QR Code Based Attendance Management System

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SUMMARY

Over the years, attendance management has been conducted manually at Trincomalee Campus, Eastern University. To overcome the manual attendance issues, the system developer proposed and implemented a smart attendance system with the aim of encouraging the potential use of the Quick Response (QR) code as a future attendance management system to track and record student attendance in lectures and exercises for all relevant courses. It will help to get customized reports of eligibility calculations for the students in the final end-of-semester examination.

The QR Code based Attendance Management System in Trincomalee Campus, Eastern University is the Web application that structured and organized the way of attendance of students. The admin of the website Management Assistant have the full authority to the system operation. He can generate add the new student details into the system, QR Code generation according to the course modules, track the attendance of the student, give warning to the students about low percentage of attendance and provide customized reports for the eligibility calculation. The admin has the authority to track, filter, edit and delete the student attendance. This system will reduce the paperwork and provide efficiency for the department. The students can scan the QR code using the web application and view the percentage of the attendance. The developer planned the implemented system can be modify into the Mobile application in further development.

The implemented system helps to reduce paper work, reduce human error, reduce time waste, and avoid fake signatures. This system will be a benchmark for universities attendance management systems.

Keywords: Administrator, Attendance, Management, QR Code, System, Web Application, Mobile Application

INTRODUCTION

The process of attendance tracking has always been a crucial and time- consuming task for universities. In most universities in developing countries such as Sri Lanka, student attendance is usually taken by the old file system approach of manual paper sheets. Traditional methods of attendance tracking, such as manual sign-in, have proven to be inefficient and unreliable, leading to errors and inaccuracies in record-keeping. To eliminate these issues, the developer implemented a system to overcome the problems associated with attendance recording.

When technology improved, universities started using digital methods of attendance tracking, such as biometric systems, Radio Frequency Identification systems, and Quick Response code-based systems. These technologies open up new ways to design and implement the smart attendance system in the classroom in order to solve many problems faced by lecturers and students, such as the security and inefficiency of traditional methods of attendance record keeping. Among these systems, QR code-based attendance systems have gained popularity due to their simplicity, affordability, and ease of use. In a QR code- based attendance system, each student is assigned a unique QR code that they can scan using their mobile phones, and the attendance is

automatically recorded in a database. The relevant attendance was recorded in the centralized database. One of the significant advantages of the QR Code Attendance Management System is its efficiency. Manual attendance is prone to errors and time-consuming. Moreover, real-time attendance is made possible, allowing administrators to monitor participation levels and generate reports effortlessly. In contrast, a QR code-based system only requires a smartphone, which is much more affordable and widely available.

The motivation of this project is to create a student attendance system application based on QR codes with unique identification capture to solve the current issues faced by the traditional attendance tracking method. To use this system on campus, students will just need to download the application and scan the QR code generated by the class lecturer during the class. With this technology, it will be hard for students to cheat on their attendance. This type of attendance system will use unique identification capture to make sure that there will be an accurate attendance generated for the lecturer.

Overall, the QR Code Attendance Management System is a great way to track student attendance. It will be a great option for the Trincomalee Campus, Eastern University, Sri Lanka.

The Purpose of the Project

In the last few decades, the development of information technology has been unbelievable. Artificial intelligence and smart cities are a few examples of that. When everything is being improved and enhanced, developers think of enhancing it by using a modern attendance tracking system. Still, the universities are using the traditional way of signing their signatures on the attendance paper for their attendance. However, students are very smart and tricky; they could have several ways to sign their attendance even if they are absent from lecturer classes. For a small amount of class, lecturers could take the students in traditional ways, but if it is for a hundred students in a lecturer class, it will be an activity that wastes time, manpower, and resources. Now, in the era of the Internet of Things, there are many more devices that could be used as a modern way of taking student attendance. The objective of taking student attendance was to make sure they could learn knowledge and experience from the university without spending money on vacations inside the university. In order to distinguish every student with their unique characteristics, there are methods such as QR codes. The QR Code system is a combination of two Android applications developed for taking and storing attendance.

Considering the wide popularity of smartphones, developers are introducing the use of smartphones for smart attendance. Practically every student will have one or more smartphones. After careful research at Trincomalee Campus, manual attendance is inefficient and time-consuming. To reduce time wasting, we can propose the new QR Code-based Attendance Management System. Students will be using their smartphones and installing an application to sign their attendance for class. This will be implemented in a web service and mobile application with a unique identification tracking system. The QR Code-based attendance management system requires internet connectivity, such as Wi-Fi or 4G, to connect to the connect to the database residing on the remote server. This project does not require any kind of hardware device other than a smartphone, which will greatly reduce the implementation time, the cost of placing extra devices, and the accuracy of tracking attendance data, productivity, and affordability of implementing this project at Trincomalee Campus.

The QR Code-based attendance management system will expect a workable prototype application that can be downloaded to Android devices to be used in the lecturer class. Android Studio and Python programming languages are used to design the mobile application that allows users to generate QR codes and scan QR codes to obtain certain information and store it in a database as a record. In order to counter the issue of being easily prone to manipulation by the students, the proposed system has a unique identification tracking system. Besides that, the system will be obtaining the unique ID from the user's phone so that they can’t cheat the attendance by logging out and signing in to another user’s email.

The proposed system will design two types of login method interfaces. One of the login methods is for administrators to sign in with their institute email and password in the web application. Administrator features in the web application will enable administrators to generate a certain subject-class QR code. Other than generating the QR Code features, the administrator could summarize and generate the attendance list of students that scan the QR Code using the web application. For the convenience of administrators, they could

generate the QR code earlier, save it, and post it to the web site for students to scan the QR code. For the student mobile application function, students will need to sign in with their email and register their name, student ID, phone number, course, and faculty. Besides that, the features of the students' mobile application are that they could use this mobile application to scan the QR code that was generated by the administrator for signing their attendance in the class. It will also contain a feature that allows students to view their subject's attendance percentages. The administrator will be able to view the number of students that attended the class and, most importantly, generate a report for the 80% attendance calculation.

The vision is to create an attendance management system that is simple and effortless to use. The data is automatically recorded in real time and is, first and foremost, extremely accurate and reliable. It reduces mistakes and inaccurate record-keeping. It is more cost-effective than biometric devices and barcode reading systems.

Using the QR code-based management system will help replace the existing manual sign-in sheet on Trincomalee Campus.

Goal of the Project

The main objective of this project will be to develop a student attendance system based on QR codes with unique identification capture.

To develop an application that can scan QR codes on mobile devices. To create an UI that can easily retrieve and track accurate attendance records 80% Attendance Calculation Report Generating Notification system for the attendance marking

For this project, a QR code-based attendance management system is a modern technological way to take attendance, replacing the traditional attendance system. There are several objectives and goals for this project that the developer going to achieve. The main goal that the developer wants to achieve is to provide a fast and efficient attendance system instead of using a traditional attendance system that is time-consuming and a waste of manpower for a student to sign in their attendance. This could explain why the process of a student signing their attendance using their mobile phone and scanning the generated QR code will be much faster and more effective than signing their attendance on a piece of paper.

In addition, this system could work in any place or classroom and be applied to all the students, lecturers, and administrators on Trincomalee Campus. Other than that, the developer plans to provide a system that requires minimum hardware and could be maintained at a minimum cost. This could be using a QR code-based attendance system; the hardware that is required is mobile devices. In the age of advanced technology, all university students own a device, and this will be essential to meet the requirement of using minimum cost. It won't be unlike other modern attendance systems, such as biometric- based attendance systems, which require much more hardware to obtain student attendance. Besides that, using this proposed system could help lecturers, teaching classes, or administrators of events reduce errors in attendance, such as oversampling or counterfeiting friends' signatures, to give a hand to their friends who are absent.

Based on the findings, the goal of the final paper is to develop an open-source, cost-effective, and seemingly secure web-based application that takes accurate class attendance without running the risk of exposing students' sensitive data should there be a technical issue. The mobile phone is the QR Code scanner that sends the designated students' data to the database. This is a needed project for the Trincomalee Campus.

Scope of the Work

The QR code-based attendance management system will be implemented in the BMS department at Trincomalee Campus. They use the traditional method to make attendance. That leads to inaccuracy and time-wasting in the calculation of the attendance. To reduce that, the QR code-based system will help. When we think about the feasibility study,

Economic Feasibility: The proposed system is time-effective because attendance is marked automatically. In

the manual system, there is an MA to insert the attendance and calculating that. The help from the QR Code based Attendance Management System the manual laboring will be reducing. It is also cost-effective because there is no need for paperwork. It will provide low cost for the Nonacademic staff and solution for storage of staff. The availability of

Internet reduces the budget of the system is another economic feasible factor that developer can concentrate.

Technical Feasibility: The system is economic, and it does not use any other additional hardware or software. Without using the additional hardware and software system, developer can use the web application that help with the Internet. The system will be available online without additional cost to maintain by the developer. Using the simple hardware resources makes the system simplicity rather than the Complexity.

Behavioral Feasibility: The system is user-friendly, Easy and Simplicity. For the non-technical users can easily understand the operation of the system and can use that knowledge to training another user. It will help to reduce the time for the training period. The system can be adaptable and flexible compare with the other standalone system because it will be available on the Internet. It will be help for User friendly Interfaces and User-friendly Databases.

According to the feasibility study, the project can be granted without any delay in the work.

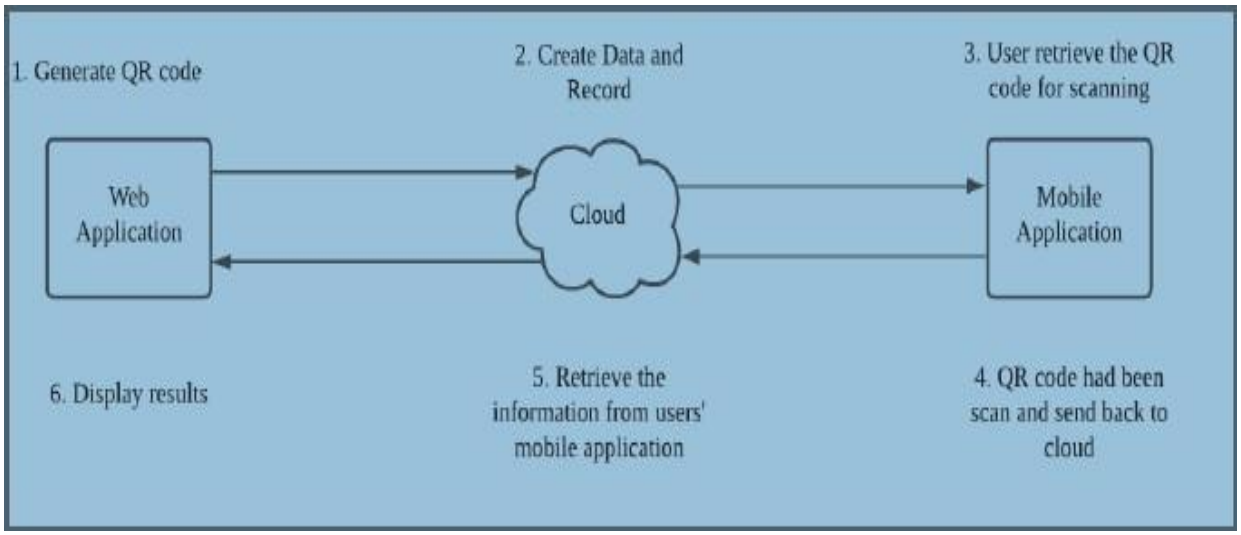


Figure 1.1 Scope of the Project

This diagram shows the general scope of the project. In this general scope, the attendance system will be differentiated by its parts, which are web applications, cloud computing, and mobile devices. The web application will allow admins to login to the web to generate QR codes, save them to the cloud as records, and create attendance data for the specified class. A mobile application could scan the QR code that was generated by the administrator, and the cloud would retrieve the information from the user as evidence of attending the class. At last, the administrator could retrieve records of the attendance from the cloud and display the results in the web application. In this project, highlights that have been achieved are the creation of a local host that allows users to proceed with several features, such as signing up, signing in, and capturing attendance data from the database directly and being able to make changes, for example, updating and deleting records of attendance. Other than that, this project consists of using Restful PI, which allows other users to request data or post data into the database. Besides that, a mobile application had been developed using Android Studio and Python. This mobile application consists of features such as scanning the QR code, sign-in, sign-up methods, and a unique identity system that gets the user's mobile device unique information, such as an Android ID.

The main modules of the system can be categorized into different categories. Admin Module: The admin module for QR code-based attendance is a system that allows authorized administrators to manage and maintain the attendance records of students on the Trincomalee Campus. The admin is the Management

Assistant of the Trincomalee Campus. The admin module is a user-friendly dashboard that allows users to generate QR codes that they can use to track their attendance and add new students to the system by entering their relevant information. The admin module can view the attendance and make reports for HOD purposes. Admin is the one that make the operations in the system.

Student Module: The student module for the QR code-based attendance system provides an efficient and reliable way for students to mark their attendance. Students can simply scan the QR code with their smartphones to mark their attendance in the system. and also, they can use web application for scanning the QR code. When a student scans the QR, the system records the student's attendance along with the time and date of the class. This data is automatically saved and can be accessed by the admin for monitoring and data analysis.

The proposed system will replace the traditional system of the Trincomalee campus with a smart attendance management system.

Related Works

There have been a number of related works involving the implementation of various methods and principles for the effective monitoring of student attendance. The following systems are available:

Bio Metric System

In A, K, & N.O (2017) the advancement of the recognition accuracy of students automated attendance systems using biometrics was proposed. A capture of the student's face using a webcam and fingerprint reader is the main data that is taken by the system for attendance purposes; these data are stored alongside their particulars in a database. This capture of the face is then preprocessed by transforming the color images into grayscale images, which in turn get normalized for noise reduction. The authors made use of the principal component analysis (PCA) algorithm to extract the facial feature and support vector machines (SVM) for the classification. The digitalization and extraction of the scanned fingerprints were done using a decreasing algorithm, and the fusion of the two biometric data was done using a logical technique. This system, as described, returned 87% minimum accuracy.

Banu & Marti (2018) Proposed a system that uses the concept of the Internet of Things (IOT) and fingerprint models for attendance taking and fast processing of these data. This was built in stages where the student has to first fill out a form, which they submit alongside their fingerprint using the fingerprint module; this then gets sent and saved in the server database uniquely. When the students mark their attendance by fingerprint, the data gets sent from the class node via the Thing Speak cloud, thereby saving this attendance to the server.

Face Recognition System

Unique techniques for face detection and recognition Automated attendance systems were introduced using a method that captures specific features of a human, such as the nose, eye, and face. This system detects a student at the entrance of the lecture hall with the help of the specified features; the system recognizes the particular student and marks their attendance. The Principal Face Recognition (PCA) algorithm was employed for the face recognition process. The success evaluation of the system was done using different face recognition systems and considering distinct real-time situations.

Partha, Chowdhury, Mahamud, & Saifur (2020). Qingdong & Wenting (2018) Developed a face recognition attendance system employing the technology of the deep semi-NMF algorithm. The intent behind this is for the system to automatically detect and recognize faces through the video images and then get comprehensive information from the database.

Barcode Related System

Using the Unified Modeling Language (UML), Microsoft Access 2007 and ASP.NET programming language, Sheikh, et al. (2019) designed and implemented a barcode-based student's attendance system that updates and

generates attendance analytics in real time. They analyzed an already existing system and then used the UML to redesign a new system. This system only allows access to the teacher, who will install the application on their smart phone and then access the database, pull the students data, and mark their attendance with a check mark for the present students and a cross sign for the ones who are absent.

Radio Frequency Identification System

Ahmed, Olaniyi, Kolo, & Durgo (2016) Developed a multifactor attendance system that utilizes the preservation of fingerprint biometrics and the resilience of radio frequency identification (RFID) technology to conduct students' attendance records. In this case, RFID, which has unique characters, gets generated and assigned to each student, respectively. The RFID transceiver hardware module. At the point of swipe, the number attached to this student label is caught and sent to the processor, which then displays the details of the student on a Liquid Crystal Display (LCD) screen. This then gets authenticated when the students can also put their fingerprint on the fingerprint module; this records their attendance time in SD card memory. In the event of a success evaluation with respect to the average execution time, 10 students were used to test the system, and an average run time of approximately 4.61 seconds was derived. Similarly, the system reports a zero percent fault, which tests the reliability of the system and its integrity.

Username and Password System

Hameed (2017) Implemented an Android-based smart student attendance system where the mobile application is built on Java, PHP, and HTML for the scripting, MySQL for the database, the WAMP server as the local host, and CSS for the design of the UI. This system gives access to three people (an administrator, a reporter, and an instructor). The administrator has the ultimate access to login and amends the database, including editing and deletion. The instructor has access to login and marks their attendance. The reporter has access to login, show, and report all the tasks. From the information provided in this journal, the database contains information about the entire curriculum, the institution, and the students in each curriculum. After the instructor selects the curriculum and subject, all the names of the students that are meant to be in attendance get pulled up, and the instructor then check-marks all the students in attendance. This automatically pulls the stats of students who are in attendance and displays the once-absent students. This makes it easier for the reporter to register the information at once.

QR Code Based System

Duman & Gokoz (2018) Introduced a QR code-supported web-based student attendance system where a smartphone is required for the students to scan the QR code that has been projected on the screen by the lecture. The proposed QR code-based attendance management system is more affordable than the fingerprint system and easier to use than the facial recognition system. The other advantage of the proposed system is that lecturer participation is less involved in the process. They want to generate the code only. The reporting part is considered by the administrators of the system.

Challenges with Related Works

According to the Manssor & Sun (2019) paragraph 1 *"Although great progress has been made in facial recognition systems, there are many problems which hinder the identification process, especially the recognition under low light conditions or at night (full darkness)"*.

This is an indication that sometimes the system can run into errors or not capture adequately. Studies on Biometric security and privacy with fingerprints Belhuechi, Alimi, Cherrier, Lacharme, & Rosenberger (2011) reveal that there are two errors associated with privacy on the verification level, and these are:

False match: This indicates the fingerprints of two different people are from the same person.

False non-match: This indicates that the fingerprints of one person are from two different people.

On the security aspects Abidin, Matsuura, & Mitrokotsa (2014) it was discussed that leaked biometrics reveal

sensitive and personal information such as one's identity, genetics, medical conditions, race, and religion, which leaves individuals vulnerable and tractable.

The barcode system is great, but it wants the machine to mark the attendance. The proposed system, where the smart is not really needed for attendance to be taken, is proposed to be printed alongside student information on their ID cards, but the QR code will be specifically for class attendance. This helps the students whose smartphones are damaged to still mark their attendance.

Project Plan

GHANTT CHART - QR BASED ATTENDANCE MANAGEMENT SYSTEM

Milestone	Duration	Start Date	End Date	Deliverable
Project Prposal	1 week	01.06.24	15.06.24	Report
Project Confirmation	1 week	01.07.24	02.07.24	Letter
Information Gathering	2 week	03.07.24	17.07.24	
Requirement Gathering	2 week	17.07.24	31.07.24	
System Design	3 week	01.08.24	20.08.24	Report and System
System Development	6 week	21.08.24	06.10.24	System
System Testing	2 week	06.10.24	20.10.24	Test Cases
Evaluation	1 week	20.10.24	27.10.24	System
Implementation	1 week	27.10.24	03.11.24	System
Maintanance	1 week	03.11.24	11.11.24	System
Documentatation	4 month	01.06.24	11.11.24	Report

Figure 1.2 Project Plan

Requirement Specifications

Stakeholders

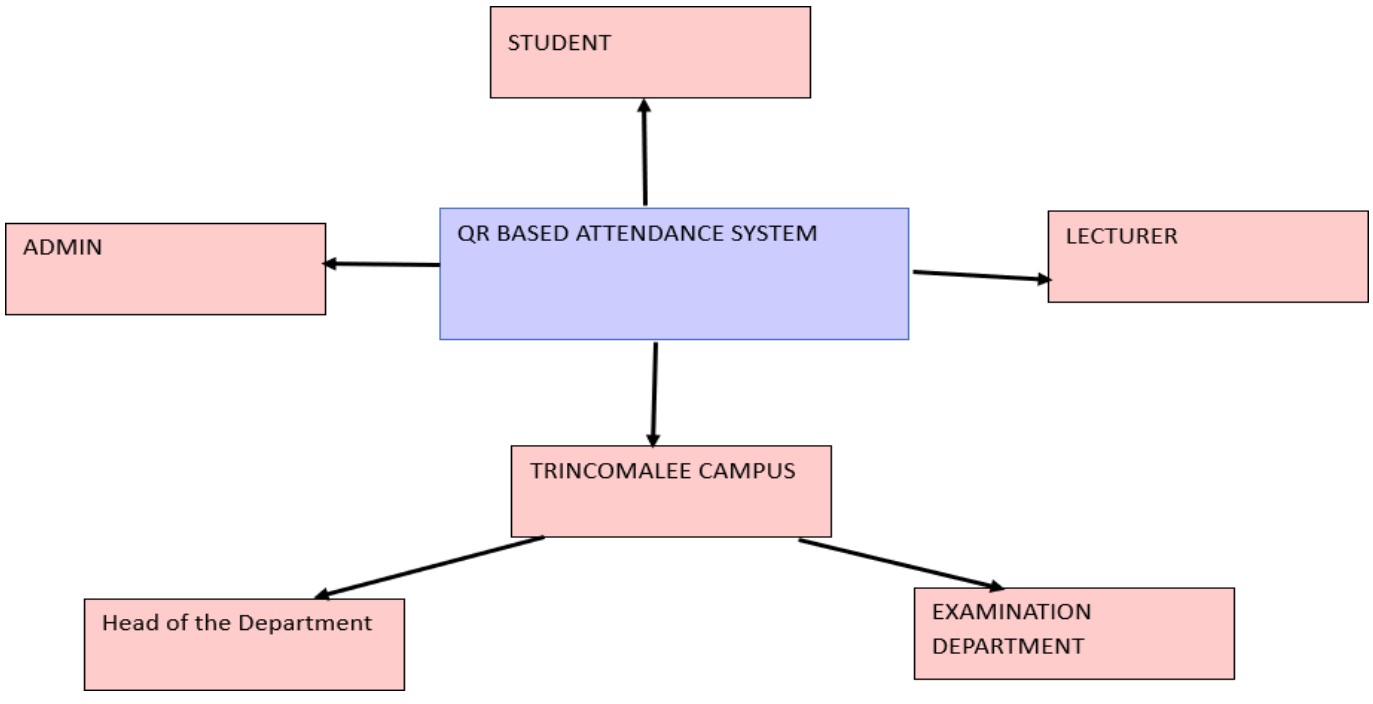


Figure 2.1 Stakeholders Map

Stakeholders mapping is the process of finding out the key stakeholders relating to the project. The process involves identifying all individuals who have an interest in the project outcome. QR-based Attendance Management System at Trincomalee Campus, Eastern University, may benefit both direct and indirect stakeholders. The direct stakeholders are:

Student: The students can be classified into the main stakeholders of the QR- based Attendance Management System. The system mainly focuses on the attendance of the students. Based on their attendance, students can identify their eligibility for the end-of-semester exam. It will provide ease for the students. The only thing students have to do is scan the QR code on their mobile phones. The result will lead to the current percentage of students' attendance in each course. When the attendance is low, students get a notification from the mobile application. It helps to identify the courses that need more focus and maintain regular participation in the classes. It will avoid the impersonation of signatures in the traditional method and the impersonation in scanning because the devices are uniquely identified.

Lecturer: Another direct stakeholder are lecturers. Lecturers can get the QR code generated by admin and send it with the students to scan. That method helps reduce the time wasted on manual sign-in sheets and paper waste on the sheet. It will lead to more lecture time availability. The lecturer can check the attendance of the class by viewing the web portal. It will help to identify the people who are getting present and who are getting absent from the lecture. The view of the attendance sheet can be easily counted without errors. It will avoid the human error of calculating the number of students available in the lecture.

Admin: The administrator is the key stakeholder in the system. The Management Assistant is the admin of the QR code-based attendance management system in Trincomalee campus, Eastern university. The administrator is the person who controls the overall attendance management system at Trincomalee Campus. The admin has the power to generate the QR code for each class, including the date, venue, and module. The QR code will be sent to the lecturer through the institutional email. Once the students scan the QR code, the admin can view the attendance of each class. The admin can insert the new device, update the devices, and delete the records of the student. The admin can generate reports of attendance, which will be shared with the HOD for the calculation of 80% eligibility.

The QR Code-based Attendance Management System will have indirect stakeholders as well. The indirect stakeholders are:

Head of the Department: The Head of the Department has the power to request student attendance from time to time. She can audit the attendance of classes and get the details of the percentage and absenteeism of the classes in each module. It will help to identify the areas and classes that have to improve for the next batch. It helps to update the course module and teaching techniques of the lecturers. The HOD can release the eligibility report before the end-of- semester exam. That will be beneficial for the students, lecturers, and exam department too.

Examination Department: The main indirect stakeholder is the Exam Department. The proposed system can generate customized reports. The reports are sending over to the HOD of the department as the summary sheet of the student attendance. Once the HOD get the summary sheet she will pass that over to the subject lecturer for check the eligibility of the students. After the lecturer approval, The HOD can share the attendance of each student 80% eligibility in the batch for the exam department. The proposed system will provide the reports of the eligible It will help to make the exam preparation go smoothly and easily. It will avoid human errors and hardware errors while calculating the percentage of attendance.

The QR Code-based Attendance Management System is beneficial for both direct and indirect stakeholders on the Eastern University Trincomalee Campus.

Functional Requirements

QR code-based attendance management should be helpful to

User Authentication

The proposed system should be able to sign in and register. The admin has access to the register of the students and their mobile phones in the database. The admin has to enter the username and password for the system. Admin can be able to add, update, and delete the records of the student. Admin is the management assistant of the Trincomalee Campus.

The students can access the system using the mobile application. Once the username and password enter the mobile application, the system will be able to scan the QR code. The username and password should be unique for each student.

QR Code Generation

The proposed system should be able to generate the QR codes. The admin has to generate a unique QR code for each class. That QR code has to be shared with the lecturers while using the email address of the lecturers. Lecturers can be shared among the students while the class is beginning. The admin makes the timestamp for the QR code scanning to avoid the false attendance of the students in Trincomalee Camus.

QR code scanning

Once the QR code is shared with the students through the lecturers, they should be able to scan the QR code using their mobile phones. The scanning can be done via the mobile application of the student attendance system. There is a time limit for the scanning. Once the code is scanned, it is marked in the localhost web application. The student gets a notification of successful marking, or they can try again.

Attendance Recording

Once successful attendance is marked, the system should record the date, time, and student details in real time with the local host. The scanning between the timespans helps to get real-time data on accurate attendance. While the timespan is finished, the system avoids the present attendance of the student and marks the absence automatically.

Report Generation

The proposed system's main specialty is generating customized reports. Attendance reports of individual students can be handled by the admin and shared with the HOD for calculating the percentage of attendance. The HOD can publish the eligibility reports before the examination period. It helps the examination department to make smooth and easy work without distraction.

Notifications

When the students get low attendance for each course, they have the chance to check their attendance. It helps to get an idea of the eligibility for the examination. Once the attendance is low, the proposed system will provide a warning message for each student. The notification will send to the students with half of the semester. It will give the recommendation for the students to attend the lecture continuously or provide the medical chart for the days that missed. But the medical recommendation is only available one time per each semester within required terms and conditions. The students can maintain their availability for the lectures without problem.

User Management

The administrator of the system can search, add, update, or delete the user information. The admin can add new students and devices to the database, update the mobile phones of the students, and delete the records of the students and devices that no longer participate in the degree program.

The information about the student’s attendance helps the course coordinator get an idea about the improvement

of the courses as well as the improvement of the teaching techniques. It helps to maintain the quality of the of the subject courses in each degree program.

Database Management

The proposed system should be able to get and post data from an Application Interface. The application Interface is the design that insert, update, edit and delete the information from the database. It is act as the mediator of the Database and the users of the System. The system should store the student and attendance data securely. The data should be maintained properly. It helps to provide accurate reports on attendance. The database should be backed up regularly to minimize data losses. The data should be secured in an encrypted way with minimum access.

Session Management

Admin should be able to create and manage the class sessions, including date, time, and venue. The QR code is generated based on the unique information of the classes. It will reduce the repetition of the data in the database and store accurate data in the database.

Non-Functional Requirements

QR Code based attendance Management System have to,

Security

Secure the authentication mechanism using username and password. The admin and the student portals are only usable for the verified users. The username and password can't be share within the students. The username and password are given by the unique MAC address of the mobile phones. It reduces the unauthorized access to the database. Once the data is tired in the database the data will be encrypted. The limited person like admin can access the data directly. Lecturers can access the data through the administrator permission. The future updating of the database is only limited to the Admin. Students can access the database using their username and password.

Performance

The proposed System should generate QR code effectively and Real time processing of attendance. The QR code should be uniquely for each class. It cannot be duplicated in to the same class. The QR is generated by using the class, venue and time. It will reduce the duplication of the code. The scanning data should be stored in real time without delay of the system. It will help to make the reports more accurately and efficiently.

Scalability

The proposed system should provide the facilities for growing number of students in BMS Faculty. The students getting enrolled more in each year of Trincomalee campus. The system should provide the facilities for the larger batches. It should be handling the peak times. When higher number of students scanning the QR code the system should not be down and make sure the real time data recording in the database.

Reliability

The system should be having Minimum downtime and high availability. As well as the scalability, the large number of students can be recording their attendance without distraction. It also provides the regular backup for minimum data loss. The data have to be backup regularly for save the data in down time of the system. The system should be efficiently for the Trincomalee Campus.

Usability

The Proposed system will be providing the User-friendly Interfaces for the Students and Admin. The student

portal is available in the Mobile application, and the admin portal is available on the web application. The both should be accessible easily and understanding easily for the users. It helps to increase the number of interactions between the system and the users of the Trincomalee Campus. It can accessible via mobile phones.

Maintainability

The system has to be easily updated and maintain the system. When the advance techniques come the system should have capability to adapt those updating without hardware or software error. As well as s the system will be loss some functionalities the developer has the knowledge for the system maintenance. When there is a drawback of the system, the developer should be able to access the drawback carefully.

Support and Training

The proposed system will be implemented in the BMS Department of the Trincomalee Campus. The staff, lecturers and students will be given the Training for the effective system usage. The developer provides the user manual and workshop for the newly proposed system. It will help to get the exact idea about the system. It will help to make interaction with the system.

Interoperability

The web application of the system should deal with various browsers. The mobile application is compatible with the version of the mobile phones. The proposed system should be able to integrated with the administrative systems. When the systems are integrating it is easier to make decisions effectively and efficiently. It also led to easiness for the academic, non-academic staff as well as the students of the Trincomalee Campus.

Use Case Diagram

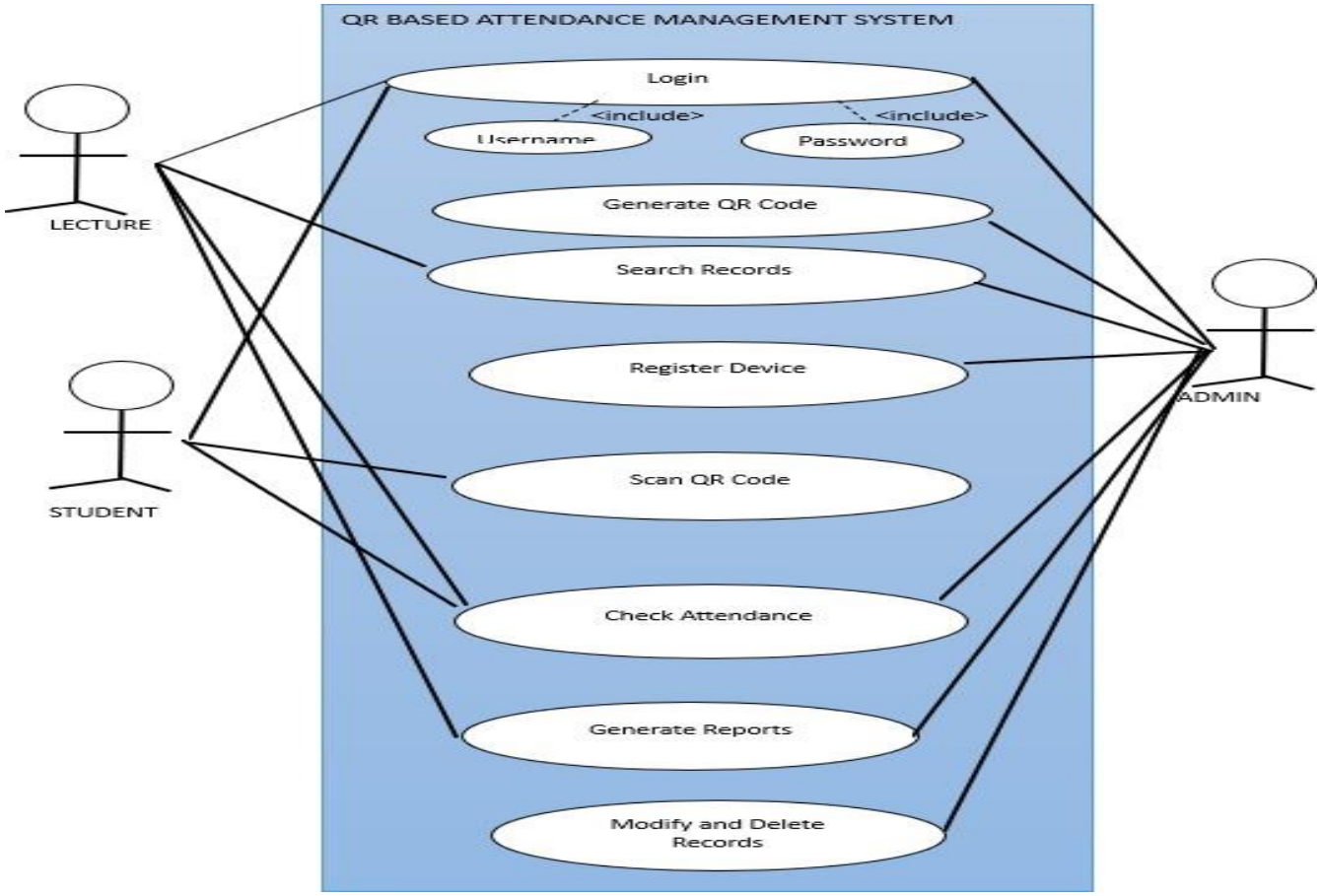


Figure 2.2 Use case Diagram

According to the Use Case Diagram of the QR Code based Attendance Management System, there are three main users of the system.

Lecturer – The Lecturer can access the system using Username and Password. The Username should be institutional acknowledgeable one and the password must be unique one for each lecturer. The relationship between username and password into the Login function is mandatory. If the username or password is wrong the system doesn't allow to login to the system. The lecturer can view the attendance of their class participation through the supervision of the Administrator. Once the admin generates the QR code that will be share with the lecturer. Lecturer have the authority to share that with the students for scanning purpose. The Lecturer can't modify the data in the database. They can only see the percentage and make sure the attendance is accurate.

Administrator – The Admin is the person who operate the system effectively and efficiently. In the Trincomalee Campus, Eastern University scenario, admin can be Management Assistant of the nonacademic staff member. The admin has to operate the system timely manner without delay. That will help to reduce the operational problems and unnecessary time consumption in traditional method. The admin has the major roles and responsibilities in the system. Admin can add additional functionalities like Student details adding and Course details Modification. Admin have to login to the system using web application. The username is required with institutional name and the password should be unique and standard one. The login function is success when the correct username and password providing. The admin has to make sure to register the mobile devices of the students that have to be used for the scanning purpose. Each device must be registered with their MAC address, for avoid the impersonate in scanning and duplication of the scanning. Another important function is generating the QR codes for each class. It has the timespan. Once the timespan is exceeding the system will be automatically record absence in the system. The QR code is unique to the classes and it share with the lecturer. Once the QR code is scanned the admin can view the attendance of each class. If there is any error due to the timespan admin can fix that error according to the rules and regulations. The admin also can search the individual or class records of the students, modify the user devices and also delete the records of the devices and users that are no longer participating in the degree program or classes. Admin can get the customized reporting in the attendance. This reporting including the eligibility of the end semester examination. The reports can be shared with the HOD for the further processing. The admin is the main user of the QR based Attendance Management System.

Student – Student will be the main part of the system. For the students' attendance organizing is the main purpose of the proposed system. Students have a web portal for check their attendance and limited access. Apart from that, the student has to login to the Mobile Application using the Username and Password. Each username and password issued by the admin according to the MAC Address of the mobile phones. It is unique to each student. The students can scan the QR code that shared by the lecturer during lecture time. The mobile application allows to scan the code in limited timespan. When the code is scan it will be notified the success or unsuccess of the scanning. Once it's received the success message students can check their attendance based on each course. Students can get the idea about the attendance of the course. When the attendance is low, the system will be generated the warning message. It helps the students to maintain the regular attendance without issue.

Data Requirements

QR Code based Attendance Management System will be provide the following Data Requirements.

User Data – The admin has the major role in the system. The Admin ID act as the primary key of the database. It should be uniquely identified by the admin. The Name of the admin, Email and Phone number must be included in the admin table. It will be easier to identify the access person for the system.

Each Lecturer have to be Lecturer ID for identifying the lecturer. Lecturer Name, Email, Phone number are the personal details that are stored in the lecturer table. The Department and the Courses that have been teach by each lecturer must be included in the lecturer table in database. It helps to generate unique QR code based on their courses. The student has Student ID as the unique primary key. It will be differed from department to

department and batches to batches. The Name of the student, Email and Phone number are the personal details of the student table. The enrolled Courses can be more than one for the student. It helps to identify the student uniquely using their Student ID.

Class Data- Class ID act as the Primary Key of the class table. each Class has name and Schedule for the classes. Course ID act as the Foreign Key. Because it connects with the Courses table. Faculty ID is also act as the Foreign Key for uniquely identifying the faculties. When they schedule the classes, the Venue must be included in the table.

QR Code Data - The QR code table QR Code ID act as the Primary Key. Referencing the Class Table, Class ID act as the Foreign Key of the table. The code lifespan is determining by the Generation timestamp and Expiry timestamp. It should be time format and make sure to record that accurately.

Attendance Data - The most important table is Attendance table. The Attendance ID is the Primary Key of the table and Class ID act as the Foreign Key of the table. As well as the Student ID also act as the Foreign Key of the attendance table. The QR Code ID is another Foreign Key references by QR code table. The Scan timestamp is in before the expiry timespan. The Attendance Status (Present/ Absent/ Late) mark the attendance of the student in each class.

Session Data - Session ID make a Primary Key of the session table. The Class ID act as the Foreign Key and also the Faculty ID act as the Foreign Key. The Data and Time for the session must be in date format and the Venue is recording in the database.

Authentication Data - The unique User ID of the admin, lecturer or student act as the Primary Key of the authentication table. The Username and Password record in the table. It will help to identify the users that login to the system. The Last Login timestamp should be noted for the privacy and security policy.

Report Data - The Main function of the System is Report generating. Each report has the unique Report ID and act that as a Primary Key of the system. The Report type should be included in the table such as, Individual/ Class). The reports can be able to generated by Admin. The Admin ID act as the Primary Key of the Table. The Generated timestamp should be recorded in the table.

Backup Data - In Backup table the Back Up ID act as the Primary Key. The Data Covered in the backup (User/ Attendance) should be record in the table. The Backup file location should be wireless cloud server.

System Design

Design Goals

Design Goals of QR Code based Attendance Management System using the Software Development Life Cycle models. Each type of SDLC models will be having the most suitable development lifecycle for the proposed system.

Iterative Model

Figure 3.1 Iterative Model

The first SDLC model is Iterative Model. In the SDLC approach, it is well known as the incremental development that can develop the project quickly more compare than traditional SDLC approach. It usually breaks a big application to a smaller part and iteratively enhance their module to a useful application for developing the project. In this process, it will keep repeat and keep enhancing with a better version of the application at the end of each iteration, this could be explained that it could be review, implement and testing back to the previous iteration of the project and enhance to a more advance and complex program.

Iterative model having the advantage which it could be more efficient and faster in some of the module in the early stages. This SDLC model will be saving more time and resources early in development stage. The upcoming advantage will be supporting changing requirements. When some of the functional requirement does not meet the expected results, it could be change or modify earlier to avoid some system failure in future development.

Other than that, the disadvantage of this SDLC approach will be requiring more resources in developer. Although it saves resources in developing modules in early stage, but it requires more resources for manpower to track on the process.

Agile Model

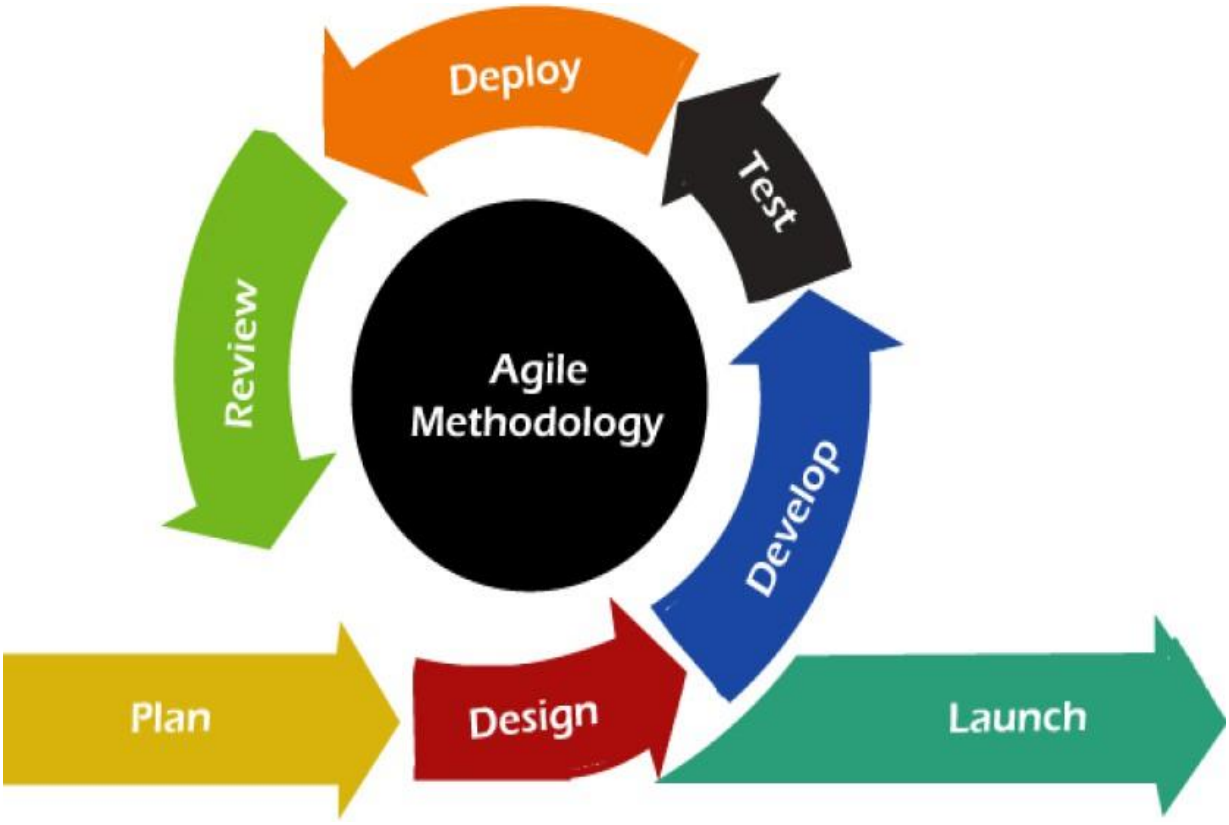


Figure 3.2 Agile Model

The next SDLC Model is Agile Model. It was same as the first SDLC model iterative model which it is an incremental development in SDLC approach. It will be more concentrate on the process and client feedback in developing a project rapidly. It could be mentioned as limiting planning will be enough for people to start the project due to the project requirement can be change frequently followed by the client feedbacks.

Advantage of Agile model is the frequent delivery and reduces total development time. The developer can develop the project rapidly and receive feedback from client for applying decision in selecting changes is needed for the project or not. Other than that, the procedure of this SDLC approach will require lesser document that need to plan and analysis. This could be meaning that it could save a lot of development time for developer to deliver the prototype toward their client.

Disadvantage of agile model will be lacking documentation. This will lead to confusion for different developer to understand the requirement of the project due to shortage of formal documentation. It has a difficulty to trace back the project requirement when it comes to maintenance part.

Waterfall Model

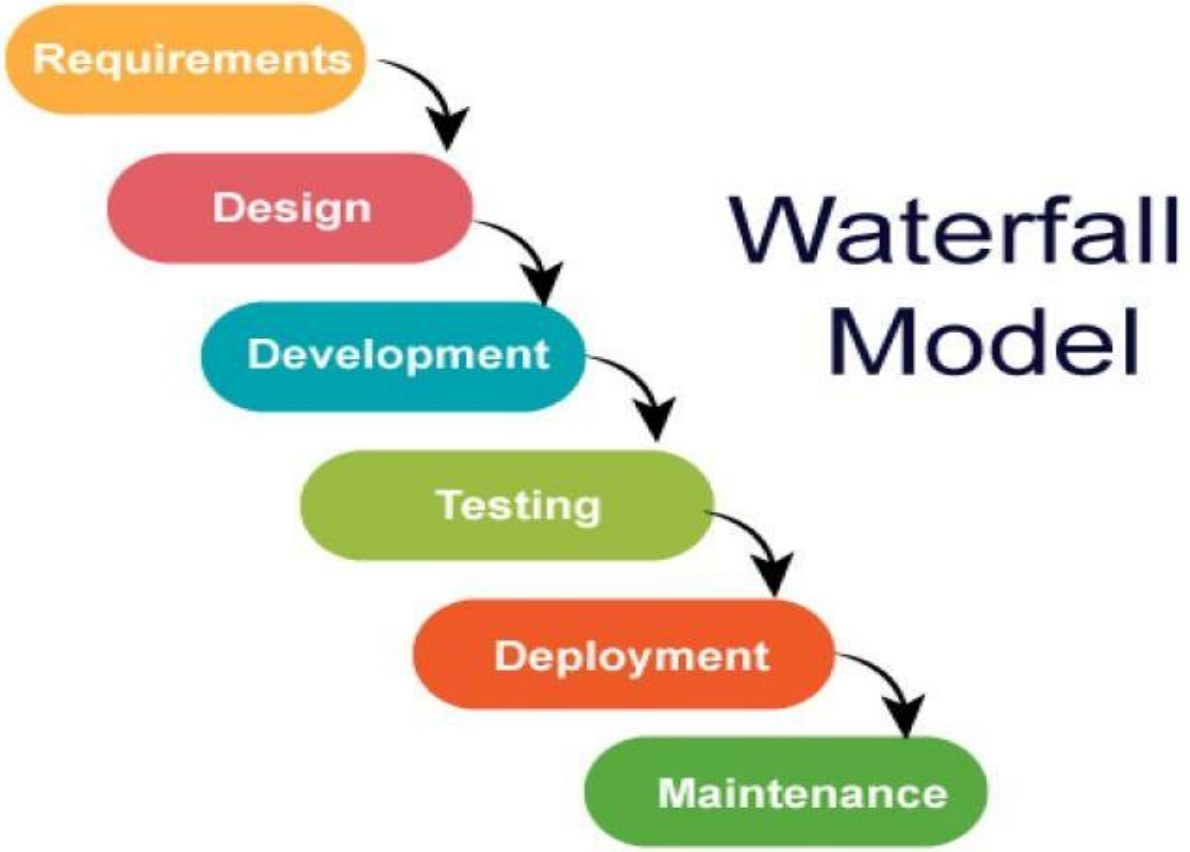


Figure 3.3 Waterfall Model

The traditional SDLC model that mostly used for software development is Waterfall Method. Many software projects were still using the model approach in development process. This SDLC model, the phase that consist in the model has to be complete at a time and follow up with new phase. This could be mean that every phase must be done in step by step. Moreover, the process and documentation in this approach will be well arranged and it will be able to trach back the documentation easily in the previous phases.

Advantage of this waterfall model is that it was a well-arranged documentation for each phase, process and results. This could be explained that this SDLC approach will have record well in every phase which it will be convenient in tracing back when it reaches maintenance phase. Other than that, the advantage for this waterfall model is the ease of task arrangement during development phases. Every development phase will be going through in a strict order will be clearly defined for people during developer working their tasks.

The disadvantage for this model is difficult in changing the project requirements, it will be wasting much more resources and manpower if they might want to change the requirements once the developer and the client had decided the requirements. (Kee, 2021)

Selected Model

Throughout the research of SDLC, the most suitable SDLC model for this project will be Iterative model. The reason for choosing Iterative model is it could be developed application rapidly at the earlier stages. Other than that, for this project to use this model for involving iterative process to seek enhancement for the project and it could be modify earlier to avoid system failure. The disadvantage if this model which it was required much

more resources such a s time and manpower, but advantage will be much far greater than disadvantage which in improve the overall performance of the QR code-based Attendance Management System. Hence, this SDLC is the first choice to be applied in this project.

Proposed Software Design

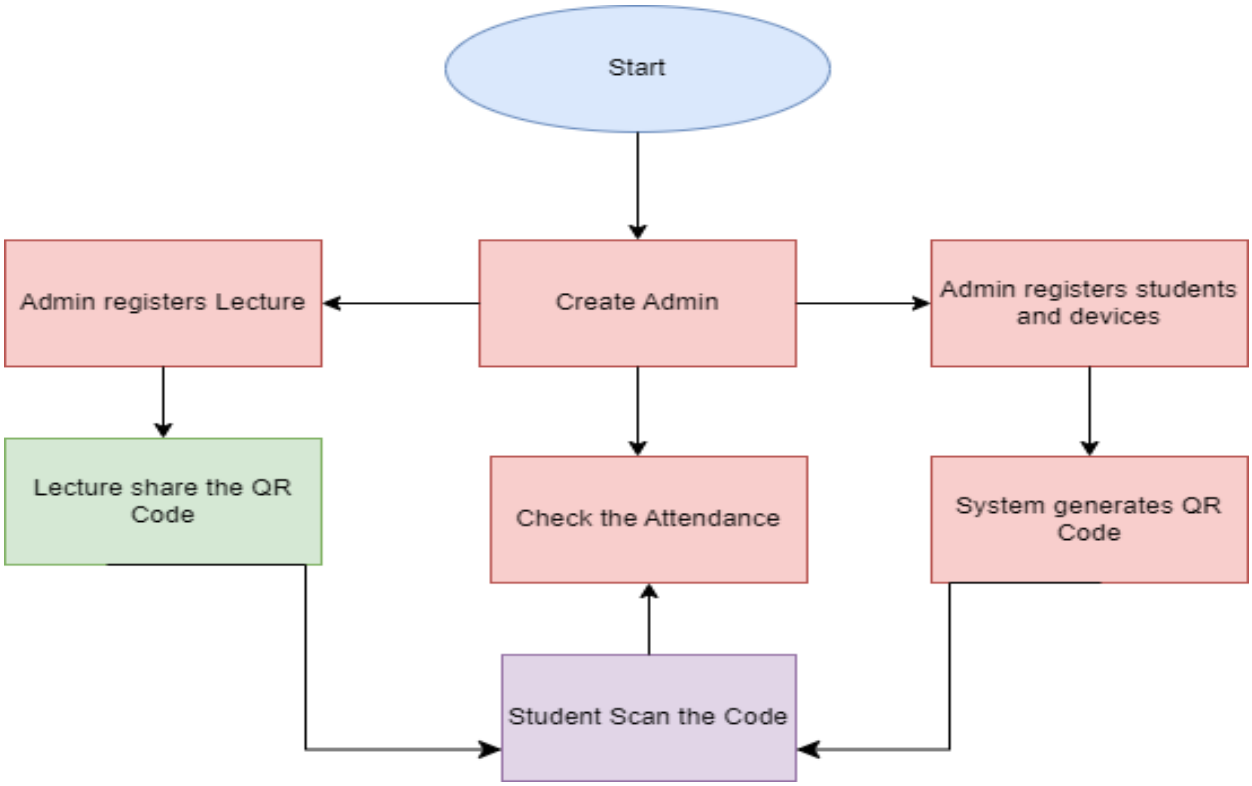


Figure 3.4 QR Code based Attendance Management System

QR code-based attendance system overall functionalities are display in the Diagram. Firstly, the developer must create the admin portal for make the operation smoothly. The admin can register the lecturers and students in to the system. The admin has the authority to generate the QR Code for their Courses. The Lecturer can share the QR Code among the students for mark their attendance correctly. Students can Scan the code that generate in the smart tv and mark their percentage in the class. Students can get the message and view the attendance of their classes. The admin has the authority to edit the records of the attendance. The admin can share the attendance and the reports for the HOD to the checking the eligibility of the students for the final examination. HOD passed that over to the Examination Branch. This system will help to make the accurate attendance system for the Trincomalee Campus, Eastern University.

Class Diagram

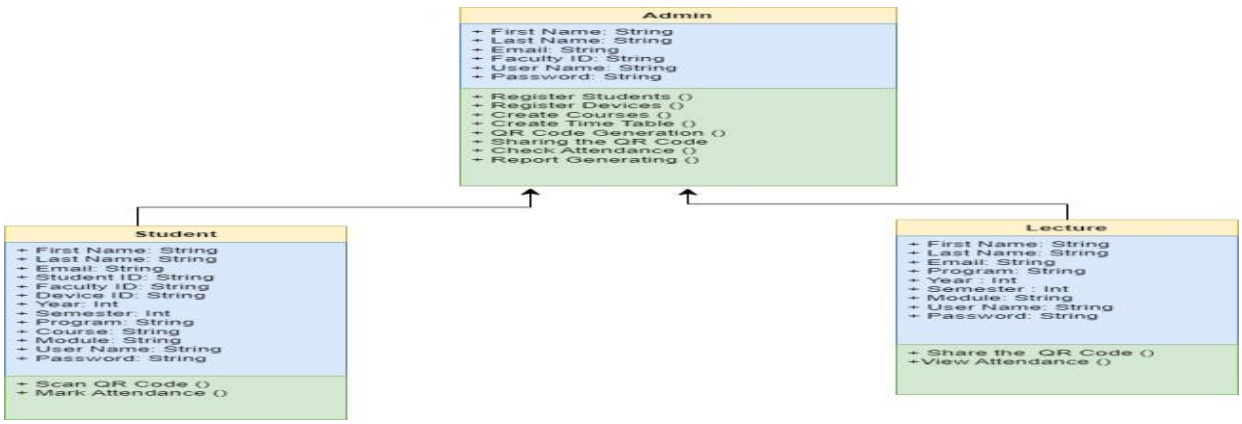


Figure 3.5 Class Diagram of the System

In QR Code based Attendance Management System has three main classes.

Admin Class – Admin have the main responsibility for the purposed system. Mainly the attributes of the admin can be categorized as First name, Lastname, email, Faculty ID as the String data type. Most important attribute of admin class is username and password. This have to be unique for the admin. The Methods of the admin are Register students and their devices. That has the higher priority in the admin class. Create courses and create time table is directly connect with the lecturer. QR Code generation and the Report generating is another important field of the admin class. Admin can view the attendance of the student as well.

Student Class – Students class has attribute that can be unique for each other. The special attributes are Device, Year, Semester, Course and the Username,

Password. The Username and Password is generated from the admin. That is lead to unique one for the students. The methods of the students are Scan the QR Code for mark their percentage and the view the marked attendance. Students will get the message of their course percentage. That will be help for the students to know the eligibility before the exam.

Lecturer Class – Lecturer class has the attributes like First name, Last name, email, Year, program and semester of the courses. The Username and Password is another main attribute that the lecturer class has. Using That username and password lecturer can share the QR Code to students and the view the attendance of each course. But the lecturer doesn't have the method to edit the information of percentage.

Sequence Diagram

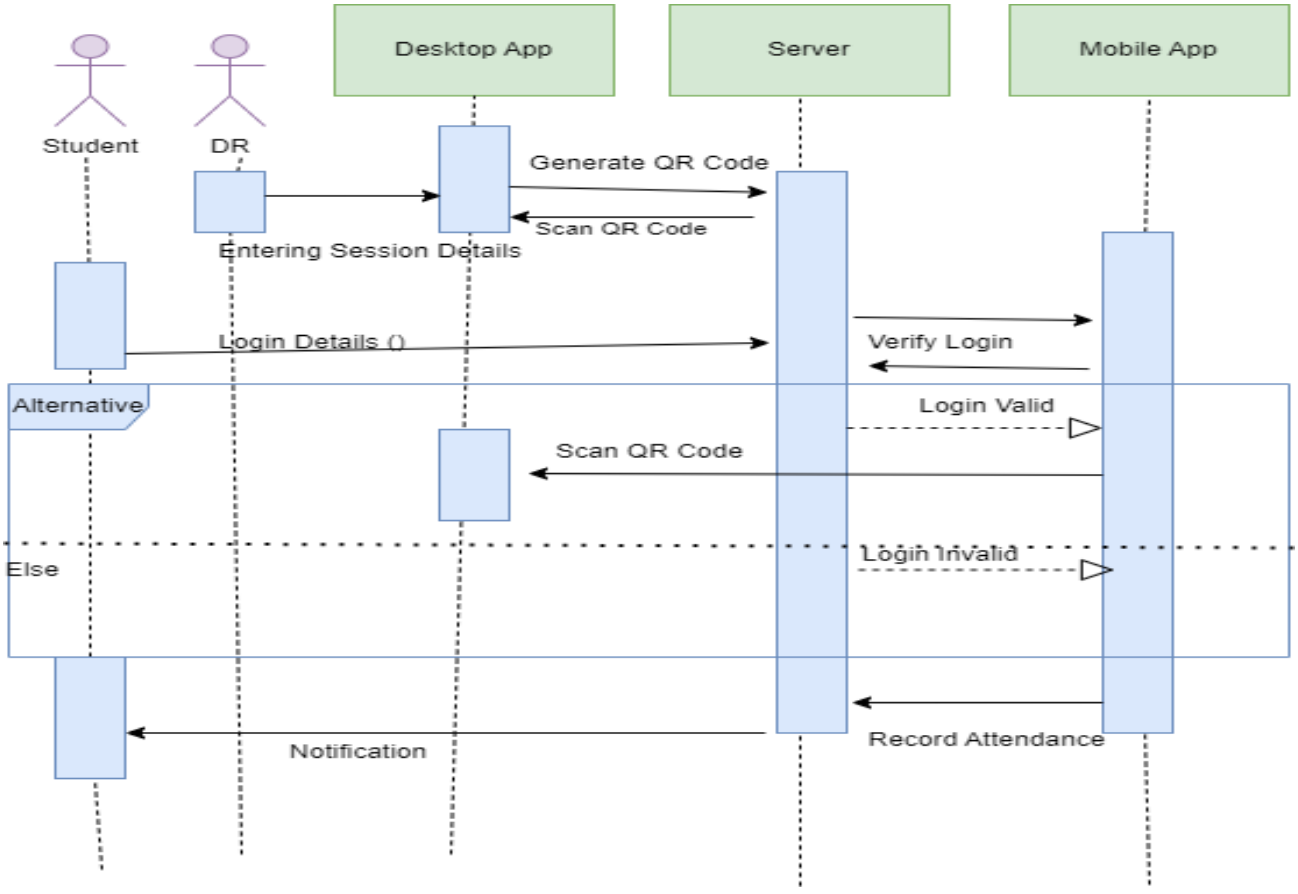


Figure 3.6 Sequence Diagram of the System

The Sequence Diagram is shown the how students to record the attendance in the database. The proposed system has the Web applications, Mobile application and the server. Admin request the Web application to generate the code. The web application will be generating the code according to the request. Student have to login to the system using the Username and Password given by the admin. The server checking the login

details. The Mobile application granted to the student and the verify the login. If the login is valid the students can scan the QR code. If not, the Mobile application doesn't provide the access to login to the system. When the student marks their attendance the server records the attendance. Students get the notification from the server. The students can view the attendance from mobile application. Admin can view the attendance using Web Application.

Data Flow Diagram

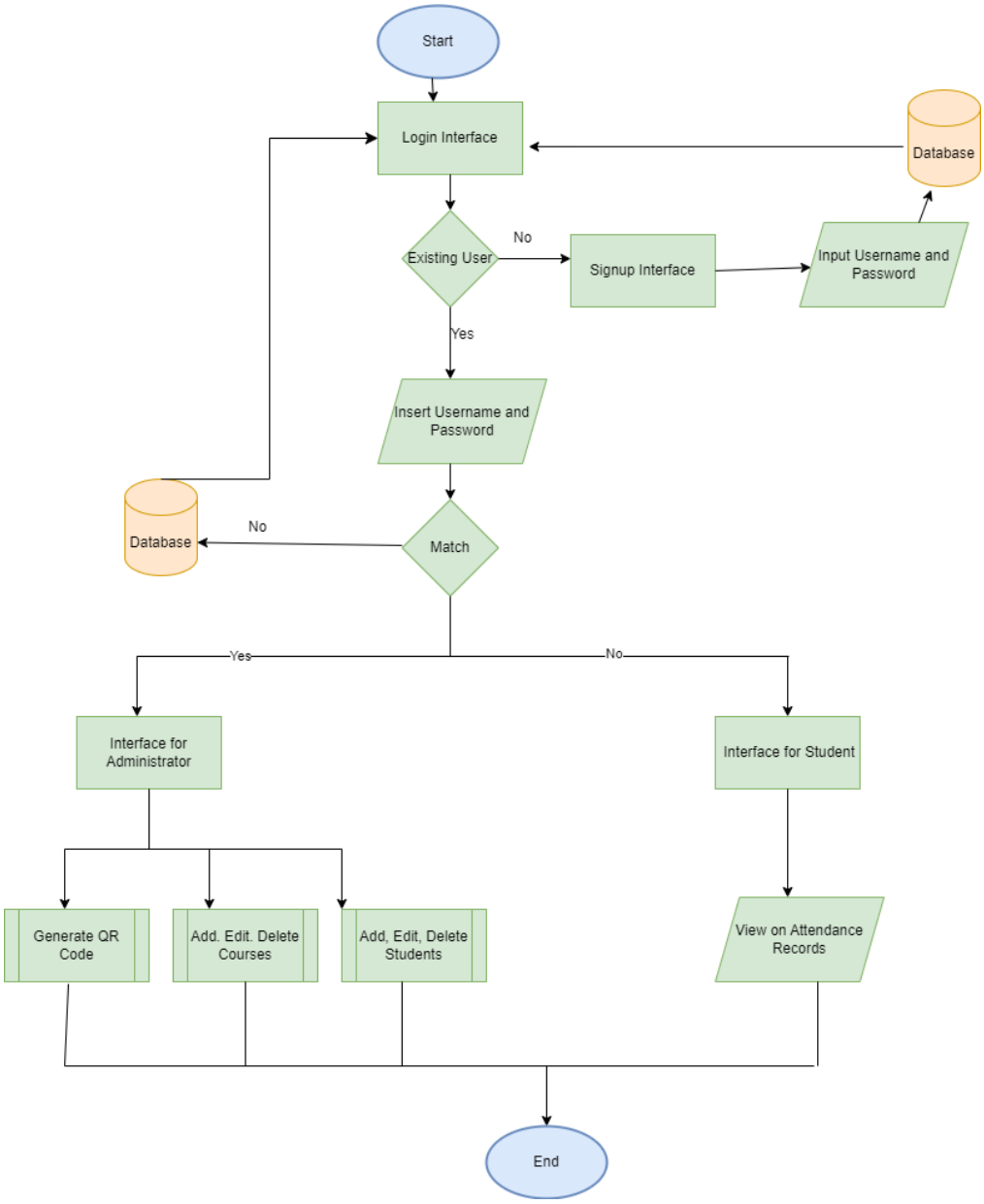


Figure 3.7 Data flow Diagram of Web Application

The Dataflow Diagram for Web application has the Login Interface for Admin, Students and Lecturers. When the user is existing user then can Input the Username and Password. When the user is new the Signup Interface will be pop up. Then user can sign up with username and password of theirs. The user information is stored in the Database server. The database is checked and verify the login details of users. When the information matched there are two Interfaces.

Admin Interface - The Admin interface can generate the QR Code, Edit the course information, Edit the Student records and View the Attendance records.

Student Interface – Student Interface only can view the attendance of each module they are attended. The students can't edit the details of their attendance.

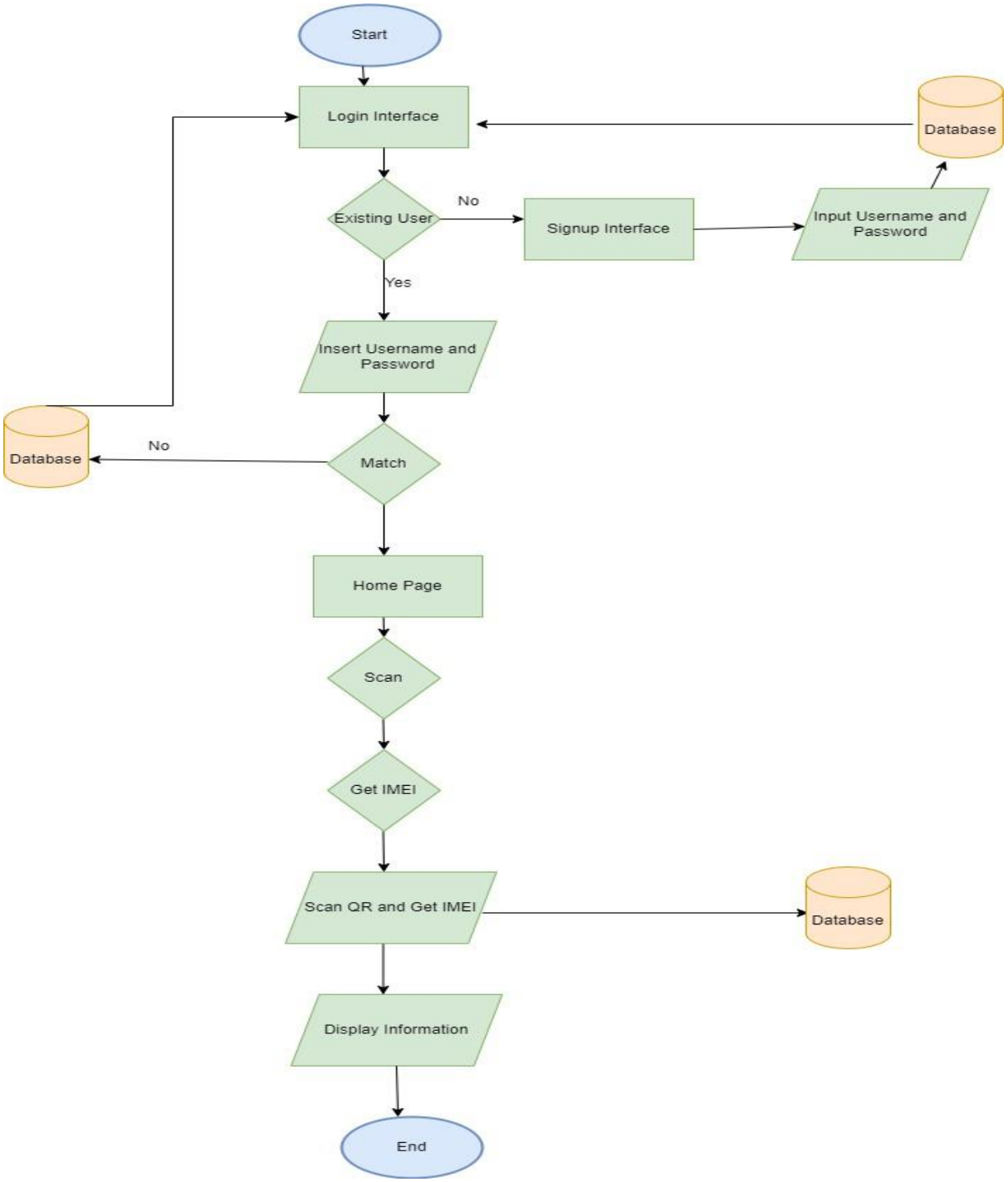


Figure 3.8 Data Flow Diagram of Mobile Application

The Dataflow Diagram for the Mobile Application also has the Login Interface; the Existing users can provide the Username and Password for Login purpose. The database server check that information. When the login is verified, the user can enter into the Home page of Mobile application. The new user can be sign up using the username and password given by the admin. The details are stored in the database. In the Homepage there is a Camera to scan the QR Code displaying in the Smart TV. Getting that Camera students have to get the IMEI from the tab. The students can Scan the QR Code using the Scanning camera function. When the scan is successful student get the notification. The application displays the Information of the percentage. If there is a low percentage of attendance in course students will be get the alert message from the Mobile Application.

Database Design

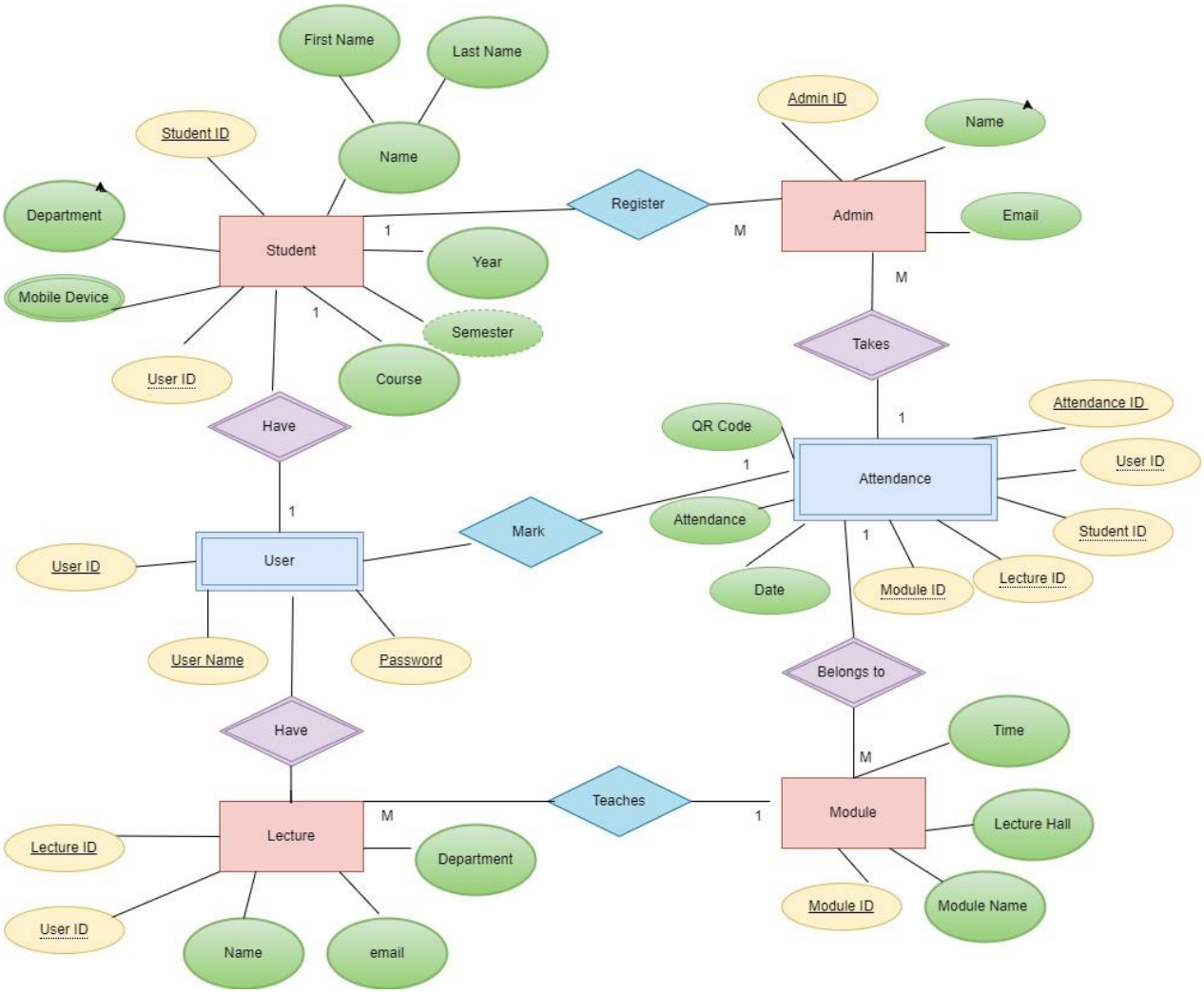


Figure3.9 ER Diagram of the System

The ER Diagram of the QR Code based Attendance Management System have strong entities like Student, Admin, Lecturer and the Module.

Student Entity - The Student ID is the Primary key of Student Entity. The User ID is the foreign key of the entity. Name is composite attribute that consist First name and Last name. The Multi Valued attribute is Mobile phones. Students can have more than one mobile phone. The semester is derived attribute from the Year. The students have the Total Participation for the Weak entity User.

User Entity – The User Entity has the Weak Total Relationship with students. The User is depending on the student. The User ID, Username and Password is unique and changeable for the lecturers and students. It acts as the foreign keys of the Entity. The student and the user have one to one relationship.

Lecturer Entity – Lecturer entity is a strong entity that has lecturer ID as the Primary key. The foreign key is considered the User ID. The user and the lecturer have the one-to-many relationships in the proposed system.

Admin Entity – The Strong entity with Total participation in the student entity. The Admin ID is the primary key of the entity. The admin has one to many relationships with the students.

Attendance Entity – Attendance is the Weak entity depends on the admin and the Module entities. Attendance ID is the Primary key of the entity. The Foreign keys are considered as the User ID, Student ID, Lecturer ID and Module ID. The attendance has the Total participation between Admin entity, Module entity and the User

entity. The attendance has the special like QR code and the Attendance. The admin has one to many relationships between admin and the attendance. The user has one to one relationship between attendance and the user entity.

Module Entity – Strong entity that have Primary key like Module ID. The Module has Total participation with the Attendance entity. The Attendance entity is depended on the Module entity. The relationship between Module ad the Attendance is one to many relationships. The relationship between Lecturer and Module is also the One-to-Many relationships.

The ER Diagram is displayed the full idea of the Database of QR Code based Attendance Management System in the Trincomalee Campus, Eastern University.

UI Design

The User Interface will be divided into two parts. The Web Application Interface and the Mobile Application Interface.

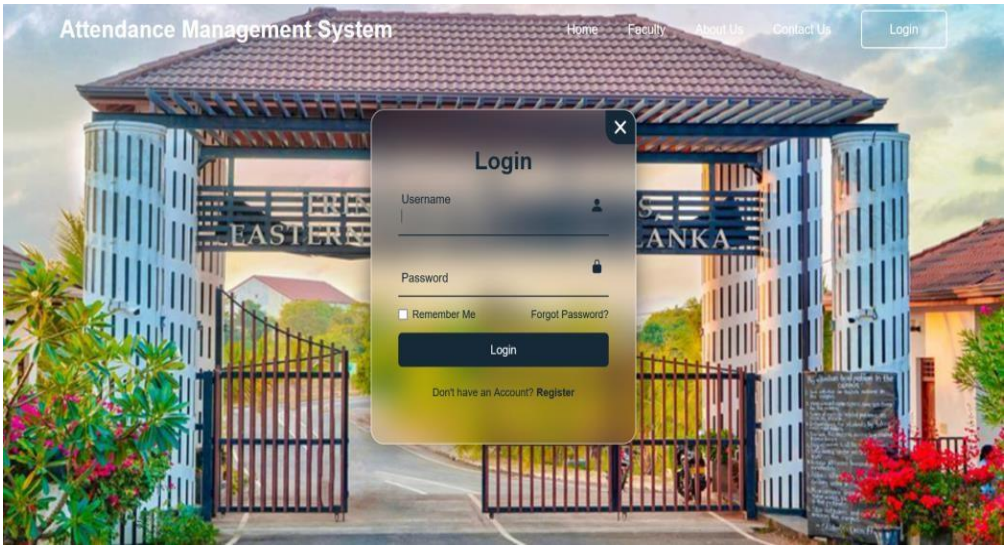


Figure 3.10 User Interface of Web Application Register Form

Web Application Sign Up Interface for Admin. The admin can Sign Up in to the proposed system using the email address, Username and Password. The admin information will be registered in the server.

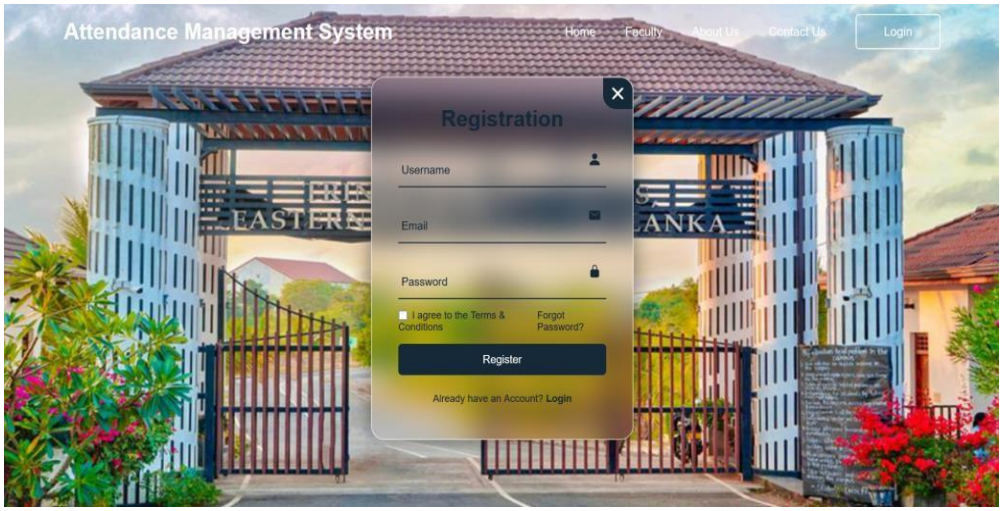


Figure 3.11 User Interface of Web Application Login Page

The Login Page of the Web Application. The admin can Login to the System using this Interface. When the admin input their username and password server will be verified that.

Figure 3.12 User Interface of Web Application Home Page

The Admin Home Page of the Web Application has the menu like Dashboard, QR Code, Attendance, Student Details, Reports, Messages and Settings. The QR Code will be generated according to the lecture time, Courses and Year. The record attendance will be display in the attendance table. The admin can get the reports using the report function. The Report display the percentage of the attendance of the students.

Figure 3.13 User Interface of Web Application QR Code Generator Page

The QR Code poratal will be helps to generate the QR Code for the Classes. It has the start timestamp and the

Expiry Timestamp. The code is unique for each classes. It helps to reduce the errors of the system.

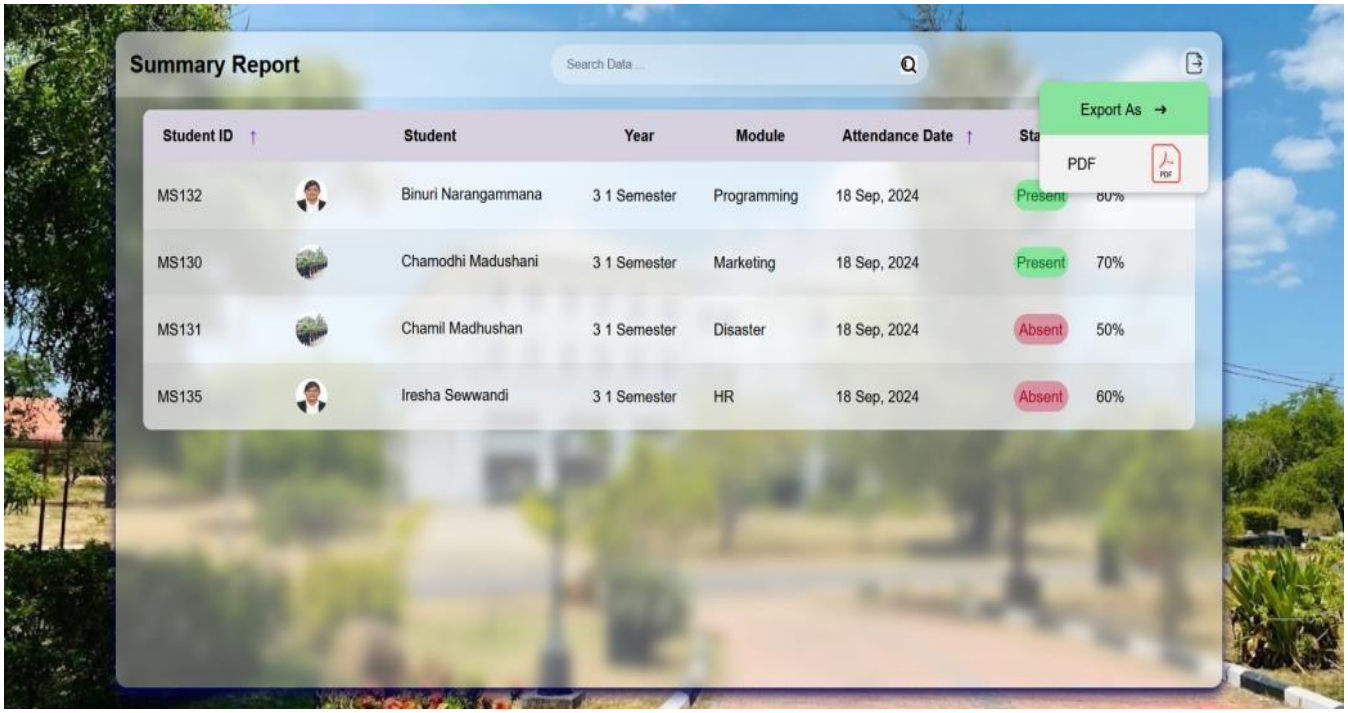


Figure 3.14 Web Application Admin Table User Interface

The Report display the information about the scanning of the Atten ace. The Admin can edit the data of the student table. Admin can generate the customized reports using this Function. While the students get the displayed information in the web application including the attendance precentages.

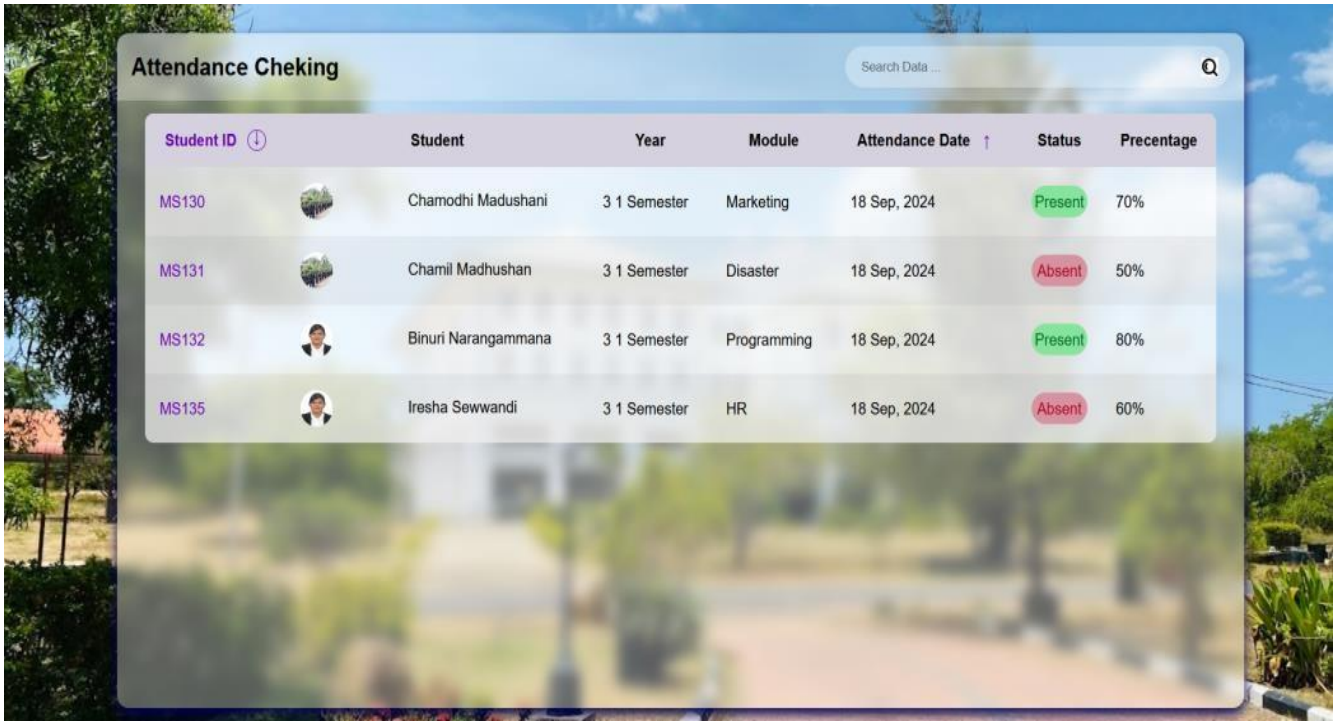


Figure 3.15 Web Application Attendance Viewing Interface

Web Application Attendance Interface. The admin can login to the system using Username and Password. The admin can view the attendance of the students and filter the data according to the admin requirement. The data can be sorted out according to Student ID as well as the Attendance Date.

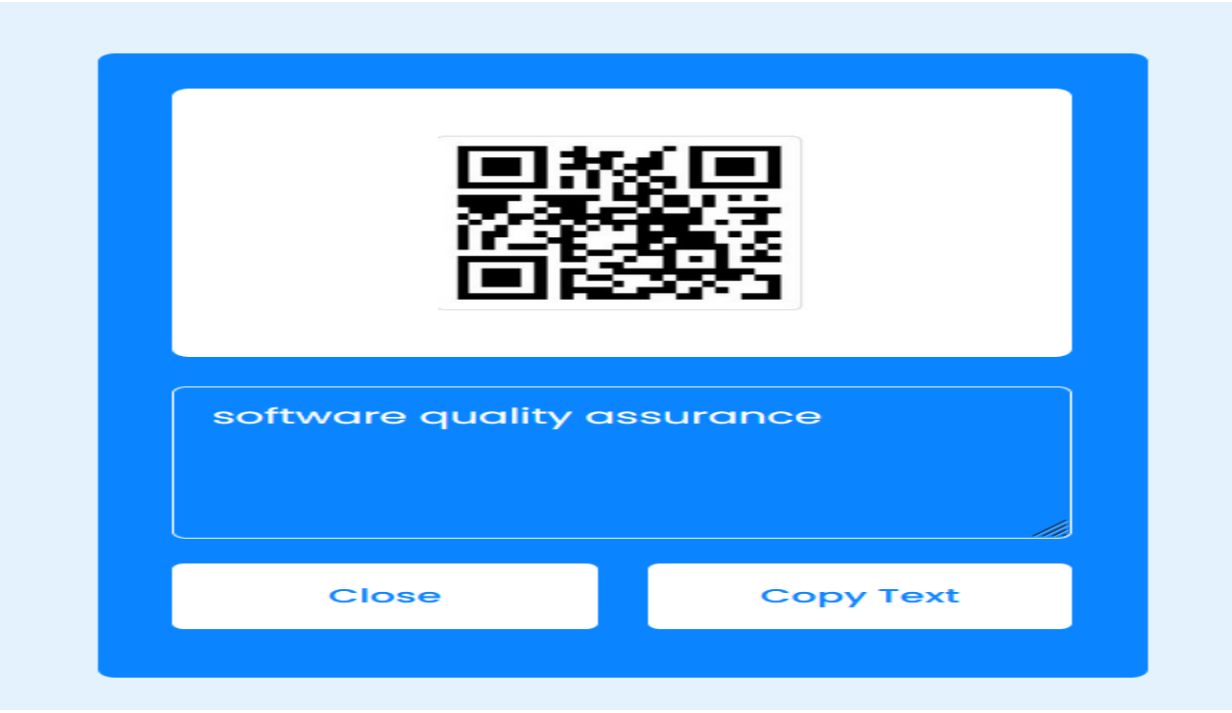


Figure 3.16 Web Application Scanning Function

The students can scan the QR Code using the Scanning function of the Web application. The most important function of student in the web application is scanning function. Once the lecturer displays the QR code in the smart TV students have to scan the QR code for mark their attendance. The scanning has to be done before the expiring of the Time Span.

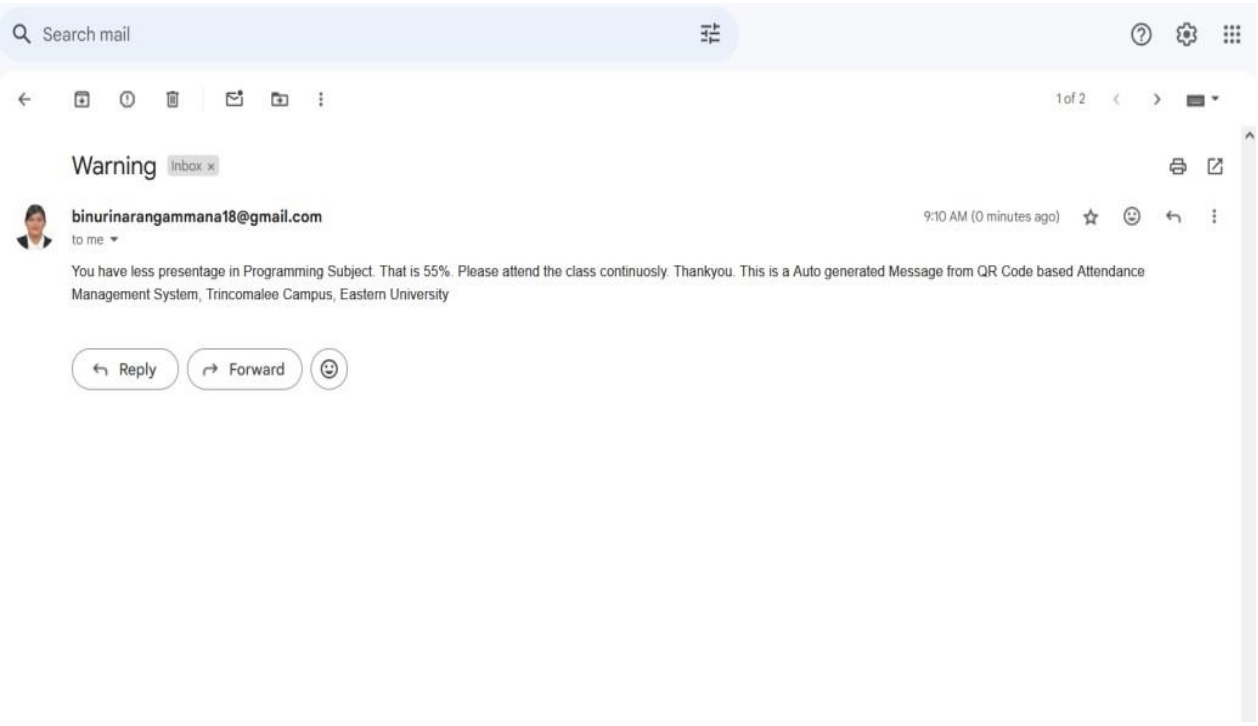


Figure 3.17 Web Application email notification message Interface

The Mobile Application of Displaying Information about the Attendance of the Users. This will help to students to get the idea about their attendance percentage. Students can easily get the idea about low attendance courses. For the low attendance the warning message will be send to the user. After the academic year students can easily view the eligibility of the modules in the Final Examination.

System Testing

Features to be tested / not to be tested

The developer used the Software Testing for identify maximum errors and faults of the QR Code based Attendance Management System. Mainly the System categorized into Blackbox Testing and the Whitebox Testing. Under Blackbox Testing the developer using the Documentation Test, Security Test and Stress Test. The Whitebox Testing using the Database Development Test and System Test for the ongoing project.

Features to be Tested

Table 4.1 - Features to be Tested

Function	Testing Method	Explanation
Sign Up to the System	Blackbox Testing	The main functionality of the system is Sign Up. Once the admin creates an account, they can make changes to the system.
Login to the System	Blackbox Testing	Once the admin creates an account, they can log in to the system using the relevant username and password.
Admin Panel	Blackbox Testing	The admin has the authority to generate QR codes, share them with lecturers, retrieve attendance data from students, track students using student ID, and generate reports.
Student Panel	Blackbox Testing	Students can log in using the user portal and have limited functionalities in the system.
QR Code Generation	Whitebox Testing	QR code is central to the attendance system. It must be generated accurately to ensure correct and efficient output.
QR Code Scanner	Whitebox Testing	A separate mobile app could not be developed within the time frame. Instead, developers must use a third-party scanning app from the Play Store to record attendance.
Attendance Tracking	Whitebox Testing	When a student scans the QR code, the data is updated on the web application and can be tracked by date for further functionalities.
Eligible Calculation	Blackbox Testing	After reviewing attendance data, the admin can calculate eligibility based on a defined method.
Report Generation	Blackbox Testing	The results from eligibility calculations can be shared with stakeholders such as the HOD and Examination Department.
Notification System	Blackbox Testing	The admin can send notifications (e.g., toast notifications) to students with low attendance.
Chatbot	Blackbox Testing	This function is not working properly due to restrictions with API keys.

Features not to be tested

Table 4.2 - Features not to be Tested

Aspect	Testing Method	Explanation
Interoperability	System Testing	The system should be adaptable for any browser and hosted on the web.
Usability	System Testing	The system should not exhibit any errors or failures before the implementation process.
Simplicity	System Testing	The web system has limitations with compatible browsers.
Security	System Testing	The system should be fully secure. Preventing unauthorized access is a key functionality.
Adaptability	System Testing	The system should be hosted on the internet.
Flexibility	System Testing	All system functions should work together to perform accurately and efficiently.
User Friendly Interfaces	System Testing	The user interface should be simple enough for non-technical users like the admin to operate easily.

Test Plans

Table 4.3 - Test Plans

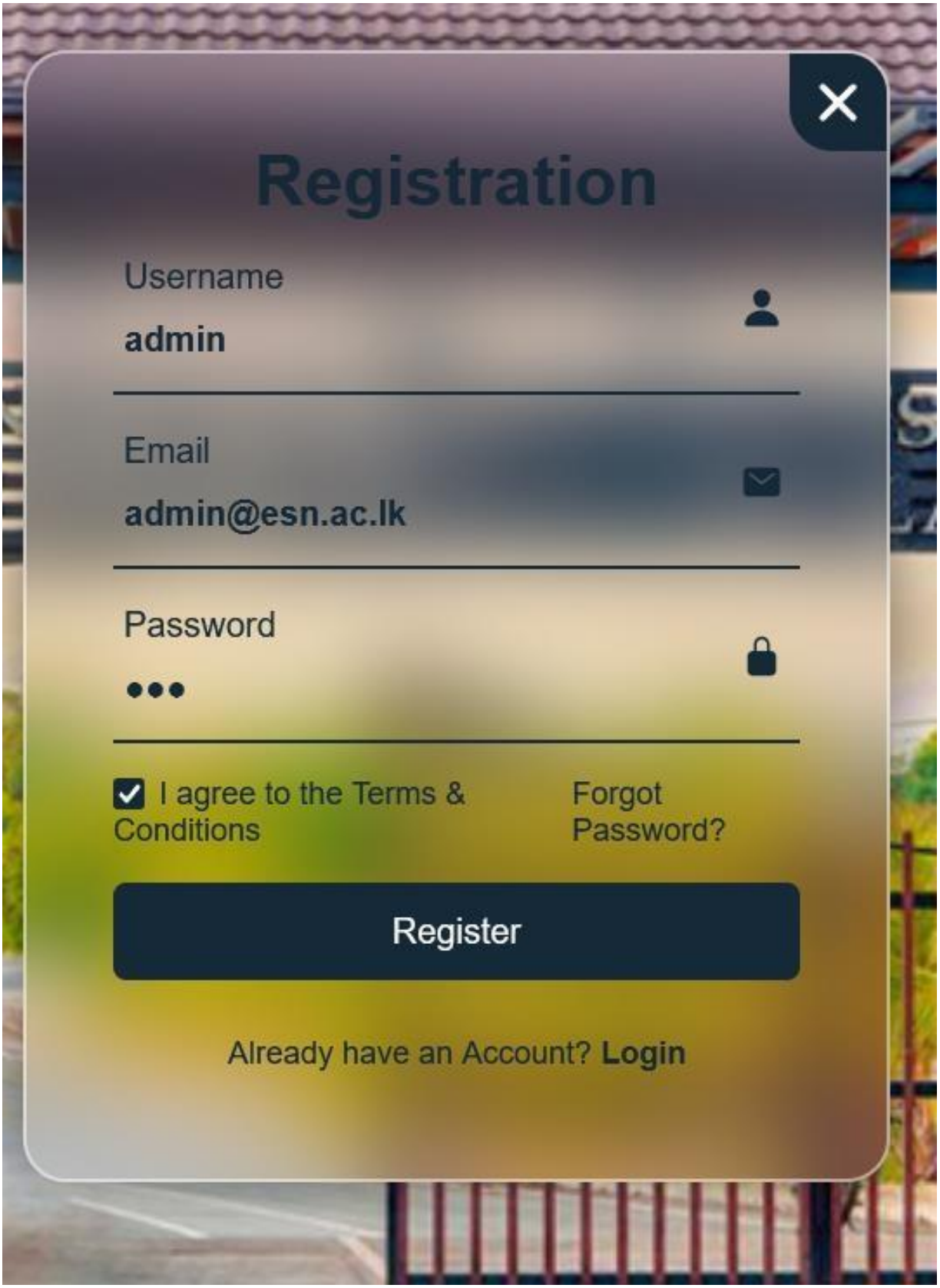
Date ID	Test ID	Test Requirement Addressed	User	Expected Result	Actual Result	Pass/Fail	Corrective Action
08.1.00	1	Sign Up - Admin or User must register	Admin/User	Login to the system	Same as Expected	Pass	None
08.1.00	2	Admin Login through login page	Admin	Login to Admin Portal	Same as Expected	Pass	None
08.1.00	3	Display Admin Portal Functions	Admin	Browse admin page	Same as Expected	Pass	None
08.1.00	4	Display Student Portal Functions	Student	Browse student page	Same as Expected	Pass	None
09.1.00	5	QR Code Module - Generate QR Code	Admin	Generate QR Code	Same as Expected	Pass	None
09.1.00	6	QR Code Scanning	Student	Scan QR Code	Same as Expected	Pass	None

09.1.00	7	Attendance Tracking	Admin	Filter/Search Student Attendance	Same as Expected	Pass	None
09.1.00	8	Report Generation	Admin	Export Report	Same as Expected	Pass	None
10.1.00	9	Student Attendance View	Student	Progress Bar of Student Attendance	Same as Expected	Pass	None
10.1.01	10	New User Adding	Admin	Insert Data Message	Same as Expected	Pass	None
10.1.01	11	Manual Attendance Adding	Admin	Insert Data Message	Same as Expected	Pass	None
11.1.01	12	Student Search, Edit, Delete	Admin	Successful Search/Edit/Delete Message	Same as Expected	Pass	None
11.1.01	13	Attendance Record Search, Edit, Delete	Admin	Successful Message	Same as Expected	Pass	None
11.1.01	14	Send Email Notification for Low Attendance	Admin	Email Sending	Same as Expected	Pass	None
11.1.01	15	Calculation of Student Attendance	Admin	Eligibility Calculation Output	Same as Expected	Pass	None
11.1.01	16	Student Sends Messages to Admin	Student	Message Sent Successfully	Message Didn’t Send	Fail	Code has to be checked again
11.1.01	17	Chatbot Working	Student	Chatbot gives responses	Chatbot didn’t respond	Fail	API key error – needs to be corrected

Implementation and Testing

Table 4.4 - Test Case 001

Test ID	Function	Testing Method	Description	Result
1	Sign Up	Blackbox Testing	The Sign-up form is connected with the database user table. The data is stored in the database. Admin can enter the Email, Username, and Password for Sign Up.	(Result not provided — please specify)



Test ID: 002	Function: Login	Testing: Blackbox Testing. The Login form with username and password	Description: The Login Form with Correct Username and Password. It led to the Home Page.

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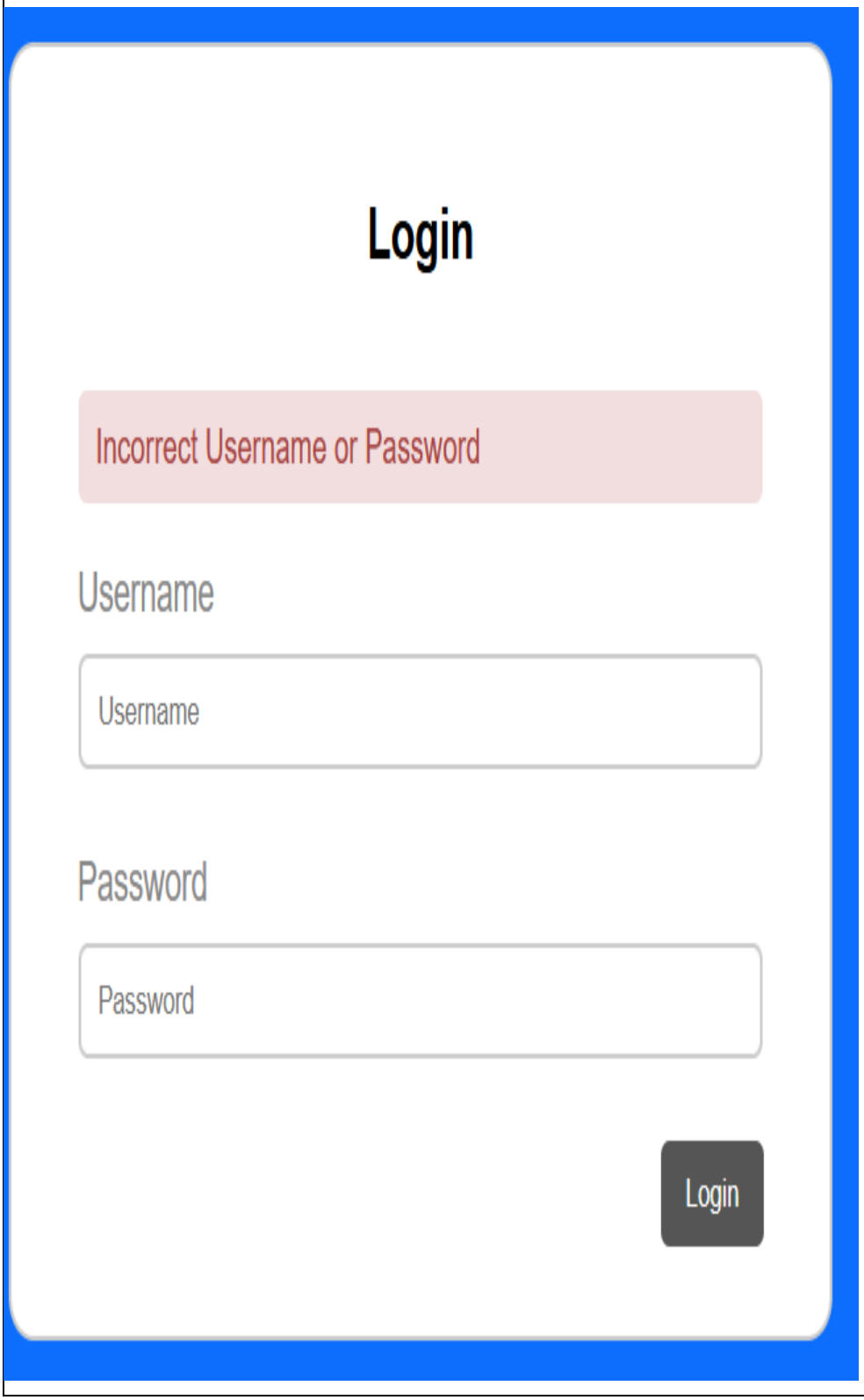
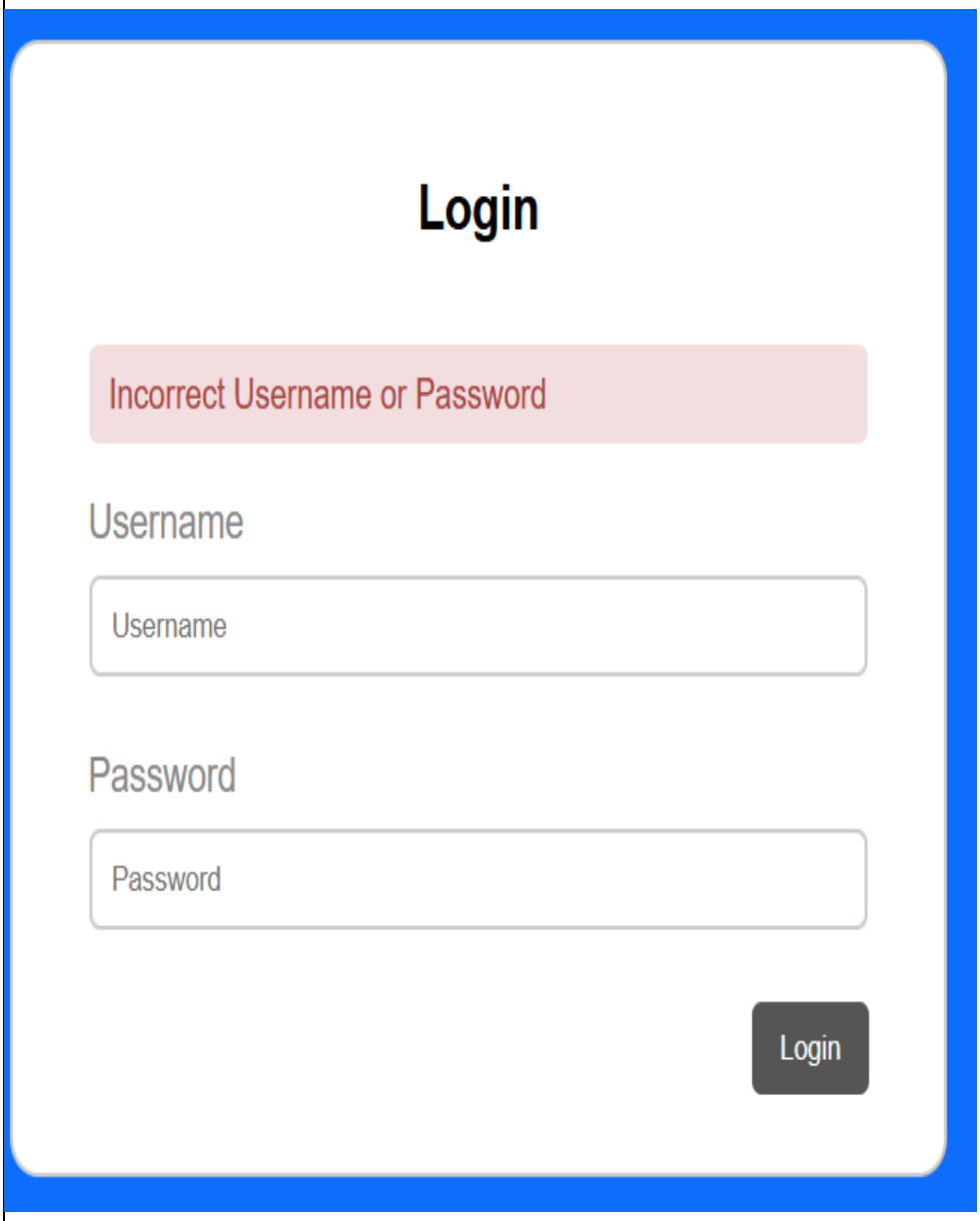
Test ID: 003	Function: Login	Testing: Blackbox Testing. The Login form with username and password	Description: The Login Form with Correct Username and Incorrect Password. The Error message is Displayed.

Result:



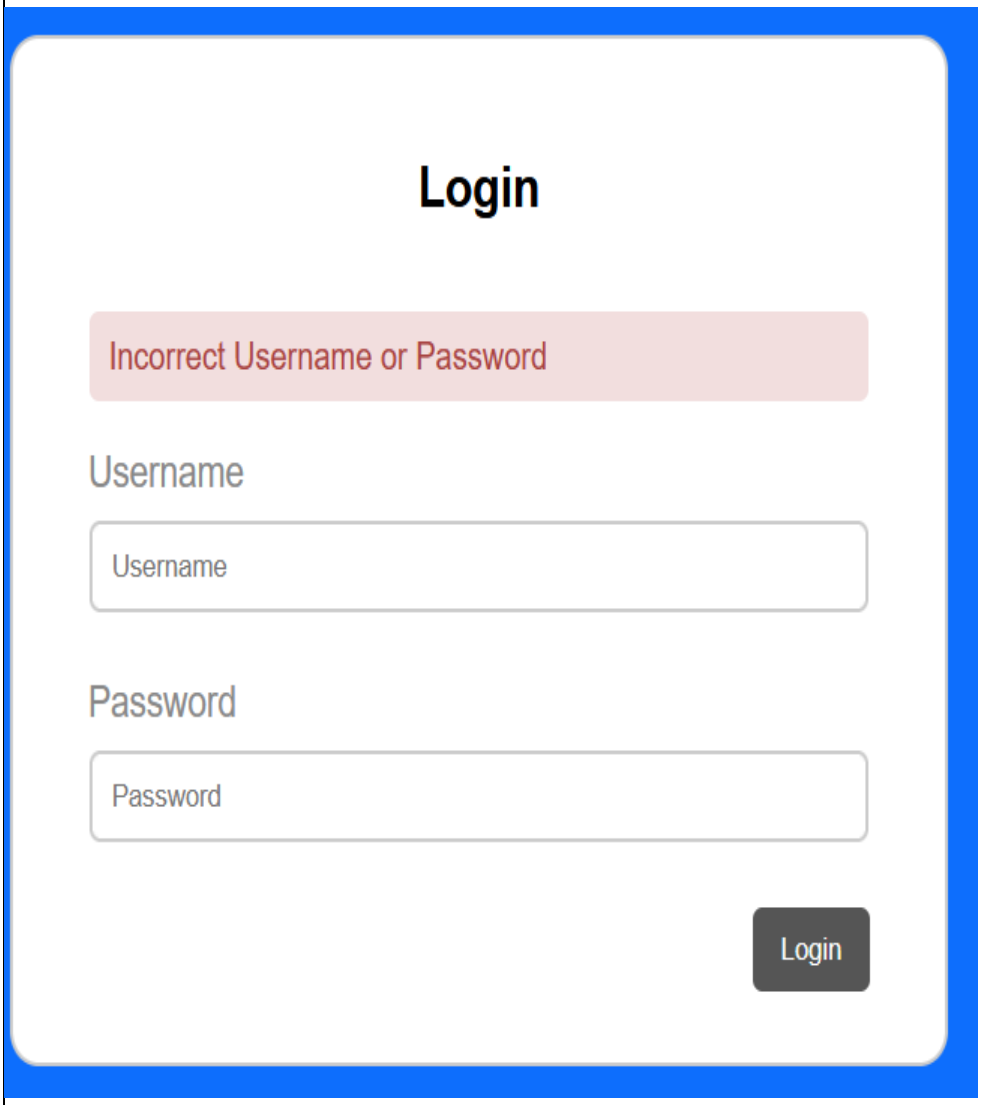
Test ID: 004	Function: Login	Testing: Blackbox Testing. The Login form with username and password	Description: The Login Form with Incorrect Username and Correct Password. The Error message is Displayed.

Result:



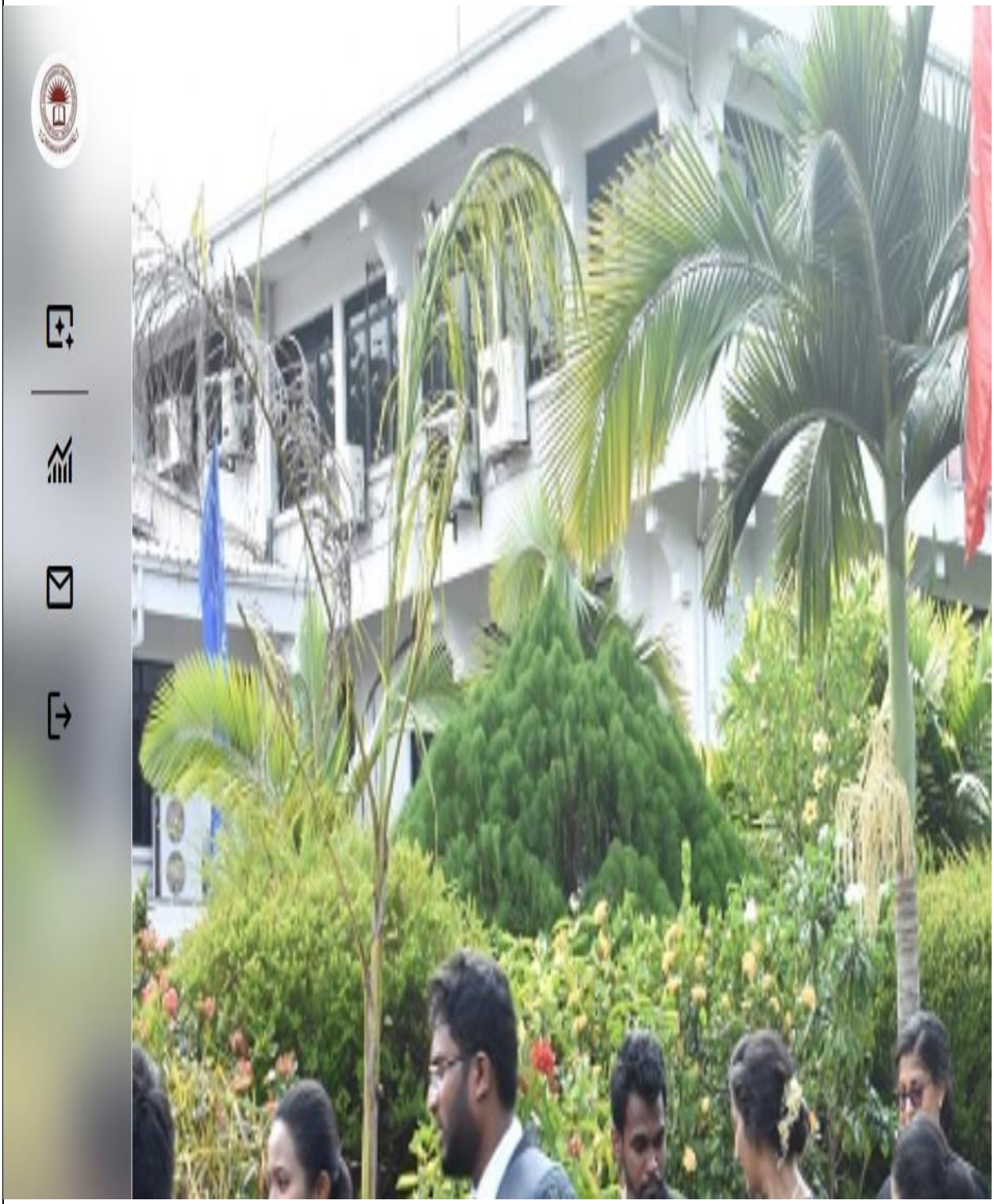
Test ID: 005	Function: Login	Testing: Blackbox Testing. The Login form with username and password	Description: The Login Form with Incorrect Username and Incorrect Password. The Error message is Displayed.

Result:



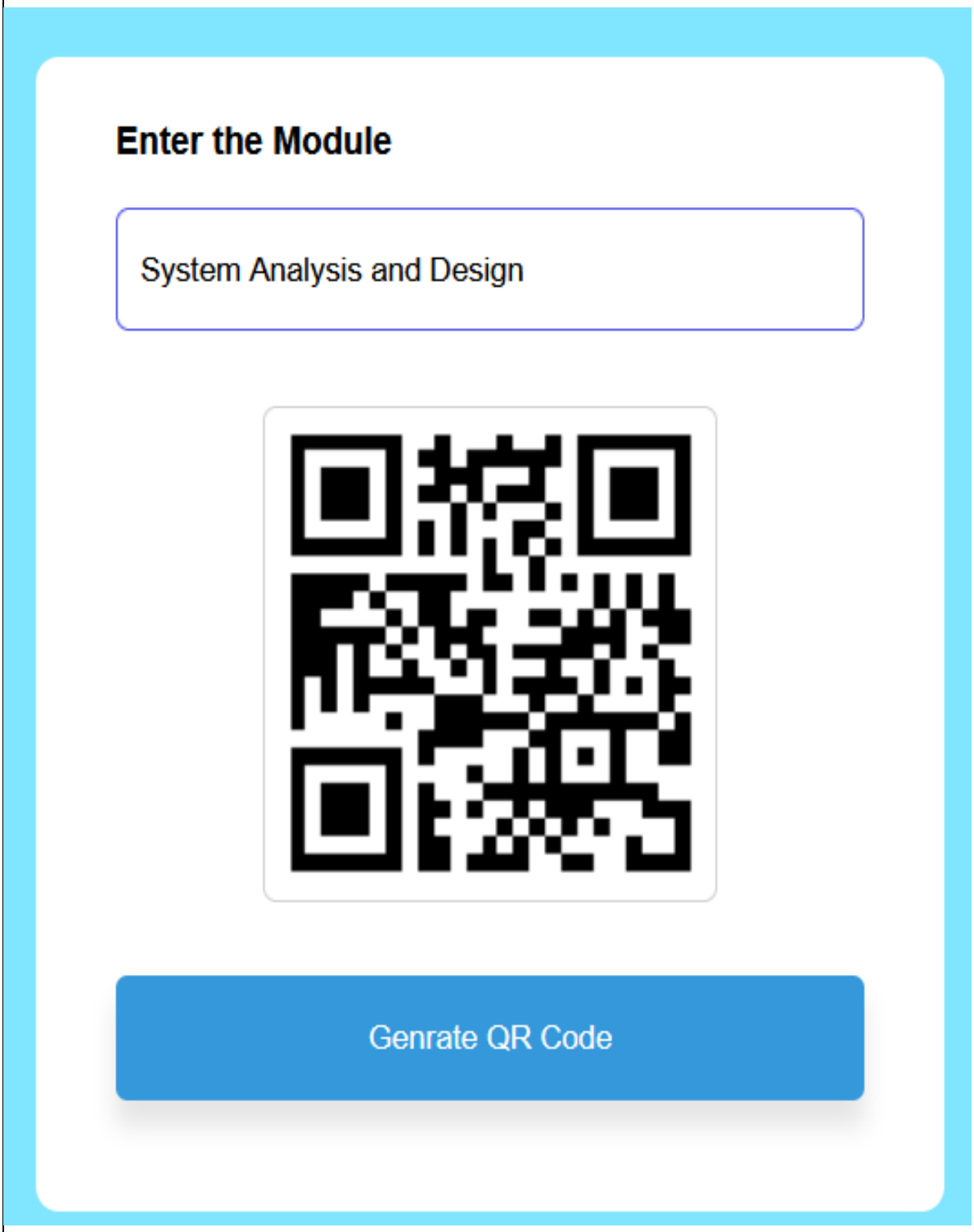
Test ID: 006	Function: Admin Panel	Testing: Blackbox Testing. Browsing the Admin Panel	Description: After the Admin Login the adminm panel is browsing.
Test ID: 007	Function: Student Panel	Testing: Blackbox Testing. Browsing the Student Panel	Description: After the User Login the student panel is browsing.

Result:



Test ID: 008	Function: QR Code Generation	Testing: Blackbox Testing. QR Code is generating using Internet	Description: According to the Module the QR Code is Generating

Result:

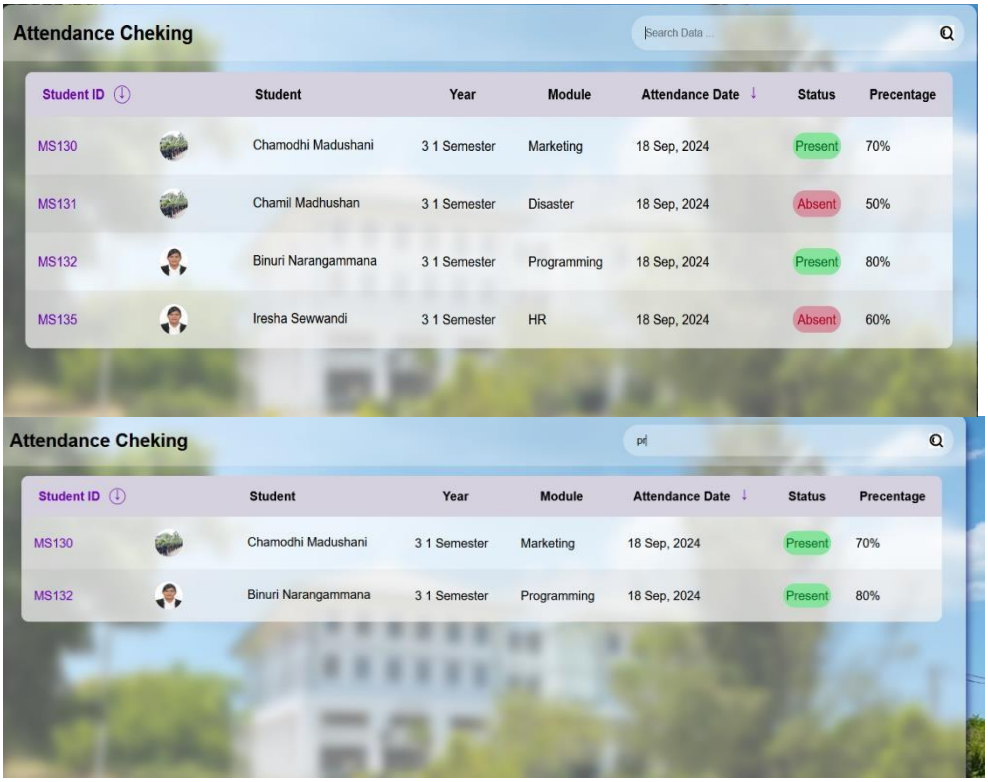


Test ID: 009	Function: QR Code Scanning	Testing: Blackbox Testing. QR Code is scanning using the webpage	Description: According to the QR Code the Result can be Scanned

Result:

Test ID: 010	Function: Attendance Tracking	Testing: Blackbox Testing. The Data can be Filtered	Description: Attendance data can be tracked and filtering by the admin

Result:



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Test ID: 011	Function: Attendance Report	Testing: Blackbox Testing. The report can be export	Description: Attendance data can be exported as the Reports.

Result:

Summary Report

Search Data ...

Student ID	Student	Year	Module	Attendance Date	Status	Precent
MS132	 Binuri Narangammana	3 1 Semester	Programming	18 Sep, 2024	Present	80%
MS130	 Chamodhi Madushani	3 1 Semester	Marketing	18 Sep, 2024	Present	70%
MS131	 Chamil Madhushan	3 1 Semester	Disaster	18 Sep, 2024	Absent	50%
MS135	 Iresha Sewwandi	3 1 Semester	HR	18 Sep, 2024	Absent	60%

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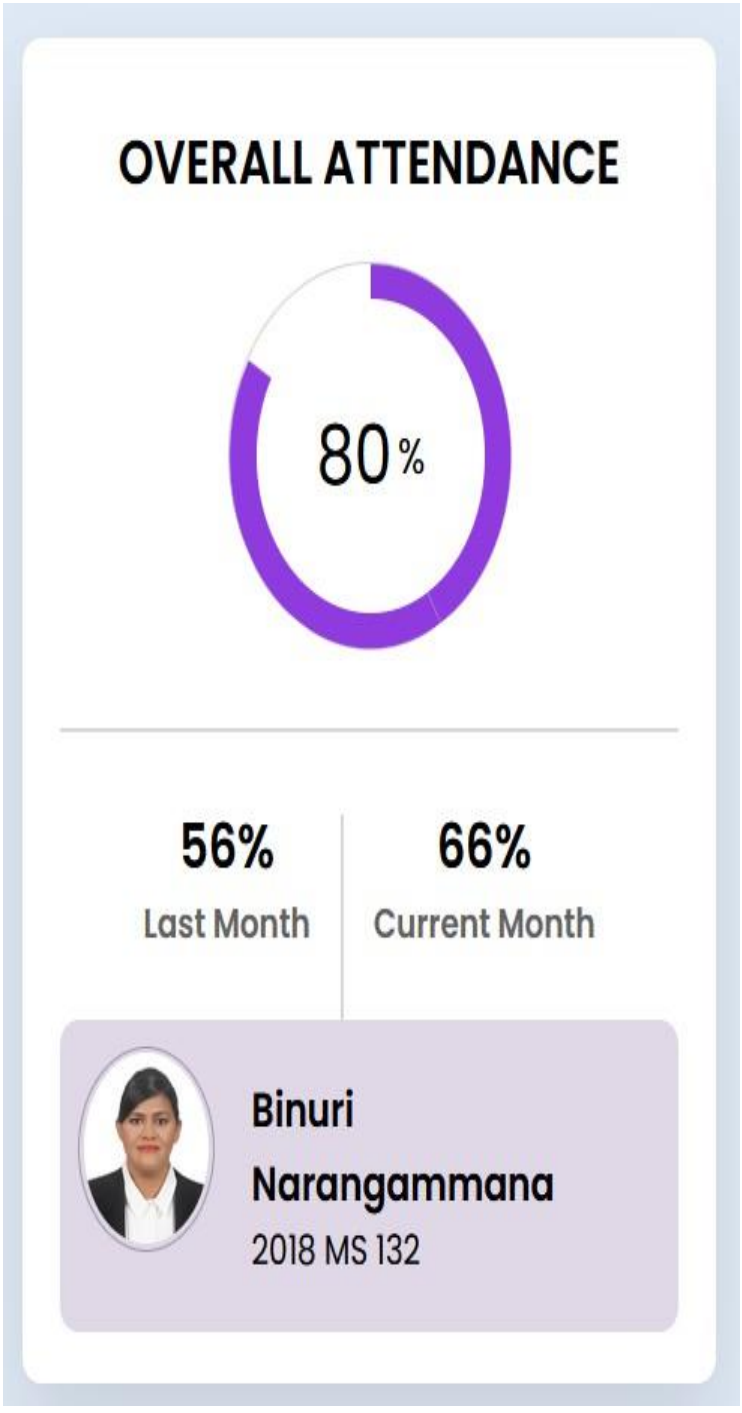
Test ID: 012	Function: Attendance Report	Testing: Blackbox Testing. The student attendance is displaying	Description: Student can track their attendance using progress bar

Result:



Test ID: 013	Function: New Student Adding	Testing: Blackbox Testing. The form is connected with the database student table	Description: The admin can add new student for the System

Result:

Test ID: 014	Function: Search Student Adding	Testing: Blackbox Testing. The form is connected with the database student table. Retrieve the data of the Database	Description: The admin can display the student for the System

Result:

Table 4.18 - Test Case 015

Test ID: 015	Function: Edit Student Adding	Testing: Blackbox Testing. The form is connected with the database student table. Edit the data of the Database	Description: The admin can edit the student data form the System

Result:

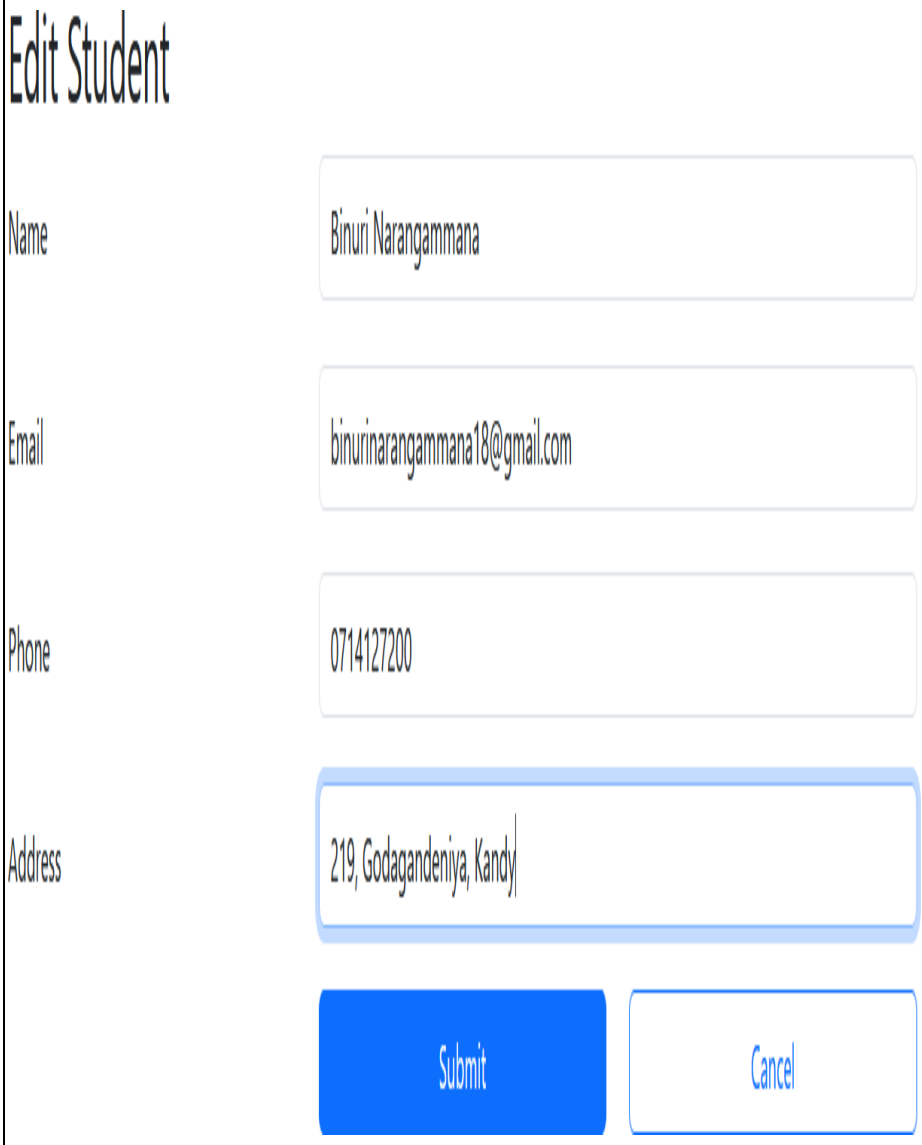


Table 4.19 - Test Case 016

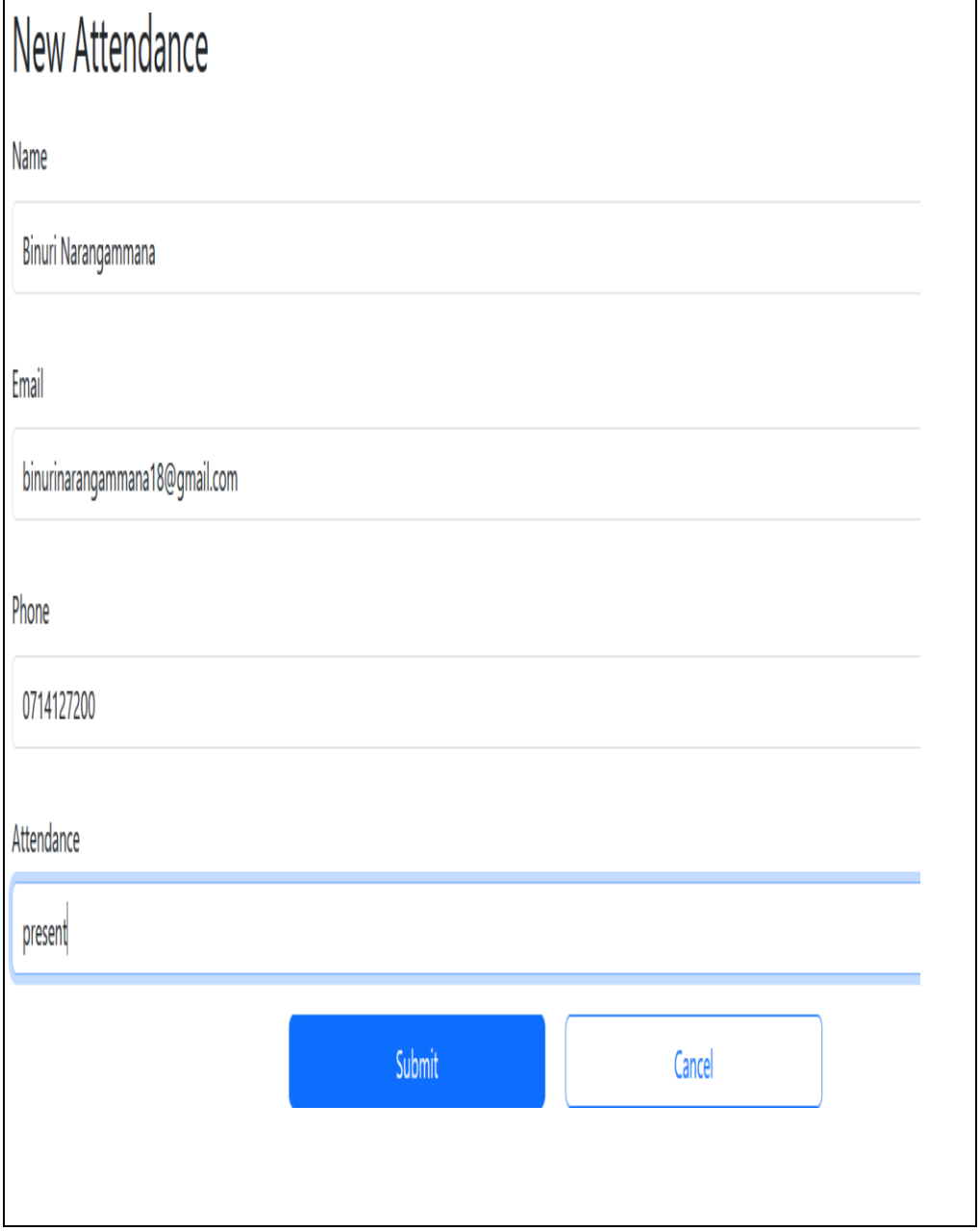
Test ID: 016	Function: Delete the Student	Testing: Blackbox Testing. The form is connected with the database student table. Delete the data of the Database	Description: The admin can delete the student data form the System

Result:

Table 4.20 - Test Case 017

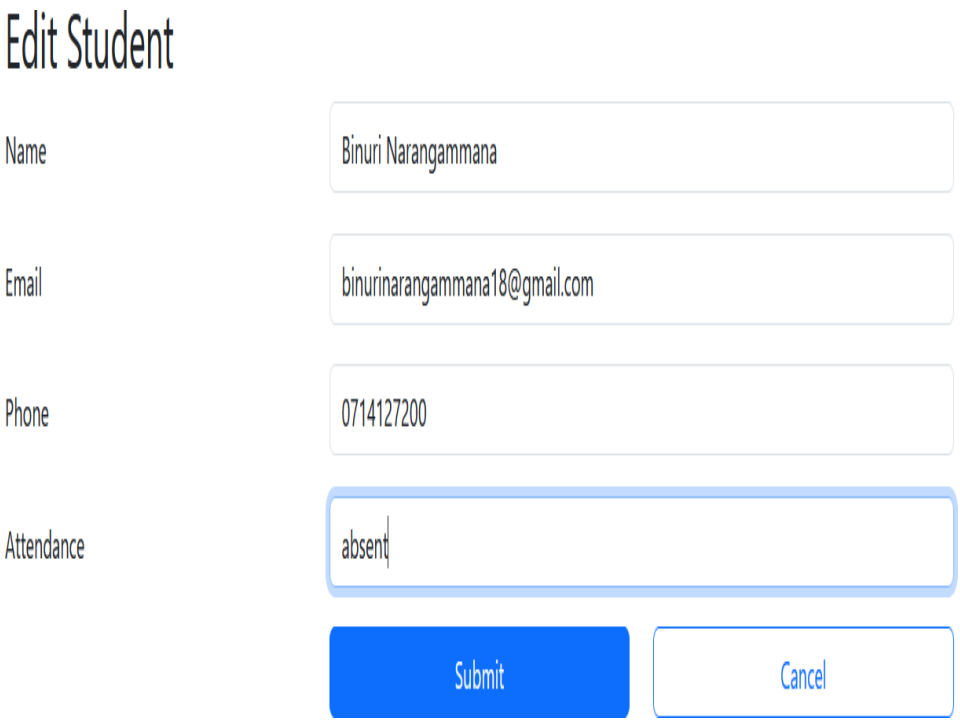
Test ID: 017	Function: Enter new Student Attendance	Testing: Blackbox Testing. The form is connected with the database attendance table. Insert the data of the Database	Description: The admin can enter the student attendance data for the System

Result:



Test ID: 018	Function: Search Student Attendance	Testing: Blackbox Testing. The form is connected with the database attendance table. Search the data of the Database	Description: The admin can search the student attendance data for the System
Test ID: 019	Function: Edit Student Attendance	Testing: Blackbox Testing. The form is connected with the database attendance table. Edit the data of the Database	Description: The admin can edit the student attendance data for the System

Result:



Test ID: 020	Function: Delete Student Attendance	Testing: Blackbox Testing. The form is connected with the database attendance table. Delete the data of the Database	Description: The admin can delete the student attendance data for the System

Result:

Table 4.24 - Test Case 021

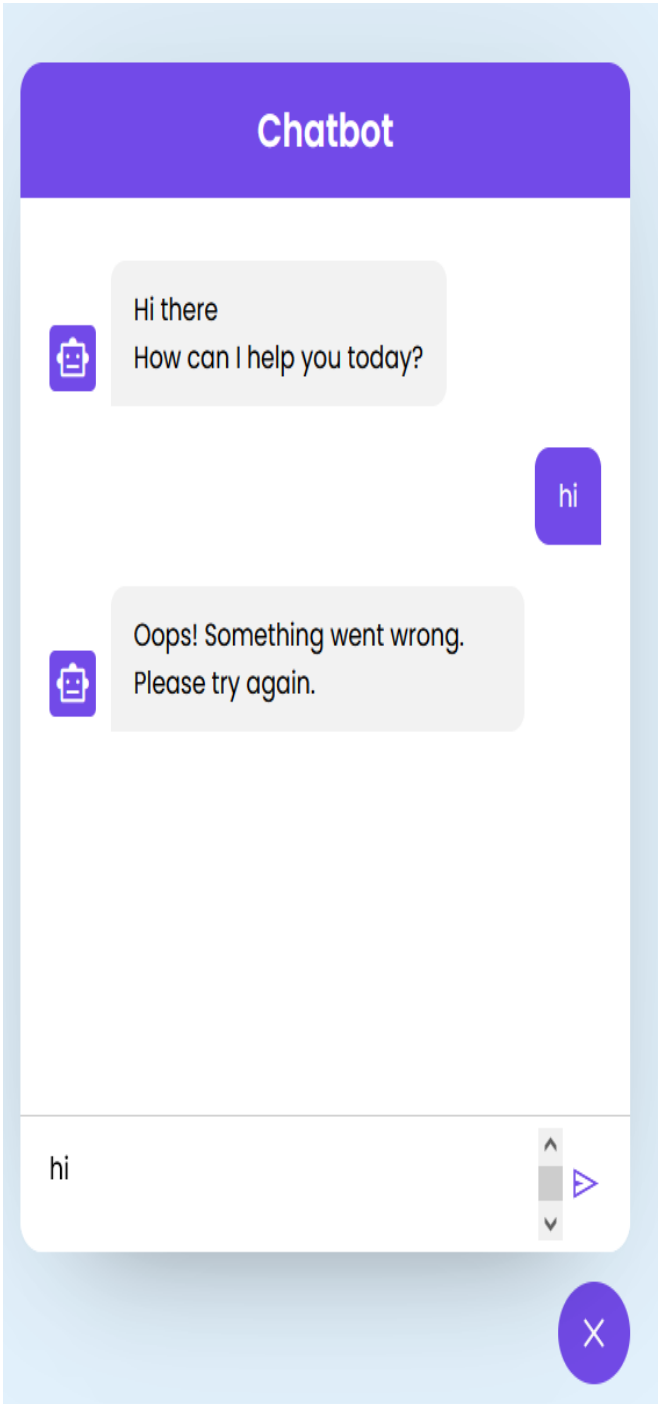
Test ID: 021	Function: Email Notification	Testing: Blackbox Testing. The form is connected with email of the student	Description: The admin can send the warning message for students about low attendance

Result:

Table 4.25 - Test Case 022

Test ID: 022	Function: Chat Bot	Testing: Blackbox Testing. The chatbot can response for the question that student asking	Description: The Chatbot helps to communicate with the students for their relevant questions

Result:



Test ID: 023	Function: Percentage Calculation	Testing: Blackbox Testing. The Eligibility of students can be tested	Description: The admin can calculate the attendance percentage

Result:

Calculate Presentage of Attendance	
Enter Attendance Amount:	100
Enter Precentage(%):	80
	Get Percentage Amount

Original Attendance:	100
Require Presentage(%):	80
Attendance Percentage Amount(%):	80

CONCLUSION

The QR code-based Attendance Management system in Eastern University, Trincomalee Campus is basic system for make the attendance organized in a structured way. This system is a beginner project of the system developer. Most of the universities in the worldwide using innovative system for their attendance purpose. The QR Code Scanning is a beginner system for some of universities.

For adding more value for the system developer plan to add Mobile application for the Attendance Management. The Mobile application that user can scan and present the attendance and also the admin can perform functionalities that are perform in the web application. That will be a complex and useful project for the future undergraduates of Eastern University Trincomalee Campus.

Furthermore, the system developer planned to expand this system into different way of organizing the attendance. This can be expanded toward the Fingerprint based attendance management-based system in future project. That is the trend of the global university's attendance tracking. It will provide accurate and timely manner attendance.

Developer made the first step to break the cycle of the traditional manual attendance taking. The future developers of Trincomalee Campus can modify the QR Code Attendance Management System in Eastern University, Trincomalee Campus into further developed and innovative System.

The process of attendance tracking has always been a crucial and time- consuming task for universities. Traditional methods of attendance tracking, such as manual sign-in, have proven to be inefficient and

unreliable, leading to errors and inaccuracies in record-keeping. To eliminate these issues, the developer implemented a system to overcome the problems associated with attendance recording. That is the Easy and Affordable System of QR Code based Attendance Management System in Eastern University, Trincomalee Campus.

From the Project Proposal to Development of the System there are number of hurdles that developer have to step in. The development process will be harder than expected. But the developer able to manage the system that covers the main scope and functionality of the system that proposed by the documentation. But because of time management and proficiency of making the Mobile Application that proposed in the documentation is a difficult milestone. The developer trying to develop the Mobile Application in further project. The QR Code Attendance Management System in the Trincomalee Campus, Eastern University provide a greater impact for attendance management in Sri Lankan wide other Universities as well. It will reduce the manual paper work and structured the attendance that follow the global innovation. This is the basic system. The future developers can make greater system that follow the global trends of the Universities.

REFERENCES

1. A, C., K, O., & N.O, E. (2017). A bimodal biometric student attendance system. IEEE 3rd International Conference on Electro Technology for National Development, 464-471.
2. Abidin, Matsuura, & Mitrokotsa. (2014). Security of a privacy preserving biometric authentication protocol revisited. International Journal of Computer Application, 290-304.
3. Ahmed, Olaniyi, Kolo, & Durgo. (2016). Smart Attendance System using RFID. Pure and Applied Mathematics, 410-460.
4. Banu, & Marti. (2018). Design of Student Attendance System Using Internet of Things Technology. International Conference on Applied Science and Education, 1742-6596.
5. Belhuechi, Alimi, Cherrier, Lacharme, & Rosenberger. (2011). An Overview on Privacy preserving biometrics. CISP-BMEI, 65-84.
6. Duman, & Gokoz. (2018). QR Code supported Web Based Student Attendance System. International Technological Sciences and Design Symposium, 415- 426.
7. Hameed. (2017). Android based Smart Student Attendance System. Engineering and Technology, 1-5.
8. Kee, S. (2021). Student Attendance system based on QR code with unique identification capturing. 6th International Tourism Conference, 22-25.
9. Manssor, & Sun. (2019). IR Facial Recognition. CISP-BMEI, 1-7.
10. Partha, Chowdhury, Mahamud, & Saifur. (2020). Automatic Student Attendance System using Face Recognition. Engineering and Advanced Technology, 93-99.
11. Qingdong, & Wenting. (2018). College Student Attendance System Based on Face Recognition. Material Science and Engineering, 1757-1800.
12. Sheikh, A., Assami, A., Bahar, A., Suhaibani, A., AIsmadi, AIshabanh, & Tayfour. (2019). Developing and Implementing a Barcode Student Attendance System. Engineering and Technology.