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BKMI Event Management System using QR Code and Two-Factor Authentication

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Abstract: The Biro Kebudayaan Mahasiwa/I India (BKMI) event management application addresses the challenges associated with event tracking and information gathering. Currently, there is a significant problem in manually collecting proper data related to events, resulting in a lack of organized information. This makes it difficult to keep track of events, retrieve relevant data efficiently and the process of gathering information on events is time-consuming. This application aims to enhance security and streamline event coordination. The application utilizes QR codes and two-factor authentication (2FA) to improve attendance integrity, prevent fraud, and simplify the check-in process. Additionally, the system incorporates 2FA to add an extra layer of security. Thus, organizations can streamline their event management processes, enhance data accuracy, and save significant time and effort in information gathering.

Keywords: Event, QR Code, 2FA, Mobile Application

1. Introduction

The increasing number of events worldwide has led to advancements in event management methods. Traditional approaches face limitations, particularly in handling multiple service providers concurrently. To address these challenges, a mobile-based event management system has been created. By utilizing QR codes and two-factor authentication, this system enhances security, efficiency, and effectiveness in event organization. It streamlines tasks for organizers and ensures a more seamless management process. The system offers most of the fundamental capabilities needed for an event [1].

The project aims to address challenges faced by the Biro Kebudayaan Mahasiswa/I India (BKMI) club by developing an efficient event management system. The current manual system has limitations as it is time-consuming and inefficient. Organizers spend significant effort on paperwork, data entry, and manual processes, leading to delays and errors. The manual system also lacks centralized data storage and accessibility. Important event information is scattered across various documents, making it challenging to retrieve and share. The current manual system continues to be highly prone to human errors, including data duplication, incorrect data entry, and miscommunication. This can lead to inaccuracies and misunderstandings during event planning and execution. The absence of real-time updates and collaboration features in manual systems hampers effective communication among team

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members. These limitations underscore the necessity for automated event management systems that streamline processes, enhance data accuracy, and foster collaboration, ultimately enabling efficient event organization.

The BKMI event management system utilizes QR codes and two-factor authentication for improved security and efficiency. It allows users to create and manage event details on the admin page. Access is restricted to logged-in users, and new users can register with two-factor authentication. The system provides a comprehensive overview of objectives, methodology, and results, emphasizing the need for a streamlined event management process. The objective of this project is to design, developing, and testing an event management system that utilizes QR Code and two-factor authentication through SMS based onetime password (OTP). QR code is used to store massive information in a smaller space [2]. All the information is stored in a database, and users can log in to the system to see updates about the programs. There are two types of users: admins and students. Admins can manage events, users, and view reports. Students can register for events, log in, and perform other tasks. This online system helps the event management club organize their work and stay updated on the latest events.

The rest of the paper is organized as follows: Section 2, discuss related topics, including the BKMI Event Management System, Quick Response Codes (QR), and other research contributions. Section 3 presents an overview of the Waterfall Model methodology utilized in this system. Section 4 details the system analysis and design. Section 5 delves into the implementation of this project. Section 6 focuses on the results and discussions. Finally, Section 7, provides the conclusion.

2. Related Work

This chapter reviews literature on the integration of QR codes and two-factor authentication (2FA) into event management systems, highlighting their benefits such as increased efficiency, improved attendee experience, and streamlined data gathering. However, further exploration is needed to discover new applications and address existing challenges.

2.1 BKMI Event Management System

Current systems, often manual and reliant on physical presence, are vulnerable to unauthorized access and data breaches due to limited security measures, lack of two-factor authentication, and lack of portability due to their dependence on specific hardware or manual paperwork. By identifying and addressing the shortcomings observed in other systems, the event management system can be guided towards effective mitigation of these issues over time [3]. Furthermore, the benefits offered by these systems provide valuable insights for enhancing the overall quality of the proposed system. An event management system tailored for BKMI would cater to the specific needs and requirements of the organization or event. It would provide features and functionalities designed to support BKMI's event planning and management processes. This could include features like online registration for BKMI events, tracking attendance, sending event reminders and updates to participants, and generating event reports. The event management system would serve as a comprehensive tool to optimize the planning and execution of BKMI events, enhance participant experience, and streamline administrative tasks for the organization.

2.2 Quick Response Code (QR)

QR codes are machine-readable visual labels that contain information about the linked object or product. Information in QR code is only carried in one direction or one dimension. The size of modules (black and white squares) which make into a QR code determines its size. The size of the modules depends on the version of the QR code, and how they are organized in a square grid style. Each version

shown in Figure 1 has a varied number of modules, with versions ranging from 1 to 40 [4]. Higher versions produce bigger QR codes but allow more data to be encoded inside.

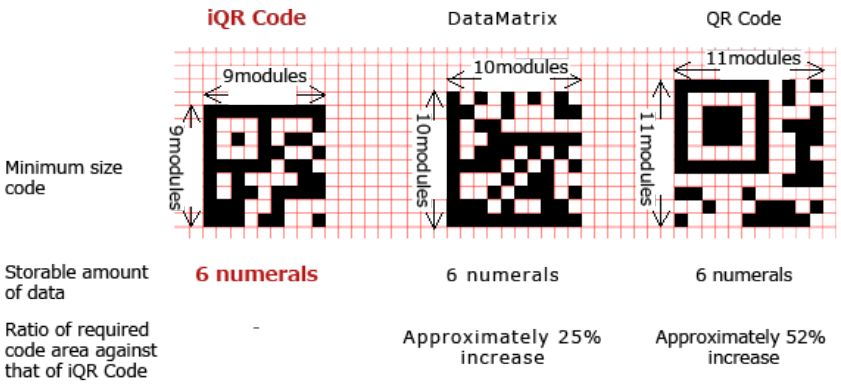

Figure 1: Size of a QR Code [4]

Static QR codes have certain limitations. Once a QR code is generated, it cannot be modified or updated. On the other hand, dynamic QR codes provide the flexibility to update the scanned content even after the code has been created. While both codes serve a similar purpose, a static QR code directly points to a fixed destination, while a dynamic QR [5] code redirects the user through an intermediary link before reaching the intended destination. With a dynamic QR code, users can modify or update the data associated with the code without the need to generate a new one. For event management systems, the use of dynamic QR codes is highly recommended as organizers can generate unique codes for multiple events, enabling attendees to receive real-time updates on event schedules.

2.3 Two-Factor Authentication (2FA)

Two-factor authentication (2FA) is a secure method that requires two forms of identification for accessing resources. It enhances security, reduces unauthorized access, improves user satisfaction, and is easy to implement. In today's digital world, it is crucial for protecting user accounts and sensitive data. Two-step verification requires two credentials from the same category “Something you know”, “Something you have”, or “Something you are” [8]. A strong protection against unauthorized access to user accounts is provided by two-factor authentication, which considerably reduces the likelihood of account breach [6]. Various 2FA authentication techniques shown in Figure 2 are utilized to prevent unauthorized access and safeguard data privacy. Time-Based One-Time Password (TOTP) is a widely used method that generates a time-limited code on a trusted device or app. Additionally, SMS-based verification codes sent to registered phone numbers provide an additional layer of security alongside other authentication methods. Other biometric characteristics that can be used for the authentication process include fingerprints and face recognition [7].

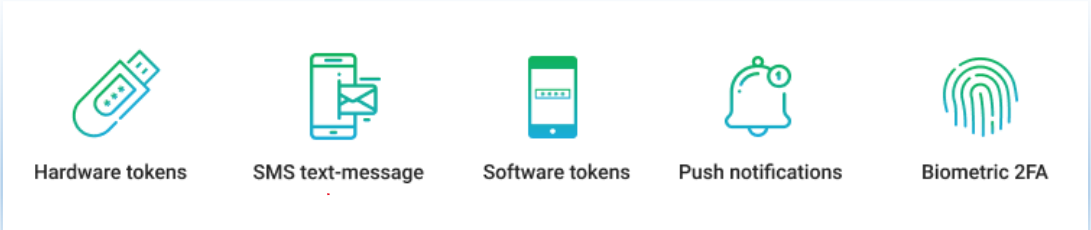

Figure 2: Different type of 2FA [7]

Furthermore, 2FA is completely supported by several online services, platforms, and applications due to the confidential level it offers is very high. Moreover, it can be accomplished via mobile applications, SMS, or email and is not needed for specific hardware. In general, the user experience will be error-free, and the extra step provides only minor additional setup, given the improved protection it gives.

2.4 Comparison with Existing System

Several features and elements are adopted from the previously discussed systems and improved in terms of security and ease of use. Table 1 compares the advantages and disadvantages of the proposed event management system and other existing systems. BKMI Event Management Manual System, Event Engage [9] and Insider.in [10] system have been selected to do a brief comparison. A few characteristics of the studied systems which include users, language, user interface, background color, database, login and registration, location, feedback, statistics, and user support system (administrator) of the application systems are well analyzed in order to avoid any inconsistency during the development process.

Table 1 shows the first feature indicates whether both attendees (people participating in an event) and administrators (those responsible for managing the event) have access to the system which all the system above contains this feature in their respective system. The next is security, which pertains to the security measures in place for user authentication. It indicates that the system uses a login mechanism involving usernames and passwords. Users must enter their unique credentials to access the system which all except BKMI manual system does not possess this feature. Mobility refers to the ability to access the system from mobile devices or on the go. Only BKMI Event Management System has mobility which means the system is designed to be mobile-friendly or may have dedicated mobile apps, allowing users to access it using smartphones or tablets. All systems have the portability that is refers to the ease with which the system can be used from different devices or locations. Two-factor authentication (2FA) is an additional layer of security beyond just usernames and passwords. BKMI event management system supports 2FA via SMS. In this case, users receive a one-time password (OTP) on their mobile devices to further verify their identity during login. In addition, BKMI event management system also supports QR code-based attendance. Attendees may scan QR codes to register their presence at an event. Finally, a database is a structured collection of data used to store and manage information. All of the above systems have a database component which uses a digital database to store event-related data except for BKMI manual system that relies on paper-based methods for data storage, which may involve manual record-keeping.

Table 1: Comparison Existing System with the proposed system

Features/System	Event Engage	Insider In	BKMI Manual System	BKMI Event Management System
User (Attendee & Admin)	√	√	√	√
Security (Login Username & Password)	√	√	X	√
Mobility	X	X	X	√
Portability	√	√	√	√
Two-Factor Authentication	X	X	X	√ (SMS-Based, send OTP to user's mobile)
QR Code (Attendance)	X	X	X	√ (Attendee attendance)
Database	√	√	√ (Paper-Based)	√

3. Methodology

Methodology is a systematic and theoretical analysis of research procedures, rules, and principles. It is crucial for developing applications that align with scope, purpose, and user requirements to ensure the application meets objectives and effectively caters to users.

3.1 Waterfall Model

In this segment, we analyze the methodology used in designing the BKMI Event Management System. The chosen approach for this system is the Waterfall Model. The Waterfall Model, a sequential and linear software development process [8], is recognized as the initial design model in the Software Development Life Cycle (SDLC) approach. The Waterfall Model is a systematic approach that involves completing each phase before moving on to the next. This model offers advantages such as easy management, early incorporation of changes, clear progress understanding, and suitability for hierarchical organizations. Figure 3 shows the phases of waterfall model methodology and Table 2 shows each phase and its outputs during the project development.

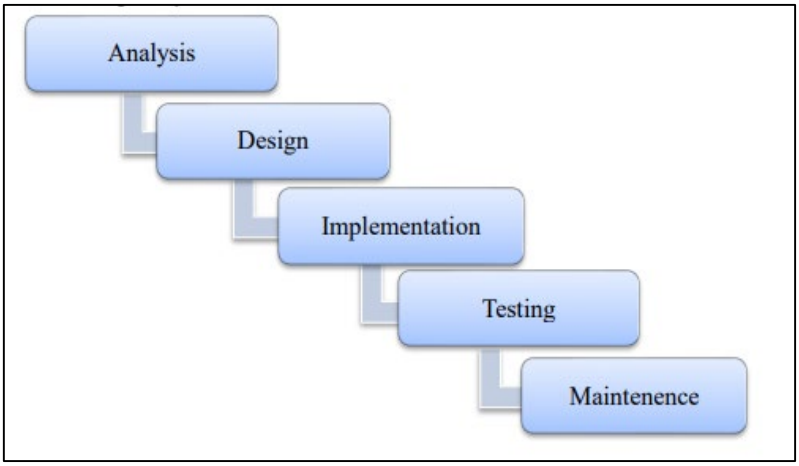

Figure 3: Waterfall Model [8]

Table 2: Software development activities and their task

Phase	Task	Output
Analysis	✓ Gantt chart is designed. ✓ Determined the functional and non-functional requirements. ✓ Identified the problem related to manual event management system. ✓ Studied about 2FA and dynamic QR code.	✓ Gantt chart ✓ Proposal ✓ Functional and non-functional requirement.
Design	✓ Designed proposed system flow chart. ✓ User interface (UI) is designed. ✓ Developed the general system architecture. ✓ Designed the proposed system's context diagram, data flow diagram (DFD), Entity Relationship Diagram (ERD). ✓ Classes of proposed system are designed. ✓ Database modules and relationships are developed based on the proposed system requirements. ✓ User acceptance form and test plan are designed. ✓ Event management application prototype is designed.	✓ Flow chart ✓ General system architecture ✓ Context diagram ✓ Entity Relationship Diagram ✓ User Interface (UI) design ✓ Data Flow Diagram ✓ Data dictionary ✓ User Acceptance Form ✓ Test plan ✓ Prototype

Table 2: (Cont.)

Phase		Task		Output
Implementation	✓	Fully developed dynamic QR code and two-factor authentication.	✓	Event Management System with QR code and 2FA
	✓	Firebase services		
	✓	User interface developed using Android Studio.		
Testing	✓	Integration testing	✓	System user manual
	✓	Unit testing	✓	Test plan result
	✓	System testing	✓	User Acceptance Test
Maintenance	✓	Fixed Bugs	✓	System with new features.

4. System Analysis and Design

This section explains the system analysis and design process, using diagrams like general system architecture, data flow diagram, context diagram, flow charts, and entity relationship diagram to illustrate system functionality. It covers admin and student users, with different access controls, and the charts and diagrams are designed based on user permissions.

4.1 System Requirement Analysis

Before initiating system development, a thorough analysis of system requirements was conducted in collaboration with users. This analysis aimed to understand their specific needs and expectations, ensuring a seamless and user-friendly system. By gathering valuable insights, the development team designed a product that closely aligns with user preferences. The system requirement analysis serves as a vital foundation, providing clarity and direction for subsequent development stages, ultimately leading to the creation of a successful and user-focused system.

Table 3 outlines the functional requirements of the BKMI event management system, including modules for login, registration, administration, student record, event record, and attendance record. The login module grants access to registered users, while the register module is for students and admins who receive an activation key from the main admin. Valid username and password are required for system entry. The event record module allows admins to manage events and generate QR Codes for attendance. Students scan the QR Code, and attendance is stored in the report module accessible to admins.

Table 3: Functional requirement analysis

No.	Modules		Functionalities
1.	Register Module	✓	New users should be directed to the registration page in the system.
		✓	Only users who have the account activation key should be permitted to register as new users.
		✓	The system should validate user inputs and prevent the insertion of invalid information.
		✓	Once registered, users should be automatically directed to the system's discover page.
2.	Login Module	✓	The system should provide users with an OTP generated for their phone number.
		✓	User validation should be performed before granting access to ensure the user's authenticity.
		✓	An alert message should be displayed on the screen to notify users of any invalid inputs.
		✓	After a successful login, users should be allowed to access the system.
3.	Administration Module	✓	The system should facilitate the main admin in generating account activation keys.
		✓	Creation and deletion of events should be restricted to the admin only.
		✓	The system should enable the admin to generate dynamic QR codes.

		✓ Access to the participants list and student attendance records should be granted exclusively to the admin.

Table 3: (Cont.)

No.	Modules	Functionalities
4.	Student Module	✓ The system should enable students to easily register for events. ✓ Students should have the capability to view the events they have registered for in the system. ✓ The system should provide students with the functionality to scan their attendance for the registered events.
5.	Event Module	✓ The event module should allow the user to add, update, view and delete the event. ✓ The user should have the ability to access and view the location on a map within the system. ✓ The system offers the capability to upload an event poster during the event creation process. ✓ The system should provide the user with the ability to specify the event type and location when creating an event. ✓ The system should be able to show live updates on the number of students who have registered and attended the event.
6.	Report Module	✓ The event report can be accessed exclusively by the admin, who has the privilege to view it. ✓ The system should include the attendance list of students in the generated report.

The non-functional requirements of the BKMI Event Management System have been identified, which include security, availability, performance, and usability. Table 4 outlines the specific functionalities associated with these requirements.

Table 4: Non-functional requirement

No.	Modules	Functionalities
1.	Security	✓ The system should ensure that each user has only one account. ✓ To register in the system, users must provide a valid account validation key. ✓ In case of invalid inputs, the system should display an alert message. ✓ OTP generation should be accessible only to authenticated users. ✓ Event registration should be restricted to authenticated users. ✓ Changing the password in the user's profile should only be allowed for authenticated users. ✓ QR code generation for events should be limited to the admin, who is responsible for creating the event. ✓ Passwords should meet specific requirements, including a minimum length of 8 characters and a combination of different character types.
2.	Availability	✓ The system should be always available and accessible, providing uninterrupted services 24/7.
3.	Performance	✓ The system should be always available, ensuring uninterrupted service to users at optimum performance guarantee. ✓ Under expected workloads, the system should deliver prompt and responsive user interactions.
4.	Usability	✓ The system should have a user-friendly interface that is easy to comprehend. ✓ The system should provide a seamless and intuitive user experience. ✓ The system should consistently deliver effective results.

4.2 General System Architecture

The BKMI Event Management System's architecture is shown in Figure 4, incorporates QR Code and Two-Factor Authentication. It begins with a main page offering separate access for admins and students. Admins have privileged access for various tasks like managing participants, events, and generating QR

codes. Students can sign up, log in, register for events, and view their registrations. The QR Code feature simplifies attendance recording. All-important data, including participant lists and event information, is securely stored in the database for reliable record-keeping.

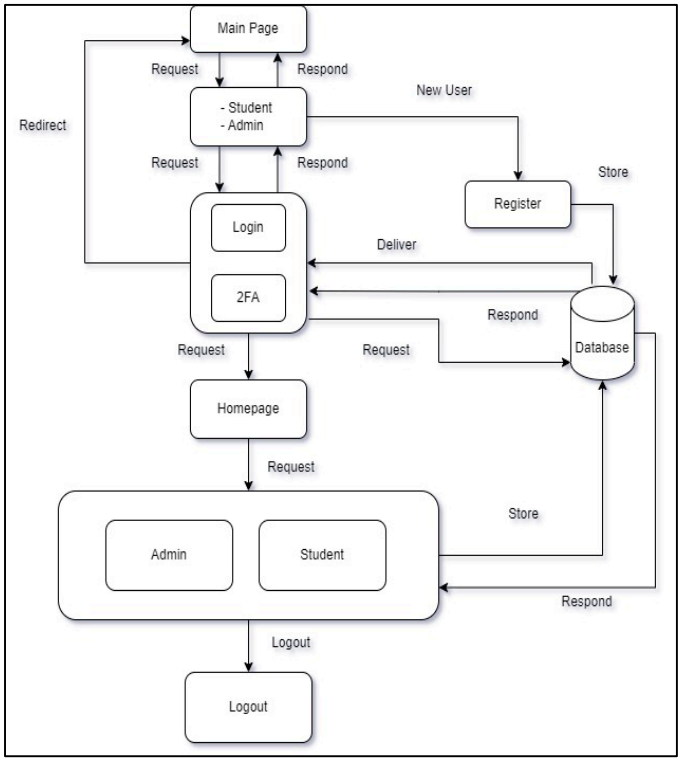

Figure 4: General System Architecture

4.3 System Analysis

Unified Modeling Language (UML) is a standardized visual representation used for system analysis. It employs various diagrams such as data flow, context, activity, and class diagrams to depict the system's structure and behavior. UML serves as a common language, enabling effective communication between stakeholders. These diagrams aid in documenting and conveying insights from the analysis phase, facilitating a clearer understanding of the system's components and their interactions. UML plays a vital role in visually presenting system analysis results.

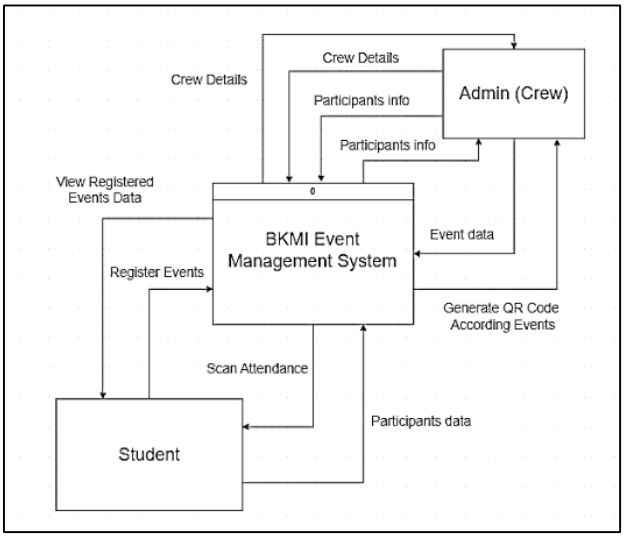

Figure 5: Context diagram of proposed system

The context diagram of event management system, as shown in Figure 5, integrates QR Code and two-factor authentication. It involves two primary users: admins (crew members and club board members) and students. Admins manage accounts, create and delete events, and store event data securely in the system's database. Participant attendance is updated through dynamic QR code scanning, with attendance records accessible to admins. Students and admins have various data flows, emphasizing the interactive nature of the system.

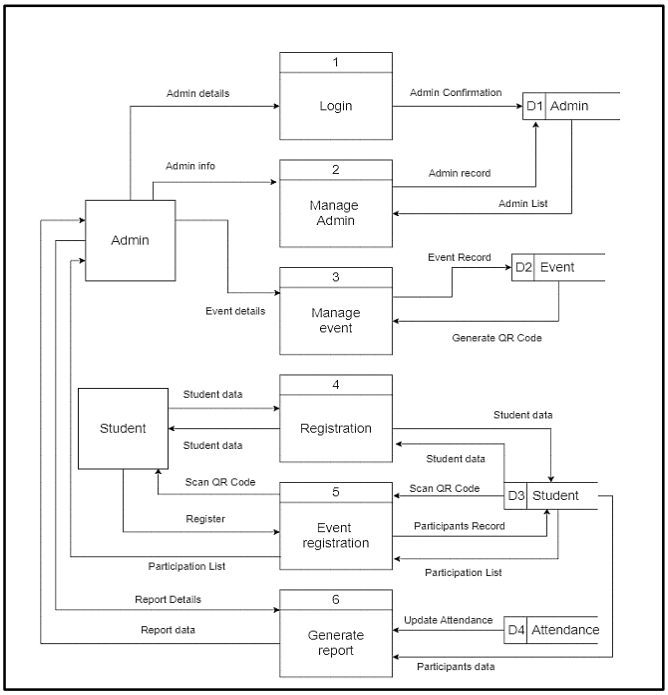

Figure 6: Data Flow Diagram, Level 1

Figure 6 showcases the system's data flow diagram, highlighting key activities such as Login, Manage Admin, Manage Event, Registrations, Event Registration, and Generate Report. The system involves two entities, namely admin (crew members) and students (participants), along with four data stores: D1 Admin, D2 Event, D3 Student, and D4 Attendance.

The BKMI Event Management System consists of various data stores for managing different aspects of the system. The admin data store stores admin details, the Event data store holds event information, the student data store maintains student details, and the Attendance data store tracks participants' attendance through scanning. Admins can enable user registration and securely store registered user data. They can create and manage event details, which are also stored in the database.

The report module allows admins to monitor participant engagement. Students can register as club members by providing personal information. Once registered, they gain access to the BKMI Event Management System and can participate in listed events. Students can view registered events and record their attendance by scanning the admin generated dynamic QR Code. Attendance records are accurately stored in the database for tracking and reporting purposes.

The flowchart demonstrates how different activities in the system interact to provide services and operate the BKMI event management system. Figure 7 specifically represents the flowchart for this system, starting from the login page. New users must first register as club members before logging in with their credentials, which are then verified through authentication.

Based on Figure 7, to enhance security, a two-factor authentication process is implemented, requiring users to enter a verification code received via SMS. Invalid credentials prompt users to re-enter correct information on the login page. After successful login, registered users are directed to the homepage. Administrators can manage participant data, events, and access event reports. Students can register for events, view their registrations, and record attendance by scanning dynamic QR codes. Attendance records are securely stored in the system's database, accessible only to administrators.

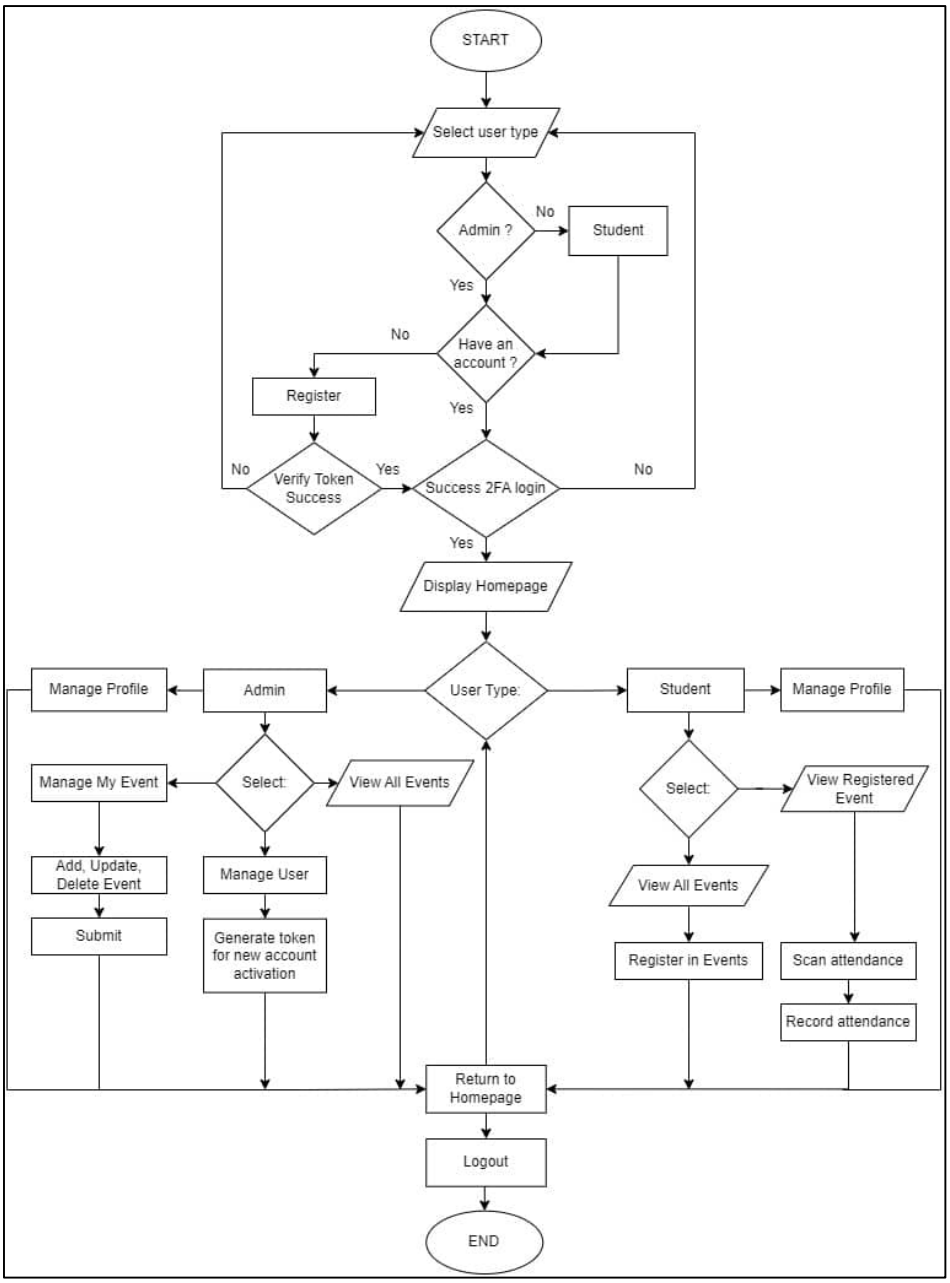

Figure 7: Flow Chart of the proposed system

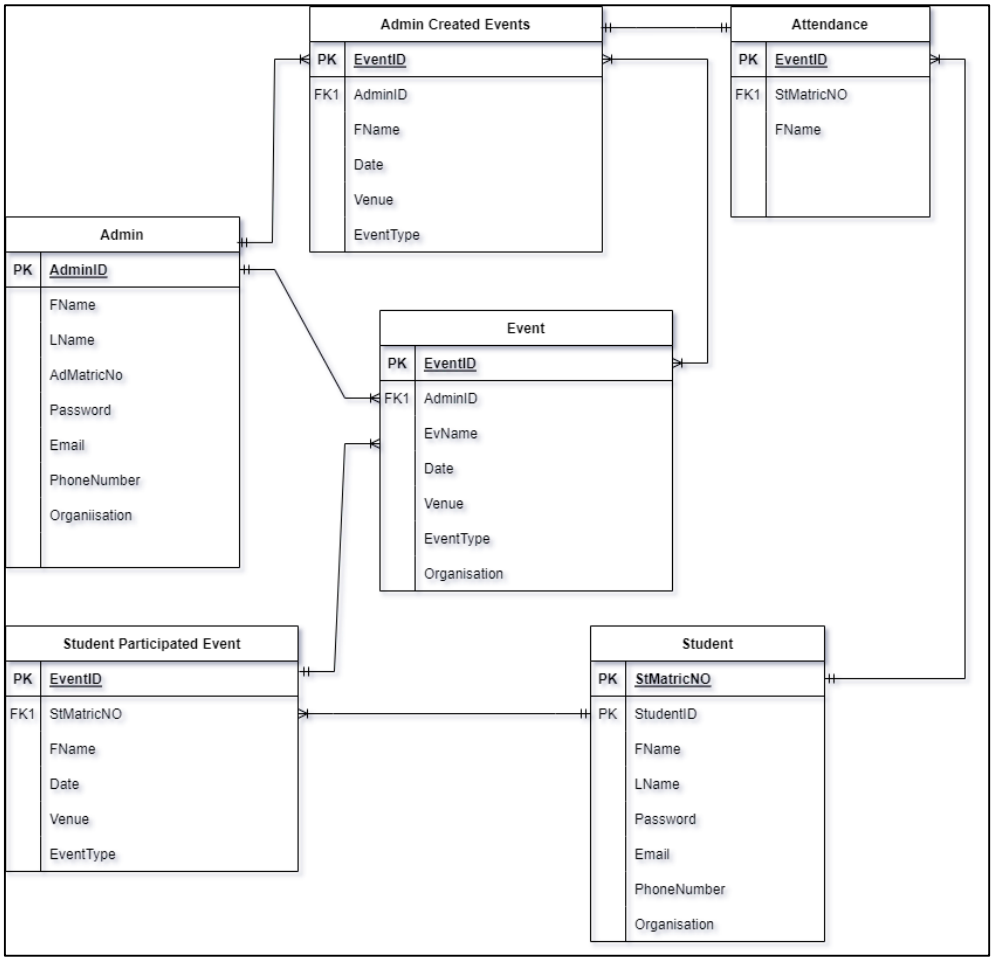

Figure 8: Entity Relationship Diagram of the proposed system

Figure 8 displayed the Entity Relationship Diagram (ERD) which is a design that helps determine how different tables in the system are related to each other and how data is stored. In the proposed system, there are six tables: admin, student, event, attendance, admin created events, and student registered events. Each table has its own specific information. The event table controls the Admin Created Events and Student Participated tables, allowing students to be associated with multiple events. The Admin Created Events table keeps track of upcoming and past events. It is linked to the admin and attendance tables for proper management.

5. Implementation

This section focuses on the security measures implemented in the proposed event management system. These measures ensure the system's confidentiality, availability, and integrity, while the source code is developed to meet the system's requirements and ensure its smooth operation. The implementation involves constructing the system based on the previous design phase. It includes crucial steps such as programming to make different elements and designs work together. The code is developed to fulfill user requirements and specifications, creating interfaces and modules connected to a database for desired functionality. User interfaces are designed on an appropriate platform, using Android Studio and Java programming language for mobile application development.

The login module consists of two important components. In the first part, the user needs to enter a valid username and password as shown in Figure 9. Once the username and password are verified, the user proceeds to the second level of authentication, depicted in Figure 10. This second phase of authentication involves a One-Time Password (OTP) sent via SMS shown in Figure 11 and Figure 12.

The user can click on the "Generate" button to receive the OTP on their mobile number. After receiving the code, the user must enter it in the designated text-field and click on the "Continue" button to access the system.

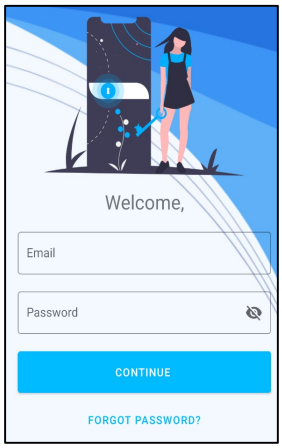

Figure 9: Login Screen

```
public class LoginActivity extends AppCompatActivity {
    private static final String TAG = "LoginActivity";
    private Database db;
    // variables for previous value
    private String fName, lName, mNumber, phoneNumber, role, email, password, orgName, documentID;
    private boolean validusername=false, validpassword=false;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_login);

        final FirebaseAuth mAuth;
        mAuth = FirebaseAuth.getInstance();

        db = new Database(new AsyncResponse() {
            @Override
            public void resultHandler(Map<String, Object> result, int resultCode) {
                if (resultCode == 0 && validusername==true && validpassword==true) {
//                  Person p = (Person) result.get("documentID");
```

Figure 10: Login screen code segment

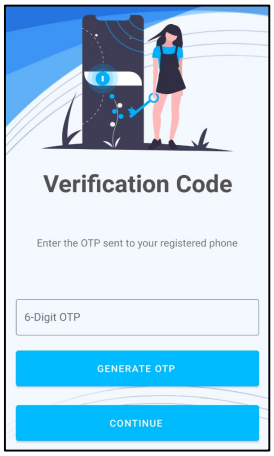

Figure 11: OTP Screen

```
// setting onclick listener for generate OTP button.
generateOTPBtn.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        // below line is for checking whether the user
        // has entered his mobile number or not.
        if (TextUtils.isEmpty(edtPhone.getText().toString())) {
            // when mobile number text field is empty
            // displaying a toast message.
            Toast.makeText( context: OTPverify.this,  text: "Please enter a valid phone number.",
        } else {
            // if the text field is not empty we are calling our
            // send OTP method for getting OTP from Firebase.
            String phone = "+6" + edtPhone.getText().toString();
            sendVerificationCode(phone);
        }
    }
});
```

Figure 12: OTP code segment

Figure 13 and Figure 14 display the Profile screen, where users can make updates to their personal information, including their name, email, phone number, and password. The ability to generate an account activation key is exclusive to the admin role. When a new user registers an account and requests an account activation key, they will receive an email containing the key. This feature is accessible only on the admin's profile screen.

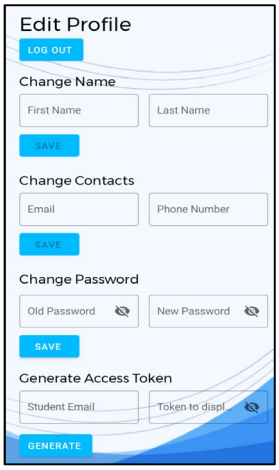

Figure 13: Profile Screen

```
@Override
public View onCreateView(LayoutInflater inflater, ViewGroup container,
                         Bundle savedInstanceState) {
    View view = inflater.inflate(R.layout.fragment_profile, container, attachToRoot: false);

    final TextInputEditText fNameView = view.findViewById(R.id.fName);
    final TextInputEditText lNameView = view.findViewById(R.id.lName);
    final TextInputEditText emailView = view.findViewById(R.id.email);
    final TextInputEditText phoneView = view.findViewById(R.id.phoneNumber);
    final MaterialButton saveContact = view.findViewById(R.id.saveContact);
    final MaterialButton saveName = view.findViewById(R.id.saveName);
    final MaterialButton book = view.findViewById(R.id.genButton);
    final TextInputEditText userEmail = view.findViewById(R.id.useremail);
    final TextInputEditText generatedKey = view.findViewById(R.id.generatedkey);

    db = new Database(new AsyncResponse() {
        @Override
        public void resultHandler(Map<String, Object> result, int resultCode) {
            if (resultCode == 0) {
                p = (Person) result.get(mAuth.getUid());
                assert p != null;
                fNameView.setText(p.fName);
                fNameView.setEnabled(true);
```

Figure 14: Profile Screen code segment

In Figure 15, the Dynamic QR code generated by the admin is displayed. This Dynamic QR code has a time limitation, meaning that its pattern changes after a certain amount of time, creating a unique QR code pattern. This QR code can only be generated on the day of the event and cannot be generated after the event's designated time and date.

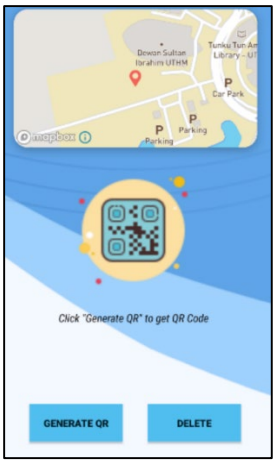

Figure 15: QR Code Screen

```
db.filterWithTwoFields( collectionName: "tickets", field1: "userId", mAuth.getUid(), field2: "eventId", event.eventId, Ticket

notificationforQR.setText("Click \"Generate QR\" to get QR Code");
generateButton.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        // to generate qr for event created by the user only
        if((event.userId!= null) && (event.userId).matches(mAuth.getCurrentUser().getUid())){
            if (event.end.toDate().compareTo(getTodayDate())>0 && event.start.toDate().compareTo(getTodayDate())<0){
                //genQRcode(event.eventId, event.start.toDate() ,event.end.toDate());
                countDownTimer(event.eventId, event.start.toDate() ,event.end.toDate());
            }
        }

    }
});
```

Figure 16: Generate QR code segment

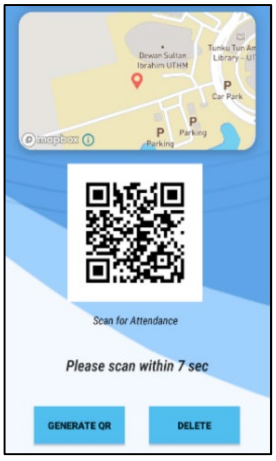

Figure 17: QR code timer Screen

```
public void genQRcode(String eventDocId, Date eventdatestart, Date eventdateend) {
    if (eventdateend.compareTo(getTodayDate())>0 && eventdatestart.compareTo(getTodayDate())<0){
    //initializing MultiFormatWriter for QR code
        MultiFormatWriter mWriter = new MultiFormatWriter();
        try {
        //BitMatrix class to encode entered text and set Width & Height
         BitMatrix mMatrix = mWriter.encode( contents: eventDocId+"&&"+getTodayDate(), BarcodeFormat.QR_CODE, width:
         BarcodeEncoder mEncoder = new BarcodeEncoder();
         Bitmap mBitmap = mEncoder.createBitmap(mMatrix);//creating bitmap of code
          qrCode.setImageBitmap(mBitmap);//Setting generated QR code to imageView
          notificationforQR.setText("Scan for Attendance");
        } catch (WriterException e) {
         e.printStackTrace();
        }
    }
    else
        notificationforQR.setText("QRCode for attendance not available. Event is ended");
}
```

Figure 18: Dynamic QR code segment

Figure 19: Count down screen

```
public void countDownTimer(String eventId, Date startdate , Date enddate){
    genQRcode(eventId, startdate, enddate);
    new CountDownTimer( millisInFuture: 10000,  countDownInterval: 1000){
        int counter=10;
        public void onTick(long millisUntilFinished){
            countDownTimer.setText("Please scan within "+String.valueOf(counter)+" sec");
            counter--;
        }
        public  void onFinish(){
            //countDownTimer.setText("QR Code Expired. Please Generate again");
            countDownTimer(eventId, startdate, enddate);
        }
    }.start();
}
```

Figure 20: Count down code segment

6. Result and Discussion

This phase is very important to ensure that the system works well and is designed without any problems. It is crucial to focus on implementing security measures before releasing the application. Two types of testing, namely unit testing and user acceptance testing, were performed on this application as discussed in the previous chapter during the analysis and design phase. The results of these tests are displayed below.

6.1 Unit Testing Result

The developers responsible for designing the code perform unit testing on each module, ensuring thorough testing. The outcome of the unit testing is presented in Table 6.

Table 6: Unit testing results

No.		Check List	Expected Result	Actual Result
1.	Login - Insert the registered data	Login - Insert user's valid username and password.	Login successful and redirect to OTP page	Passed
	Login - Insert invalid user credentials	Login - Enter username and password.	Pop-up an error message on screen and redirect to main page	Passed
	Login - Insert verification code (SMS-Based OTP)	Login - Generate OTP and insert the verification code	Login successful and redirect to homepage	Passed
	Login - Insert invalid verification code (SMS-Based OTP)	Login - Generate OTP and insert the verification code	Pop-up an error message on screen and redirect to main page	Passed
2.	Register - Request for account activation key	Register - When creating an account, the user needs to request an account activation key from the main admin.	Once the user has received the account activation key, user can proceed with the registration process.	Passed
	Register - input new user credential details	Register - Insert first and last name, matric card number, email address, phone number, organisation, new password, confirm password and account activation key	Registered successfully and redirect to homepage	Passed

Table 6: (Cont.)

No.		Check List	Expected Result	Actual Result
3.	Admin - generate an account activation key	Admin Profile -Enter the user's email address as requested and initiate the key generation process.	Generated successfully and start generating new key	Passed
	Admin - create new events	Admin - Insert event name, start and end date, time, event type, location and poster.	Successfully added and redirect to discover page.	Passed
	Admin - delete created event	Admin - Select the event from “My Events” and click on the “submit” button.	Successfully deleted and redirect to discover page.	Passed
	Admin - view event report	Admin - The event information and attendance list will be displayed on the screen.	Display the selected event report on screen	Passed
	Admin - upcoming events on discover page	Admin - Scrolling to the right will allow you to see all the upcoming events that have been created by admins.	Display all the upcoming events in “Discover page”	Passed
	Admin - past events on discover page	Admin - Scrolling to the right will allow you to see all the past events that have been created by admins.	Display all the past events in “Discover page”	Passed
	Admin - generate dynamic QR code	Admin - In “My Events” select the event, scroll down and start generating the QR code.	Successfully generated the dynamic QR code	Passed
4.	Student - Register an event	Student - Select an event from the “Discover Page”. Scroll down and click on the “Register” button	The "Register" button, it will be transformed into "Registered”, and the colour will change to red.	Passed
	Student - View Registered Events and Past events	Student - Get the registered event details and past events in “My Events”	Able to view the registered event and past events list in “My Events”	Passed
	Student - Scan attendance	Student - To record your attendance, choose an event from the "My Events" section and scroll down. Use the scanner to scan the QR code.	Able to scan the dynamic QR code using the scanner in “My Events”.	Passed

6.2 User Acceptance Testing

The user acceptance testing conducted for the BKMI Event Management System application received positive feedback from 20 respondents. The application received high ratings across different aspects, including security features, availability, comprehensive information, application efficiency, event management convenience, and user management effectiveness. The results indicate a high level of satisfaction and success in meeting user requirements, user-friendliness, reliability, and system efficiency. Table 7 and Table 8 show the result of system user interface evaluation and system function evaluation acquired from 10 respondents.

Table 7: Result of System User Interface Evaluation

No.	Features	Ranking					Total
		1 (Poor)	2	3	4	5 (very good)	
1.	Easy to use and user-friendly				3	7	10
2.	Content navigation			1	4	5	10
3.	Layout of content				5	5	10
4.	Content display				7	3	10
5.	Interface design and structure			2	2	6	10
6.	System responsiveness					10	10

Table 8: Result of System Function Evaluation

No.	Features	Ranking					Total
		1 (Poor)	2	3	4	5 (very good)	
1.	User registration					10	10
2.	Login function					10	10
3.	Student module				1	9	10
4.	Admin module				2	8	10
5.	Event management module				3	7	10
6.	Event report module			2	3	5	10

7. Conclusion

The BKMI Event Management System, a mobile-based application for the Biro Kebudayaan Mahasiswa/I India club, successfully addressed the problem of manual event management achieved the stated objectives of designing, developing, and testing an event management system that utilizes QR Code and two-factor authentication. The system uses QR code and two-factor authentication to streamline event management and eliminate manual registration processes. It provides organizers with efficient tools for handling tasks, retrieving data, and managing events securely. The application has the potential for further improvements, such as implementing payment methods, live chats, feedback systems, and biometric security in the future. Overall, the BKMI Event Management System has enhanced efficiency, user satisfaction, and system security in event management.

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