# Project Proposal

# QR Based Attendance Marking System

**[Group No. 09]**

QR Based Attendance Marking System

# Contents

# 1. Introduction

## 1.1 Problem Domain

In the traditional manual attendance marking system prevalent in educational institutions, including our university, numerous challenges have been identified that hinder efficiency, accuracy, and overall effectiveness. These challenges necessitate the exploration and implementation of modern solutions to streamline the attendance management process.

### Manual Attendance Marking Challenges

- Current manual attendance systems often rely on time-consuming and error-prone methods, such as paper-based sign-in sheets or manual entry into electronic systems.
- These techniques can result in fraudulent activity, manipulation, and mistakes, making attendance records untrustworthy.
- Administrative burdens associated with manual data entry and verification consume valuable time and resources, detracting from more productive endeavours**.**

### Limited Accessibility and Convenience

- Students face hurdles in accessing and marking their attendance, particularly in large lecture halls or when absenteeism is unavoidable due to extenuating circumstances.
- Inefficient attendance processes contribute to frustration and disengagement among students, impacting their academic experience and overall satisfaction.

### Technological Advancement and Expectation

- With the proliferation of digital technologies and the increasing reliance on mobile devices, there exists an expectation for educational institutions to embrace modern solutions for attendance management.
- Leveraging innovative technologies such as QR codes presents an opportunity to enhance the accessibility, accuracy, and convenience of attendance marking while aligning with contemporary trends in digitalization.

### Security and Data Integrity Concerns

- Manual attendance systems are inherently vulnerable to security breaches, data manipulation, and unauthorized access.
- Ensuring the integrity and confidentiality of attendance data is paramount to safeguarding student privacy and maintaining the trust of stakeholders.

## 1.2 Importance and Relevance of the Project

- **Efficiency**: It streamlines the attendance taking process, saving time for both students and faculty. With a quick scan of QR code, students can mark their attendance without the need for manual roll calls or sign sheets.

- **Accuracy**: QR code systems ensure more accurate attendance records compared to traditional methods. There's less chance of errors or falsification, leading to more reliable data for tracking student participation and engagement.

- **Transparency**: The system provides transparency regarding attendance. Both students and lecturers can access real-time attendance data, fostering accountability and encouraging punctuality and attendance.

- **Data analysis**: By collecting attendance data digitally, institutions can analyse attendance trends and patterns over time. This information can be used to identify students who may need additional support or intervention and to assess the effectiveness of teaching methods and course structures.

- **Scalability**: QR code systems are highly scalable and adaptable to various educational settings, from small classrooms to large lecture halls. They can also be integrated with existing digital platforms and systems used by educational institutions.

## 1.3 Objectives

- The web application facilitates QR code generation and scanning, streamlining data entry and paperwork through smartphone compatibility.

- A centralized database system securely stores attendance records, ensuring data integrity and minimizing errors associated with decentralized storage methods.

- Real-time synchronization between the mobile app and the database enhances efficiency by eliminating manual data syncing processes.

- Analytical tools are provided for generating attendance reports and insights, empowering decision-makers with data-driven insights for optimizing engagement and performance.

## 1.4 Purpose

The **QR-based Attendance Marking System** is designed to automate the process of taking attendance in various settings such as schools, universities, and events. It eliminates the need for manual attendance marking and provides an efficient and accurate way of tracking attendance.

Traditional attendance marking methods, such as manual sign-in sheets, are time-consuming and prone to errors. A QR-based system can streamline the process and provide accurate and efficient attendance tracking
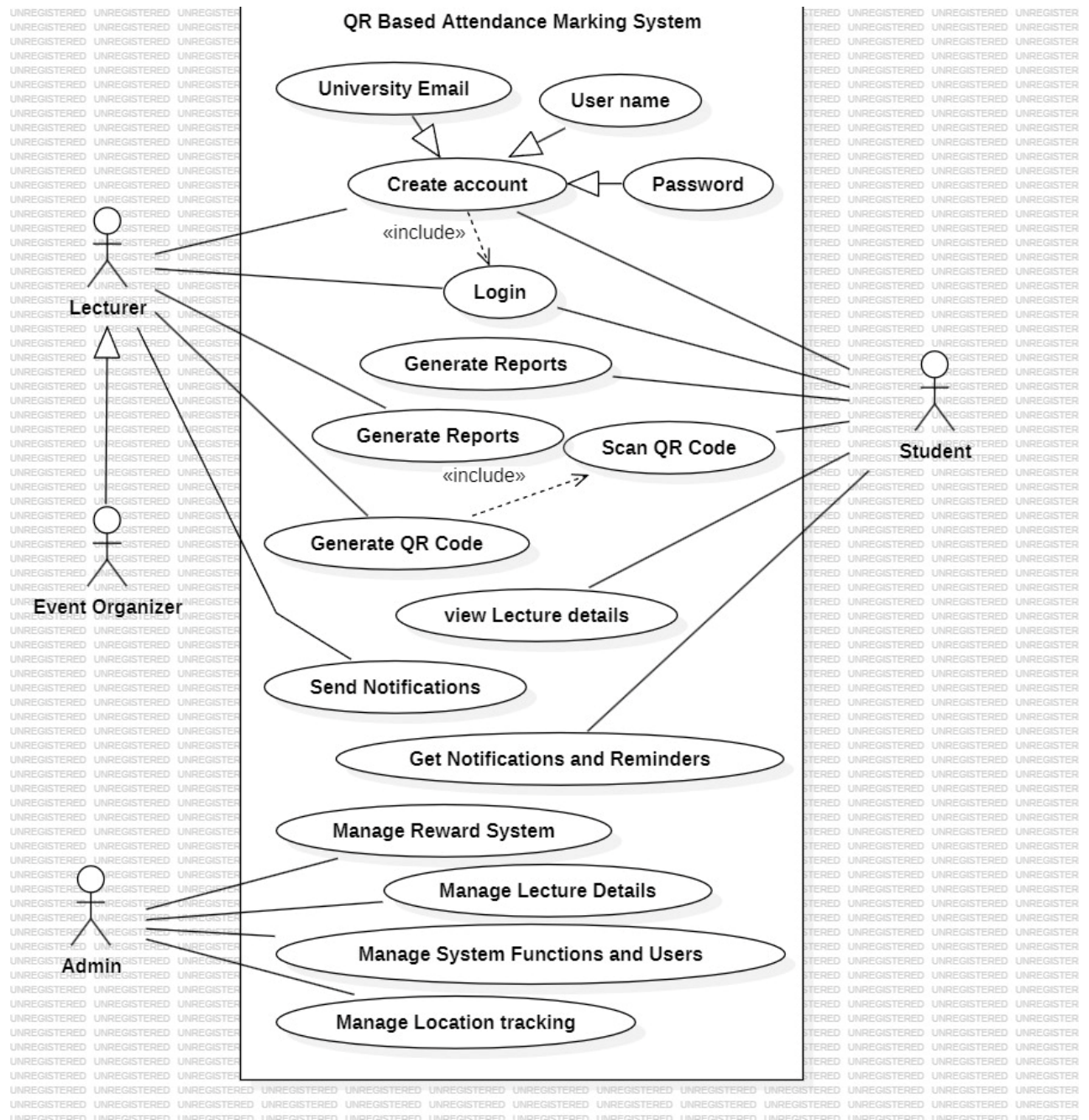
## 1.5 Scope

- Attendance Marking
- QR Code Generation
- QR Code Scanning
- Analytics and Reporting
- View Lecture and Event Details
- Integration with another System
- Real Time Sync

# 2. Overall System Description

## 2.1 Overview

When considering the overview, student can visit the site and register for the system using University Email Address. After system validates the given Email Address student can create a account using Preferred Username and Password. Lecturers also can create profiles. After login, each lecturer can Generate a Real-Time QR Code Using the system and display the QR Code. Then student can scan the QR code using Mobile devices. System gets the students information and store attendance details in database. Location Tracking Option of this system prevents fraud by verifying location. And the Reward System encourages students attendance through Rewards. Also, lecturer can generate reports and students can view attendance by the system.

## 2.2 Usecase Diagram

## 2.3 Block Diagram



SYSTEM
ADMIN

**10**
Services
Access

**8** Confirmed
Attendance
sheet

LECTURER

STUDENT

**1** Creating
Account and
login

**1** Creating
Account and
login

SYSTEM
AND
DATABASE

**7** Editable
Attendence
sheet

**2** Requesting
to Generate
QR code

Notifications
**9** [ attendance marking
successful and etc..]

Sending
**3** Genarated
QR code

**6** Marking Attendence

Showing QR
**4** code to
student

INTERFACE

**5** Scanning QR code After
login to the Account

System    Admin

Controls Rewards ,
System Functions
and
users of the
system

Editable Attedence sheet

Lecturer can Edit
it manually .

Services       Access

Access services provided
by the system

• Report Generation
• View Event Details
• View Lecture Details

Marking     Attendence

Connecting With System
and The Database

# 3. Requirement Analysis

## 3.1 Functional Requirements

### User registration

- Students should be able to register themselves into the system.

- Lecturers should have the option to create accounts or be pre-registered.

### User authentication

- Secure login functionality for both students and lecturers.

- Password encryption to ensure data security.

### Real-Time QR Code Generation

- The system should be able to generate real-time unique QR codes for each Lecture. Also lecturer can generate the QR code.

### Attendance Marking

- After scanning the QR, student details should be entered using the system.

- The attendance data should be stored securely in a database.

### Real-time Reporting

- The system should provide real-time attendance reports to event organizers.

- The reports should include information such as total attendees, present attendees, and absentees.

### Data Security

- The system should ensure the security and privacy of attendee data.

- Access to the database should be restricted to authorized personnel only.

### Send Notifications and Reminders

- The system should send automated notifications to students and instructors upon successful attendance marking and upcoming Lectures and Events Details.

### Viewing Lecture and Event Details

- System should provide a user-friendly interface for students to access detailed information about lectures, events, classes and other details.

### Reward System for Attendance

- The system should be able to assign points, badges, or virtual currencies based on attendance performance.

## 3.2 Non-Functional Requirements

### Performance

- The system should be able to handle a large number of concurrent users without any significant decrease in response time.

- The attendance marking process should be completed within a few seconds to ensure efficiency.

### Scalability

- The system should be able to handle an increasing number of users and attendance records without any performance degradation.

- It should be easy to add new features and functionalities to the system as the requirements evolve.

### Security

- The system should have robust security measures in place to protect the attendance data from unauthorized access.

- User authentication and authorization should be implemented to ensure that only authorized users can access and modify the attendance records.

### Reliability

- The system should be highly reliable, with minimal downtime and data loss.

- It should have backup and recovery mechanisms in place to ensure data integrity and availability in case of any failures.

## 3.3 External Interface Requirement

### User Interface

The System interface Should be User Friendly and responsive, catering to both users and that will be accessible through any web browsers.

### Hardware Interface

The system Requires smartphone with camera  capabilities for QR Code scaning. And Compatibility with various mobile devices and Operating Systems (Android/ ISO/ Windows/ Linux)

### Software Interface

All the interfaces will be running withing the web browser.

### Application Programming Interface

Integration with location services API (Mapbox API) to access device location data.

Integration with notification service API (FCM) to send push notifications to mobile devices.

## 3.4 Gathering Requirements

- Interview lecturers and students to understand their expectations and preferences for the system, including user interface design, functionality requirements, and desired features.

- Design surveys to collect quantitative data on user preferences, including preferred devices, notification methods, and desired features, aiding in the development of the system.

- Analyse existing QR attendance systems to identify their strengths and weaknesses, allowing us to enhance our own system effectively.

- Make rough drafts of the system to get feedback from users and fix any problems before starting the actual development.

- Arrange meetings with teachers and students to hear what they think about the system as it's being made, so we can make sure it's what they want.

# 4. Development Tools

## 4.1 Frontend

- **HTML(v5)** – HTML (Hypertext Markup Language) is a text-based approach to describing the content structure of an HTML file. A user can create a basic web page and upload it to the Internet by applying these HTML conventions to a text file in any text editor.

- **CSS(v3)**– CSS stands for Cascading Style Sheets. CSS describes how the HTML element should be displayed on screen, webpage, or other media. It can control the layout of several web pages at once. Normally External design sheets are stored in CSS files with .css Extension.

- **Figma** – To create, share, and test designs for websites, mobile apps, and other digital products and experiences.

- **JavaScript(ES6)** - JavaScript (JS) is a cross-platform, object-oriented programming language used by developers to make web pages interactive. It allows developers to create dynamically updating content, use animations, pop-up menus, clickable buttons, control multimedia, etc.

- **Visual Studio Code (v1.88)** – Visual Studio Code combines the simplicity of a source code editor with powerful developer tools such as IntelliSense code complement and debugging.

## 4.2 Backend

- **PHP (v8.2)** – PHP (recursive acronym for PHP: Hypertext Preprocessor) is a popular open-source general-purpose scripting language that is suitable for web development and can be embedded in HTML.

- **MYSQL(v8.0)** – MySQL is a relational database management system that is free and open source. We use MYSQL to connect databases and manage data tables in our system.

- **Laravel (v8.16.1) Framework** – Laravel is a free and open-source PHP framework that provides a collection of tools and resources for creating advanced PHP applications.

- **WampServer(3.3.2)** – XAMPP is an open-source software package that contains Apache distributions for the Apache Server, MariaDB, PHP, and Perl. This is a local server that works on a desktop or laptop. We use Wamp to test our website before uploading it to the remote web server.

- **Node.js(v21.5.0) –** To generate Real time Dynamic QR codes

# 5. Work Distribution

## 5.1 Making Login Interface
### (Member 1- Kumarihami D.R.S.G)

The login interface ensures secure access through registered credentials, facilitating password resets and account creation. Role-based access control differentiates between instructors and students, providing relevant features, while prioritizing user-friendliness and employing security measures like encryption and HTTPS to safeguard against unauthorized access.

### Features and Functionalities

- **User authentication:** The module should allow users (both students and lecturers) to log in securely using their registered credentials (username/university email and password).

- **Account management:** Users should be able to create new accounts or reset their passwords if they forget them.

- **Role-based access control:** distinguishes between students and lecturers, allocating appropriate functionalities such as viewing attendance records for students and generating QR codes and accessing attendance data for lecturers.

- **User friendly interface:** Design an intuitive and user-friendly interface for seamless navigation and ease of use.

## 5.2 Manage Lectures and Event Details
### (Member 2- Sandanayake C.T)

Viewing and managing lectures and event details in a web-based application offers users a seamless experience by providing a centralized platform for accessing all relevant information. Users can effortlessly navigate through upcoming events, browse lecture schedules, and review event details such as location, time, and agenda. The intuitive interface enables easy viewing of event descriptions, speaker profiles, and any additional resources or materials.

**Features and Functionalities**

- **Content Management**: Create the system for organizing and displaying lectures and event details. This may involve categorizing content by course, date, instructor, or topic, and providing search and filtering functionalities to help users find relevant materials easily.

- **Documents Upload**: Develop the feature that allows users to upload relevant materials such as event posters, handouts, or additional resources. Ensure that the system enforces file size limits, accepts file formats (e.g., JPG, JPEG, PNG), and performs proper validation to prevent malicious uploads.

- **Event Management**: Implement tools for managing events, including creating event listings, scheduling lectures, and providing event details such as date, time, location, and agenda. Users should be able to RSVP for events and receive notifications or reminders.

- **Access Control**: Define access permissions to control who can view, upload, and manage content on the platform. For example, instructors might have permissions to upload lecture materials and create events, while students might only have permission to view content and RSVP for events.

- **Filtering and Sorting Options**: Provide filtering and sorting options to allow users to narrow down their search for upcoming lectures and events based on criteria such as topic, date, location, and speaker.

## 5.3 Location Tracking
### (Member 3 -Navodya D.D.A)

This module can ensure precise attendee management and event security with real-time location updates. Seamlessly integrate GPS technology with QR code scanning for accurate check-ins within designated event areas. This module can prevent fraud by verifying location.

**Features and Functionalities**

- **GPS Integration** - Utilize GPS technology to track the location of attendees when they scan their QR codes for check-in.

- **Geofencing** - Define virtual boundaries around the event venue using geofencing to ensure attendees are within the designated area for check-in.

- **Real-time Location Updates** - Provide organizers with real-time updates on attendee locations, allowing for better event management and security.

- **Attendance Validation** - Verify attendance based on both QR code scans and location data, ensuring accurate tracking of attendees.

- **Customizable Radius** - Adjust the radius of the geofence to suit the size and layout of the place like lecture hall or Inside of University to optimizing location tracking accuracy.

## 5.4 Making Attendance Reports
### (Member 4- Perera V.C.C)

The Attendance Report module serves as a vital component within attendance management systems, providing users with comprehensive insights into attendance data within University. This module facilitates the efficient tracking, analysis, and reporting of attendance records, enabling administrators, Lecturers and students to make informed decisions and optimize resource allocation.

**Features and Functionalities**

- **Customizable Reporting** - Users can generate attendance reports tailored to their specific needs, including various timeframes, classes, departments, or events.

- **Visual Representation** - Attendance data is presented visually through charts, graphs, or tables, enhancing readability and analysis.

- **Exporting Options** - Users can export attendance reports in different formats (e.g., PDF, CSV) for sharing, analysis, or archival purposes.

- **Filtering and Sorting** - Attendance data can be filtered and sorted based on criteria such as date, time, class, department, or individual attendee, facilitating targeted analysis.

- **Real-time Updates** - Attendance reports are updated in real-time as new data is entered or synchronized with the system, ensuring timeliness and accuracy.

- **Accessibility and Permissions** - Allowing administrators to define user permissions and access levels for viewing, editing, or exporting attendance report

## 5.5 Attendance Gamification/Reward system
### (Member 5- De Kurukularathne S.W.I.G)

Earn points for attending, participating, and engaging, then redeem them for exciting rewards. This module encourage students to participate every lectures.

**Features and Functionalities**

- **Point Accumulation:** Attendees earn points for each attendance or for meeting specific criteria like punctuality or participation.

- **Tiered Rewards :** Offering different levels of rewards based on the number of points earned or certain achievements, creating motivation for attendees to strive for higher levels.

- **Gamification Elements:** Incorporating gamification elements like leaderboards, badges, or challenges to make the reward system more engaging and enjoyable for attendees.

- **Automated Processes:** Streamlining the reward system with automated processes for point calculation, redemption requests, and reward distribution to minimize administrative burden and ensure efficiency.

## 5.6 QR Code Generation / Scanning
### (Member 6- Disanayaka D.M.P.S)

QR code generation, validation, and potential encryption to ensure attendance is recorded only by authorized users.

**Features and Functionalities**

- **QR Code Generation:**

     **Unique Codes:** Generate unique QR codes for each Event or Lecture. This ensures unauthorized codes can't be used for attendance.

     **Limited Scans**: Consider limiting the number of times a code can be scanned to prevent reuse.

     **Short Expiry:** Set an expiry time for QR codes. Expired codes become invalid, preventing misuse after a certain period.

- **QR Code Validation:**

     **Client-Side Validation:** Perform basic validation on the user's device (phone) to catch simple errors (e.g., invalid QR code format).

     **Server-Side Validation (Mandatory):** Always perform thorough validation on the server-side to ensure data integrity.

- **QR Code Scanning**: Support for scanning QR codes using a mobile device's camera and Real-time decoding of QR code data.

- **Attendance Tracking:** Automatic recording of attendance data upon successful QR code scanning and Real-time updating of attendance records in the system database.

## 5.7 Manage Notification and Reminders
### (Member 7- Sepiyumi K.D.C)

**Attendance notification:**

Instant notifications confirm attendance upon QR code scanning, providing lecture details. Delivery options include email, SMS, or in-app notifications with customizable preferences, bolstering user experience while ensuring security and accessibility.

### Features and Functionalities

- **Instance feedback:** After a student successfully scans the QR code using their mobile phone, the system triggers an instant notification to acknowledge the successful attendance marking. This immediate feedback assures the student that their action was recognized and recorded by the system.

- **Confirmation message:** The notification should contain a confirmation message indicating that the attendance for the specific lecture session has been marked successfully. This message could include details such as the course name, date, and time of the lecture.

- **Delivery channels:** Notifications are delivered through diverse channels like email, SMS, or in-app, catering to user preferences and ensuring accessibility, with email for formal communication, SMS for instant updates, and in-app for seamless user experience.

- **Customization options:** Customization options allow students to personalize notification preferences, including choosing communication channels and opting in/out of attendance confirmation notifications, enhancing user experience by tailoring the system to individual preferences.

- **Accessibility:** Design the notification system to be accessible to all users, including those with disabilities. Provide options for adjusting notification settings, such as font size and colour contrast, to accommodate users with visual impairments or other accessibility needs.

# 6. Implementation Plan

### Phase 1: Planning

- Define project scope, objectives, and requirements.
- Identify technical requirements for platform compatibility, databases, and security.
- Create a project plan with tasks, timelines, and resource allocation.

### Phase 2: Analysis

- Analyze existing attendance systems and processes.
- Gather requirements from stakeholders.
- Identify risks and constraints.

### Phase 3: Design

- Design system architecture and database structure.
- Create wireframes or prototypes for user interfaces.
- Define QR code generation and scanning process.

### Phase 4: Development

- Develop backend system for managing lectures and attendance data.
- Implement frontend interfaces for lecturers and students.
- Integrate security measures such as authentication and encryption.

### Phase 5: Testing

- Conduct unit testing for individual components.
- Perform integration testing.
- Conduct user acceptance testing (UAT) with stakeholders.

### Phase 6: Deployment

- Deploy system to test environment for validation.
- Deploy to production servers or cloud infrastructure.
- Provide training and documentation for users.

**Phase 7: Maintenance**

- Monitor system for issues and performance.
- Provide ongoing support and maintenance.
- Review and enhance system regularly based on feedback and advancements.

# 7. Timeline

| Process | Start and End Dates | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | March | April | May | June | July | Aug | Sep | Oct | Nov | Dec |
| **Planning** | | ■ | ■ | | | | | | | | | |
| **Analysis** | | | | ■ | | | | | | | | |
| **Design** | | | | | ■ | | | | | | | |
| **Development** | | | | | | ■ | ■ | ■ | ■ | | | |
| **Testing** | | | | | | | | | | | ■ | |
| **Maintenance** | | | | | | | | | | | | ■ |

# Software Requirements Specification

for

# QR-Based Attendance Marking System

**Version 0.1**

**Group 09**

**2024-05-13**

# Table of Contents

# 1.  Introduction

## 1.1  Purpose

The QR-based Attendance Marking System is designed to automate the process of taking attendance in various settings such as schools, universities, and events. It eliminates the need for manual attendance marking and provides an efficient and accurate way of tracking attendance. Traditional attendance marking methods, such as manual sign-in sheets, are time consuming and prone to errors. A QR-based system can streamline the process and provide accurate and efficient attendance tracking

## 1.2  Document Conventions

In the QR Based Attendance Marking System project's SRS document, we follow particular rules and styles in writing to make sure everyone understands what's needed. We might use different fonts, highlight important parts, or organize information in specific ways. For example, we can prioritize requirements to show which ones are most important. Also, each requirement gets a priority level to make things clearer and easier to understand.

## 1.3  Intended Audience and Reading Suggestions

The QR Based Attendance Marking System serves a wide range of people involved in the project, such as developers, project managers, academic staff, event organizer, students, testers, and document writers. This is carefully structured to give everyone a clear understanding of the project's needs, features, and technical details.

## 1.4  System Scope

The purpose of this software is to streamline the attendance tracking process in educational institutions through the use of QR code technology. By enabling students to mark their attendance quickly and accurately using their smartphones, the system aims to enhance efficiency, accuracy, and transparency in attendance management.

The relevant benefits of the QR Based Attendance Marking System include:

- Efficiency

   Simplification: The QR-based system automates the attendance process, reducing the time taken to mark attendance to less than 10 seconds per student.

- Accuracy

   Error Reduction: QR code scanning ensures that attendance records are at least 99% accurate, minimizing manual errors and reducing the chance of data manipulation.

   Falsification Prevention: Each QR code is unique and time-sensitive, ensuring a secure and accurate recording of attendance, with less than 0.1% falsification cases reported.

- Transparency:

   Real-Time Data Access: Attendance data is updated in real-time and can be accessed within 5 second of marking, ensuring transparency and accountability.

- Data analysis:

  Trend Analysis: The system provides analytical tools that generate reports on attendance patterns.

## 1.5    References

[1] "QR Code Attendance Tracking for Businesses & Classrooms," AeoLogic, 2023. [Online]. Available: www.aeologic.com.

[2] "The Power of QR Codes for Attendance Tracking," TLinky, 2023. [Online]. Available: www.tlinky.com.

[3] "How to Track Attendance with QR Codes," Uniqode, 2023. [Online]. Available: www.uniqode.com.

[4] "How QR Code Attendance System Works: The Complete Guide," QR Code Generator, [Online]. Available: www.qrcode-generator.com.

# 2.    Overall Description

## 2.1    System Perspective

The QR Based Attendance Marking System is a standalone system designed to revolutionize the traditional attendance tracking process in educational institutions. It is not a replacement for existing systems but rather a new, self-contained solution that leverages QR code technology to enhance efficiency and accuracy in attendance management. The system operates independently but may have connection with existing educational platform's database for data integration and scalability.

## 2.2    System Functions

- QR code generation for attendance marking

- Real-time attendance data entry and storage

- Automated attendance reports generation

- User authentication and access control

- Notification and reminder system

- Lecture and event details management

- Manage Absent message

## 2.3    User Classes and Characteristics

The anticipated user classes for the QR Based Attendance Marking System include:

- Students: Students are characterized by their frequent use of the system for attendance marking by scanning QR and view reports

- Lecturers / Event Organizer: lecturers or event organizers have additional privileges for generate QR and making attendance reports.

- Administrator: Administrator has privileges for manage all user and lecture details

## 2.4    Operating Environment

The system will operate in an educational environment, compatible with various hardware platforms and operating systems. It must coexist peacefully with smartphones for QR scanning, databases for data storage, and web servers for real-time synchronization.

**Minimum hardware requirements**

- **Smartphones/Tablets (for Student use):**
    - Minimum Camera Resolution: 5 MP
    - Operating System: Android 8.0 or iOS 12.0 and above
    - RAM: 2 GB or higher

- **PCs (for Administrative and Lecturer or Event Organizer use):**
    - Processor: Intel i3 2.0 GHz or AMD equivalent
    - RAM: 4 GB or higher
    - Storage: 128 GB SSD
    - Operating System: Windows 10, macOS 10.13 (High Sierra), or Linux distributions like Ubuntu 18.04 LTS or higher
    - Web Browser: Latest versions of Chrome, Safari, Firefox, or Edge
    - Network: Stable internet connection with a minimum bandwidth of 10 Mbps

## 2.5    Design and Implementation Constraints

- Corporate policies on data security and privacy

- Integration with existing educational platforms

- Use of specific technologies for QR code generation and database management

- Security considerations for user authentication and data access restrictions

## 2.6    User Documentation

- User Manual: A comprehensive guide on how to use the system for both students and lecturers.

- FAQ: Offer concise answers to frequently asked questions, aiding users in troubleshooting common issues and navigating the system effectively.

- Tutorials: Step-by-step tutorials for new users to familiarize themselves with the system's features and functionalities.

## 2.7    Assumptions and Dependencies

Assumptions:

- Availability of stable internet connectivity for real-time data synchronization.

- Compliance with data privacy regulations and institutional policies.

- Consistent user engagement and feedback for system improvement.

Dependencies:

- Integration with existing educational platforms for data exchange.

- Third-party API for Location Tracking (Mapbox API).

- Adherence to security protocols and encryption standards for data protection.

# 3.    External Interfaces and Requirements

## 3.1    User Interface

The user interface of the QR Based Attendance Marking System is designed to provide a seamless and intuitive experience for both students and lecturers.

Characteristics:

- User-friendly design with clear navigation and functionality.

- Role-based access control to differentiate between students and lecturers.

- Secure login functionality using registered credentials.

- Account management features for creating new accounts and resetting passwords.

- Standard buttons for common functions such as viewing attendance records and generating QR codes.

- Error message display standards for notifying users of any issues during system interaction

## 3.2 Software Interfaces

The QR Based Attendance Marking System will interface with various software components to fulfill its functionalities.

- Compatibility with operating systems and web browsers for user accessibility.
- Communication with location services API (Mapbox API) for accessing device location data.
- Integration with notification service API (FCM) for sending push notifications to mobile devices.

## 3.3 Communications Interfaces

- Notifications for users regarding attendance marking and upcoming events.
- Web browser access for users to interact with the system through online interfaces.
- Network server communications protocols for data transfer and synchronization.
- Secure communication standards such as HTTPS for encryption and data security.
- Data transfer rates and synchronization mechanisms will be optimized to ensure real-time updates and seamless user experience.

# 4. System Requirements

## 4.1 Functional Requirements

### 4.1.1 User Registration

The system should allow students to register themselves by providing necessary information such as name, email, and student ID and the system should provide lecturers with the option to create accounts or be pre-registered by the system administrator, enabling them to access the platform securely.

### 4.1.2 User Authentication

Secure login functionality should be implemented for both students and lecturers, ensuring that only authorized users can access the system and password encryption should be applied to all user credentials to maintain data security and prevent unauthorized access to sensitive information.

### 4.1.3 Real-Time QR Code Generation

The system should be capable of generating real-time unique QR codes for each lecture, allowing for efficient attendance tracking.

### 4.1.4 Attendance Marking

After scanning the QR code, students' details should be able to entered to the system for attendance marking purposes.

### 4.1.5 Real-time Reporting

The system should provide real-time attendance reports to lecturer or event organizers, including information on total attendees, present attendees, and absentees for each session. Also, can generate attendance reports tailored to their specific needs, including various timeframes, classes, departments, or events.

### 4.1.6 Data Security

Data security measures should be implemented to safeguard the privacy and integrity of attendee information stored in the system and access to the database containing attendee data should be restricted to authorized personnel only, ensuring data confidentiality and compliance with privacy regulations.

### 4.1.7 Send Notifications and Reminders

Automated notifications should be sent to students and instructors upon successful attendance marking and to provide updates on upcoming lectures and events.

### 4.1.8 Viewing Lecture and Event Details

The system should offer a user-friendly interface for students to easily access detailed information about lectures, events, classes, and other relevant details, enhancing user experience and engagement.

# 5.  System Scenarios

## 5.1  Use-case Diagram
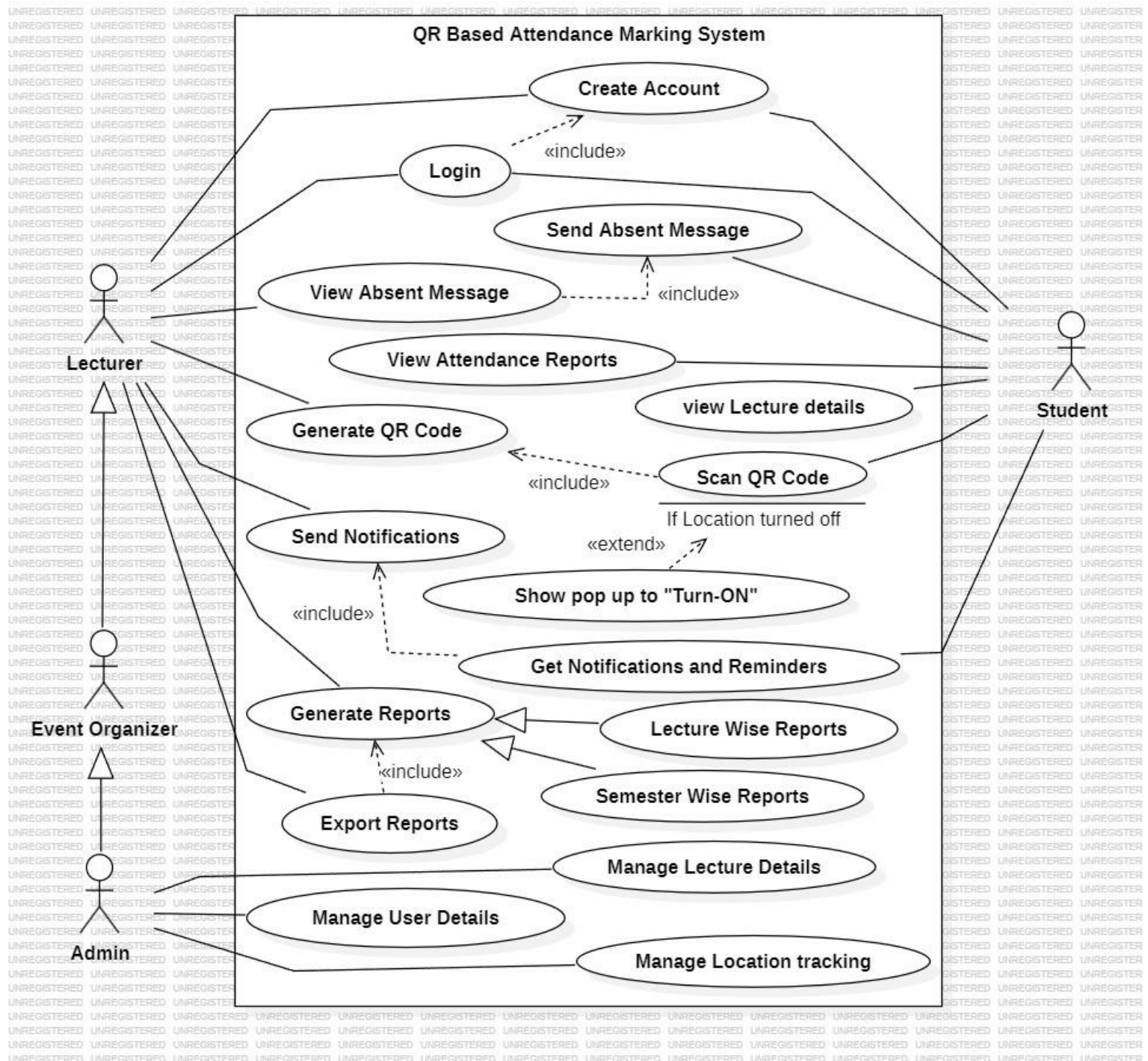
## 5.2 Scenarios

### 5.2.1 User Login

**Scenario Name:** Login

**Actor:** Student, Lecturer, Event Organizer, System Interface

**Precondition:** The user has a valid email. The user should know their login credentials.

**Basic Flow:**

1. The user creates an account using valid email.

2. The user register to the system successfully.

3. The user navigates to the login page of the QR-based attendance marking system.

4. The system displays the login interface, prompting the user to enter their university email and password.

5. The user enters their login credentials and clicks the "Login" button.

6. The system verifies the user's credentials and grants access to the appropriate functionalities based on their role (student, lecturer or event manager).

7. The system displays the attendance dashboard for the user.

8. The user can logout from the system.

**Alternative Flow:**

1.a.1  If the user enters invalid email, the system displays "Invalid email" and prompts the user to try again.

1.b.1  If the user pre-registered to the system user can login to the system directly.

5.a.1  If the user enters incorrect login credentials, the system displays an error message and prompts the user to try again.

5.b.1  If the user forgets their password, they can click the "Forgot Password" button and follow the password reset process.

**Activity Diagram for User Login**
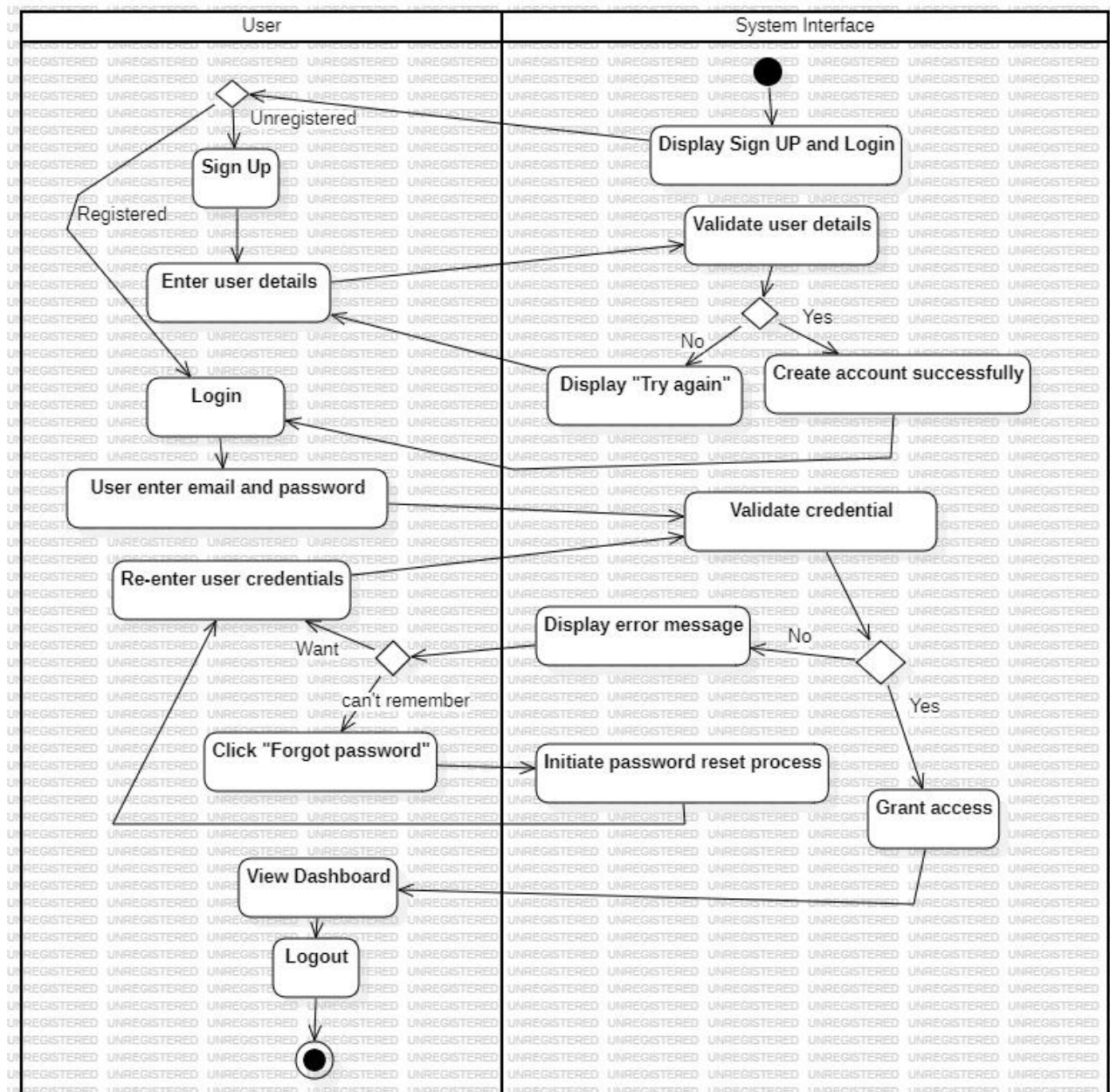
### 5.2.2 **QR Code Generation & Scanning**

**Scenario Name:** Generating a QR Code

**Actors:** Lecturer/ (Event Organizer), System Interface

### Preconditions:

- The Lecturer must have accounts in the attendance marking system.
- The system must be able to generate, validate, and manage QR codes.
- The course and subjects' information must be pre-configured in the system.

### Basic Flow:

1. The lecturer logs in to the attendance marking system.
2. The lecturer Navigate to the option to "Generate QR Code for Attendance."
3. The system prompts the lecturer to select a course section.
4. The lecture selects course and subject
5. Once the course and subject are selected, the system displays a confirmation window showing the course ID and subject ID associated with the section.
6. The lecturer confirms the selection and clicks "Generate QR Code."
7. The system dynamically generates a unique QR code that encodes the course ID and subject ID.
8. When Generation completed system show option to Display QR code.
9. Lecture Select Option to "Display the QR code".
10. System displays the generated QR code on the Lecture's screen for students to scan.

### Postconditions:

- Students who successfully scanned the QR code and passed validation are marked as present in the system.
- The QR code becomes invalid after its expiry time (2/3 min) to prevent any further scans.
- Lecturer can see an accurate attendance record for the session

## Activity diagram for QR Code Generation
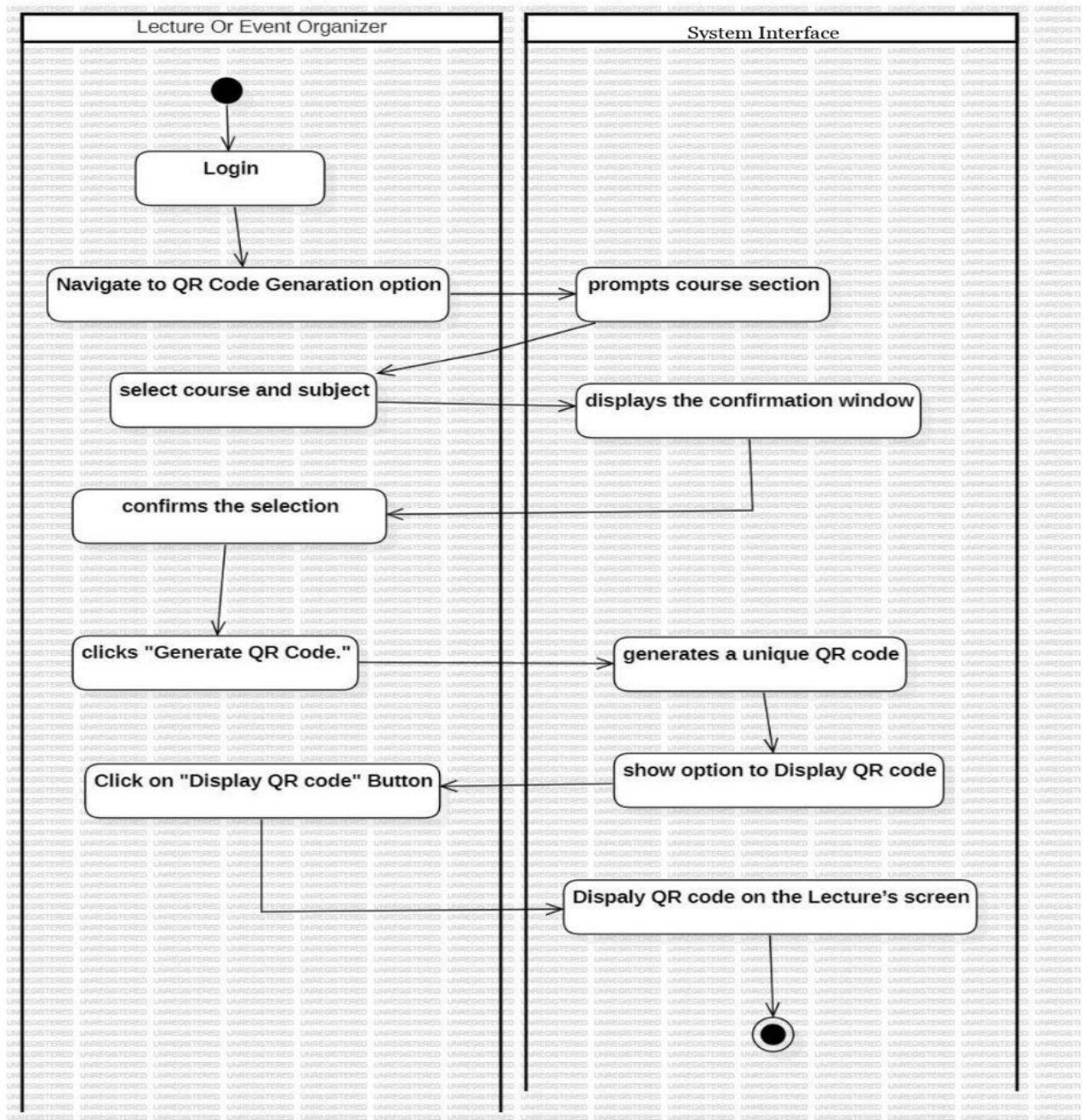
### 5.2.3    Making Attendance Reports

**Scenario Name:** Generate Reports

**Actor:** Lecturer/Event organizer, system Interface

**Precondition:** The user must be registered and logged in to the system. Only Lecturers or Event Organizers have Special Permission to Generate Reports.

**Basic Flow:**

1.  The use case begins when the user logs into the system.

2.  Navigate to reports section in system Dashboard.

3.  Selects the option to generate attendance reports.

4.  The system prompts the user to select Batch, Department and course module.

5.  The system prompts the User to specify the time frame for the report.

6.  The User inputs the desired start and end dates for the report.

7.  The system retrieves attendance data for the specified period.

8.  The system processes the data and generates a report, summarizing the attendance by date, class, and individual student.

9.  The User reviews the report for accuracy.

10. Save for viewing purpose.

11. Use case ends the system provides options to export the report in various formats (e.g., PDF, Excel).

**Alternative Flow:**

9.a.1    If the Report Accurate then goes to step 10.

9.a.2.   If the Repot not accurate then initiate Data Correction and goes to step 10.

QR Based Attendance Marking System

## Activity Diagram for Generate Report
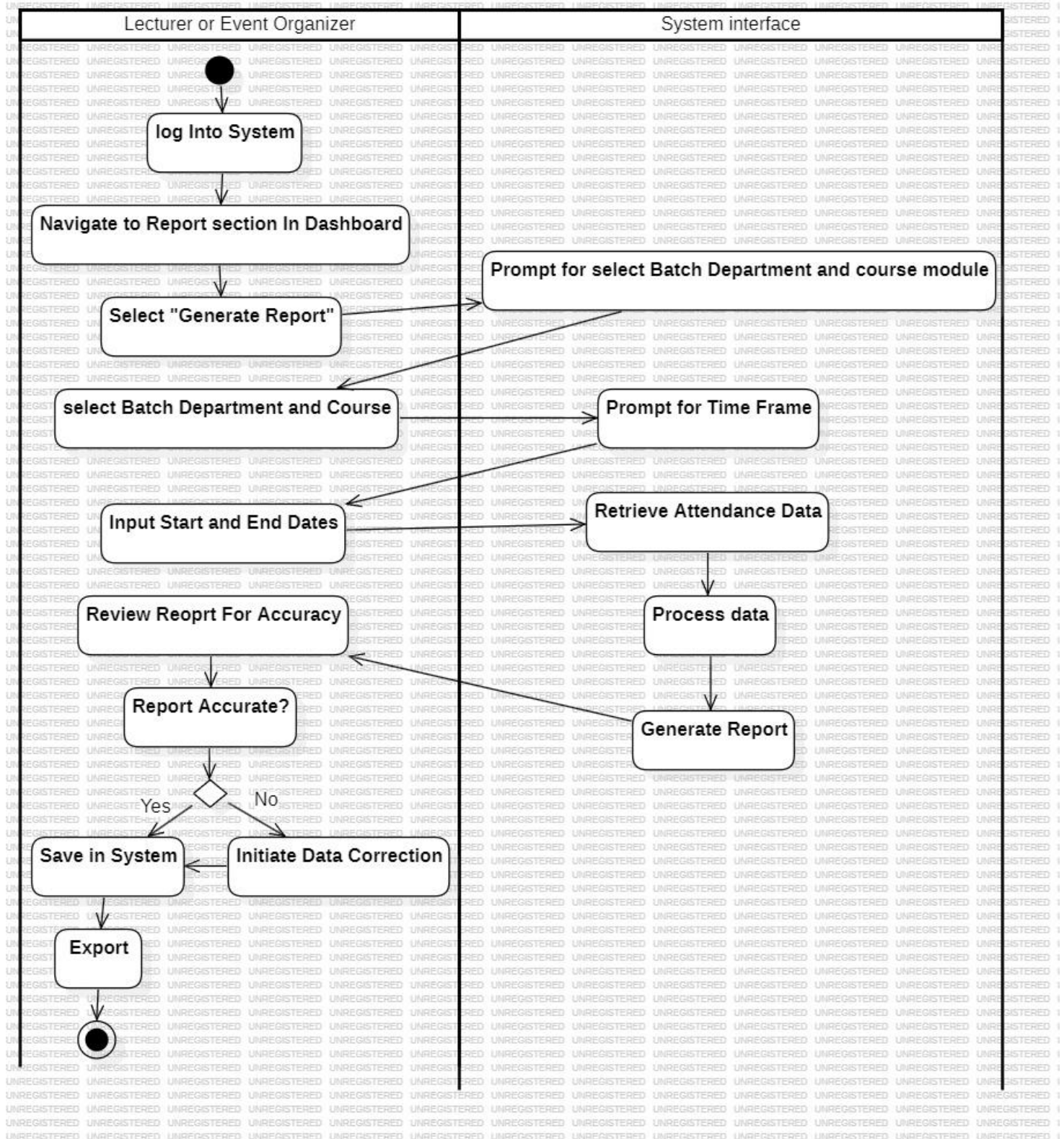
# 6.    System Constraints

## 6.1    Important Nonfunctional Requirements

### 6.1.1    Performance

Response Time: The system responds to user actions within 5 seconds under normal load conditions with a stable internet connection

Attendance Marking Time: Each attendance marking process (scanning a QR code and recording attendance) should be completed within a maximum of 10 seconds.

### 6.1.2    Scalability

User Load: The system should support up to 1,000 concurrent users with a response time degradation not exceeding 10%.

Data Handling: The system should manage up to 1 million attendance records with efficient access and retrieval times.

### 6.1.3    Security

Authentication: Implement multi-factor authentication for all user accounts, ensuring unauthorized access is prevented.

Data Encryption: All attendance data and user information should be encrypted both in transit (using TLS 1.2 or higher) and at rest (using AES-256 encryption).

### 6.1.4    Reliability

Data Backup: Implement automated daily backups of all attendance data, with backups retained for a minimum of 30 days.

# 7.    Other Requirements

**Database Requirements:**

- The system should utilize a relational database management system (RDBMS) to store attendance data securely and efficiently.

- The database schema should be designed to accommodate information about students, lecturers, lectures, reports, events, courses, departments, and batches.

- Consider additional tables for managing QR codes, user permissions, and audit logs for tracking system activity.

**Reuse Objectives:**

- Evaluate the potential for reusing existing university system components for authentication, authorization, and data integration with the attendance marking system.

- Consider developing the system with modular components that could be adapted for other applications within the university in the future.

**Glossary**

- **QR Code (Quick Response Code):** A two-dimensional barcode that can store information and be scanned using a smartphone camera.

- **Geofencing:** A virtual boundary created around a specific location using GPS or other technologies.

- **Authentication**: The process of verifying a user's identity.

- **Authorization:** The process of determining a user's access rights to specific system functionalities.

- **Encryption:** The process of transforming data into a scrambled format for security purposes.

- **RDBMS (Relational Database Management System):** A type of database that stores data in structured tables with relationships between them.

**Analysis Models (to be developed)**

- **Use Case Diagrams**
- **Activity Diagrams**

**To Be Determined List**

- Specific details regarding data encryption standards.
- The chosen RDBMS platform and its configuration requirements.