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An Employees Attendance Management System with QR Code

Deebana Kanthi Perumal[1], Nureize Arbaiy[1]*

[1]Faculty of Computer Science and Information Technology,
Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, 86400, MALAYSIA

*Corresponding Author Designation

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Abstract: Tracking attendance is a time-consuming and exhausting process. The same technique for taking attendance will be followed each day. Despite the fact that electronic presence systems are available, many large corporations have yet to implement them. Managing attendance data as it relates to the payroll system necessitates a large number of manual staff. As a result, automated attendance systems can reduce human workers and increase the efficiency of attendance recruitment. The purpose of this project is to automate the tracking of attendance. The development of systems is guided by evolutionary prototypes. The system's users are human resources and workers. Registration and login module, employee profile module, mark attendance module, attendance management module, payroll module, and reporting module are among the six modules of the system. The system is based on the Object - oriented Software Development (OOSD) approach and is written in C#. The project may save time for administrators when controlling attendance, provide ease for employees when registering attendance, and lower the chances of inaccurate attendance records. Future potential for the project is enormous. In the future, the project may be deployed on an intranet.

Keywords: Attendance System, QR Code, Payroll, Leave

1. Introduction

The employees' hours are tracked using the attendance management system. It's the method that is used to track how much time the workers spend working and how much time they spend off. Attendance management may be accomplished by keeping track of staff hours on paper, using spreadsheets, punching timecards, or through online attendance software and many more. Employees should have access to an Attendance Management System in every company. Regardless of how it may be implemented, the system must meet the timekeeping standards of the Employment Act of 1955. Attendance Management Systems also accurately calculate the number of hours that employees work. This is especially useful if the company's employees are paid by the hour. It must be able to determine the precise pay owed to employees by the firm. Also, the firm needs to know if any employees are owed overtime pay. Employee time tracking will also inform the firm about punctuality. This works only if the firm requires employees to record the precise time they enter and exit. The company can determine whether an employee has a habit of arriving late or leaving early.

Corresponding author: nureize@uthm.edu.my

The case study for this project is focused on the employee attendance process conducted at The Store Corporation Berhad which is the leading operator of supermarkets and convenience stores in Malaysia. Based on this project, we mainly focused on The Store Kulim Berhad. The Human Resource officer and the employees faced numerous problems with the existing system. At present, when the employees arrive and leave work, they enter a punch card into a machine. To specify a start and finish time, the machine stamps the date and time on the card. Employees and employers must have a high level of trust in manual time and attendance systems. It requires employees to fill out their punch card accurately and honestly and not engage in time theft or buddy punching.

The manual attendance system starts when the Human Resource (HR) unit sets the time on the machine and checks if the time set is correct. If not, HR needs to reset the time according to the current time. The employees must insert the punch card in the machine and the time will appear on the punch card. Then, the employees need to place the punch card at the card rack according to the employee number. Once all the punch cards are placed, the HR will check the card rack. At the end of the month, the HR will calculate the payroll manually based on the employees' working hours, as well as their late arrivals, early departures, break time, and absenteeism. However, it consumes paper sheets and punch cards which is not eco-friendly. Thus, the Human Resource (HR) experience is time consuming when the officer needs to spend some time on the machine and when to calculate the payment payroll manually.

Hence, an attendance management system is proposed to address the above-mentioned problem. QR code technology is employed to utilize the attendance recording. This approach is created to overcome the weaknesses in the manual system. This software is designed to eliminate or, in some circumstances, minimize the difficulties that this existing system faces. To eliminate data entry errors, the software is kept as simple as feasible. It might help the HR focus on her other tasks rather than maintaining track of the records. As a result, the company will be able to make better use of its resources. This proposed system may lessen the theft and buddy punching among the employees. It may also benefit the HR from time consuming as the system records the attendance and calculates the salary automatically. The HR will not manually set the time on the time punch machine so that it can be more effective. Furthermore, the chance for HR to make mistake will be minimized too as all the information are delivered in a more consistent and simple way rather than referring the information manually

This paper is organized into five sections. The first part introduces the background of the project. The second section describes the related work. In the third section, the methodology is explained. The result and discussion are described in the fourth section. In the last section, a conclusion is given.

2. Related Work

Attendance management is the act of managing attendance or presence in a work setting to minimize loss due to employee downtime. Attendance control has traditionally been approached using time clocks and timesheets, but attendance management goes beyond this to provide a working environment which maximizes and motivates employee attendance [1]. Attendance management is a major part of today's human resource systems; take organization towards better human resource practice, systems and excellence, hence regular attendance and punctuality are expected of all employees or candidates in a work setting. Unsatisfactory attendance caused by unscheduled absences and tardiness cause a disruption in work, affects productivity, and creates morale problems when workloads are shifted to other employees [2].

Based on research on the employee attendance process conducted at The Store Kulim Berhad, there are some problems that are recognized and cannot be resolved. The company is still using a manual punch card attendance machine and paper punch card method to record the attendance of the employees. The manual attendance system starts when the HR unit sets the time on the machine and

checks if the time set is correct. If not, HR needs to reset the time according to the current time. The employees must insert the punch card in the machine and the time will appear on the punch card. Then, the employees need to place the punch card at the card rack according to the employee number. Once all the punch cards are placed, the HR will check the card rack. At the end of the month, the HR will calculate the payroll manually based on the employees' working hours, as well as their late arrivals, early departures, break time, and absenteeism. However, it consumes paper sheets and punch cards which is not eco-friendly. Thus, the Human Resource (HR) experience is time consuming when the officer needs to spend some time on the machine and when to calculate the payment payroll manually.

Some of the issues are buddy punching. It is one of the most common instances of time theft, in which one employee punches the clock on behalf of a late or absent co-employee. Employee time theft is common in the workplace and comes in various forms, the most of which are difficult to detect. The employees may not notice that inserting fake time to their timesheets will have a significant impact on the profitability, but it could make payroll considerably more expensive than intended, depending on the size of the firm. Therefore, the attendance system needs to be enhanced with technological and database capabilities. This is important so that all parties get the benefits and the corresponding work results. The development of the new system will use QR code technology [3], databases, and information systems.

Table 1: Comparison analysis among similar systems

Features / System	Employee Leave Management System [11]	Payroll Management System [6]	Students Attendance Management System [12]	Attendance Management System with QR Code
Module	Streamline the process of submitting and approving leave applications.	Maintain track of hours worked, compute earnings, withhold taxes and other deductions, generate, and distribute checks.	Evaluate students daily in their continuous assessment records and performance.	The attendance status of each employee attendance status, calculate the salary payroll using QR Code
Login and Registration	Staff ID and password	Staff ID and password	Staff ID and password	Staff ID and password
User	Administrator and Employees	Administrator	Administrator, Staff / Lecturers	Human Resources, Employees
Security	Provide authorization access	Provide authorization access	Provide authorization access	Provide authorization access
Notification	Push notification	Push notification	Push notification	Push notification
Platform	Web-based system	Web-based system	Android based application	Web-based system

For comparative case study three related systems were selected. Each function in the system is examined, namely, Employee Leave Management System, Employee Payroll System and Students Attendance Management System. Few comparisons between current similar systems and the proposed system are explained in **Table 1**. The proposed system has its unique features that suit the case study. This system proposes a combination of some modules from the compared version of the system. The

function of modules for the new system has, however, covered the organization business process more widely because the project focuses mainly on attendance and payroll system.

3. Methodology

SDLC stands for Software Development Life Cycle, and it is a technique that precisely describes the process of creating high-quality software [4]. Planning, analysis, design, implementation, testing and integration, and maintenance are the six phases of the SDLC approach. There are a variety of SDLC models available. However, not all of them are appropriate for every type of software development [5].

A total of four phases will be used from the SDLC Iterative model. **Table 2** shows the research activities in each phase to be conduct and followed during the entire research

Table 2: Activity in each phase and its deliverable

Phase	Activity	Deliverable
Analysis	● Determine the stakeholder, determine the issue, and what system features should be included in an attendance management system. ● Conduct requirement analysis o Determine the flow of the project o Determine the process that involves in a system	● Project proposal ● Gantt chart ● List of requirements ● Requirement analysis ● UML ● Class Diagram ● Requirement Traceability Matrix (RTM) ● to-be model
Design	● Produce ● system design ● database design ● user interface design	● System architecture ● Database design (schema and data dictionaries) ● User interface design
Implementation	Develop the system depending on the system's requirements.	● New usable feature ● Code program
Testing	Demonstrate and test the functionality.	● Workable system ● Test plan ● Test cases ● Project reporting

The planning phase is the very first phase of the iterative model, in which the team does proper planning to assist them in mapping out the specification documents, determining software or hardware needs, and generally preparing for the cycle's subsequent stages.

Analysis and design phase will be looked at once the cycle portion has been planned, an analysis will be conducted to identify appropriate business logic, database models, and any other requirements for this stage. Requirement analysis is the process of determining requirements that a developed system needs to fulfill, or user expectation outcome from the proposed system. System requirements include functional and non-functional requirements, user requirements and system requirements. **Table 3** and **Table 4** show the functional and non-functional requirements of the proposed system.

Table 3: Functional requirements

No	Modules	Functionalities
1.	Registration & Login Module	● The system should allow users to login and register into the system using registered username and password. ● The system should only allow a user to login and register as a user with a valid username and password. ● The system should alert the user for any invalid input. The system should redirect users to that respective main menu upon successful login.
2.	Employees Profile Module	● The system should manage the list of employees. ● The system helps to view or update employee details. ● The system should assist in searching information.
3.	Mark Attendance Module	● The system should manage attendance data with QR code ● The system should manage daily notifications. ● The system would manage daily reporting.
4.	Attendance Management Module	● The system should manage attendance information and details. ● The system should generate warning letters & notifications. ● The system should generate an attendance report.
5.	Salary Module	● The system should calculate the salary payrolls based on attendance. ● The system should provide a penalty for those with the worst attendance.
6.	Reporting Module	● The system should generate reports.

Table 4: Non-Functional requirements

No	Requirements	Description
1	Performance	● The interaction between the user and the system should be not more than 10 minutes. ● The system should be able to be used anytime.
2	Operational	● The system should be user friendly. ● The system should be easily maintained and updated. ● The system should be able to work on any web browser.
3	Security	● Only the administrator can generate the report. ● Users can only access their own account with user id and password.

System requirement analysis plays the roles by analyzing the systems generated. The purpose of the system requirement analysis is to determine the general meaning and core idea of the system environment. The Object-Oriented Programming approach is used to undertake system analysis. The following defines the results of the system analysis in the form of a Unified Modeling Language (UML) diagram. **Figure 1** shows the Use Case Diagram of Attendance Management System with QR Code.

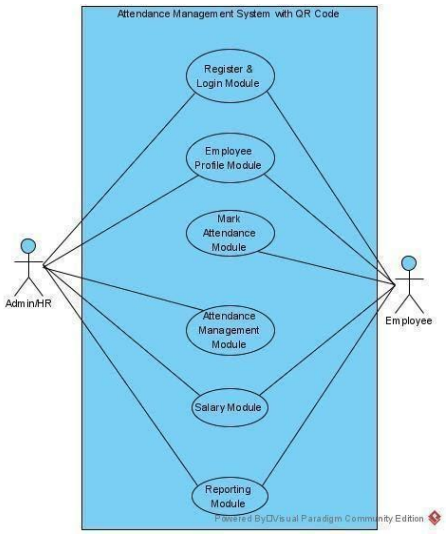

Figure 1: Use Case Diagram

Class diagrams are implemented to describe the structure of the proposed system. A class diagram uses Unified Modeling Language (UML) to depict the classes, attributes, operations or methods, and their relationships in the system. **Figure 2** displays the class diagram of the proposed system.

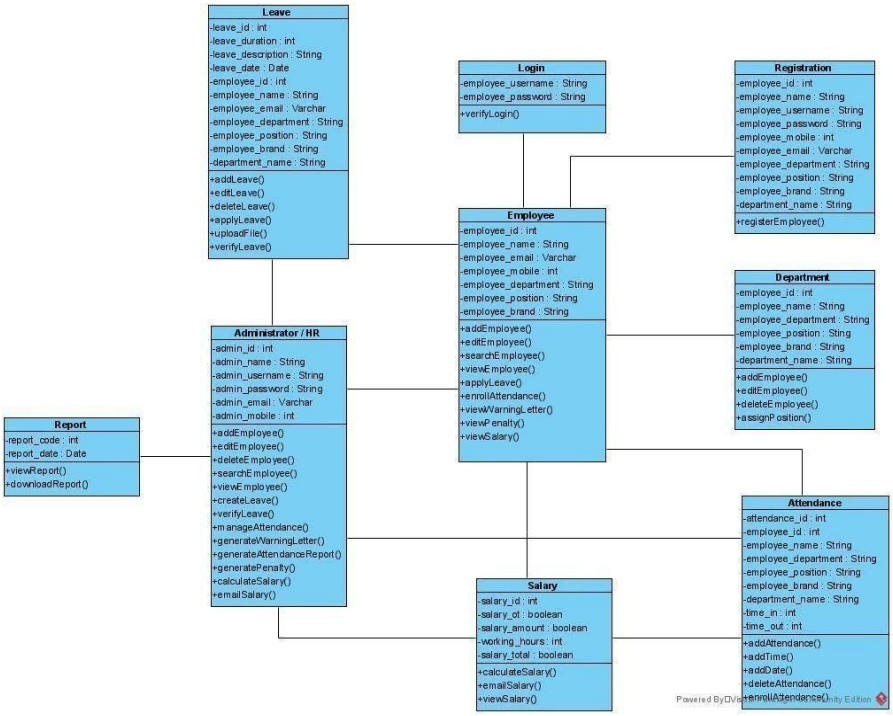

Figure 2: Class diagram

The To-Be Model of the proposed system is illustrated through a swim lane diagram. As the proposed system will be digital, there will be changes from the existing system. **Figure 3** illustrates the swim lane diagram of the proposed system.

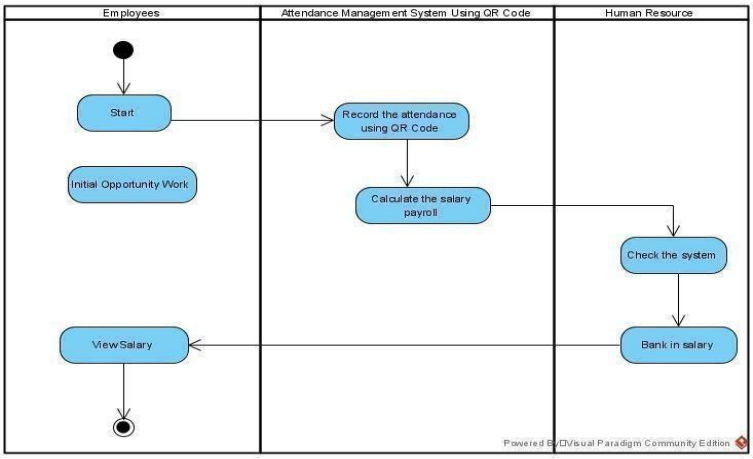

Figure 3: Swimlane of the proposed system

A requirements traceability matrix is a document that shows how requirements and other artifacts are related. It's used to show that a set of requirements has been met. It usually includes a list of requirements, testing, test results, and difficulties. The requirements of this system were listed in **Table 5** to **Table 10**.

Table 5: Requirements Traceability Matrix of Registration and Login Module

Allocated	Description
REQ_100	**Registration and Login Module**
REQ_101	The system should provide employees with the ability to enter new employee details in the registration form.
REQ_102	The system should display the successful account registration message to the employee.
REQ_103	The system shall save details of the new registered employee.
REQ_104	The system shall be able to handle exceptions.
REQ_105	The system shall be able to navigate new users to the login page once the registration is successful.
REQ_106	The system shall not allow employees to submit registration forms if the form is incomplete.
REQ_107	The system shall be able to show login to registered users.
REQ_108	The system should provide registered users with the ability to enter their details in the login form.
REQ_109	The system shall be able to validate the login credentials entered by registered employees.
REQ_110	The system should display the successful login message to the registered user
REQ_111	The system shall be able to navigate new users to the main page once the login is successful.
REQ_112	The system should display registered user's full name on the menu bar once the login is successful
REQ_113	The system shall not allow registered user to login if the login form is incomplete or invalid

Table 6: Requirements Traceability Matrix of Employee Profile Module

Allocated	Description
REQ_200	**Employees Profile Module**
REQ_201	The system shall be able to show employee profile form to employees.
REQ_202	The system should provide employees with the ability to enter new employee or existing details in the contribution form.
REQ_203	The system should display the successful saved employee information records message to the user.
REQ_204	The system shall save details of the new employee details.
REQ_205	The system shall be able to handle exceptions.
REQ_206	The system shall be able to navigate new users to the main page once the employee record is successful.
REQ_207	The system shall not allow an employee to submit an employee profile form if the form is incomplete.
REQ_208	The system will not save the new recorded data if the form is incomplete.
REQ_209	The system shall provide administrator/HR with the ability to search and view employee details.

Table 7: Requirements Traceability Matrix of Mark Attendance Module

Allocated	Description
REQ_300	**Mark Attendance Module**
REQ_101	The system shall be able to show attendance form to employees.
REQ_102	The system should allow users to retrieve data by scanning the QR Code.
REQ_103	The system should display the successful scanned QR Code message to the user.
REQ_104	The system shall save details of the new attendance record.
REQ_105	The system shall be able to handle exceptions.
REQ_106	The system shall be able to navigate users to the main page once the employee successfully stored the attendance record.
REQ_107	The system shall not allow employees to submit attendance forms if the form is incomplete.
REQ_108	The system will not save the new attendance record if the form is incomplete.

Table 8: Requirements Traceability Matrix of Attendance Management Module

Allocated	Description
REQ_400	**Attendance Management Module**
REQ_401	The system shall be able to show attendance management form to the administrator/HR..
REQ_402	The system should provide administrator/HR with the ability to view attendance details in the form.
REQ_403	The system should display the successful stored attendance record message to the administrator/HR.
REQ_404	The system shall save details of the new attendance record.
REQ_405	The system shall be able to handle exceptions.
REQ_406	The system shall be able to navigate users to the main page once the employee successfully stored the attendance record.
REQ_407	The system will not save the new attendance record if the form is incomplete.

Table 9: Requirements Traceability Matrix of Salary Module

Allocated	Description
REQ_400	**Salary Module**
REQ_501	The system shall be able to show Salary Module form to the administrator/HR.
REQ_502	The system should provide administrator/HR with the ability to enter salary details in the form.
REQ_503	The system should display the successful salary message to the administrator/HR.
REQ_504	The system shall save details of the new salary record.
REQ_505	The system shall be able to handle exceptions.
REQ_506	The system shall be able to show Salary Module form to the employee.
REQ_507	The system should provide employees with the ability to view salary details in the form.
REQ_508	The system should provide employees with the capability to download the salary document.
REQ_509	The system shall be able to navigate employees to the main page once the employee successfully viewed the salary document.

Table 10: Requirements Traceability Matrix of Reporting Module

Allocated	Description
REQ_600	**Reporting Module**
REQ_601	The system shall be able to generate a reporting form to the administrator/HR.
REQ_602	The system shall be able to show mark attendance form to administrator/HR.
REQ_603	The system shall be able to show attendance management form to administrator/HR.
REQ_604	The system shall be able to show the salary form to the administrator/HR.
REQ_609	The system shall be able to navigate administrator/HR to the main page once the employee successfully viewed the report.

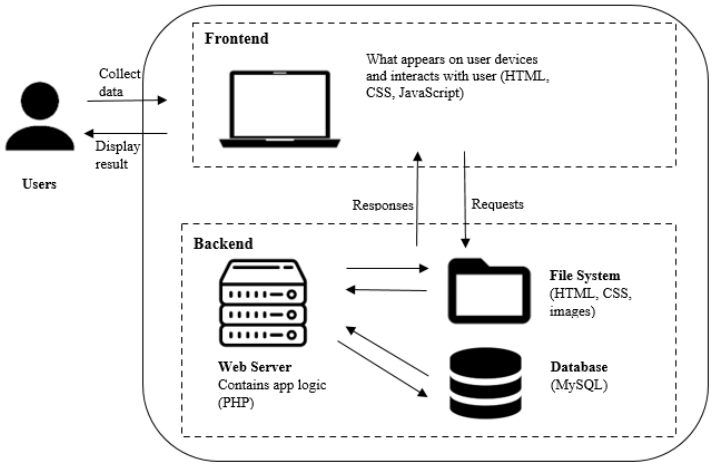

Figure 4: System architecture

The design stage occurs during this phase of the iterative model, when technical requirements are developed and used to satisfy the needs of the analysis stage. The design stage produces system architecture, database design and user interface design. The system architecture introduces a collection of hardware and software components and their interfaces to establish the framework for developing a system. The Attendance Management System with QR Code is required to ease three primary functions which are Handle inputs to the system, process data and store data in the database. Therefore, the web-based system needed to meet the requirements which consists of users, frontend, and backend. This system uses MySQL. **Figure 4** illustrates the architecture of the proposed system.

A database schema is an abstract design representing the data stored in a database. A database schema also establishes the organization of data and the relationships between tables of a database. The database schema of the proposed system is as follows:

i) `Employee (employee_id, employee_name, employee_email,employee_mobile, emploee_department, employee_position, employee_brand)`

ii) `Administrator (admin_id, admin_name, admin_username, admin_password, admin_email, admin_mobile)`

iii) `Login (employee_username, employee_password)`

iv) `Registration (employee_id, employee_name, employee_username, employee_password, employee_email, employee_mobile, emploee_department, employee_position, employee_brand, department_name)`

v) `Department (employee_id, employee_name, emploee_department, employee_position, employee_brand, department_name)`

vi) `Attendance (attendance_id, employee_id, employee_name, emploee_department, employee_position, employee_brand, department_name, time_out, time_in)`

vii) `Leave (leave_id, leave_duration, leave_description, leave_date, employee_id, employee_name, emploee_department, employee_position, employee_brand, department_name)`

viii) `Salary (salary_id, salary_ot, salary_amount, working_hours, salary_total)`

ix) `Report (report_code, report_date)`

User interface (UI) design is about creating interfaces focusing on the convenience and interactivity of the user. The User interface primarily builds an interface the user finds uncomplicated and aesthetically pleasing. The user interface can also be termed as the mediator between the user and the system.

Figure 5 shows the Login Interface. This interface is used by employees and administrators to log into the system. Employees need to log into the system by providing the correct username and password. **Figure 6** displays the Employee Profile Interface. It will be used by administrators and employees. This interface is useful for administrators as it will assist them by providing a searching function. It might also allow the administrator to view and update the employee details. **Figure 7** shows the Mark Attendance Interface. This interface is used by employees. Web module displays QR code that is generated by the backend service module. **Figure 8** shows the salary module. This is the interface where the administrator inputs the salary details while the employee might be able to view or download the pay slips.

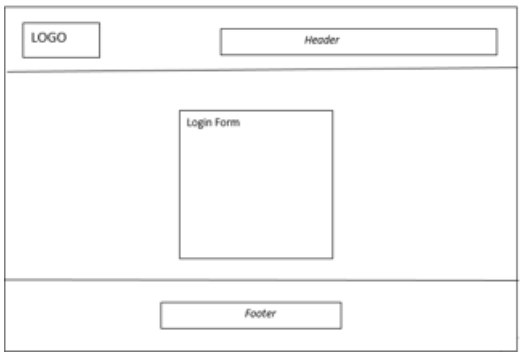

Figure 5: Login Module

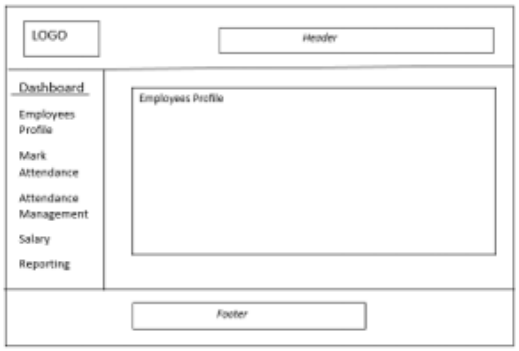

Figure 6: Employee Profile Module

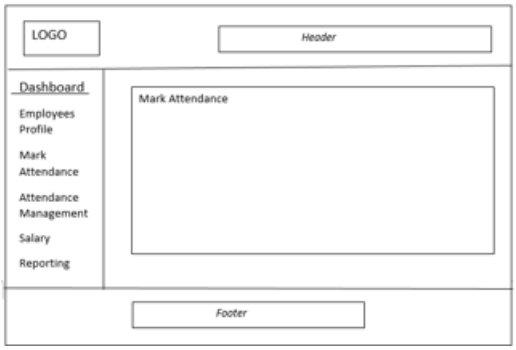

Figure 7: Mark Attendance Module

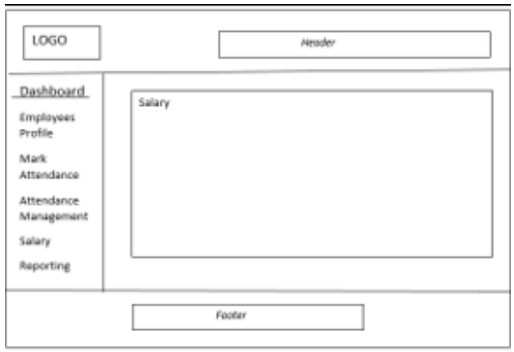

Figure 8: Salary Module

After the second phase is completed, the third and most crucial phase of the iterative model is implemented. Which is followed by the real implementation and coding procedure. All key aspects of the project, including planning, requirements, and design documents, are programmed, and executed in this first iteration. At the testing phase, each version of the program is tested against those criteria inside each cycle of the model to identify and detect any possible errors or problems in the software. Tests must be repeated to validate the most recent and each version of the program, as well as to complete the cycle. The final stage is the evaluation phase, in which the entire team, along with the clients, examines and surveys the state of the project, ensuring that it is as effective as it should be and that the recommended requirements are being fulfilled.

4.0 Result and Analysis

The Attendance Management System with QR Code implementation procedure and system testing are described in this section.

All system development procedures, such as source code, are included in the system implementation. **Figure 9** shows the interface for the login module and employees are asked to enter the user credentials to log into the system. There are basically 2 user types, which are administrator (HR) and employees. If the user credentials are correct, the employee will be redirected to the corresponding homepage. **Figure 10** shows the Employee Profile Interface. Administrators and staff may use it. Administrators will benefit from this interface because it has a search capability. It may also permit the administrator to access and amend personnel information.

The Mark Attendance Interface is shown in **Figure 11.** Employees make use of this interface. The backend service module generates a QR code, which is displayed by the web module. The salary module

is depicted in **Figure 12.** This is the interface via which the administrator enters salary information, while the employee may view or download pay stubs.

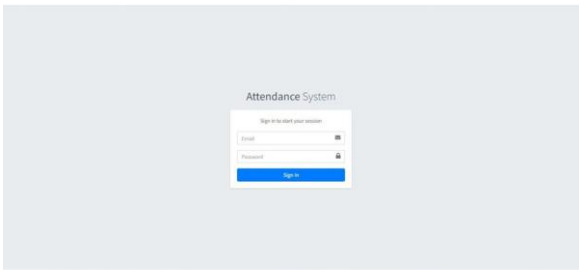

Figure 9: Login Module

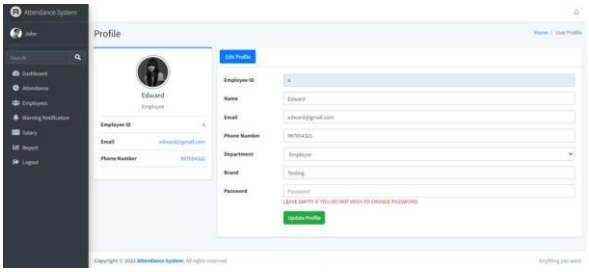

Figure 10: Employee Profile Module

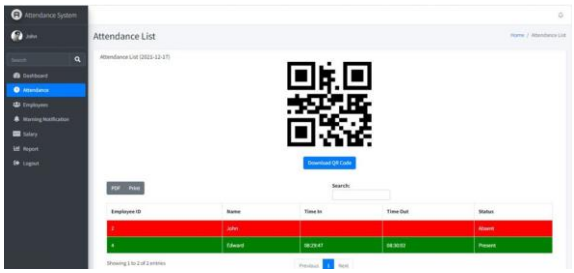

Figure 11: Mark Attendance Module

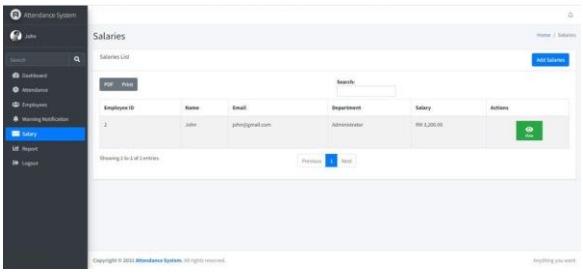

Figure 12: Salary Module

Table 2: Test Case for Login and Registration Module

Test Case ID	Description	Expected Result	Actual	Result
T1-1	To check whether users can login into the system	The user should be able to login into the system	The user has successfully logged into the system	Pass
T1-2	To check whether the system redirect users to respective page after correct credential is entered	The system should redirect users to respective page after correct credential is entered	The system redirected users to respective page after correct credential is entered	Pass
T1-3	To check whether the system will show error message whenever a wrong credential is entered	The system should show error message when an incorrect credentials has been entered	The system showed error message when an incorrect or no credentials has been entered	Pass
T1-4	To check whether administrator can register for an account	The administrator should be able to create for an account	The administrator has successfully created for an account	Pass
T1-5	To check whether administrator can change the role of users	The administrator should be able to change the role of other users.	The administrator has successfully changed the role of other users.	Pass

Following the completion of the system development, a test will be performed to determine whether the system meets the functional and non-functional requirements. The test will be carried out to see if the system is integrated and to ensure that the outcome is correct. Comments and suggestions will be collected in order to keep the system up to date. **Table 2** shows the test case for the Login and Registration module.

Table 3 shows the test case for the Employees Profile module. There are a total of three test cases for this module. The purpose of this test is to verify whether the administrator can manage the list of employees, view or update employee details and search information about the employee.

Table 3: Test Case for Employees Profile Module

Test Case ID	Description	Expected Result	Actual	Result
T2-1	To check whether an administrator can manage the list of employees.	The administrator should be able to manage the list of employees	The administrator has successfully managed the list of employees	Pass
T2-2	To check whether the administrator can view or update employee details.	The administrator should be able to view or update employee details.	The administrator is successfully able to view or update employee details.	Pass
T2-3	To check whether the administrator can search information about the employees.	The administrator should be able to search information about the employees.	The administrator was successfully able to search information about the employees.	Pass

Table 4: Test Case for Mark Attendance Module

Test Case ID	Description	Expected Result	Actual	Result
T3-1	To check whether employees can scan the attendance data with QR code.	The employees should be able to scan the attendance data with QR code.	The employees are successfully able to scan the attendance data with QR code.	Pass
T3-2	To check whether employees can manage daily notifications.	The employees should be able to manage daily notifications.	The employees have successfully managed daily notifications.	Pass
T3-3	To check whether the administrator can handle daily reporting.	The administrator should be able to handle daily reporting.	The administrator has successfully handled daily reporting.	Pass

Table 4 shows the test case for the Mark Attendance module. There are a total of three test cases for this module. The purpose of this test is to verify whether the employees can scan the attendance data with QR code and manage daily notifications. Whereas the administrator can handle daily reporting.

Table 5 shows the test case for the Attendance Management module. There are a total of two test cases for this module. The purpose of this test is to verify whether the administrator can manage attendance information and details and generate warning letters & notifications.

Table 5: Test Case for Attendance Management Module

Test Case ID	Description	Expected Result	Actual	Result

T4-1	To check whether administrators can manage attendance information and details.	The administrator should be able to manage attendance information and details.	The administrator has successfully managed attendance information and details.	Pass
T4-2	To check whether an administrator can generate warning letters & notifications.	The administrator should be able to generate warning letters & notifications.	The administrator has successfully generated warning letters & notifications	Pass

Table 6 shows the test case for the Salary module. There are only one test cases for this module. The purpose of this test is to verify whether the administrator can calculate the salary payrolls based on attendance.

Table 6: Test Case for Salary Module

Test Case ID	Description	Expected Result	Actual	Result
T4-1	To check whether an administrator can calculate the salary payrolls based on attendance.	The administrator should be able to calculate the salary payrolls based on attendance.	The administrator has successfully calculated the salary payrolls based on attendance	Pass

Table 7 shows the test case for the Report Generation module. There is only one test case for this module. The purpose of this test is to verify whether the administrator can generate reports.

Table 7: Test Case for Report Generation Module

Test Case ID	Description	Expected Result	Actual	Pass/Fail
T5-1	To check whether administrator can generate reports	The administrator should be able to generate reports	The administrator has successfully generated reports	Pass

5. Conclusion

Finally, a web-based attendance management system with functional modules has been established with success. When compared to the manual method, the newly built attendance management system can greatly improve the efficiency of the procedure.

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