Quick Response (QR) Code Based Students' Attendance System in the University.

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ABSTRACT

This research presents a Quick Response (QR) code-based student attendance system that generates unique QR codes for each class session in Computer Science Department, Nnamdi Azikiwe University. Traditional attendance tracking methods can be time-consuming and prone to errors, disrupting the learning environment. The system addressed these challenges by allowing students to scan QR codes upon entering the classroom using their smartphones, facilitating quick and accurate attendance recording. Agile methodology was used throughout the development process, enabling iterative progress and adaptability to changing requirements. The backend was developed using PHP, while the frontend utilized bootstrap framework to create a user-friendly interface. The web-based platform allowed lecturers/ teachers, and administrators to efficiently manage class schedules and attendance records. Additionally, real-time database updates enable immediate attendance marking and report generation for easy analysis. Students received instant notifications regarding their attendance status, promoting responsibility and engagement. Initial trials of the system demonstrated a significant improvement in attendance tracking efficiency and a marked reduction in administrative workload. Overall, this QR code-based system represents a modern, effective solution for attendance management in educational settings, enhancing both student engagement and administrative efficiency.

Keywords: QR codes, Agile methodology, PHP, bootstrap, tracking, attendance, backend, frontend, CSS

INTRODUCTION

The need for efficient and reliable attendance tracking has never been more critical. Traditional methods, such as manual roll calls or paper sign-in sheets, have become increasingly inadequate in meeting the demands of modern classrooms. The advent of technology has paved the way for innovative solutions, one of which is the QR code-based student attendance system. This system harnesses the power of Quick Response (QR) codes to streamline attendance processes, enhance accuracy, and improve overall student engagement. QR codes are two-dimensional barcodes that can store a significant amount of information, which can be easily scanned using a smartphone camera or a dedicated QR code reader. Unlike traditional barcodes, which can only hold a limited amount of data, QR codes can encode URLs, text, and other types of information. This versatility makes them particularly suitable for various applications, including attendance tracking in educational settings. The QR code-based attendance system is an efficient, fast, and user-friendly tool for tracking attendance, utilizing HTML, CSS, and PHP to create a web-based interface. This system allows teachers to display QR codes using a classroom projector, enabling students to scan and mark their attendance in real-time, thereby ensuring accurate tracking and easy access to attendance records (AzeemIdrisi, 2023).

The QR code-based student attendance system represents a significant advancement in the management of attendance in educational settings. The benefits of enhanced efficiency, improved accuracy, cost-effectiveness, and user-friendly experiences make QR code systems an attractive option for educational institutions. As technology continues to evolve, QR code attendance systems are likely to become even more sophisticated, incorporating new features and innovations that further enhance their effectiveness. By embracing these advancements, educational institutions can create a more streamlined and accountable attendance tracking process, ultimately contributing to a more engaging and effective learning environment.

Problem Statement

The process of manually calling out names, having students sign in, or using paper-based records wastes valuable lecture time and can lead to inaccuracies in attendance tracking. To address these limitations, there is a need to

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develop a more efficient and accurate system. QR code-based attendance systems have emerged as a practical solution, allowing students to quickly scan a unique QR code displayed during lectures to record their attendance electronically. The main problem this type of system aims to solve is automating the attendance tracking process to reduce the time and effort required for manual attendance taking, eliminate errors and provide detailed attendance data and reports for instructors, administrators, and parents, and enhance the overall efficiency and accuracy of student attendance monitoring in educational institutions. By designing and implementing a QR code-based attendance system, educational institutions can modernize their attendance tracking processes, save time, and ensure more reliable attendance records for their students.

REVIEW OF RELATED WORK

A Quick Response (QR) Code Based Student Attendance System by Jonathan kwilyam (2019), was environment friendly, cost effective, user friendly, innovative, and fast. It was highly acceptable in terms of reliability, efficiency, accuracy, usability, and security. The system does not require an internet connection and can export data to Microsoft Excel. Limitations were technology reliance and potential technical issues.

Feasibility of Using QR Code for Registration & Evaluation of Training written by Elwin Sheet Masih (2022). This study assessed learners' perception of using QR codes for registration and evaluation. It found QR codes to be feasible for attendance and evaluation purposes, enhancing the efficiency of the process. The study focused on learners' perceptions and did not delve into technical or systemic limitations.

Kenge et al. (2024) utilized Python and MySQL to create a QR code attendance system that automates attendance tracking. The user-friendly interface enhances data management, but the system's reliance on technology may pose challenges for users unfamiliar with digital tools.

QR Code Based Attendance System developed by Sujyot Raut et al (2023), was more secure, faster, and more cost effective than traditional methods. It eliminated the need for expensive equipment like biometric scanners and reduces the time required for attendance recording. It also promoted student accountability and punctuality. Limitations include potential issues with internet connectivity and security, though these can be mitigated with proper measures.

Tunku Abdul Rahman in 2021 in a project at the university ensured accurate attendance by using unique identification capturing, making it hard for students to cheat. It was efficient, cost effective, and minimized hardware requirements. Limitations include; requires students to have mobile devices, potential issues with QR code scanning and unique ID verification.

QR Code Based Smart Attendance System developed by Pradip Selokar (2021), combined Google Apps Script and MIT App Inventor to create a mobile attendance system. It reduced paperwork, prevented data loss, and provided accurate attendance records using Google Sheets. The system was highly practical and accessible online by management. Limitations include; reliance on smartphones and internet connectivity, potential technical issues with QR code scanning and database integration.

Student Attendance System Based on QR Code with Mobile Devices developed by Ng Sam Kee (2021), increased effectiveness and efficiency in taking attendance, eliminated high-cost hardware implementation, and solved issues with traditional attendance methods. It ensured accurate attendance records and strict authentication. Limitations include; requires students to have mobile devices and internet access, and there could be technical issues with QR code scanning and authentication.

METHODOLOGY ADOPTED

Agile methodology was used in developing the system. It ensures the development of a system that is intuitive, efficient, and easy to use, reducing errors and enhancing the overall educational experience. The iterative development cycle of agile methodology allows for continuous improvement and refinement of the system. This ensures that the system remains up-to-date, relevant, and effective, even in a rapidly changing educational landscape. The system was developed using PHP and MySQL. The system supports three roles: Admin, Teacher/Lecturer, and Student, each with distinct functionalities to ensure efficient and secure attendance tracking in the Department.

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The Administrator can Add, view, and edit students, teachers, and timetables, View and manage all attendance records, including the ability to manually mark attendance in case of scanning issues and Manage attendance data for multiple classes and semesters. The Lecturer/Teacher can generate QR codes for attendance for allocated classes, and semesters, View attendance records for their classes. The student can mark attendance by scanning the QR code generated by the Lecturer during the lecture and also view their attendance records. The system also have some advanced security features which include; allowing only one attendance per student and per IP address to prevent multiple submissions, Attendance marking is restricted to ensure that students cannot use proxies or VPNs, Attendance can only be marked if the student is within the allowed campus radius, ensuring the student is physically present on campus, **Time-Sensitive Attendance:** QR codes are valid only during the lecture time, adding another layer of security. Figure 3.1 shows the data flow of the system.

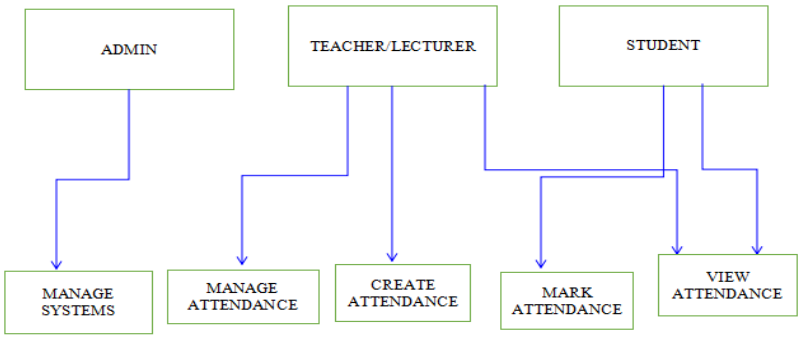

Figure 3.1: Data flow of the system

High Level Diagram

This is a visual representation that provides an overview of the entire system's architecture, showing the main components or modules, their interactions, and how data flows among them. Fig 3.2 shows the high-level diagram of the system.

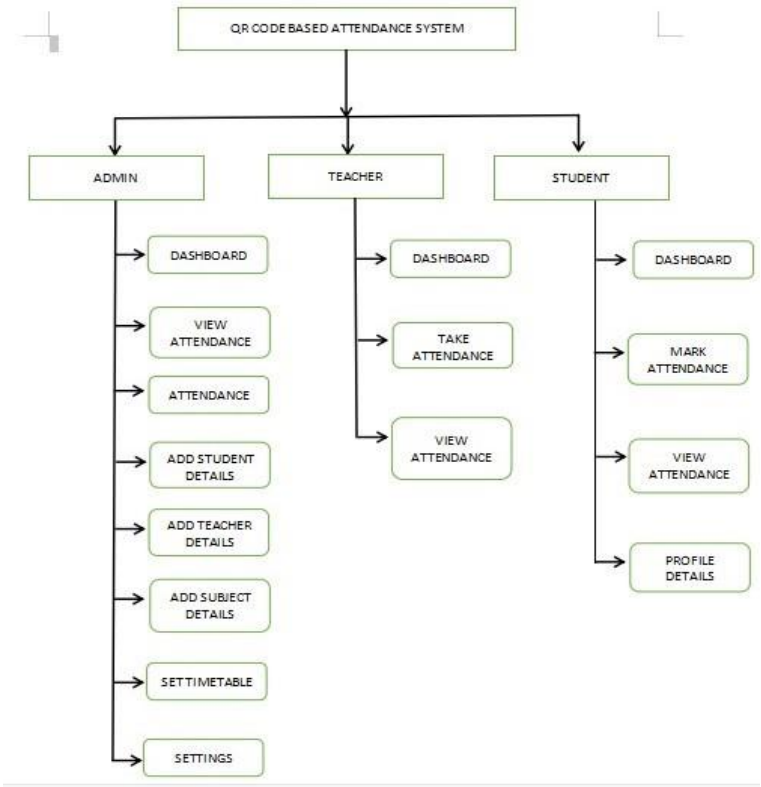

Fig 3.2: High level diagram of the system

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RESULTS AND DISCUSSION

Table 4.1 shows the Lecturers view on the student's attendance which clearly indicates each student's name, the enrolment number, the date and day, the course being thought and the exact time the student scanned the QR code with his/her smart phone.

Table 4.1: Lecturers view on students' attendance

Enrollment No	Name	Date	Day	Course	Time Scanned
001	Eze John	23/5/24	Tuesday	CSC 201	10:20am
002	Onu Nneka	23/5/24	Tuesday	CSC 201	10:23am
003	Oge Jacob	23/5/24	Tuesday	CSC 201	10:25am
004	Nkem Madu	23/5/24	Tuesday	CSC 201	10:26am
005	Frank Edeh	23/5/24	Tuesday	CSC 201	10:27am

The system clearly demonstrates a significant improvement in attendance tracking efficiency and a marked reduction in administrative workload. Overall, this QR code-based system represents a modern, effective solution for attendance management in educational settings especially in Computer Science Department, Nnamdi Azikiwe University. This enhances both student engagement and administrative efficiency. The clarity of the report also makes it easy for the management or the Lecturer in charge to take necessary decissions.

The screenshots shown in figure 4.1 and 4.2 also clearly shows how user friendly the system is making it very easy by all the stakeholders involved in the system. The system also have some advanced security features which ensures only one attendance is allowed per student per IP address to prevent multiple submissions, Attendance marking is also restricted to ensure that students cannot use proxies or VPNs. Attendance can only be marked if the student is within the allowed campus radius, ensuring the student is physically present on campus. Time-Sensitive Attendance ensures that QR codes are valid only during the lecture time, adding another layer of security.

Figure 4.1 shows the web page where the student marks the attendane.

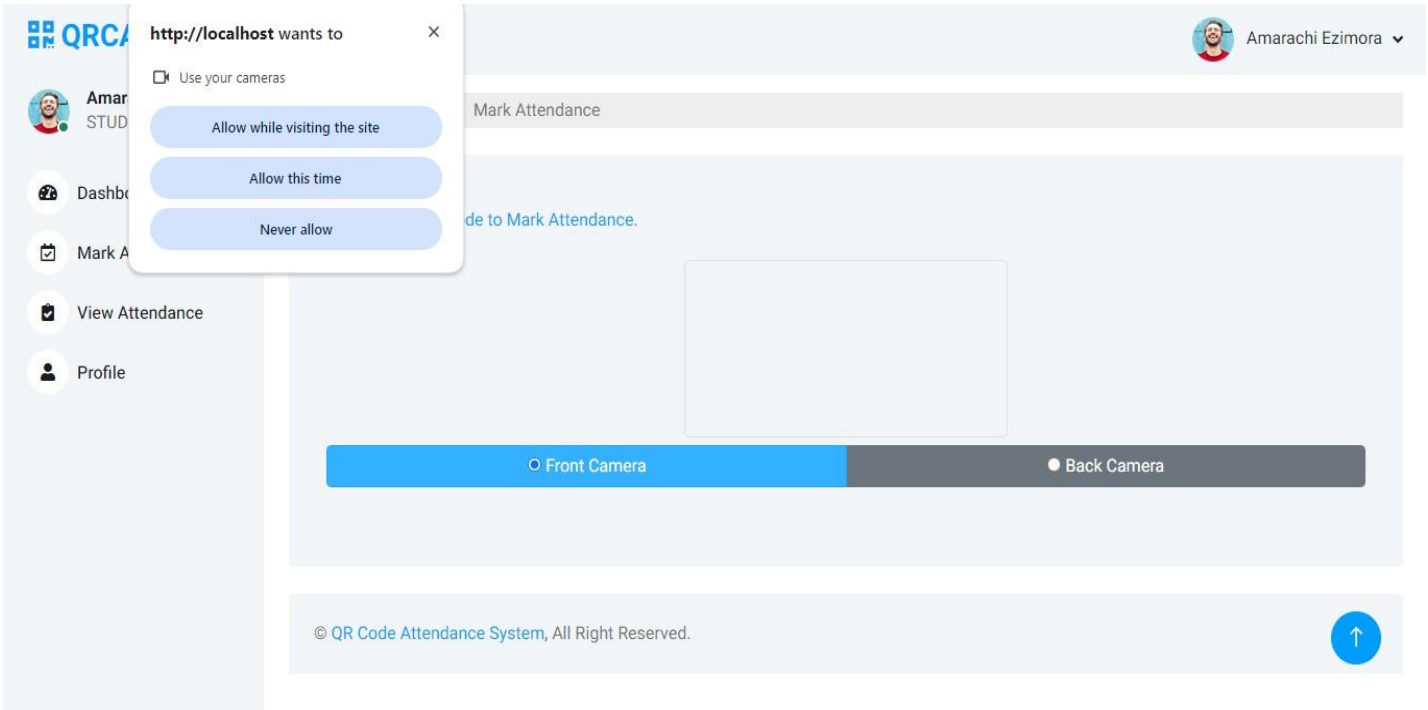

Figure 4.1: Students page to mark attendance

Figure 4.2 shows the student page immediately he/she logs in with the correct log in details to ensure more security.

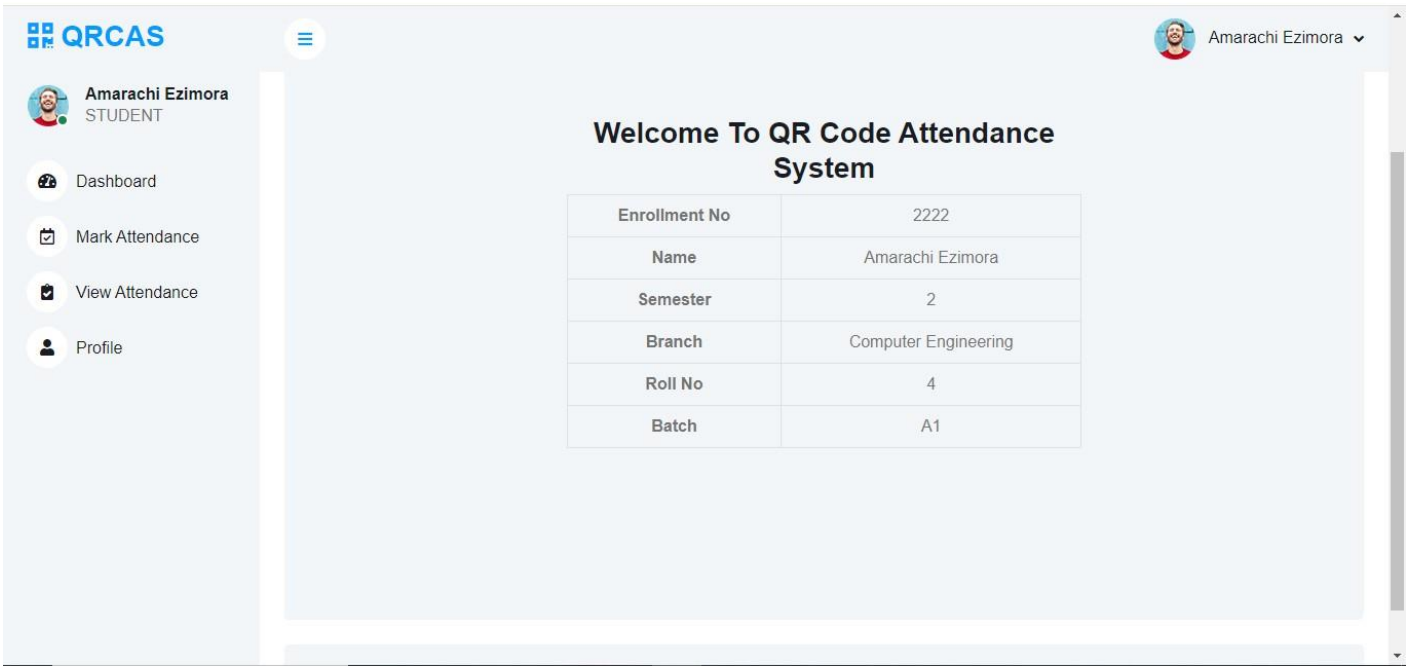

Figure 4.2: Students page after logging in

CONCLUSION

The QR Code Based Student Attendance System seeks to revolutionize the way student attendance is tracked in the Department, making the process more efficient, accurate, and user-friendly. The system involves generating unique QR code for each class session, which students can scan with their smartphones to quickly and easily mark their presence. This eliminates the time-consuming practice of manual roll calls and significantly reduces the potential for errors that often accompany traditional attendance methods.

The system will be accessible through a web interface, allowing for real-time attendance recording. When students scan the QR code, their information is instantly captured and logged into a central database, which streamlines data management for instructors. This setup not only saves valuable classroom time but also provides educators with the ability to easily access and analyze attendance records. Detailed reporting features will enable lecturers to monitor attendance trends and identify patterns in student engagement, fostering more informed decision-making regarding academic interventions.

User-friendliness is a core focus of this system, ensuring that both students and the department can navigate the platform with ease. Students will be able to view their attendance records, enhancing their awareness of their participation. Security measures, such as time-limited QR codes, was implemented to prevent misuse and ensure that attendance data remains accurate and reliable.

Suggestions For Further Research

Further research on the QR Code Based Student Attendance System could explore several important areas to enhance its effectiveness and adaptability. One suggestion is to investigate the long-term impact of this system on student engagement and academic performance. By analyzing attendance data alongside academic outcomes, researchers can determine whether consistent attendance correlates with improved student success. Another area for exploration is the integration of biometric authentication methods, such as facial recognition or fingerprint scanning, to complement QR code scanning. This could enhance security and prevent potential misuse of the system while maintaining user convenience.

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