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SP Mega Mariharta Staff Management System and Dynamic QR Code Attendance System with Role Based Access Control

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Abstract

This project addresses the inefficiencies in traditional staff attendance systems by implementing a modern solution at SP Mega Mariharta. The system is proposed to solve the current manual attendance tracking which is prone to errors and lacks real-time monitoring capabilities. The system incorporating role-based access control and dynamic QR codes where the employees will use a web-based system to generate dynamic QR codes for daily check-ins, enhancing security and convenience. Administrators can manage access rights dynamically based on roles, ensuring data integrity and compliance. Expected outcomes include improved accuracy, efficiency, and transparency in attendance management, benefiting both staff and management.

1. Introduction

Recording employee attendance is a vital component of this management. In addition to ensuring responsibility, keeping an eye on attendance is essential for payroll processing, performance reviews, and compliance adherence in both small and large businesses. The extensive attendance system is to help expedite this crucial procedure [1]. This system offers a variety of features that are specifically developed to satisfy the various demands of contemporary workplaces, all while keeping user ease and organizational efficiency in mind. Regarding this, SP Mega Mariharta manages their staff's attendance in a manual way. Staff in SP Mega Mariharta have to sign their attendance on a piece of paper that contains details like their name, identity card number, check in and check out. Next, if the staff need to apply for leave, they need to fill in a form for the leave request. Besides, all the current workers and the ex-employees' details have been stored manually in this company, which is not so confidential and safe.

So, this system is designed to stored staffs details which is their profile management, where staffs can update their profile time to time for example, if they change their phone number, they can just log into the system, and update their phone number in the profile management view, to enable staffs to apply for a leave application, to enable admin to view the attendance of staffs based on their staff id. Furthermore, many security features have also been proposed to implement to this system so that the data stored in this system maintain its confidentiality, integrity, and availability. [2] For instance, the use of CAPTCHA, multifactor authentication and password encryption and a lot more. By implementing security features, this system will be safe to use and could be user friendly system. SP Mega Mariharta is facing the following problems such as Loss of data confidentiality, integrity and availability, time consuming and prone to human errors. The proposed system is a staff attendance system that includes the security features, functionalities, and objectives of the SP Mega Mariharta. This system allows users to scan in the QR code generated for attendance log in and apply for any leave request through the system. Director of SP Mega Mariharta could also manage employee details such as by enabling or disabling the

details of staff to appear in this system. Also, this system will enable to view back the attendance history of specific date chosen and to view the work status of an employee. This system is developed based on agile methodology. The programming language used in developing this system is PHP and the database is MySQL.

Table 1 *Admin module*

Module	Function
View work status	Admins can view the work status of other staff by entering their staff id to view either they are on medical leave, present or absent
Generate QR Code	Admins generate QR code for attendance
Leave Application	Admins can view other staff's leave application requests while they can also apply for leave by uploading the relevant attachments.
Manage profile	Admins are allowed to register new staff, log in to the system to update their phone number, email and address

Table 2 *Staff module*

Module	Function
Scan QR	Staff can scan the dynamic QR code generated by admin.
Manage attendance	Staff can view history of attendance
Manage profile	Staff can log in and manage their personal information.

Table 3 *Director module*

Module	Function
Manage leave application	Director can either approve or reject leave application request made by employees.
Manage employee details	Directors can enable or disable employees' details from appearing in system.
Manage work status	Director can view work status of employees
Manage attendance	Director can view attendance history of employees.
Manage device	Directors can view the device IP address used by staff to scan attendance.

2. Literature Review

The practice of utilizing an attendance system for evaluating an employee's attendance is an important component of an organization when it comes to assessing salaries as well as providing other benefits. Most firms struggle greatly with employee absenteeism. One of the problems is that management must manually record each employee's attendance [3]. There might not be a more appropriate analogy in business. Regretfully, time is something that everyone struggles with.

2.1 QR Code

Quick Response Code, or QR code, is a trademark for a sort of matrix barcode, sometimes known as a two-dimensional bar code, that was originally created in Japan for use in the automotive sector [4]. Attached to products, bar codes are optical labels that can be read by machines and include information about the product.

2.2 Role Based Access Control

Further complicated versions of RBAC allow us to define relationships between users and roles, roles and permissions, and roles and roles. To prevent a single user from assuming more than one position, it is possible to designate two roles as mutually incompatible [5].

2.3 Zoho people Attendance System

The goal of the attendance monitoring system Zoho People is to make attendance management procedures for businesses more efficient and straightforward. Users can request and track leave, create shift plans, manage attendance, and generate reports using a variety of methods, including clock-in/clock-out, geofencing, and facial

recognition. In this system, there is not required for an OTP when there are any changes made in this system. For example, if an employee wishes to reset their password, they can directly change it without entering one time password. This might affect the integrity of this system [13].

2.4 Calamari Attendance System

Calamari helps companies successfully manage employee attendance and leave policies by increasing transparency and efficiency. Although there are advantages in this system, some security issues could be found through this system such as the vulnerabilities in the authentication procedures of the Calamari system which could result in unauthorized access to confidential employee data, which would be a security concern because there is no role-based access control implemented in this system [14].

Table 4 *Comparison between proposed system and 3 existing related system*

System Features	Calamari Attendance System	Zoho People Attendance System	Existing system	Proposed System
Role Based Access Control (RBAC)	No	No	No	Yes
One Time Password (OTP)	No	No	No	Yes
Register / Login	Yes	Yes	No	Yes
Platform	Cloud-based	Web-based	Paper-based	Web-based
Dynamic QR Code	No	No	No	Yes
Database	Yes	Yes	No	Yes

Additional enhancements can be made to the current attendance systems, Calamari and Zoho People, to increase their security features. By implementing Role-Based Access Control (RBAC), sensitive data would be protected from unwanted access by limiting user access to only the information required by their responsibilities. Additionally, by adding an additional layer of authentication, using One-Time Passwords (OTP) for password resets or important modifications can greatly enhance the integrity of the system. By addressing potential security flaws, these enhancements would provide a more reliable and secure attendance management system.

2.5 One Time Password (OTP)

A password that is only good for a single login session or transaction is known as a one-time password (OTP). Similar to time-synchronized OTPs the user inputs the OTP that is shown on the device at the moment in order to log on. In addition to being a unique instance, challenge-based OTPs frequently make use of hardware. To produce the OTP, the user must supply a known value, such as a personal identification number (PIN). In Europe, this kind of OTP is presently being implemented to give credit and debit cards additional authentication. The current password is generated using a synchronization parameter (the time or counter value), a secret key, and maybe a PIN by some form of cryptographic processing, which is the foundation of all OTP solutions currently in use.

3. Methodology

A methodical approach of designing, developing, testing, deploying, and sustaining systems is called the Software Development Life Cycle (SDLC) as in Fig. 1. It is a framework that describes the stages or procedures involved in software development. Depending on the approach being employed, the SDLC's stages and tasks may change. Agile technique was selected for this suggested system.

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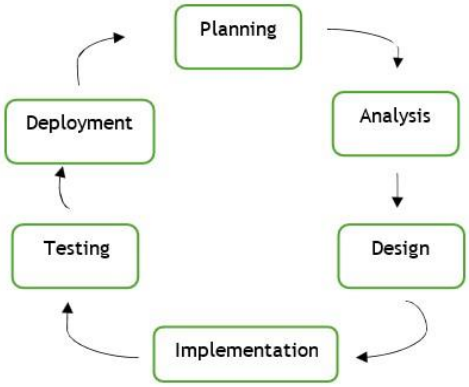

Fig. 1 *Agile Model Methodology*

3.1 Software Development Activities and Tasks

The Planning phase outlining the project's goals, scope, and essential deliverables is part of the Plan Phase. To start, an attendance system is suggested to enhance personnel tracking and administration. Analysis phase determining system specifications and comprehending project needs are the main goals of the analysis phase. It starts by determining the goals, problem descriptions, and parameters while taking user and system viewpoints into account. Next Design Phase focuses on developing the server-side functionality and user interface of the system. A smooth user experience is ensured by the system interfaces' alignment with the functionality of each role. Then, the Implementation phase writing code and integrating all the system's components are part of the implementation phase. Testing phase carries out extensive testing to guarantee that every module operates as intended. This entails finding and correcting mistakes while getting input from interested parties. Finally, after fixing mistakes and receiving comments, the final system is put into use during the deployment phase.

Table 5 *Software development activities and tasks*

Phase	Task	Output
Plan	1. Proposed an attendance system.	Project title and develop Gantt Chart
Analysis	1. Identify the objectives, problem statements and the scopes in terms of user and system scope 2. Study the existing attendance system of proposed system. 3. Determine what are necessary features for the various user roles (Admin, Staff, Director).	Project proposal that defines the specification of requirements. Admin features include staff attendance management and management of attendance QR codes. Staff features include the ability to see attendance history and scan QR codes for attendance. Director functions include checking staff attendance records and approving leave requests.
Design .	1. Developing the user interface and the server-side functionalities. 2. Designing the system interfaces based on the functionalities of each role like admin, staff and director.	Data flow diagram that illustrates the inputs, processing, and outputs of data as it passes through the system. Context diagram that illustrates the external entities that engaged the system with their connections.
Implementation	1. Develop the system using coding. 2. Each interface of system is developed based on the accessibility of each role in the system. 3. To produce a fully functional system, develop and integrate the frontend, backend, and database.	Allow them to view their leave status and attendance history. Then, developed system on the role based privileged access to the system.
Testing	1. Test the functionality of each module	Find errors and gather feedback from module stakeholders and make User acceptance testing (UAT) and security
Deployment	1. Errors and feedback improvement	Systems successfully developed can be used without enhancement and any errors.

3.2 Software and Hardware Requirements

The software and hardware requirements encompass all the necessary components for the project. Table 6 explains the software tools used while developing this attendance system.

Table 6 Software Requirements

Function	Software
Visual Studio Code	Used for developing code
XAMPP	Used for connecting the system to database
PhpMyAdmin	To create the database and tables
Draw.io	To design wireframe design and database design
Lucid chart	To create diagrams such as entity relationship diagram

Table 7 *Hardware requirements*

Hardware	Component
Laptop	HP
System Type	64-bit operating system, x64-based processor
Random Access Memory	8 GB
Processor	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz 1.80 GHz

4. System Analysis and Design

The process of system requirement analysis, which is essential to the development of any software system, involves identifying, documenting, and managing the requirements and conditions that a system must meet. In order to do this analysis, comprehensive information from stakeholders must be gathered to comprehend their needs and expectations, both functional and non-functional (pertaining to how the system should operate) as well as any limitations and operational contexts.

Table 8 *Table functional requirements*

No	Module	Requirement	User
1	Registration	Allow the admin and director to register themselves and to add staff into the system.	Admin, Director
2	Login	Allows all users to log in to the system using credential-based authentication and OTP authentication.	Admin, Staff, Director
3	Profile	Allows users to update their profiles such as updating their phone number, email address and home address.	Admin, Staff
4	Attendance Status	Allows all users to view their attendance history by selecting any dates.	Admin, Director, Staff
5	Work status	Allows admin and director to view employees' work status such as absent, present and on medical leave.	Admin, Director
6	Leave Application	Admin and staff allowed to apply for leave together with the attachments required	Admin, Staff
7	Update leave application	Director allows to either approve or reject leave application	Director
8	Manage employee details	Director manages employees' details such as to enable or disable their data in system.	Director
9	Dynamic QR Code	Admin generates dynamic QR code for attendance	Admin
10	Scan QR Code	All staff are allowed to scan in the QR code to log on to their attendance.	Staff, Admin

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Table 9 *Table non-functional requirements*

No	Requirement	Description
1	Compatibility	System should be able to access in any web browsers
2	Usability.	The system's interface should be user-friendly where it can easily be understood by anyone.
3	Data Security	Data breaches and unwanted access must be prevented by rigorous access controls and the encryption of all sensitive data.
4	Scalability	The system needs to be able to manage increasing user numbers and service demands while remaining dependable
5	Adaptability	The system should be able to integrate and adapt quickly to the current traditional method after being replaced
6	Operational	Users must be able to access the system anytime to scan in their availability attendance.
7	Response Time	Each page load in this system should response within 2 seconds
8	Compliance with standards	The system should follow all the local and regulations international protection.

4.1 General System Architecture

A system's architecture must be constructed to satisfy requirements while ensuring functionality, scalability, performance, and reliability. This consists of establishing and structuring the system's components and the way they interact. Designing an action plan defining every aspect of the system, their relationships, how they work together, and the objectives it seeks to achieve is the first step in the process. The system architectural design of the SP Mega Mariharta is displayed in Fig. 2.

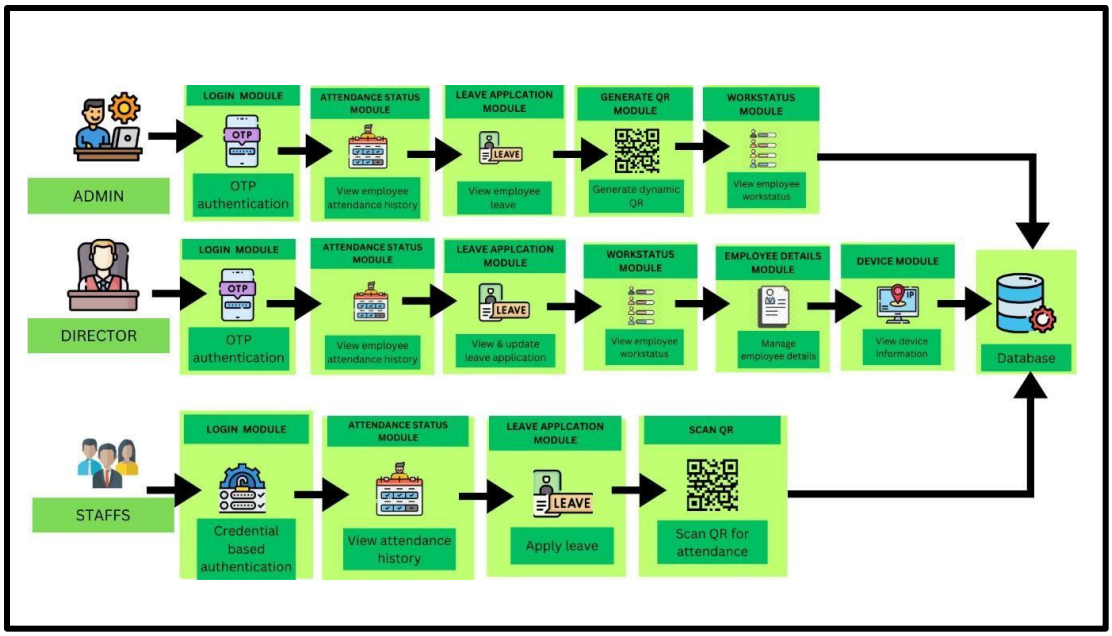

Fig. 2 *System architecture of proposed system*

4.2 System Flowchart

Fig. 3 illustrates the system flowchart. It is a concise and concise illustration model that defines the fundamental framework of the system and how it begins, advances through major steps, and ends.

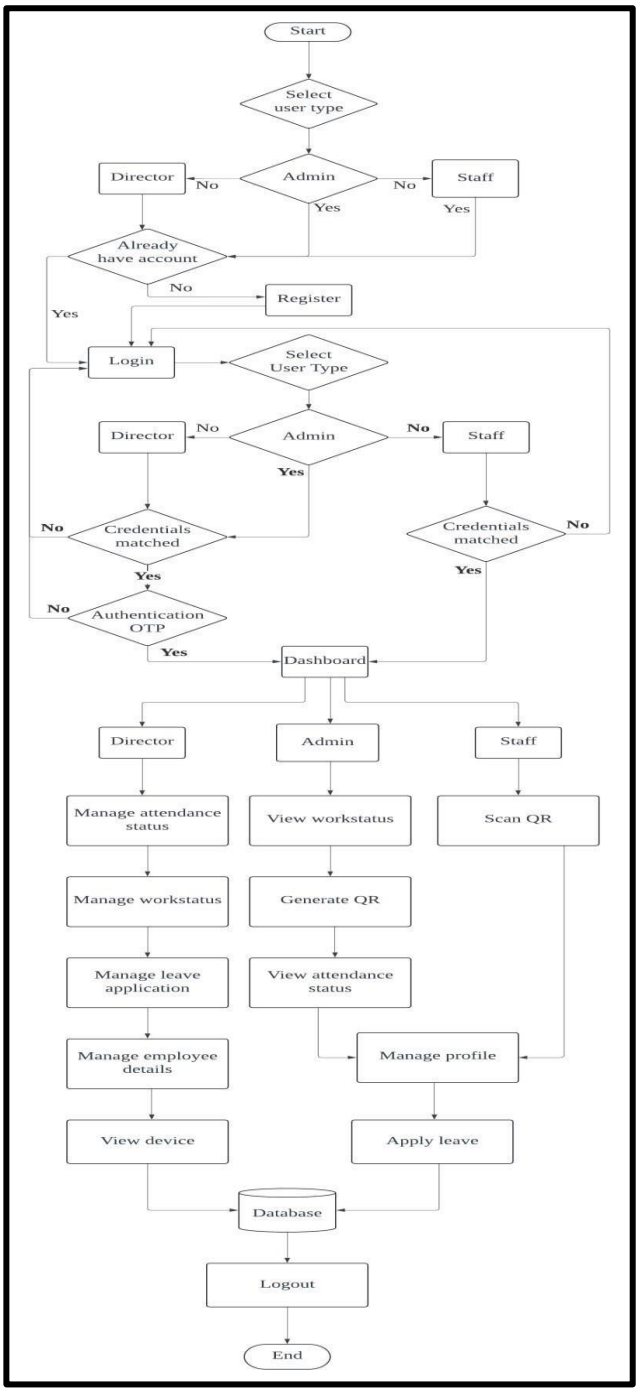

Fig. 3 *System Flowchart*

4.3 Activity Diagram

An activity diagram, which illustrates the interactions between various activities in a particular order, might help one understand SP Mega Mariharta better. It displays the chronology of events as well as the various components that comprise the dynamics of the system. By connecting them with arrows, it makes the variations between processes or activities very evident. Fig. 4, 5 and 6 effectively illustrate the operation of the system by visualizing the decision-making situations, parallel activities (tasks occurring simultaneously), and the execution sequence.

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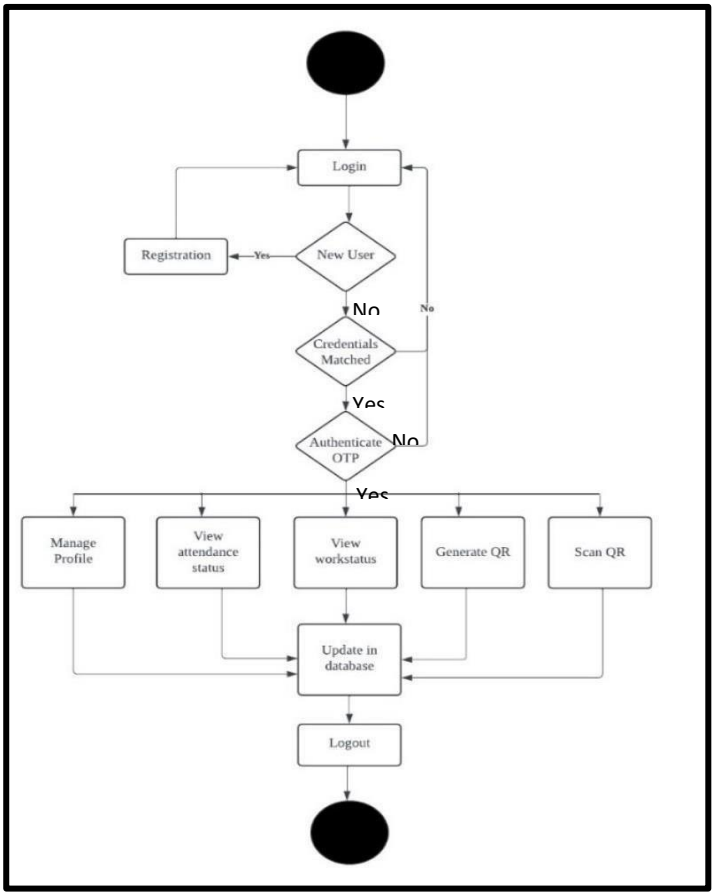

Fig. 4 *Activity Diagram for Admin*

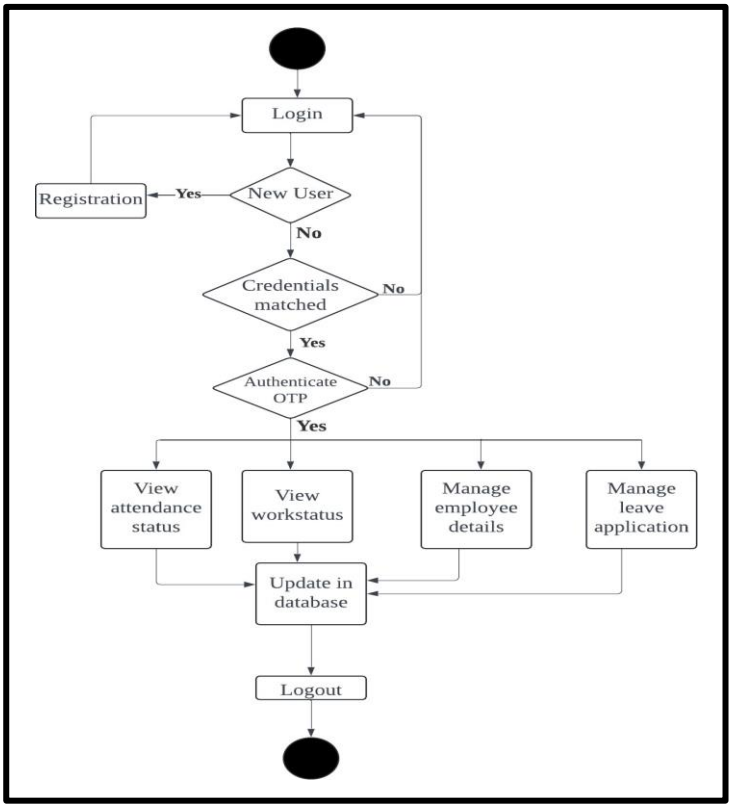

Fig. 5 *Activity Diagram for Director*

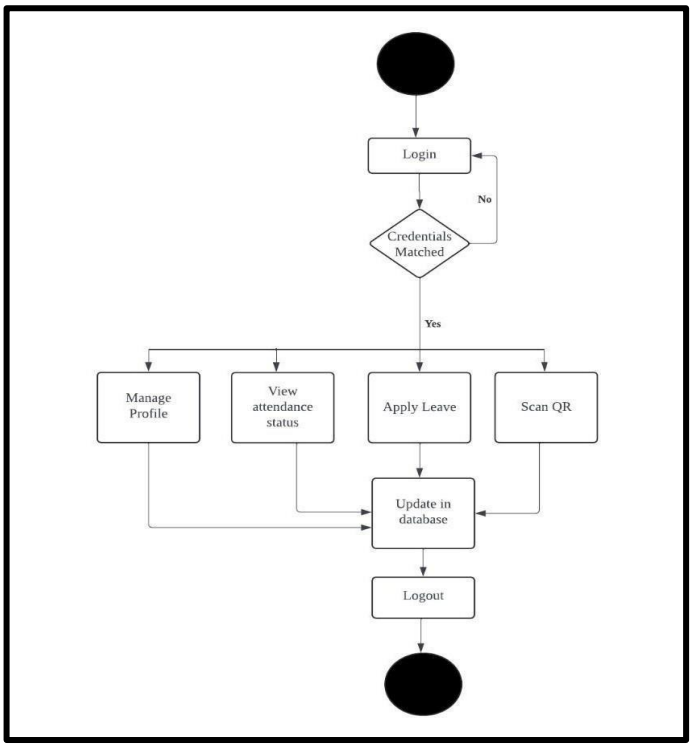

Fig. 6 *Activity Diagram for Staff*

4.4 Data Flow Diagram

Fig. 7 illustrates DFD Level 0, which consists of eight processes, with three users which are admin, directors and staff while having ten data stores. The processes are the register, login, QR code, attendance status, leave application, work status, manage employee details.

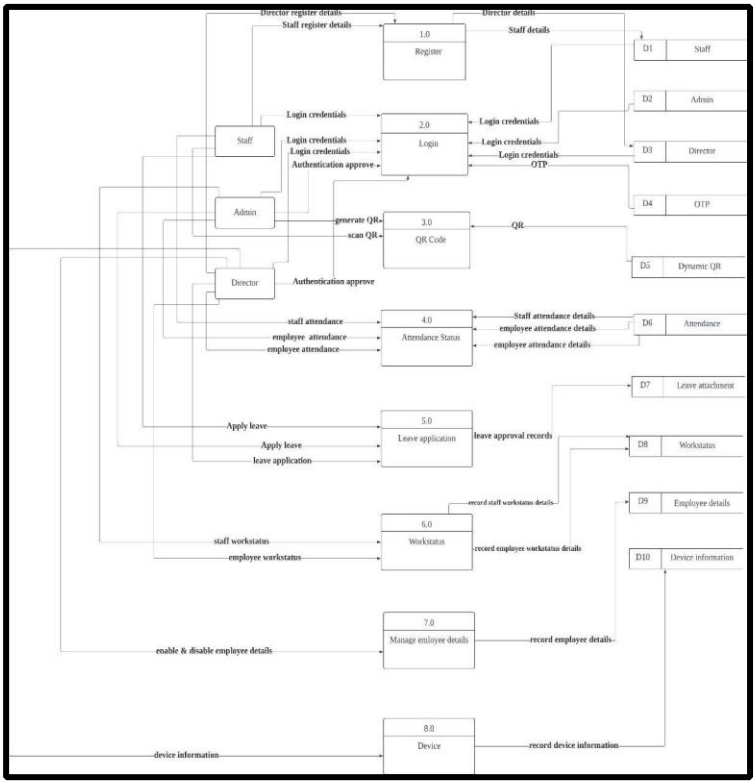

Fig. 7 *Data Flow Diagram*

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4.5 Entity Relationship Diagram

Fig. 8 explains about the ERD which consists of nine entities which are admin, staffs, director, work status, leave application, profile, device, attendance and authentication.

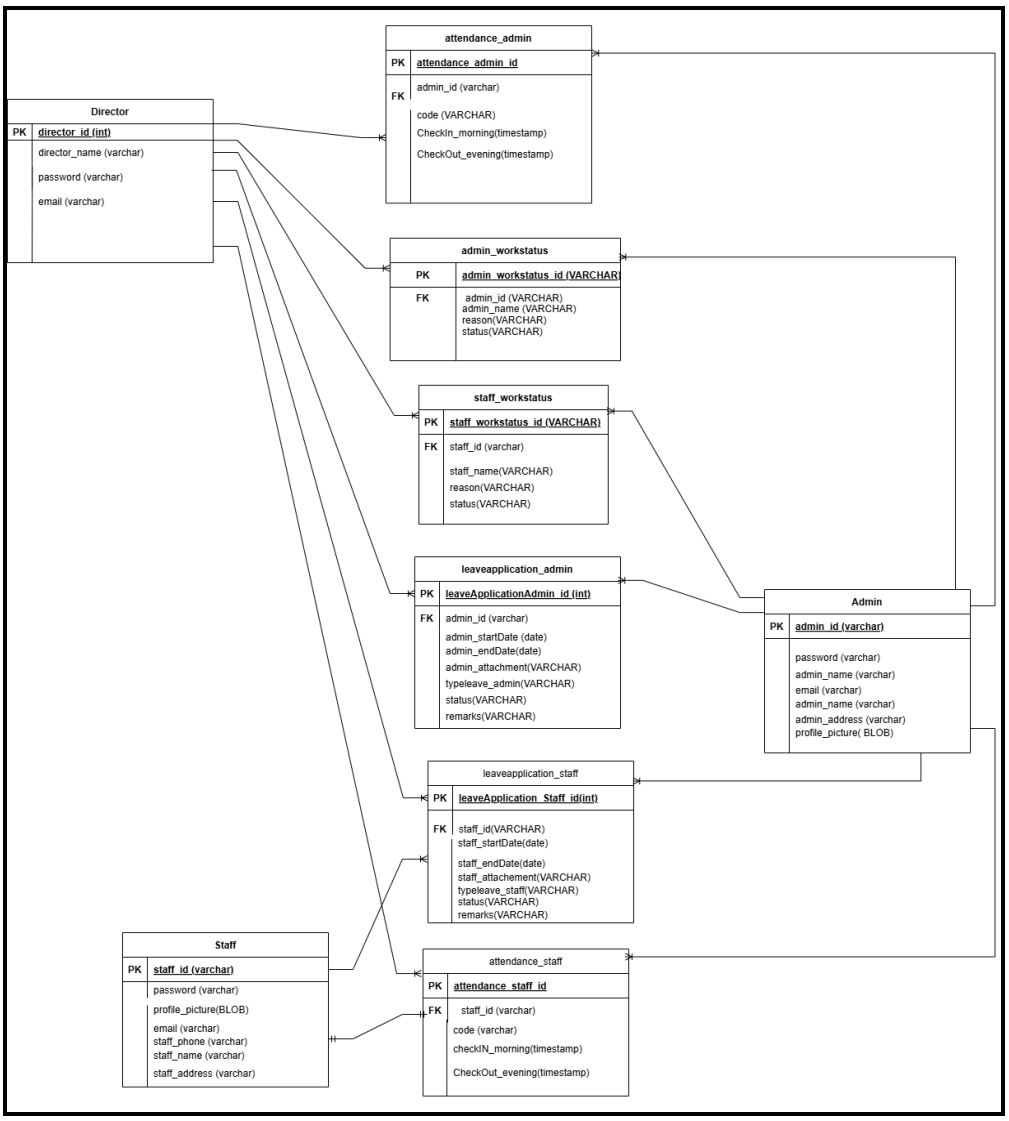


Fig. 8 *Entity Relationship Diagram*

5. Implementation

This section discusses how to develop a security framework that incorporates features like role-based access control, one-time passcode (OTP), captcha verification, username and email validation, password hashing, strong passwords, and account lockout to protect user's confidential data and privacy. This section also discusses the system prototype's implementation and operation.

5.1 Implementation of Security Model

To ensure the privacy and security of user data, a security model must be implemented as part of the implementation phase. The security model is composed of several components, as will be discussed in Fig. 9 to 13. To stop unauthorized access, these include role-based access control, input validation, password hashing, and account lockout techniques. Every element is essential to maintaining the system's secrecy and integrity.

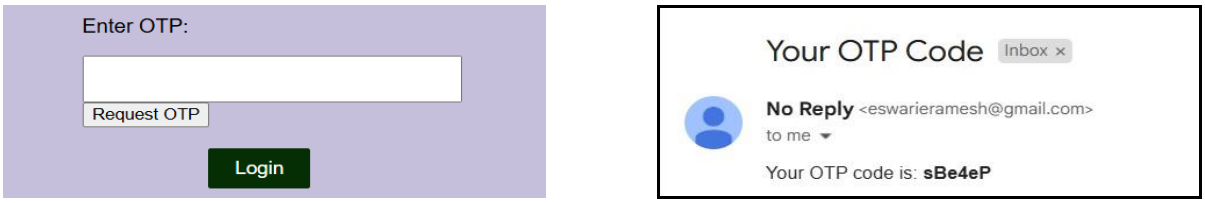
```php
// If password is correct, generate OTP
function generateOTP($length = 6) {
    $characters = '0123456789';
    $otp = '';
    for ($i = 0; $i < $length; $i++) {
        $otp .= $characters[mt_rand(0, strlen($characters) - 1)];
    }
    $_SESSION['otp'] = $otp;
    $_SESSION['otp_expiry'] = time() + 300; // OTP valid for 5 minutes
    return $otp;
}
```

(a)

```php
// Send OTP to admin's email
function sendOtpToAdmin($email) {
    $otp = generateOTP();

    $mail = new PHPMailer(true);
    try {
        $mail->isSMTP();
        $mail->Host = 'smtp.gmail.com';
        $mail->SMTPAuth = true;
        $mail->Username = 'eswarieramesh@gmail.com'; // Your email
        $mail->Password = 'pquy pzwm gumy nsks'; // Your email app password
        $mail->SMTPSecure = PHPMailer::ENCRYPTION_STARTTLS;
        $mail->Port = 587;

        $mail->setFrom('no-reply@yourdomain.com', 'No Reply');
        $mail->addAddress($email);

        $mail->isHTML(true);
        $mail->Subject = 'Your OTP Code';
        $mail->Body = "Your OTP code is: <strong>$otp</strong>";

        $mail->send();
        $_SESSION['success_message'] = "OTP has been sent to your email.";
    } catch (Exception $e) {
        $_SESSION['error_message'] = "Failed to send OTP. Please try again.";
        header("Location: index.php");
        exit();
    }
}
```

(b)

Fig. 9 *OTP generation for login (a) OTP generate (b) Send OTP in email*



(a) (b)

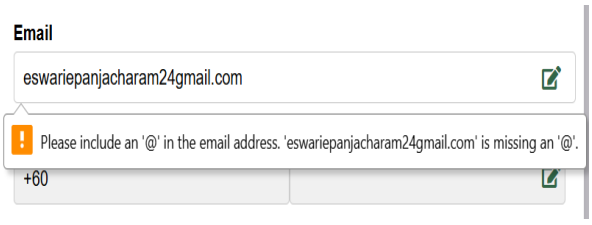
Fig. 10 *(a) Interface OTP request (b) OTP received in email*

(a) (b)

Fig. 11 *(a) Implementation of code for password validation (b) Output in interface for password validation*

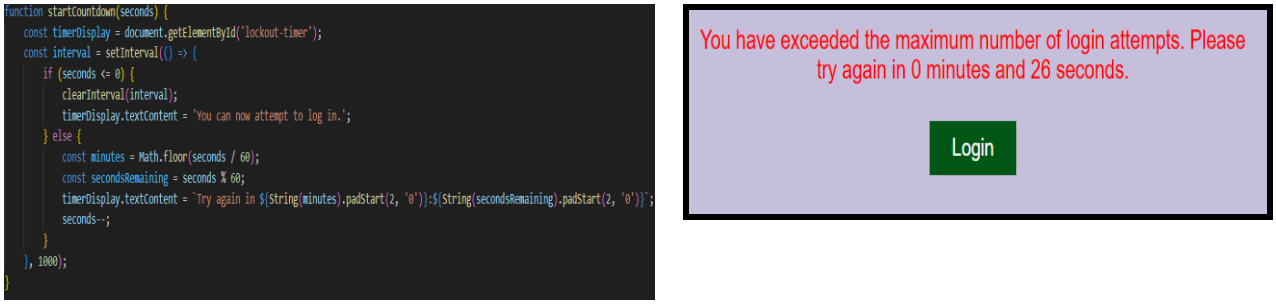
```javascript
// Enhanced email validation
const emailPattern = /^[a-zA-Z0-9._-]+@[a-zA-Z0-9.-]+\.[a-zA-Z]{2,6}$/;
if (!emailPattern.test(adminEmail)) {
    alert('Please enter a valid email address.');
    return;
}
```

(a)



(b)

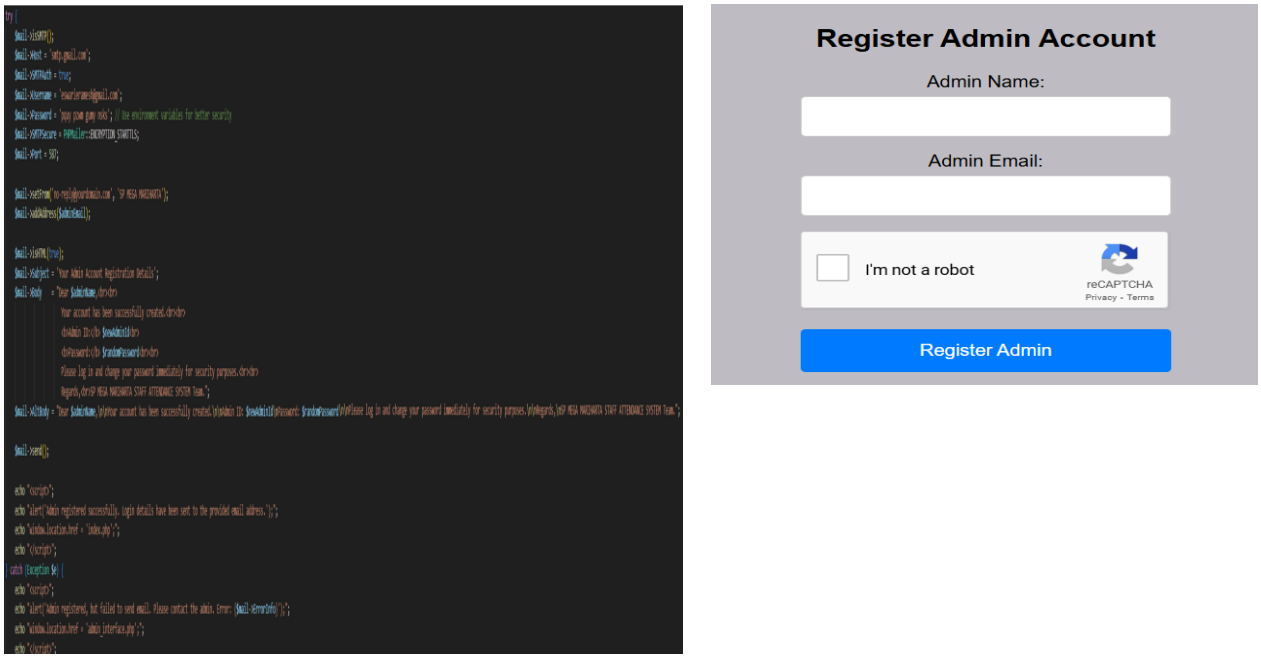
Fig. 12 *(a) Implementation of code for email validation (b) Output in interface for email validation*



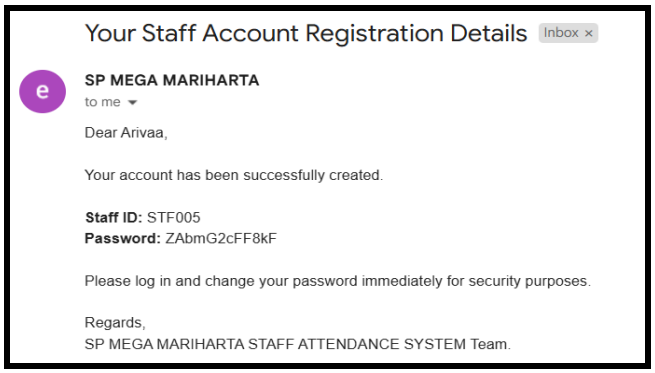
(a) (b)

Fig. 13 *(a) Implementation of code for account lockout (b) Output in interface for account lockout*

5.2 Implementation of Account Registration Module



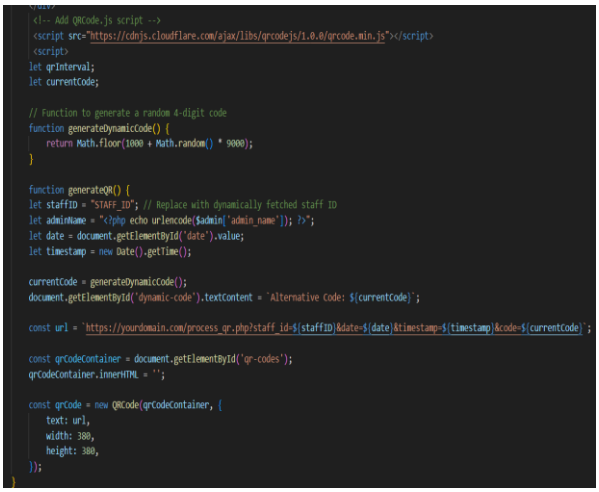
(a) (b)



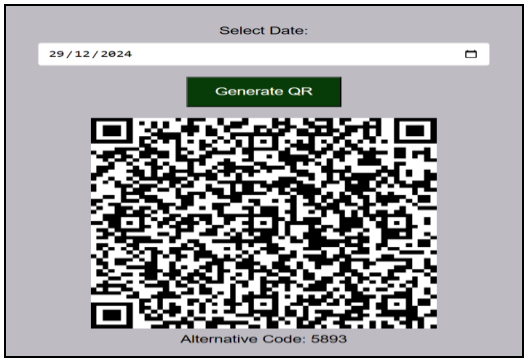
(c)

Fig. 14 *(a) Implementation of code for registration (b) Output in interface for register account (c) Auto generated id and password received in email*

5.3 Implementation of Dynamic QR Code for Attendance Module

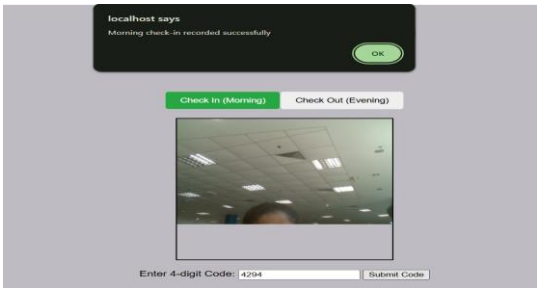


(a)



(b)

(c)



(d)

Fig. 15 *QR Code Generation (a) Implementation of code (b) Generated QR code (c) Implementation of code for scanning (d) Scanner output in system*

5.4 Test Plan

The outcome of the test plan is displayed in this section. The purpose of the test plan is to determine whether the suggested system is operating as intended. The testing procedure employs two different kinds of test plans. The system user test plan comes first, followed by the security test plan.

Table 10 *Shows user test plan*

No	Checklist	Results
SECTION A: All users of system		
1	Users can manage their account.	Pass/Fail
2	Users can view the main interface of system.	Pass/Fail
SECTION B: Director		
1	Director able to approve or reject leave request application.	Pass/Fail
2	Director able to update work status.	Pass/Fail
3	Director able to view the leave requests made by staffs.	Pass/Fail
4	Director able to view the uploaded leave documents by staffs.	Pass/Fail
SECTION: Admin		
1	Admin able to generate QR code with 4 digits dynamically for attendance.	Pass/Fail
2	Admin able to view the leave requests made by staffs.	Pass/Fail
3	Admin able to view the work status of staffs.	Pass/Fail
4	Admin able to register in new staff in system	Pass/Fail
5	Admin able to view the uploaded leave documents by staffs.	Pass/Fail

Table 10 *(Cont.)*

No	Checklist	Results
SECTION D: STAFFS		
1	Staffs able to apply for leave requests.	Pass/Fail
2	Staff can view their attendance for months.	Pass/Fail
3	Staff can upload required documents while applying for leave.	Pass/Fail
4	Staff can reset their passwords.	Pass/Fail
5	Staff can update their profiles.	Pass/Fail

Table 11 *Shows security test plan*

No	Checklist	Results
1	Users may sign up according to their positions.	Pass/Fail
2	Users can receive OTP while resetting their passwords	Pass/Fail
3	Users are not allowed to login with invalid email or usernames.	Pass/Fail
4	Users can login with valid emails and usernames.	Pass/Fail
5	Directors can navigate their roles.	Pass/Fail
6	Admin can navigate through the system based on their role.	Pass/Fail
7	Staff can navigate through the system based on Their role.	Pass/Fail

6. Conclusion

The SP Mega Mariharta Staff Management and Dynamic QR Code Attendance System enhances staff management and attendance tracking with strong security, essential features, and thorough testing, improving operational efficiency and user experience. It enables directors to create passwords, while admins and staff use system-generated credentials for secure login. Staff record attendance by scanning dynamically generated QR codes, and admins manage attendance dates. Directors approve leave requests, staff submit leave applications with document uploads, and admins track leave for payroll processing. Role-based access control, OTP verification, CAPTCHA, secure password hashing, and email validation ensure data security. The system received positive feedback for its ease of use and reliability. Future enhancements include location-based tracking via GPS, geo-fencing, and real-time monitoring to prevent attendance fraud while ensuring accuracy and privacy. The main goals for developing a safe and useful staff management and attendance system for SP Mega Mariharta are well met by the SP Mega Mariharta Staff Management and Dynamic QR Code Attendance System. The system has proven that it can improve the operational efficiency and employee experience of the business by integrating strong security measures, essential functionality, and thorough testing. The system's functionality, security, integration, and user experience will all be enhanced in the future to make sure it can continue to meet the changing demands of its users.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design****: E. Panjacharam, N. Z. Harun;* ***data collection****: E. Panjacharam, N. Z. Harun;* ***analysis and interpretation of results****: E. Panjacharam, N. Z. Harun;* ***draft manuscript preparation****: E. Panjacharam, N. Z. Harun. All authors reviewed the results and approved the final version of the manuscript.*

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Appendix A: User Acceptance Test

SP MEGA MARIHARTA STAFF MANAGEMENT AND DYNAMIC QR CODE ATTENDANCE SYSTEM WITH ROLE BASED ACCESS CONTROL

This survey aims to assess the usability of the Staff Management and Dynamic QR Code Attendance System. The developed web system focusses on managing staff attendance and their leave application with the work status to make sure it will protect the confidentiality and integrity of users details.

Name	CHONG HA PING
Position	HR Assistant
Department	Human Resource
Date	2/1/2025

Please indicate your level of agreement and disagreement with the following statements based on your experience with the system.

User Acceptance Testing

No.	Question	Satisfaction Scale (1-5)				
		1	2	3	4	5
1.	Is the multifactor authentication which is credential based for the staff for login works properly?				✓	
2.	Can staff successfully upload attachments for leave application?					✓
3.	Can staff view their past attendance history?					✓
4.	Can staff successfully record their attendance using 4-digit code					✓

User Acceptance Testing for Director module

No.	Question	Satisfaction Scale (1-5)				
		1	2	3	4	5
1.	Is the multifactor authentication which is OTP for the director for login works properly?					✓
2.	Can the director successfully approve or reject leave application?					✓
3.	Can the director enable and disable employee details?					✓
4.	Is the director able to view information about attendance status, work status?					✓

User Acceptance Testing for Staff module

No.	Question	Satisfaction Scale (1-5)				
		1	2	3	4	5
1.	Is the multifactor authentication which is credential based for the staff for login works properly?					✓
2.	Can staff successfully upload attachments for leave application?					✓
3.	Can staff view their past attendance history?					✓
4.	Can staff successfully record their attendance using 4-digit code					✓

User Acceptance Testing for design aspects

No.	Question	Satisfaction Scale (1-5)				
		1	2	3	4	5
1.	Are all modules' user interfaces (UI) simple to use and intuitive?					✓
2.	Is there similarity in the system design between various screens and functionalities?					✓
3.	Are the layout and navigation sensible, helping users to recognize and use various functions with ease?					✓
4.	Is the target audience going to find the color scheme and visual depiction appealing and appropriate?				✓	
5.	Are there any design features that could make it difficult for users to interact with the system or cause confusion?					✓

User Acceptance Testing for security aspects

No.	Question	Satisfaction Scale (1-5)				
		1	2	3	4	5
1.	Is OTP authentication effective in preventing unauthorized access?					✓
2.	Are private information and user credentials sufficiently shielded from intrusions and unapproved access?					✓
3.	Does the system utilize encryption methods to secure data transmission and storage?				✓	
4.	Does the system's security inspire trust in its usability?					✓
5.	Does using the system feel safe overall?					✓

Signature:

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