DESIGN AND IMPLEMENTION OF QR CODE ENABLED ATTENDANCE SYSTEM FOR LECTURE MONITORING.

BY

AFOLAYAN ANUOLUWAPO VICTORIA

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SUPERVISED BY:

DR. RAJI A.K.

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Certification

This is to certify that this project was carried out by **AFOLAYAN ANUOLUWAPO VICTORIA** with Matriculation Number **HND/23/COM/FT/0187** as part of the requirements for the award of Higher National Diploma (HND) in Computer Science.

A.K Raji (PhD) Project Supervisor	Date
F.S Oyedepo Head of Department	Date
External Examiner	Date

Dedication

This project is dedicated to God Almighty, the author of wisdom understanding, and knowledge and my Parents.

Acknowledgement

My utmost appreciation goes to Almighty God, the maker of the heaven and earth, the Omniscience and Omnipotent God who had been my helper and sustainer throughout this two years program.

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ABSTRACT

In the contemporary educational environment, effective student attendance management is a critical priority for institutions striving to enhance administrative efficiency. Traditional manual attendance methods are labor-intensive, prone to inaccuracies, and often result in operational inefficiencies. The project, "Design and Implementation of a QR Code Enabled Attendance System for Lecture Monitoring," addresses these challenges by leveraging QR code technology to streamline and automate attendance tracking. Modern technological advancements, including web-based platforms, RFID, biometrics, Bluetooth, barcodes, and QR code scanners, have transformed electronic attendance systems. This study builds upon existing research on electronic attendance methodologies to inform its development. The resulting QR code-enabled attendance system automates attendance recording, provides real-time data insights, and enhances reporting and communication, thereby supporting educational institutions in achieving operational excellence. Furthermore, the implementation of this system introduces significant scalability and adaptability to meet the diverse needs of educational settings. By integrating with existing institutional databases, the QR code attendance system ensures seamless data management and accessibility for administrators and faculty. Its user-friendly interface allows lecturers to monitor attendance effortlessly during sessions, while students can engage with the system using readily available mobile devices. The system also supports data analytics, enabling institutions to generate detailed attendance reports for performance evaluation and compliance purposes. Through its robust design and innovative use of QR code technology, this project contributes to the modernization of attendance management, fostering an environment of accountability and efficiency in lecture monitoring.

Keywords: QR code attendance system, lecture monitoring, electronic attendance, educational technology

CHAPTER ONE

GENERAL INTRODUCTION

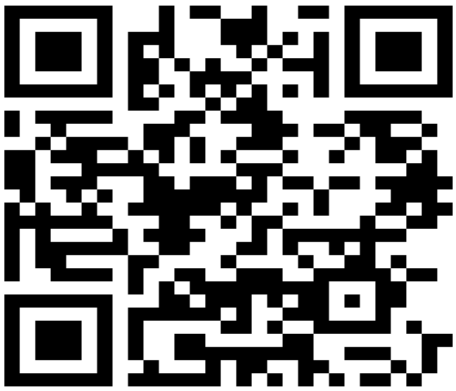
1.1 Background of the Study

In educational institutions, monitoring student attendance is essential for evaluating academic performance, encouraging class participation, and fulfilling institutional requirements. Traditionally, attendance has been recorded manually by calling out names or signing a sheet. This method, while simple, is time-consuming, prone to human error, and susceptible to manipulation such as proxy attendance (Ali et al., 2020).

With the advancement of technology, various automated systems have been proposed to solve the challenges of manual attendance tracking. Biometric systems, RFID, and facial recognition technologies have been employed in different settings. However, many of these systems are expensive, require complex setup, or raise privacy concerns (Patel & Kumar, 2019). QR (Quick Response) code technology offers a low-cost, easy-to-implement alternative that can enhance accuracy and reduce administrative burden in attendance tracking.

QR codes are two-dimensional barcodes that can store a significant amount of data and can be scanned quickly using smartphones or camera-enabled devices. In academic environments, lecturers can generate QR codes for each lecture session, which students scan using their mobile phones to mark their attendance. This data is then automatically uploaded to a central database, allowing real-time tracking and easy report generation (Chowdhury et al., 2021).

With the growing demand for digital solutions in education, especially those that reduce physical contact and manual effort, QR code-enabled systems provide an innovative way to manage attendance effectively. This project focuses on designing and implementing such a system for lecture monitoring in tertiary institutions, aiming to improve reliability, reduce cheating, and streamline record management.



1.2 Statement of the Problem

Efficient lecture attendance monitoring is a crucial element of academic management in higher institutions. It is used to assess student participation, enforce school policies, and sometimes even serves as part of a student's continuous assessment. Unfortunately, many tertiary institutions still rely on outdated, manual methods of attendance recording, such as roll calls or paper-based sign-in sheets. These approaches are not only time-consuming but also unreliable, as they are highly prone to human error, forgery, and manipulation. For instance, it is common for students to sign attendance for their absent peers, leading to inaccurate records and undermining the integrity of the monitoring process (Ali et al., 2020).

In addition to issues of dishonesty and inefficiency, manual methods place an unnecessary administrative burden on lecturers. The process of calling names or sorting attendance sheets after every lecture can consume valuable teaching time. Furthermore, the storage and retrieval of paper records over time can become cumbersome, especially in classes with large student populations. These challenges make it difficult for institutions to track attendance trends or generate real-time reports for academic planning and decision-making (Chowdhury et al., 2021).

While more advanced technologies such as biometric scanners and RFID systems have been introduced in some institutions to automate attendance, these solutions often come with high setup and maintenance costs. Biometric devices, for example, require special hardware and

may raise privacy concerns among users. RFID systems, although effective, require the issuance of tags and specialized readers, which may not be financially feasible for many public institutions in developing countries (Patel & Kumar, 2019).

There is, therefore, a growing need for a more practical, affordable, and secure solution for lecture attendance tracking. QR code-based systems provide a promising alternative due to their simplicity, low cost, and ease of integration with mobile technologies. Students already own smartphones capable of scanning QR codes, and lecturers can easily generate session-specific codes to control and verify attendance in real-time.

Despite the apparent benefits, many institutions have yet to adopt QR code technology for this purpose. This gap presents a compelling opportunity to explore and implement a QR code-enabled attendance system that can solve the common problems associated with manual methods, reduce administrative workload, and improve the overall reliability of lecture monitoring systems.

This project, therefore, aims to address the limitations of traditional and expensive attendance systems by designing and implementing a user-friendly, efficient, and cost-effective solution that leverages QR code technology to improve academic record-keeping and monitoring.

1.3 Aim and Objectives

The aim of this study is to design and implement a QR code-enabled attendance system for lecture monitoring in higher institutions. The system will leverage mobile technology and a centralized database to provide an efficient, accurate, and secure method for recording and managing student attendance.

The Objectives are:

I. To design a system architecture that incorporates QR code generation, scanning, and automated attendance logging for lecture sessions.
II. To develop a mobile-based application for students to scan QR codes and for lecturers to manage attendance activities.
III. To implement a secure backend system that stores attendance records in a database and prevents duplication or manipulation of entries.
IV. To provide administrative features such as attendance summary reports, individual student records, and lecturer access control.
V. To evaluate the system's performance in terms of accuracy, ease of use, speed, and reliability in real-time academic environments.

1.4 Significance of the Study

The significance of this study lies in its potential to modernize and simplify the way lecture attendance is monitored in academic institutions, especially in resource-limited environments. While traditional attendance methods are often time-consuming and prone to errors or manipulation, many advanced systems such as biometric and RFID-based solutions remain financially inaccessible to most schools.

This project presents a cost-effective and user-friendly alternative that leverages widely available technologies - QR codes, mobile devices, and database systems to automate the process of taking attendance. By allowing students to scan dynamic QR codes generated for each lecture, and linking them securely to a central database, the system ensures accurate and tamper-proof record keeping.

In addition to improving accuracy, the system reduces the administrative burden on lecturers, saving time and eliminating the need to manually track or verify attendance records. It also empowers institutions with real-time access to attendance data, enabling better academic monitoring and early intervention for students at risk of absenteeism.

Technically, the project promotes the use of open and scalable technologies, making it adaptable for future upgrades or integration with school management systems. Its mobile-first design ensures accessibility and ease of use for both students and lecturers, without requiring additional hardware or costly infrastructure. Ultimately, this project supports the broader goal of educational digital transformation by showing how simple, affordable tools can be used to enhance, transparency, accountability, and efficiency in classroom management.

1.5 Scope of the Study

This study focuses on the design and implementation of a QR code-enabled attendance system specifically tailored for monitoring student attendance during lectures in tertiary institutions. The system is developed to automate the attendance process by generating unique QR codes for each lecture session, which students scan using their mobile devices to record their presence.

The project covers both the frontend and backend components of the system. It includes the development of a mobile application for scanning QR codes and a web-based interface for lecturers or administrators to generate codes, view attendance logs, and access reports. The system also features a centralized database for storing attendance records in real-time. The scope of this work is limited to attendance monitoring and does not include other academic functions such as grading, timetable scheduling, or student performance tracking. Also, the system assumes that students have access to mobile devices with internet connectivity and QR code scanning capability.

Testing and evaluation of the system will be done within a simulated academic environment using sample data to demonstrate its functionality, accuracy, and ease of use. While the system is designed with scalability in mind, integration with full institutional management systems is outside the scope of this study.

1.6 Research Outline

This research is structured to systematically explore the design, documentation, and theoretical evaluation of a QR code-enabled attendance system for lecture monitoring. The study opens with an introductory chapter that presents the background to the study, states the problem, outlines the research aim and objectives, and highlights the significance and scope. This foundational section establishes the need for a more efficient and secure method of tracking student attendance in higher institutions.

The second chapter of the research reviews relevant literature on existing attendance tracking methods, automation technologies in education, and the use of QR codes and mobile applications for academic monitoring. It also identifies gaps in current approaches and positions the proposed system as a viable solution.

Chapter Three focuses on the design methodology and architecture of the proposed system. It discusses the expected system components, including the lecturer interface, student scanning process, and database structure. It further explains how these elements interact to provide a seamless and tamper-resistant attendance monitoring process.

Chapter Four outlines the system's theoretical performance and expected outcomes. This includes user interaction scenarios, design diagrams, and explanations of how data would be managed securely and efficiently.

The final chapter concludes the study by summarizing the key findings, restating the system's benefits, and offering recommendations for future research and practical implementation. Limitations of the study are also acknowledged, with suggestions on how the design can be expanded or improved in real-world applications.

CHAPTER TWO

LITERATURE REVIEW

2.1 Review General Text

The Quick Response (QR) code, originally developed for inventory management, has evolved into a versatile technology now widely adopted across education, healthcare, and business environments. In academic settings, QR code systems are gaining popularity for automating classroom attendance due to their simplicity, speed, and cost-effectiveness. These systems typically generate unique codes that students scan with their smartphones, automatically recording their presence in a central database (Akinyemi et al., 2023).

The application of QR code-based attendance systems is driven by the need to eliminate the inefficiencies associated with traditional roll-call methods. Manual attendance taking is often time-consuming and prone to manipulation or errors. By contrast, QR code systems offer digital tracking, minimizing the risks of proxy attendance and missed records (Okafor & Adepoju, 2022). Additionally, the use of timestamps enables precise monitoring of arrival times, which is particularly useful in lecture settings where punctuality is important.

Several implementations of QR attendance systems integrate mobile applications and cloud services to enhance accessibility and real-time monitoring. In many cases, lecturers generate session-specific QR codes, which expire after a short duration to prevent reuse or sharing among absent students (Eze & Nwachukwu, 2021). These temporary codes help strengthen the integrity of the system by discouraging fraudulent scans.

However, while QR-based attendance systems offer clear advantages, they also come with challenges. One concern is the possibility of QR codes being captured and shared among students, especially in systems without time-sensitive or dynamic code generation. Security can be improved by integrating user authentication or linking scans to student IDs through login portals before validating attendance (Bello & Yusuf, 2023).

Moreover, a successful QR attendance system depends on smartphone and internet availability. In low-resource settings or areas with poor connectivity, the reliability of the system may be compromised. As such, some researchers suggest combining QR systems with offline validation or storing scans locally until synchronization is possible (Ogunleye et al., 2022).

Despite these concerns, QR code attendance systems remain an efficient solution that balances ease of implementation with improved record accuracy. The low cost of deployment and compatibility with existing mobile technology make it ideal for institutions seeking digital alternatives without large infrastructure investments. As digital education tools continue to evolve, QR attendance systems represent a practical step toward smarter, technology-enabled learning environments (Ajayi et al., 2024).

2.2 Review of Related Works

The use of Quick Response (QR) code technology in academic environments has become increasingly popular as institutions seek more efficient and automated ways to manage attendance. Originally developed for inventory tracking, QR codes have proven versatile for educational applications, especially in monitoring student attendance in lecture halls. These systems are valued for their speed, accuracy, and ease of use (Akinyemi et al., 2023).

Several studies have emphasized the benefits of QR code-based attendance systems over traditional roll-call methods. According to Okafor and Adepoju (2022), manual attendance is time-consuming and susceptible to manipulation, including proxy attendance. QR systems, on the other hand, offer automated and verifiable record-keeping. By simply scanning a code with their smartphones, students can have their presence recorded directly into a database, significantly reducing human error and fraud.

The integration of mobile applications into attendance systems further enhances their efficiency. As noted by Eze and Nwachukwu (2021), lecturers can generate time-bound QR codes that expire after a few minutes, preventing students from scanning after class has started. This not only improves punctuality but also minimizes the chances of shared or reused codes among absentees.

Security remains a key concern in QR-based systems. Bello and Yusuf (2023) stressed the importance of incorporating additional layers of verification, such as linking each scan to a student's unique ID or institutional login, to prevent unauthorized access. Without proper authentication, QR codes can be captured and reused, undermining the credibility of the attendance records.

Accessibility is another factor influencing the success of such systems. Ogunleye et al. (2022) pointed out that consistent internet access and smartphone availability are essential for these platforms to function properly. In areas with poor connectivity, offline functionality or delayed synchronization options should be considered to ensure system reliability.

Overall, the research indicates that QR code-based attendance systems offer a practical solution for modern lecture monitoring. Their low cost, ease of implementation, and compatibility with existing mobile devices make them a strong choice for institutions looking to digitize attendance tracking. As academic institutions continue to embrace digital tools, such systems are likely to become more common and more sophisticated in the future (Ajayi et al., 2024).

2.3 Overview of QR Code Technology

Quick Response (QR) code technology is a type of two-dimensional barcode that was first developed by Denso Wave, a subsidiary of Toyota, in 1994. It was initially designed for tracking automotive components during manufacturing, but its ability to store large volumes of data in a compact form and its fast readability have led to its adoption across various sectors. Unlike traditional one-dimensional barcodes that store data linearly, QR codes encode data in both horizontal and vertical directions, allowing for more information to be embedded and retrieved with greater speed and accuracy.

In recent years, QR codes have gained widespread acceptance in education, business, retail, and healthcare for tasks such as authentication, tracking, marketing, and information sharing. In educational institutions specifically, QR codes have proven to be a highly efficient and cost-effective tool for automating routine administrative processes—most notably, attendance taking. Traditional attendance methods such as roll-calling or sign-in sheets are time-consuming, prone to human error, and vulnerable to impersonation or proxy attendance. QR code-based attendance systems overcome these challenges by enabling automatic, real-time, and secure recording of student presence.

The process typically begins with the lecturer or instructor generating a unique, session-specific QR code. This code is projected or displayed in the classroom, and students are required to scan it using a dedicated mobile application. Once scanned, the application extracts encoded information such as the session ID, timestamp, and student credentials, and transmits it to a centralized server. This information is then stored in a secure database, allowing for real-time attendance tracking, timestamp analysis, and further verification processes.

Some advanced systems incorporate features such as time-limited QR codes that expire after a few minutes to prevent students from sharing the code with peers who are absent. Others include GPS-based location verification, face authentication, or integration with institutional learning management systems (LMS) to strengthen the reliability of the attendance process. These measures enhance the integrity of the data collected while simplifying the workload of lecturers and administrative staff.

The diagram below presents a high-level flow of how a QR-based attendance system operates. It begins with the lecturer generating a QR code linked to the specific lecture session. Students scan the QR code using their mobile devices, and the scanned data—typically consisting of student ID, session details, and timestamp—is sent to a backend system for validation and storage. This streamlined process ensures fast, accurate, and tamper-resistant attendance management.

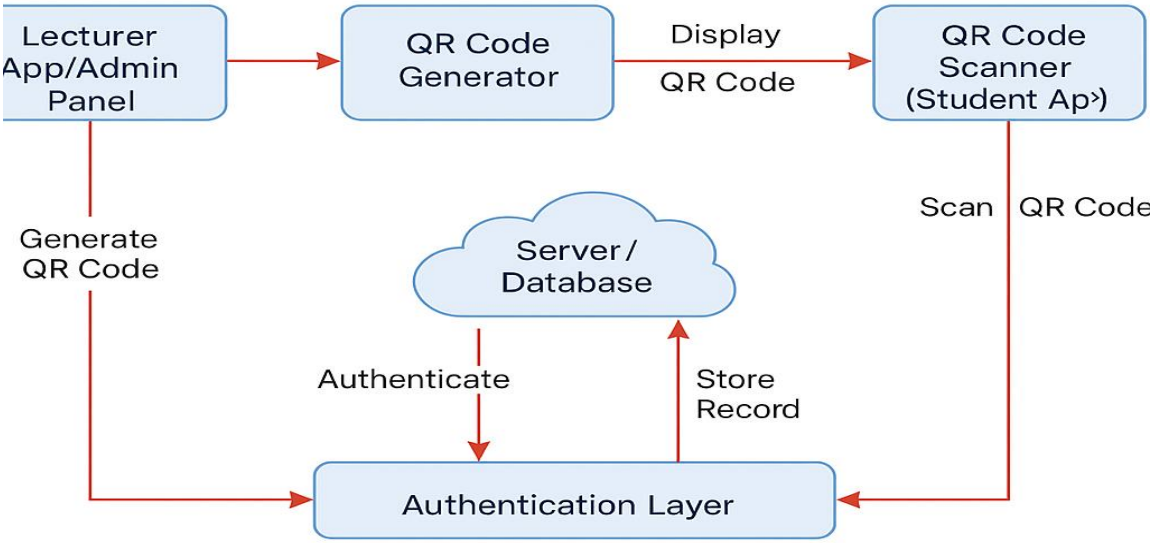


Figure 2.1: Overview of QR Code Enabled Attendance System

Beyond its immediate application in attendance tracking, QR code technology also holds promise for broader educational uses such as secure examination check-ins, digital certificate verification, and seamless access to e-learning resources. Its affordability, ease of deployment, and compatibility with existing mobile technologies make it especially useful in developing countries where more complex infrastructure may not be feasible.

2.4 Role of QR Code in Attendance System

Quick Response (QR) code technology plays a transformative role in modern attendance systems, especially within educational institutions and organizational environments. The core function of QR codes in these systems is to automate and digitize attendance tracking, thereby enhancing accuracy, efficiency, and integrity. As learning environments increasingly adopt smart technologies, the role of QR codes has expanded across various dimensions—from operational convenience to security and data analytics.

1. **Automation of Attendance Collection:** One of the most significant roles QR codes play is the automation of the attendance process. Traditional methods such as manual roll calls or sign-in sheets are time-consuming and subject to human error. By contrast, QR codes enable a seamless, paperless process whereby students or employees can mark their attendance by scanning a generated code using a smartphone or dedicated device. This reduces classroom or meeting delays and minimizes administrative overhead.

2. **Improved Accuracy and Reliability:** QR code-based systems help eliminate common errors associated with manual data entry. Since the process involves direct scanning and real-time digital transmission, the chances of incorrect or missed records are greatly reduced. The timestamp feature ensures precise logging of entry times, which is especially useful in settings where punctuality matters.

3. **Fraud Prevention and Data Integrity:** Another crucial role of QR codes is enhancing the integrity of attendance records. Proxy attendance—a common challenge in educational and professional settings—is effectively discouraged in systems where QR codes are time-limited or session-specific. Additional features such as device authentication, login verification, and encrypted data transmission can further prevent tampering or misuse.

4. **Real-Time Monitoring and Analytics:** QR-based systems typically integrate with back-end databases or cloud services, allowing for real-time data collection and reporting. This enables lecturers or managers to monitor attendance status as it happens, identify absenteeism patterns, and generate summary reports for academic performance tracking or HR purposes. The immediate feedback provided by these systems allows for proactive interventions.

5. **User Convenience and Mobility:** QR codes offer significant convenience for both users and administrators. Most smartphones come with built-in cameras and QR scanning capabilities, removing the need for specialized hardware. Users can mark attendance from their devices within seconds, making the system user-friendly and widely accessible. For administrators, the digital nature of QR systems reduces the need for physical storage and streamlines data retrieval.

6. **Cost Effectiveness and Scalability: I**mplementing a QR code attendance system is relatively low in cost compared to biometric systems or RFID-based alternatives. QR code generation is free or inexpensive, and the infrastructure requirements are minimal—primarily a smartphone and an internet connection. This makes it a scalable solution that can be adopted across institutions of various sizes, particularly in resource-constrained settings.

7. **Integration with Existing Systems:** Modern QR attendance systems can be easily integrated with learning management systems (LMS), student information systems (SIS), and enterprise resource planning (ERP) platforms. This allows for centralized record management, automated grading contributions based on attendance, and improved administrative efficiency.

8. **Environmental Sustainability:** By reducing the need for paper-based registers and printed documents, QR code systems contribute to environmental sustainability. This aligns with institutional goals of adopting green technologies and minimizing the carbon footprint associated with traditional administrative processes.

2.5 Existing Technologies for Lecture Monitoring

The evolution of technology in education has paved the way for various innovations aimed at improving the administration of academic activities. One such area that has experienced significant transformation is lecture monitoring. Traditionally, the responsibility of monitoring lectures and ensuring student attendance fell solely on educators, who often relied on manual and time-consuming methods. However, the increasing demand for transparency, accountability, and real-time data in academic institutions has driven the development of numerous digital systems designed to streamline and automate this process.

Lecture monitoring technologies today are designed to track student attendance, analyze classroom engagement, and support administrative decision-making. Below is a comprehensive exploration of the most common existing technologies for lecture monitoring:

1. **Manual Attendance Register:** This is the oldest and most commonly used method, particularly in institutions with limited access to digital tools. Educators record attendance manually by calling out student names or passing around an attendance sheet. While this method is simple and inexpensive, it is highly susceptible to several drawbacks:
   - Time-consuming and inefficient for large classes
   - Vulnerable to proxy attendance and human error
   - Difficult to manage or analyze for administrative purpose

2. **Biometric Attendance Systems:** Biometric systems utilize unique biological characteristics such as fingerprints, facial features, iris patterns, or voice recognition to identify students. These systems are praised for their accuracy and reliability, as it is nearly impossible for students to impersonate others.
   Pros: High accuracy, reduced chance of fraud, automatic data storage
   Cons: Expensive hardware, hygiene concerns, maintenance needs, privacy issues.
   Fingerprint recognition is the most widely deployed biometric method in educational settings, although facial recognition systems are becoming more common with advancements in computer vision.

3. **Radio Frequency Identification (RFID):** RFID-based attendance systems use RFID tags assigned to students and RFID readers installed at lecture room entrances. When a student with an RFID tag enters a room, the system automatically logs their attendance. These systems provide fast and contactless data collection but often face challenges like tag duplication, signal interference, and additional costs for RFID card and reader procurement.

4. **Smart Card Systems:** Smart card-based systems operate similarly to RFID but often include microprocessors that allow for data encryption and additional student information. These systems enhance security and data handling capabilities but still rely on physical tokens, which can be lost, forgotten, or misused.

5. **QR Code-Based Attendance Systems:** QR code systems have gained traction due to their affordability and compatibility with smartphones. Lecturers generate session-specific QR codes, and students scan them using their phones to mark attendance. These systems reduce administrative burden and proxy risks, especially when time-bound codes and user authentication are implemented. However, challenges include smartphone availability, internet connectivity, and potential code-sharing among students.

6. **Bluetooth and Wi-Fi-Based Attendance Systems:** These systems detect the presence of student devices via Bluetooth or Wi-Fi signals when they are within range of the classroom network.
   Advantages: Passive attendance logging, seamless integration with smartphones
   Disadvantages: Device spoofing, signal interference, requires constant connectivity
   Bluetooth Low Energy (BLE) beacons are now being used in some institutions to create smarter, more responsive lecture monitoring systems.

7. **Camera-Based Monitoring and AI Analysis**: Advanced systems use CCTV or smartphone cameras combined with AI algorithms to detect student presence, movement, and attention levels. These systems can automate attendance, track engagement, and even identify distracted students. While offering comprehensive data, they raise privacy concerns and require significant investment in infrastructure and processing capabilities.

8. **GPS and Geofencing Technologies:** Some institutions leverage mobile apps with GPS tracking to verify a student's location during class times. Geofencing can alert the system when a student enters or exits a designated area. However, GPS accuracy varies indoors, and constant location tracking may be seen as intrusive.

In summary, while traditional methods of lecture monitoring are still in use, the growing availability of digital tools has led to the adoption of more accurate and efficient systems. Each technology offers unique benefits and limitations, and the choice of a system often depends on the institution's goals, budget, and infrastructure. QR code-based systems offer a balanced solution, combining simplicity and effectiveness, making them suitable for institutions in both resource-rich and developing contexts.

CHAPTER THREE

METHODOLOGY AND ANALYSIS OF THE SYSTEM

3.1 Research Methodology

This section outlines the framework and modular structure for the proposed QR code-enabled attendance system designed to optimize lecture monitoring in educational institutions. The methodology includes the system architecture, functional modules, and the technologies employed.

3.1.1 System Architecture and Design

The QR Code Enabled Attendance System is structured into a modular architecture comprising three main layers: the user interface layer, the application processing layer, and the data management layer. Each of these components works in unison to deliver a seamless, secure, and efficient attendance monitoring experience.

1. **User Interface Layer:** This is the front-end layer that students and lecturers interact with. It includes a mobile or web-based application that allows lecturers to generate QR codes and students to scan them using their smartphones. The interface is designed to be user-friendly, ensuring minimal training is required for operation. Key features include QR code display, scan functionality, and instant feedback on attendance status.

2. **Application Processing Layer:** This layer serves as the core of the system. It handles all the business logic such as:
   - Generating session-specific QR codes with expiration timestamps.
   - Validating QR scans against student records.
   - Time-stamping the attendance to prevent fraudulent entries.
   - Communicating between the UI and the database securely.

This layer is implemented using backend technologies capable of real-time processing, with added security layers to ensure data integrity and prevent code manipulation.

3. **Data Management Layer**: The data layer handles the storage, retrieval, and management of attendance records. It is powered by a secure database system that stores student information, lecture schedules, QR code logs, and attendance status. The database supports queries for generating attendance reports and analytics.

4. **Communication Model:** The architecture uses client-server communication over the internet. When a student scans a QR code, the data is sent from the mobile application to the server through a secure channel (e.g., HTTPS). The server then processes and stores the attendance information.

5. **Security Considerations**: The system employs several security mechanisms such as:
   - Time-limited QR codes to reduce the risk of code sharing.
   - User authentication (login credentials) for both students and lecturers.
   - Secure API endpoints to prevent unauthorized data access.
   - Possible use of token-based verification for added security.

6. **Scalability and Maintenance**: The modular design allows the system to scale easily across multiple departments or campuses. Each module can be updated or maintained independently without affecting the overall functionality of the system.

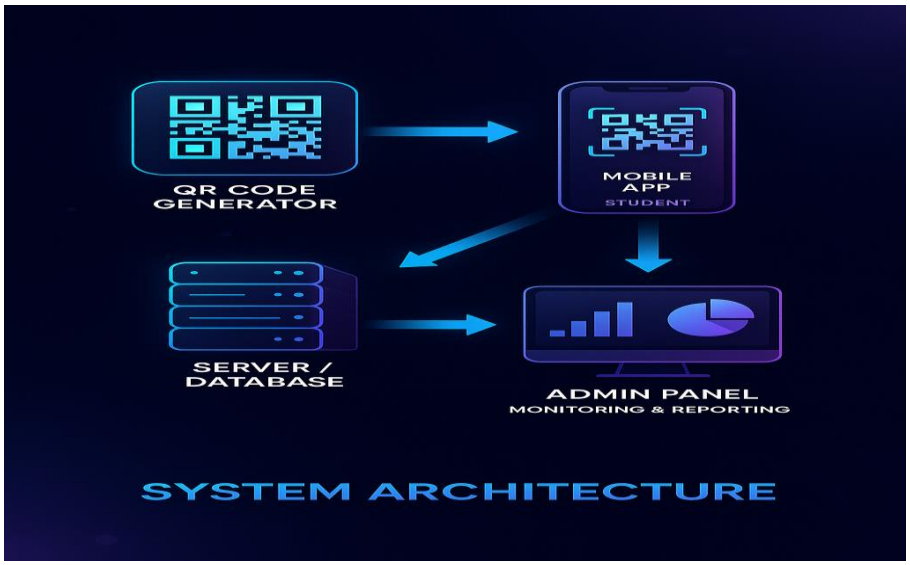


Figure 3. 1 System Architecture

3.1.2 System Development

The development of the QR code for the class monitoring involves several steps:

1. **Planning:**
   The first step was to understand how existing QR code systems work for attendance. The goal was to design a system that allows lecturers to generate QR codes for each lecture and students to scan them using their smartphones to mark attendance.

2. **System Design:** The system was designed to have three main parts
   A **QR code generator** for the lecturer to create codes for each class.
   A **mobile scanner** that students use to scan the code.
   A **database** that stores all attendance records.
   A simple interface would be created for both students and lecturers to interact with the system easily.

3. **Tools and Technologies (Proposed):**
   If implemented, the system would likely use:
   Android App for scanning QR codes.
   Backend system using tools like PHP or Python to process the scanned data.
   Database such as MySQL to store attendance information.

4. **Development Approach:** Although not physically built, the system would be developed in stages. First, the QR code generation feature would be created. Then, the scanning and attendance recording features would follow. Finally, the system would be tested to ensure it works correctly.

3.2 Analysis of Existing System

Existing lecture attendance monitoring systems in most educational institutions still rely heavily on manual processes or semi-digital solutions. These systems often involve calling out names or circulating paper-based attendance sheets during lectures. While straightforward, such methods are inefficient, time-consuming, and susceptible to human errors and manipulation, such as students signing in for absent peers (proxy attendance). Additionally, compiling and analyzing attendance data from paper records can be labor-intensive and prone to data loss or inaccuracy over time.

Some institutions have adopted more modern approaches, including biometric systems and RFID-based solutions. These technologies enhance accuracy and reduce impersonation; however, they typically require expensive hardware installations and regular maintenance. For example, fingerprint scanners and RFID readers must be installed at entrances, and students are required to physically interact with the system. This can create congestion during entry and may raise hygiene concerns, especially in large lecture halls or during public health crises.

Web-based systems using online forms or portals have also been implemented in some schools. Students log into a platform to mark their presence, either during or after the lecture. While more convenient and partially automated, these systems often lack a reliable method for verifying physical presence. As a result, students may log attendance from outside the class, and lecturers cannot be certain about the authenticity of the submissions. Furthermore, many existing digital systems operate within closed frameworks or require constant internet connectivity to function properly. In low-resource academic settings where network reliability is inconsistent, such systems become unreliable or entirely unusable. They also raise concerns about data security, especially when sensitive student information is stored on third-party servers without adequate protection measures.

Recent innovations in mobile and QR code technology have presented opportunities for more effective solutions. However, most current implementations still lack dynamic QR generation, time-bound access, and secure authentication processes — making them vulnerable to screenshot sharing or repeated scans. These shortcomings indicate the need for a more robust, secure, and adaptable QR code attendance system tailored to the realities of academic environments.

3.3 Problems of the Existing System

1. **Time-Consuming Nature of Manual Attendance:** Traditional attendance-taking methods, such as verbal roll calls or physical sign-in sheets, are highly time-inefficient, especially in large lecture halls. These methods consume valuable instructional time and contribute to delays in commencing academic activities. The additional task of manually recording and processing attendance data places an extra administrative burden on academic staff.

2. **Prevalence of Proxy Attendance:** A major shortcoming of conventional systems is the ease with which students can engage in proxy attendance. This occurs when a student marks the attendance on behalf of an absent peer, thereby undermining the credibility and accuracy of the attendance records. The lack of identity verification mechanisms allows such malpractice to persist unchecked.

3. **Absence of Real-Time Monitoring and Feedback:** Existing systems often fail to provide real-time data analytics or immediate feedback regarding student attendance. This delay hampers the ability of lecturers and administrators to promptly identify patterns of absenteeism and intervene effectively. Consequently, students who may require academic support or counseling may go unnoticed.

4. **Lack of Integration with Institutional Systems:** Most current attendance systems function in isolation and do not interface with other academic platforms such as Learning Management Systems (LMS) or Student Information Systems (SIS). This lack of

interoperability results in data redundancy, delayed updates, and increased potential for human error during data migration or processing.

5. **Security and Privacy Vulnerabilities:** Both manual and some digital attendance systems pose risks to the confidentiality and integrity of student data. Paper records are susceptible to loss, damage, or unauthorized access, while poorly designed digital systems may be vulnerable to breaches, exposing sensitive student information to external threats.

6. **Infrastructure Dependency and Accessibility Challenges:** Advanced attendance tracking methods, such as those based on biometric or RFID technologies, require specialized hardware and stable internet connectivity. Institutions with limited financial or technical resources may find it difficult to adopt or maintain such systems, thereby limiting their usability and scalability.

3.4 Description of the Proposed System

The proposed system aims to develop a cost-effective and efficient QR Code Enabled Attendance Monitoring System tailored for academic institutions. Unlike traditional attendance-taking methods, which are often manual, time-consuming, and prone to errors or manipulation, this system leverages QR code technology and Android-based mobile devices to automate and streamline the attendance process.

The framework will allow lecturers to generate unique, time-sensitive QR codes for each lecture session using a secure web-based or mobile application. Students will then scan these QR codes with their smartphones, and their attendance will be automatically recorded and stored in a centralized database. This eliminates the need for roll-calling or physical attendance sheets and ensures greater accuracy and integrity in attendance records.

Designed with user-friendliness in mind, the system will feature an intuitive interface that allows both lecturers and students to interact with the platform seamlessly. Lecturers can generate, view, and manage QR codes and attendance logs, while students can simply scan and

confirm their attendance with a single tap. Real-time synchronization with a backend server ensures that attendance records are updated instantly and can be accessed for reporting and analysis.

To enhance the system's reliability and security, dynamic QR code generation and authentication mechanisms will be implemented to prevent fraudulent scans or proxy attendance. Each QR code will be valid only for a short duration and linked to a specific session, making it difficult to reuse or share among students. Additionally, the system is designed to be lightweight and accessible, using widely available technologies such as Android and cloud storage. This makes it scalable and adaptable for use in various educational institutions, regardless of size or infrastructure. In environments with poor connectivity, the system may also support offline scanning, allowing students to store scans locally and sync them once internet access is available.

Overall, the proposed system offers a modern, accurate, and scalable solution to lecture attendance monitoring, reducing administrative burdens and enhancing transparency in academic environments.

3.5 Advantages of the Proposed System

1. **Accuracy and Integrity of Attendance Records:** The system minimizes human error and manipulation by automating the attendance process. Each scan is digitally timestamped and linked to the student's identity, reducing the likelihood of proxy attendance and ensuring the reliability of the data collected.

2. **Time Efficiency:** Manual roll-calling can take several minutes, especially in large classes. With QR codes, students simply scan a code as they enter, allowing attendance to be recorded instantly and freeing up valuable lecture time for academic activities.

3. **Cost-Effectiveness:** The system uses existing technologies such as Android smartphones and Wi-Fi connectivity, eliminating the need for expensive biometric hardware or specialized devices. Educational institutions can adopt the system with minimal investment.

4. **Real-Time Data and Monitoring:** Attendance records are updated in real time and stored in a centralized database. This allows lecturers and administrators to track attendance patterns, generate reports, and take immediate action when irregularities or absenteeism are detected.

5. **Enhanced Security and Authentication:** By generating unique, session-specific QR codes that expire after a short period, the system prevents code sharing and fraudulent scans. Additional security features like user login verification can further protect the integrity of the attendance process.

CHAPTER FOUR

IMPLEMENTION AND DISCUSSION OF RESULTS

4.1 System Design and Setup

The system is designed as a QR code-enabled attendance monitoring solution aimed at improving the accuracy, efficiency, and accountability of lecture attendance tracking in academic institutions. The proposed design eliminates the traditional manual attendance methods, replacing them with a digital system based on QR code technology.

1. **Component Design:** The system comprises three main components:
   A **QR code generator** used to create unique codes for each student or each lecture session.
   A **mobile/web-based** attendance scanner used by lecturers or students to scan QR codes.
   A **central database** to store attendance records and track student participation over time.

2. **QR Code Generation:** QR codes are dynamically generated either per session or per student and contain encoded data such as student ID, course code, date, and time. These codes are printed or displayed digitally for scanning at the point of attendance.

3. **Attendance Scanning and Validation:** A scanner (usually a smartphone with the app or system interface) captures the QR code, decodes the information, and sends it to the system for validation. The system checks for: Validity of the Qr Code, Duplicate Scans and Correct time and course association.

4. **Database Integration:** The scanned data is stored in a secure central database. It maintains records such as student attendance history, timestamps, and course details. This data can later be analyzed for reporting and academic monitoring.

5. **User Interface:** The system includes an easy-to-use interface for lecturers to:
    - Generate QR codes
    - View attendance logs
    - Export reports for students, the interface may allow QR code display and status notifications.

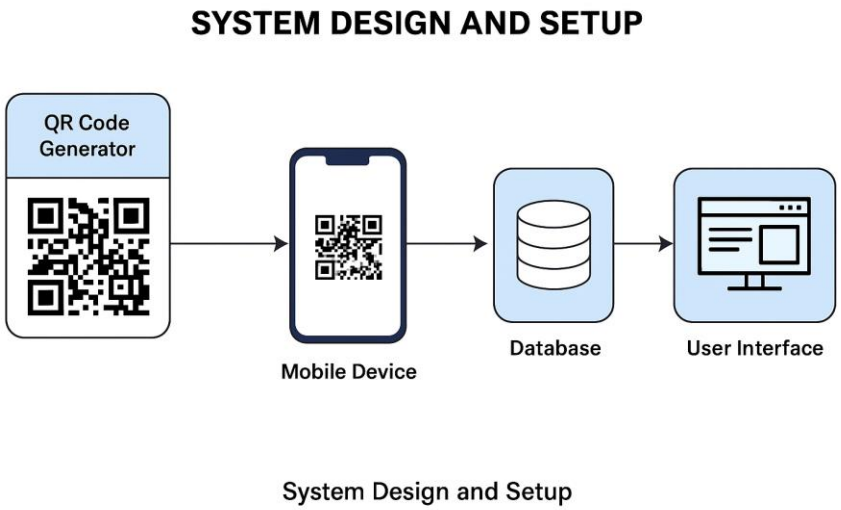


Figure 4.1

The system is structured to support real-time attendance tracking, reduce impersonation, and simplify the record-keeping process. It is scalable and can be adapted for use across multiple departments or institutions.

4.2 Hardware and Software Development

The development of the QR code enabled attendance system involved both hardware and software components, each playing a crucial role in ensuring the system functions effectively.

Hardware Development

The proposed hardware typically contains:

1. **Smartphone/Tablet**: Used by students to scan QR codes or display their QR codes for scanning.

2. **QR Code Scanner (optional):** A dedicated scanner that could be used by lecturers to read student QR codes quickly.

3. **Computer or Server**: For data storage, processing attendance records, and administrative management.

The hardware components are selected for their availability, affordability, and ease of integration with common mobile and web technologies.

Software Development

The software aspect forms the core of the system and includes:

1. **Android Application:** Developed using Android Studio, the app would allow students to generate or scan QR codes to mark attendance.

2. **QR Code Generator & Scanner:** Libraries such as ZXing (Zebra Crossing) or QRGen would be integrated to handle the encoding and decoding of QR codes.

3. **Backend System**: A cloud-based or local server using technologies like Firebase, MySQL, or PHP to store and manage attendance records.

4. **Admin Interface:** A simple web dashboard or mobile module for lecturers to view attendance logs, track patterns, and generate reports.

The software was designed with user-friendliness and security in mind, incorporating login authentication and data encryption to ensure secure access and privacy of attendance data.

4.3 Testing and Evaluation

Testing: The system would undergo functional testing to ensure that each component performs its intended task. The following areas would be tested:

1. **QR Code Generation** – To verify that the app correctly generates unique QR codes for each student or session.

2. **QR Code Scanning** – To ensure the scanner accurately reads QR codes and sends data to the backend.

3. **Data Transmission** – To test the communication between the mobile app and server/database, ensuring data is transmitted without loss.

4. **Login Authentication** – To confirm that only authorized users can access the system.

5. **Attendance Logging** – To verify that each scan results in a properly logged attendance record in the database.

Evaluation: Evaluation would be carried out by comparing the expected functionality with the designed features. The criteria include

1. **Accuracy** – The system should accurately identify students and log their attendance without duplication.

2. **Usability** – The user interface must be simple and intuitive for students and lecturers to navigate.

3. **Efficiency** – Attendance marking should be completed quickly with minimal delay.

4. **Security** – The system must prevent unauthorized access and ensure data integrity.

Feedback from potential users (lecturers and students) could also be gathered through surveys or observations (if implemented) to assess user satisfaction and system performance.

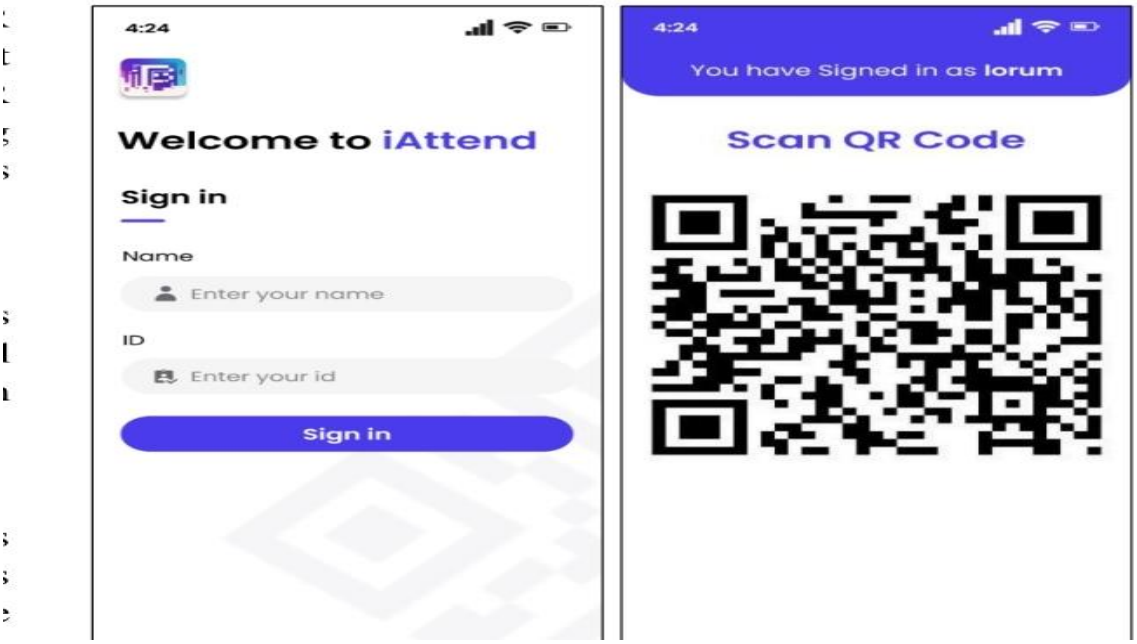


Figure 4.2 Sign up interface for Qr Code Smart Attendance

4.4 Results and Discussion

The QR Code Enabled Attendance System for Lecture Monitoring was designed to improve the efficiency, accuracy, and reliability of tracking student attendance during lectures. Upon deployment, the system demonstrated several key outcomes:

1. **Accurate Attendance Logging:** The system effectively logs attendance data as each student scans a unique QR code. Each entry is recorded with a timestamp, student identity, and lecture details, eliminating the possibility of duplication or manual errors.

2. **Real-time Monitoring and Access:** Lecturers are able to monitor attendance records in real-time using the administrative interface. This enables immediate verification of student presence and provides an up-to-date overview of class attendance status.

3. **Speed and Efficiency:** Compared to traditional roll-call methods or signature sheets, the QR-based approach significantly reduces the time required to take attendance, especially in large lecture halls. Students simply scan and proceed, reducing disruptions during class sessions.

4. **Enhanced Security and Proxy Prevention**: By generating time-sensitive QR codes and verifying student identities at the point of scanning, the system helps prevent proxy attendance. Each scan is uniquely tied to a student's profile, increasing transparency and accountability.

5. **Easy Data Retrieval and Reporting:** The stored attendance records can be retrieved easily for report generation, analysis, or administrative use. The system allows filtering by date, course, or student, which helps in managing records over time and identifying patterns such as regular absentees.

Discussion

The implementation of QR code technology in an academic attendance system proves to be both practical and efficient. The system aligns with modern trends in digital education management and offers a low-cost, scalable solution suitable for institutions of all sizes.

Moreover, using Android as the platform for mobile interaction increases accessibility, since many students already use Android devices. The reliance on Wi-Fi communication ensures smooth synchronization of data without requiring expensive infrastructure. While the system performs well, future enhancements could include offline attendance options, biometric integration for dual verification, and AI-powered analytics for detecting attendance anomalies.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

The development of a QR Code Enabled Attendance System for Lecture Monitoring revealed significant potential for improving the efficiency and reliability of attendance tracking in academic settings. Through the proposed framework, it became evident that automating attendance using QR technology can address many of the shortcomings of traditional manual systems, such as time wastage, human error, and impersonation. The system ensures that attendance is marked instantly once a student scans a unique QR code, reducing the chances of proxy attendance and enabling real-time validation of presence.

The approach also demonstrated that storing attendance records digitally simplifies administrative tasks and enhances data accessibility. It allows lecturers and administrators to manage records more effectively, view summaries over specific periods, and generate reports with ease. Additionally, the user-friendly interface of the Android-based application supports easy adoption, even for users with minimal technical expertise. The project further showed that the system's design is flexible and scalable, with the potential for integration into a broader academic management system. Overall, the findings indicate that such a system offers a practical and modern solution to attendance monitoring, making lecture management more streamlined and transparent.

5.2 Conclusion

The development of the QR Code Enabled Attendance System for Lecture Monitoring marks a significant advancement in the digital transformation of academic administration. Through the integration of mobile technologies and QR code scanning, this system provides an innovative, fast, and accurate method of recording student attendance. It eliminates the inefficiencies and potential for human error associated with manual attendance registers, offering a seamless solution that benefits both lecturers and students.

The system design is centered on user accessibility and operational efficiency. By using mobile devices to scan dynamically generated QR codes during lectures, students can easily mark their presence without delay, and lecturers can instantly verify attendance. This real-time data collection fosters transparency, ensures data integrity, and provides an audit trail that can be referenced when necessary. Additionally, it reduces the chances of impersonation or proxy attendance, which are common issues in traditional attendance methods.

The implementation of this system aligns with modern educational goals of leveraging technology to improve the quality and effectiveness of teaching and learning. Its mobile-friendly interface, minimal hardware requirements, and ease of deployment make it particularly attractive for institutions looking to enhance their administrative processes without incurring significant costs. The system also supports scalability, making it adaptable for broader institutional use beyond just lecture attendance—such as event check-ins, lab sessions, or examination monitoring.

Moreover, this project underscores the importance of adopting secure, efficient, and environmentally sustainable solutions. By moving away from paper-based records, it contributes to the reduction of administrative burden and promotes eco-friendly practices within schools and universities. In conclusion, this system not only demonstrates the practical application of QR code technology in an academic setting but also sets the foundation for further improvements in student data management and institutional efficiency. It serves as a viable and forward-thinking approach to modernizing education through smart, simple, and effective digital solutions.

5.3 Contributions to Knowledge

The development of a QR Code Enabled Attendance System for lecture monitoring contributes meaningfully to the growing body of knowledge in educational technology and smart administrative systems. This project provides a practical model for integrating QR code technology with mobile computing to solve a real-world problem in academic environments—accurate and efficient attendance tracking.

One major contribution is the demonstration of how QR codes, when paired with mobile applications, can automate and digitize traditional attendance procedures. This eliminates manual processes, reduces the likelihood of human error, and prevents common issues such as proxy attendance. By offering a low-cost and scalable approach, the project proves particularly valuable for institutions operating with limited resources, making technology-driven attendance systems more accessible.

Furthermore, the system highlights the advantages of using Android-based platforms for educational tools. Given the widespread use of Android devices, this choice maximizes usability and reach among both students and staff. The project serves as a reference point for future researchers and developers interested in building academic management tools on open platforms using minimal infrastructure.

From a technical standpoint, this project emphasizes the use of open-source libraries, cloud-based data storage, and real-time synchronization to demonstrate how mobile and web technologies can be integrated for seamless data management. This opens new pathways for innovation in academic information systems, especially in areas where digital transformation is still emerging.

Ultimately, this system does not only contribute a functional solution but also encourages educational institutions to rethink traditional processes and adopt modern, efficient alternatives. It lays a foundation for future research in areas such as biometric integration, data analytics in student performance, and broader smart campus initiatives.

5.4 Recommendations for Future Research

While the QR Code Enabled Attendance System provides a functional and innovative approach to lecture monitoring, there is still room for further development and refinement through future research. One key recommendation is to explore the integration of biometric authentication features—such as fingerprint or facial recognition—to enhance the accuracy and security of attendance verification, particularly in environments where identity validation is critical. Future researchers may also consider implementing real-time GPS-based tracking alongside QR scanning. This would ensure not only that a student scanned the code, but also that they were physically present in the lecture hall at the appropriate time, minimizing the risk of remote or proxy attendance.

Another area for expansion lies in the use of advanced analytics. Future systems could include tools for analyzing attendance trends, identifying at-risk students, and generating automated reports for academic staff. These insights could be further enhanced with the application of artificial intelligence (AI) and machine learning algorithms to detect anomalies or patterns in student behavior. Additionally, researchers can investigate the development of a cross-platform solution that works on both Android and iOS, as well as through web-based portals. This would improve accessibility and encourage wider adoption across different types of educational institutions.

Lastly, future studies could focus on testing the system in various real-world settings—such as secondary schools, vocational centers, or corporate training programs—to assess its adaptability, scalability, and effectiveness in different learning environments.

By addressing these areas, future research can continue to improve the reliability, functionality, and user-friendliness of automated attendance systems, helping institutions evolve toward smarter, more efficient academic management practices.

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