves creating a complete plan to guide system development and then breaking down the development process into smaller modules that can be assigned, performed, and measured to make the entire process more manageable[5]. Figure 1 shows a model of the prototype.

The system development workflow summarizes the activities and expert outcomes in each phase of creating the system. Table 2 indicates the starting point for all projects and operations within the prototype model. The performance of the system is determined by the results achieved during the system creation process.

Table 2 Software development activities and tasks

Phase	Task	Output
Planning	Choosing and deciding on project tittles and determine the project schedule, activities and output	Project proposal and develop Gantt chart
Analysis	Analyse system requirements and relationships between entities involved in the system	Data flow diagram, context diagram and entity relationship diagram.
Design phase	Design of a web-based information system, system interface, and database	Database design, design user interface and flowchart.
Implementation phase	Shows the systems and the process analysis	Tested system

4. Analysis and Design

The analysis and results from the study are presented in the findings and discussion section. The objectives, the historical chronology, various case groups, various settings for testing, or any other logical sequence that seems appropriate can all be used to arrange this section.

4.1 Context Diagram

Fig.1 shows a context diagram, which is a way for representing data flow in an information system. According to the Data Flow Diagram specification the context diagram is a single diagram at the top-level Diagram 0 [6].

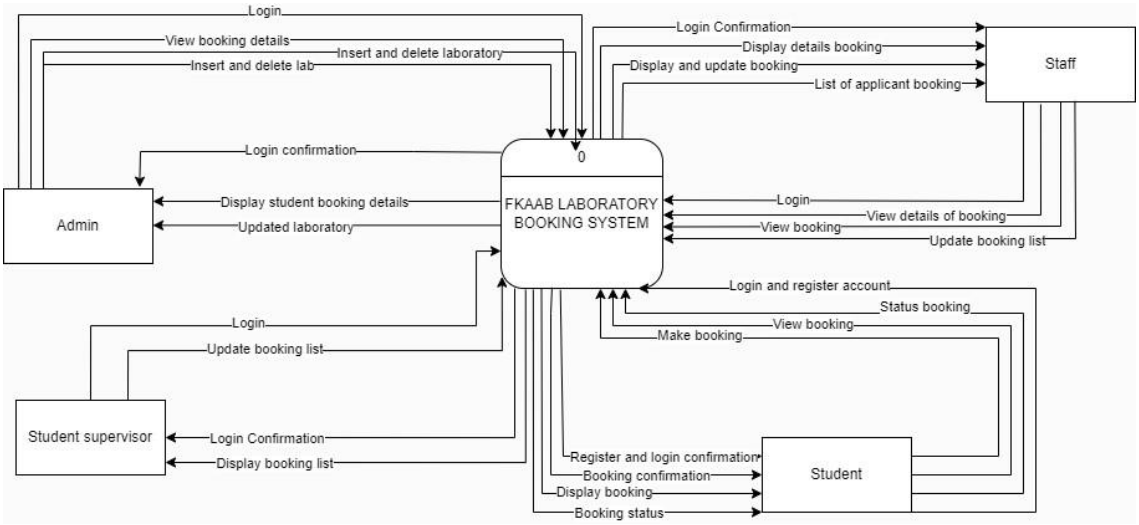

Fig.1 *Context Diagram*

4.2 Data Flow Diagram

The Level 0 Data Flow Diagram depicts how various users, such as students, student lecturers, staff, and administrators, interact with the proposed system at a high level. It depicts essential activities such as user login, registration, and booking, as well as the flow of information between these processes and the central database. It can be shown in Fig. 2

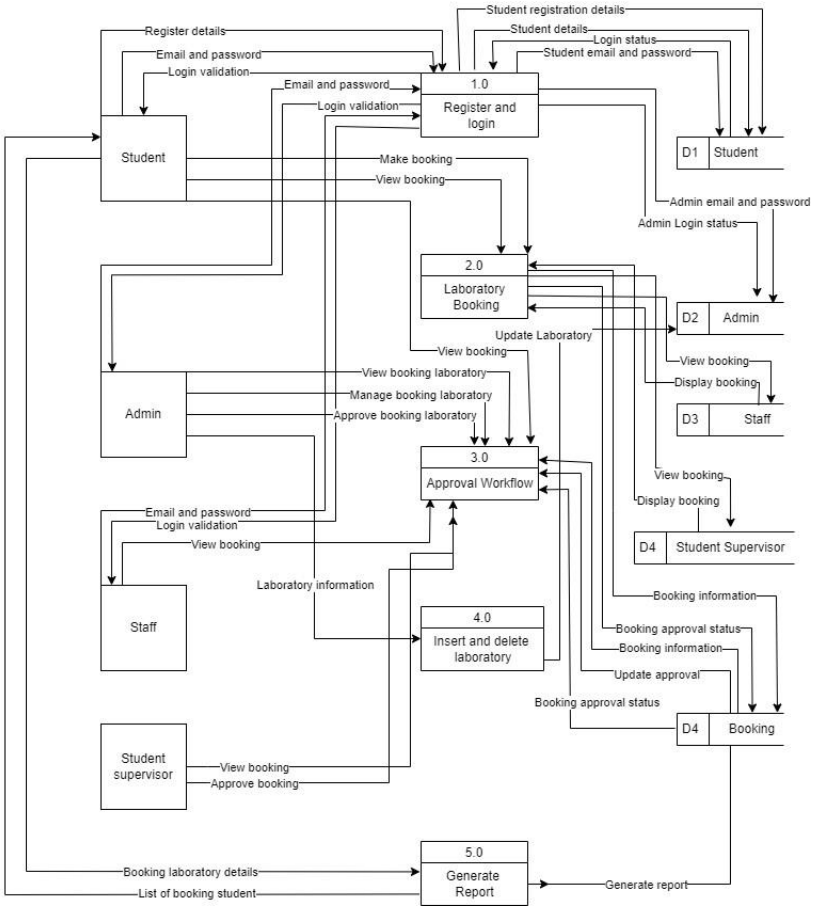

Fig.2 *Data Flow Diagram Level 0*

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4.3 Entity Relationship Diagram

The Entity Relationship Diagram (ERD) has two specification attributes: Primary Key (PK) and Foreign Key (FK). A primary key is a type of property that defines a unique database entry, whereas a foreign key is an attribute that may be shared by numerous entities [7]. The entity relationship diagram for the veterinary clinic management system is shown in Fig. 3.

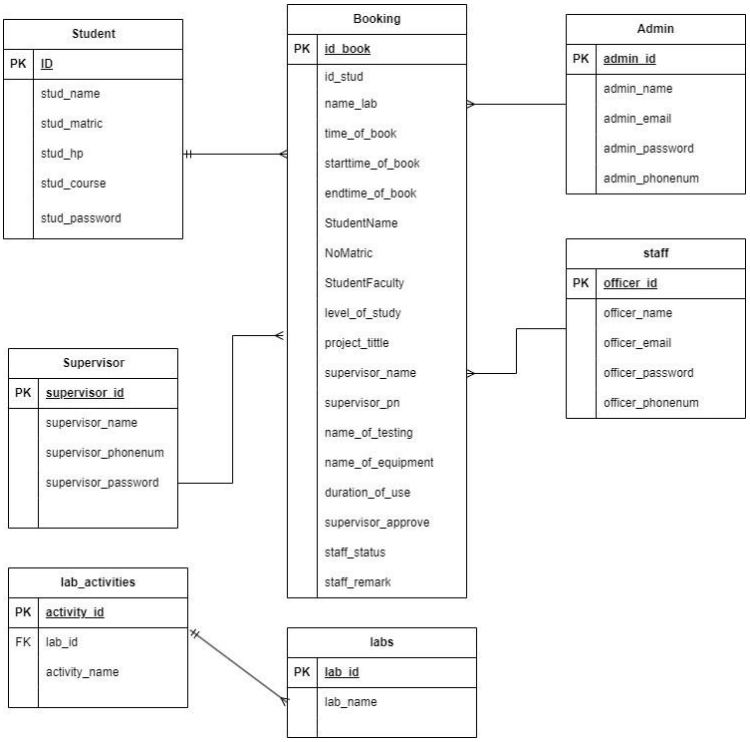

Fig.3 *Entity Relationship Diagram*

4.4 Flowchart

A flowchart is simply a graphical representation of steps. Figure 4 until 7 below shows flowchart for three user of the proposed system which are student, student's supervisor, staff which is science officer or assistant engineer and administrator.

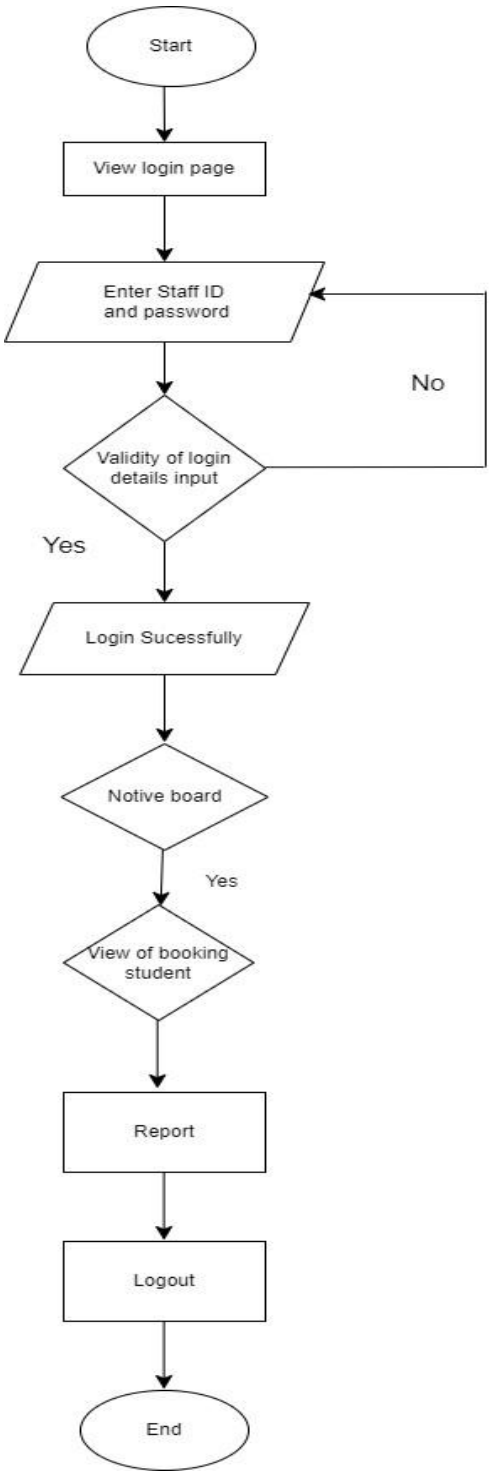

Fig.4 *Flowchart for Administrator*

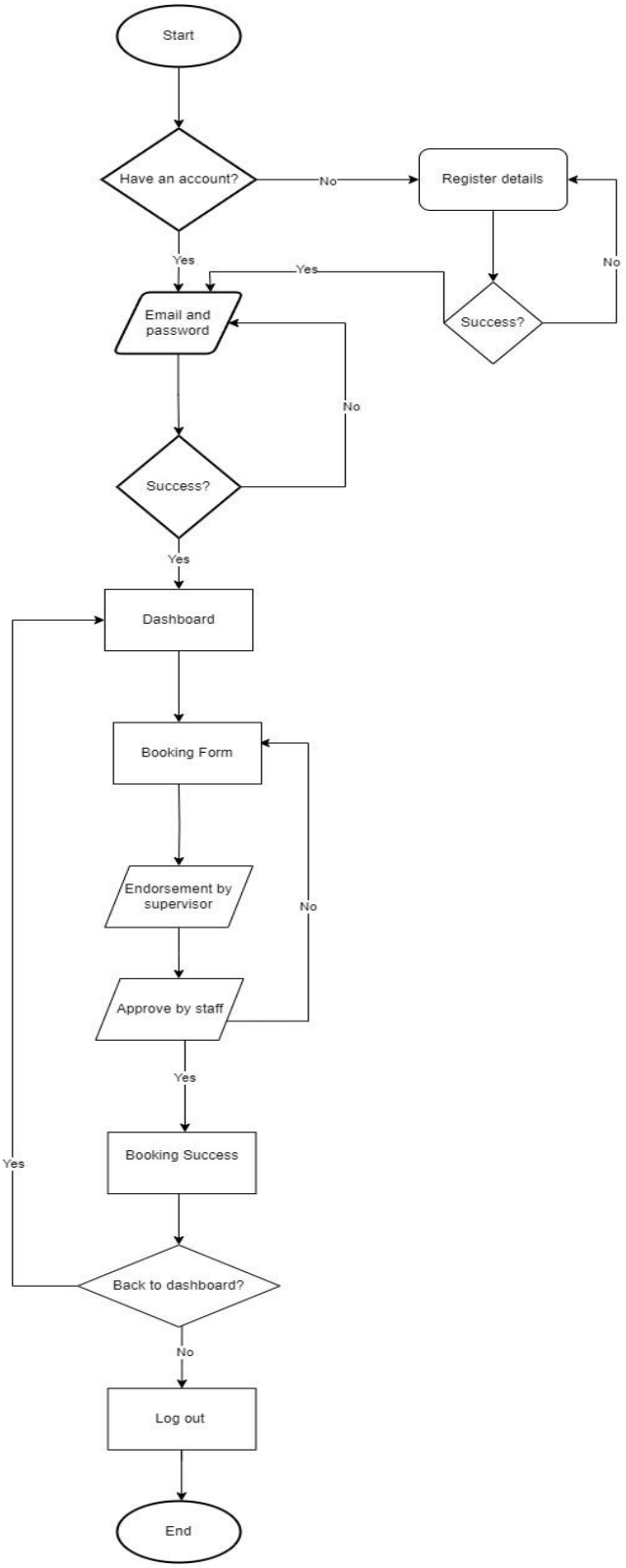

Fig.5 *Flowchart for Student*

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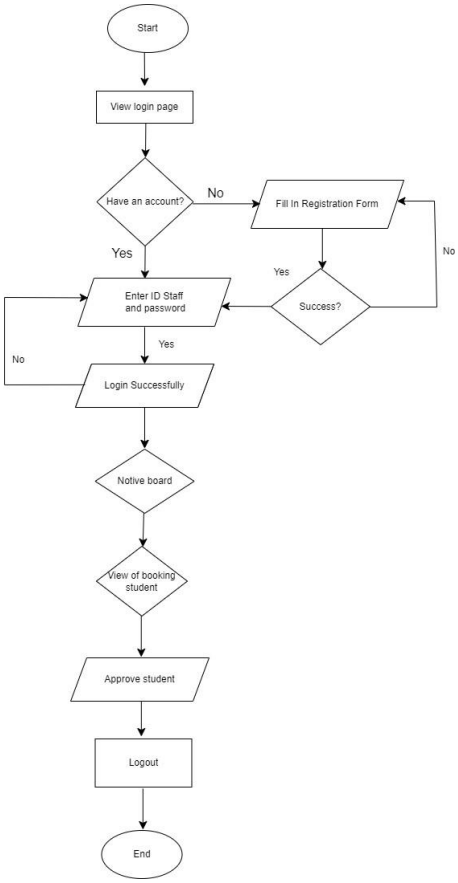

Fig.6 *Flowchart for Student's Supervisor*

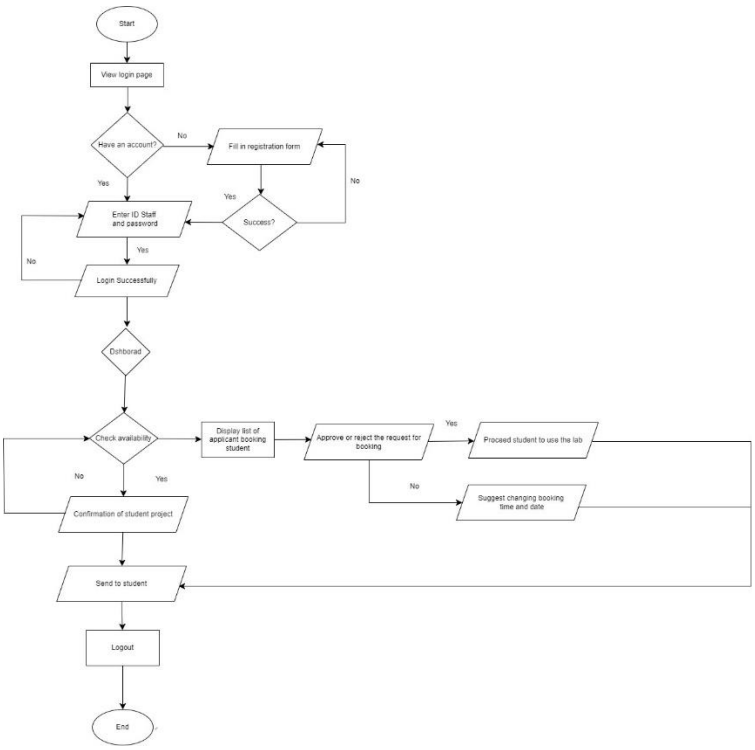

Fig.7 *Flowchart for Staff*

5. Implementation and testing

Xampp and Visual Studio Code are used in the creation of these system modules in order to implement this project. This system was created using HTML, PHP, JavaScript, and CSS as programming languages.

5.1 System Implementation

FKAAB Laboratory Booking System development and implementation is based on FKAAB booking original planning, analysis, and design, completed during the previous phase. The implementation phase involves the coding and executing of the system. There are four roles for accessing this system: student, student supervisor, staff, and admin. Except for admin, all users are required to sign up or log in to the system.

5.2 Users Interface

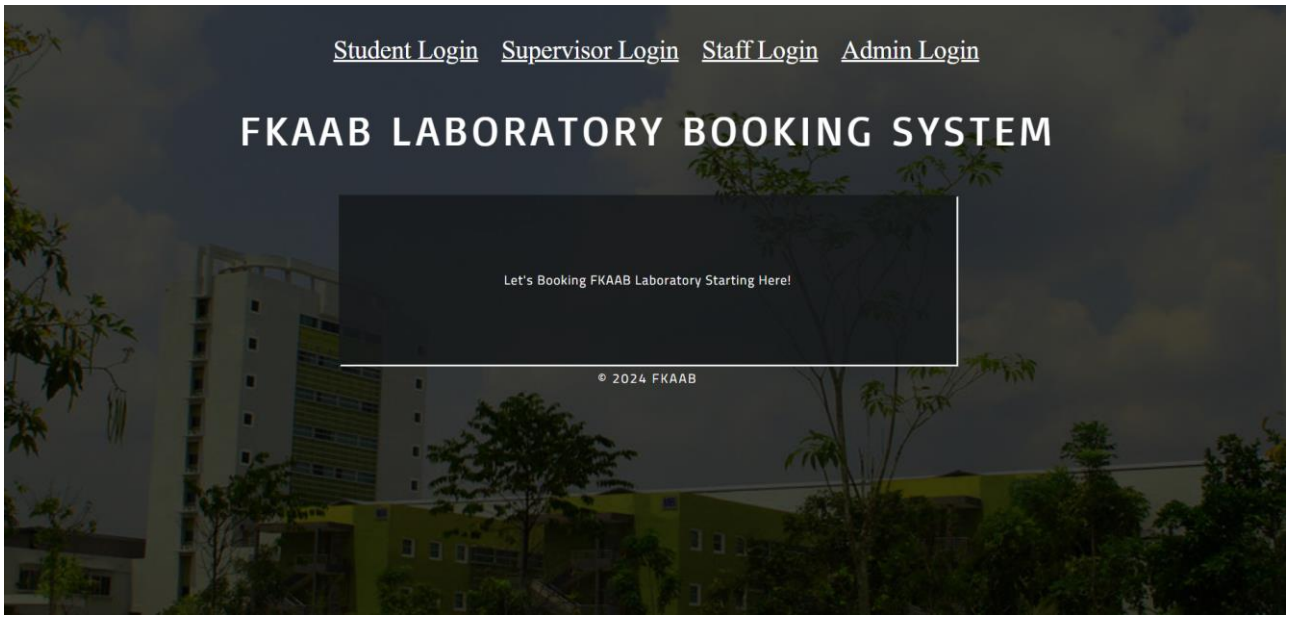

Fig.8 *Login page*

Based on the Fig. 8, FKAAB Laboratory Booking System's user interface was created with simplicity and convenience of use in mind. Users may easily access their individual portals using the four prominently displayed login options at the top of the interfaces such Student, Supervisor, Staff, and Admin. The visually appealing background and simple layout make for an intuitive and user-friendly experience that makes it easy for users to navigate and complete booking tasks.

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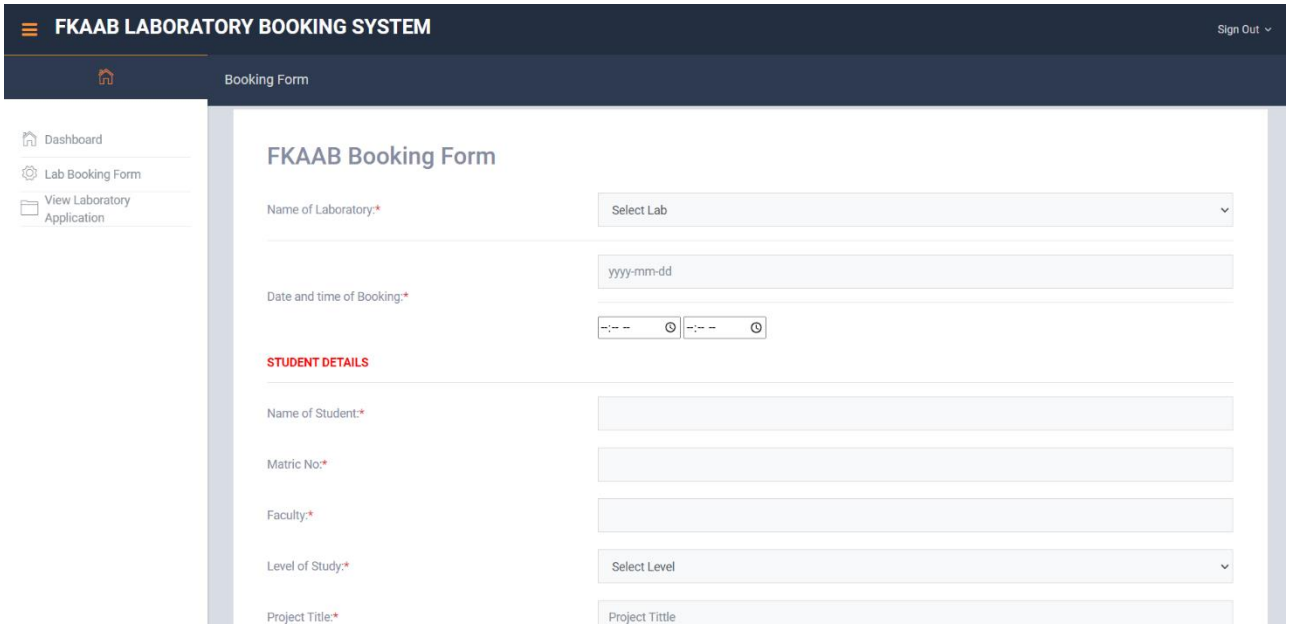

Fig.9 *Booking form page*

Fig. 9 shows students can schedule laboratory usage through a booking form on the FKAAB Laboratory Booking System's user interface. The process of input and accessibility is easier, the interface has been divided into multiple sections.

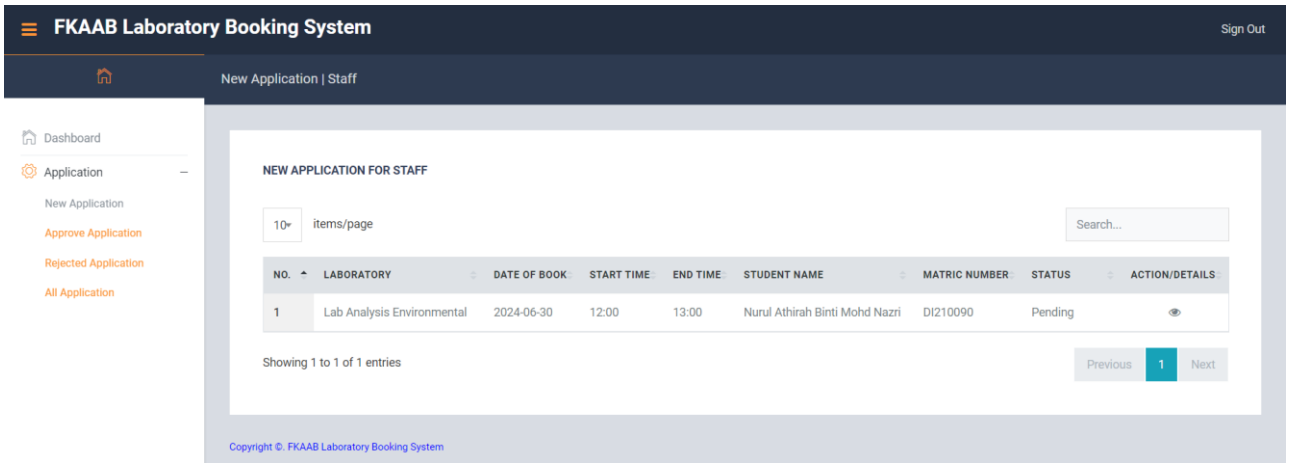

Fig.10 *New application form page*

Fig. 10 shows the new application part in the FKAAB Laboratory Booking System is shown on the interface seen in the diagram. The management and review of new laboratory reservation requests is the purpose of this department. It is also shown at the sidebar for verified application, rejected application and all application. A newly filed laboratory booking application initially shows up in the 'New Application' area. The application has to be reviewed and approved by supervisors. The application goes to the staff section for final approval once the supervisor gives their approval, making sure that all pertinent information is confirmed before the lab is used.

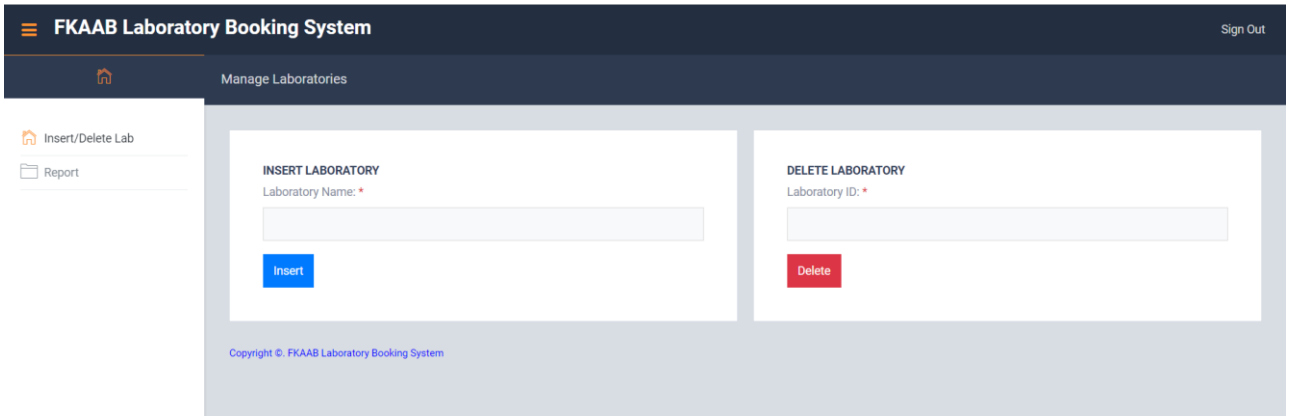

Fig.11 *Manage Laboratories*

Based on Fig. 11, admin can manage laboratories through the FKAAB Laboratory Booking System interface. It has two sections: one named insert laboratory that has fields for the names of the laboratories and insert button, the other is named delete laboratory and has a field named laboratory ID and a delete button. Users can effectively add or remove laboratory entries with the use of these choices.

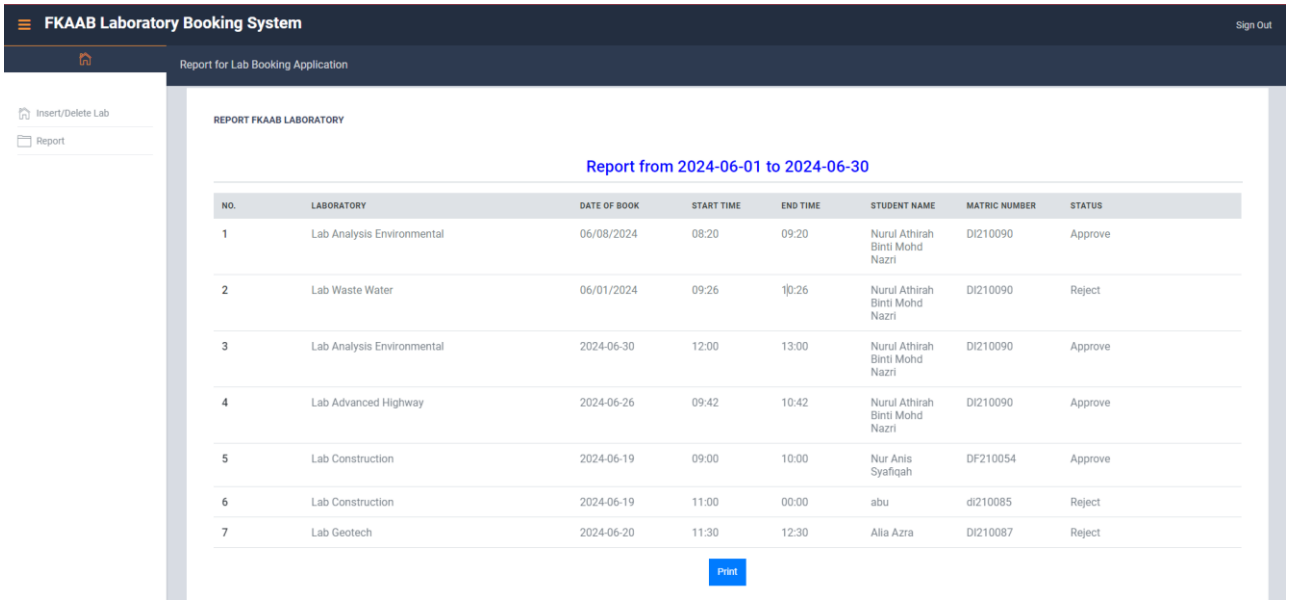

Fig.12 *Generate report*

Fig. 12 shows the FKAAB Laboratory Booking System, admin can generate a report, which allows them to view the dates associated with booking usage. Additionally, they have the option to print the report.

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5.3 Functionality Testing

This functional test determines that the system delivers the results of the final user request or the user request. Functional testing involves evaluating and comparing every module that is accessible with the request. This system is tested by giving significant input, and all output displayed is assessed to determine whether this system will solve every issue encountered.

Table 3 Functional testing list

Module	Testing	Expected Output	Result
Register and Log in	Log in account	Access is allowed, and the homepage displays if the request is authenticated.	Passed
Laboratory Booking	Booking Laboratory using book form	Student details are successfully updated.	Passed
Approval workflow	Supervisor need to approve before staff and student can get the approve to use the lab	The approval is successfully updated.	Passed
Insert and delete laboratory	Admin can manage the laboratory	Laboratory can insert and delete successfully.	Passed
Generate Report	Generate a laboratory report for the given timeframe.	Accurate report is generated	Passed

5.4 User Acceptance Testing

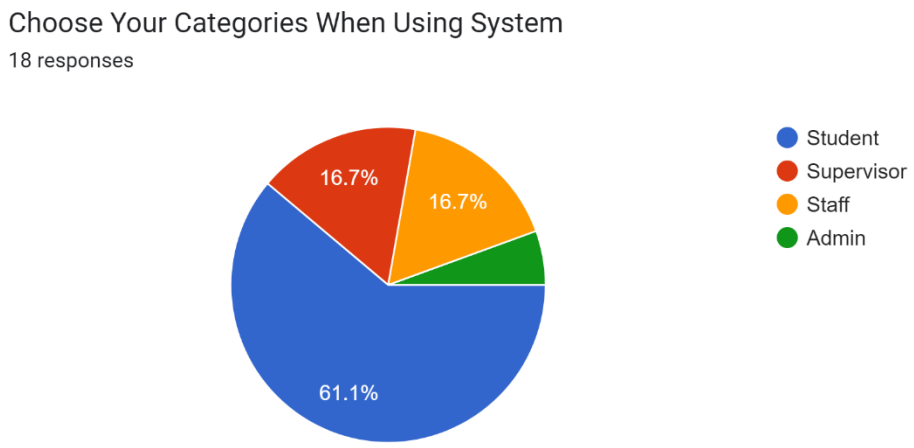

Fig.13 *User Testing Result Graph*

Based on Fig. 13, the distribution of answers to the question "Choose Your Categories When Using System" among the 18 participants is depicted in the pie chart. It shows that students are the majority using the system, accounting for 61.1% of the respondents. Staff and supervisors each account for 16.7% of the replies, indicating a similar but diminished presence. Finally, 5.6% of all responses are from administrators, making them the least represented group. This distribution shows that students represent most system users, with staff, administrators, and supervisors making up a far smaller percentage.

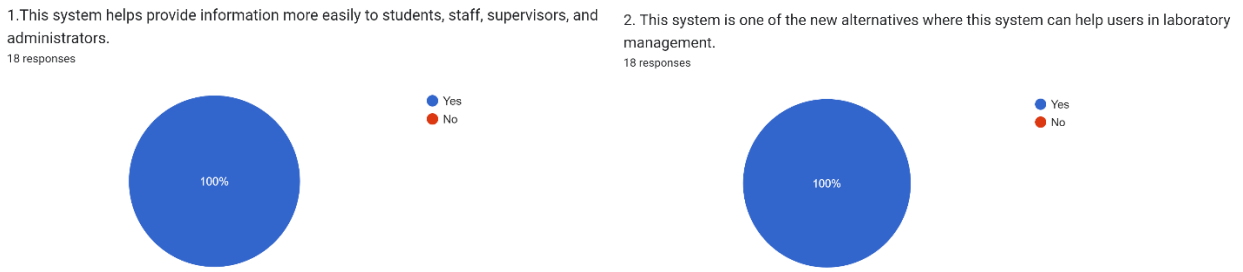

Fig.14 *User Testing Result Graph*

Based on Fig. 14, the two pie charts reflect the 18 participants' agreement in reaction to two assertions regarding the system. One hundred percent of respondents agreed with the first statement, "This system helps provide information more easily to students, staff, supervisors, and administrators," demonstrating how well the system works to make information access easier. There was 100% agreement on the second statement, "This system is one of the new alternatives where this system can help users in laboratory management," indicating the importance of the system in lab management. The two totally blue charts demonstrate total agreement regarding the advantages of the system.

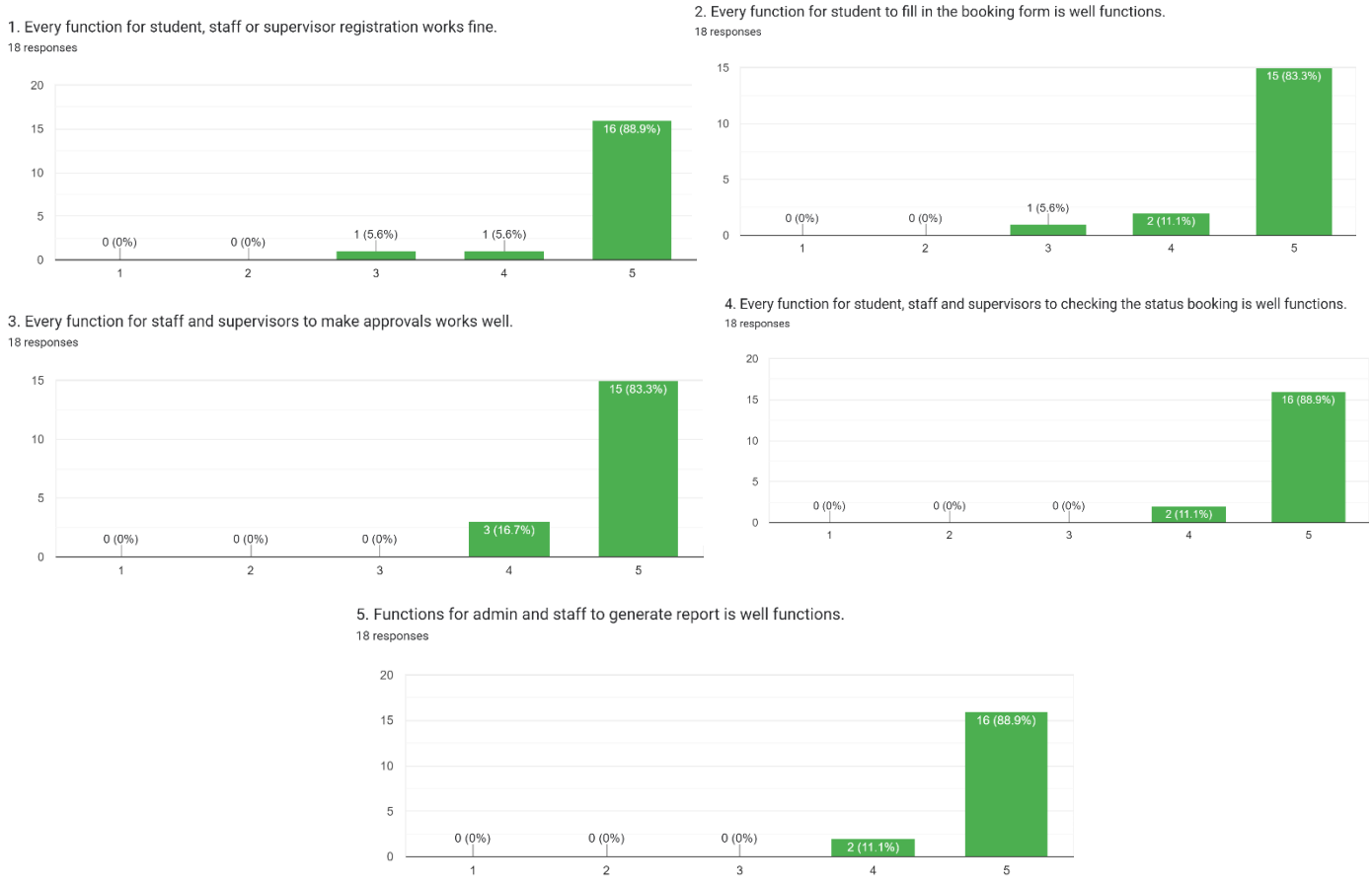

Fig.15 *User Testing Result Graph*

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Based on Fig. 15, 18 respondent's opinions on 5 system features are displayed in the bar charts. Regarding overall performance, all systems have received great reviews from most users. These results demonstrate the system's efficacy and usability and demonstrate how well-functioning, clear, stable, and valuable the system is.

6. Conclusion

This system's development results in the implementation of a system to ease laboratory booking scheduling for the Faculty of Civil Engineering and Built Environment. This method also helps in avoiding the possibility of data duplication in student laboratory bookings. The system created must be efficient and simple to use for all users, including the administrator, FKAAB student, student's supervisor, and science officer or assistant engineer. The created diagram demonstrates the significance of a seamless procedure for all users

7. Acknowledgement

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