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Implementation of a QR Code-Based Attendance System for Students Using Web Technology

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A B S T R A C T

Student attendance recording is an essential component of academic administration, but conventional manual methods are often inefficient, prone to errors, and difficult to manage. This study aims to implement a web-based student attendance system utilizing QR Code technology to improve the efficiency and accuracy of attendance recording. The system was developed using a structured software development approach consisting of requirement analysis, system design, implementation, and testing phases. Each student is assigned a unique QR Code that can be scanned using a device with a camera, and the attendance data are automatically stored in a centralized database through a web application. The system provides several features, including user authentication, QR Code generation, attendance scanning, and automated report generation. Functional testing results indicate that the system operates effectively in recording attendance data and generating reports in real time. The implementation of the QR Code-based attendance system reduces manual errors, accelerates attendance processing, and improves data management efficiency. Therefore, the proposed system can serve as an effective solution for digital attendance management in educational institutions.

INTRODUCTION

The rapid development of information and communication technology has significantly influenced various sectors, including education. Educational institutions increasingly rely on digital systems to improve administrative efficiency and data management. One important administrative activity in schools and universities is student attendance recording, which serves as an indicator of student discipline and participation in learning activities. Accurate attendance data are essential for monitoring student performance and supporting academic decision-making processes (Sari, et all, 2024).

Despite technological advancements, many educational institutions still use manual attendance systems, such as paper-based attendance lists or manual input into spreadsheets. These conventional methods are often inefficient, time-consuming, and prone to human error. In addition, manual attendance systems increase the risk of data manipulation and make it difficult to generate timely and accurate attendance reports. As the number of students increases, managing attendance records manually becomes even more challenging and less reliable.

To address these issues, the implementation of an automated attendance system using Quick Response (QR) Code technology has become a promising solution. QR Codes enable fast and accurate identification by allowing students to scan their unique codes using a camera-equipped device. This technology reduces the time required for attendance recording and minimizes errors associated with manual data entry. Furthermore, QR Code-based systems can be integrated into web-based applications, enabling centralized data storage and real-time monitoring (Sari, et all, 2025).

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Web technology plays a crucial role in developing flexible and accessible attendance systems. A web-based attendance system allows administrators and teachers to access attendance records from various devices connected to the internet. Additionally, the system can automatically generate attendance reports, making it easier for educators to monitor student attendance patterns and take appropriate actions when necessary (Sari, et all, 2024).

This study aims to implement a QR Code-based student attendance system using web technology to improve the efficiency and accuracy of attendance recording. The proposed system is designed to provide features such as user authentication, QR Code generation, attendance scanning, and automated reporting. By implementing this system, it is expected that attendance management can be performed more effectively and efficiently compared to traditional methods.

SITUATION ANALYSIS

Attendance management is an essential administrative activity in educational institutions, as it provides important information about student participation and discipline. Accurate attendance records are necessary for monitoring learning activities, evaluating student performance, and supporting institutional decision-making. However, many schools and universities still rely on conventional attendance methods, such as paper-based records or manual entry into computer systems. These methods often result in inefficiencies, including time-consuming data processing, increased risk of human error, and difficulties in maintaining accurate records.

In the current situation, manual attendance systems create several challenges for both teachers and administrators. Teachers must allocate additional time during class sessions to record attendance, which reduces effective teaching time. Furthermore, manual data entry can lead to inaccuracies such as duplicate entries, missing records, or incorrect student identification. These issues can affect the reliability of attendance data and complicate the process of generating attendance reports.

Another challenge is the lack of real-time access to attendance information. In many cases, attendance data must be manually compiled before reports can be generated, which delays the availability of important information. This delay makes it difficult for educators and administrators to monitor student attendance patterns and respond promptly to issues such as frequent absences or tardiness. Additionally, paper-based records are vulnerable to physical damage or loss, which may result in incomplete or missing data.

With the advancement of information technology, there is an increasing need for automated attendance systems that can improve efficiency and data accuracy. QR Code technology offers a practical solution for digital attendance management because it allows quick and reliable identification of students through scanning processes. When integrated into a web-based system, QR Code technology enables centralized data storage, real-time attendance recording, and automatic report generation.

Despite the availability of such technologies, their implementation in some educational environments remains limited. Many institutions face challenges such as limited technological infrastructure, lack of digital systems, and insufficient integration between attendance processes and information systems. Therefore, there is a need to develop an attendance system that is simple, efficient, and accessible using commonly available devices and web technology.

Based on these conditions, the implementation of a QR Code-based attendance system using web technology is proposed as a solution to improve attendance management. The system is expected to simplify the attendance process, reduce errors in data recording, and provide real-time access to attendance information. By addressing the limitations of manual attendance methods, the proposed system can enhance administrative efficiency and support better monitoring of student attendance.

IMPLEMENTATION METHOD

The implementation of the QR Code-based attendance system was carried out through several structured stages to ensure that the system meets user requirements and functions effectively. The method used in this study consists of five main phases: requirement analysis, system design, system development, system testing, and system implementation.

Requirement Analysis

The first stage involved identifying the requirements of the attendance system by analyzing the existing attendance process. Observations were conducted to understand how attendance was recorded manually and to identify the main problems associated with the current method. The analysis focused on determining the functional and non-functional requirements of the system. Functional requirements included user authentication, student data management, QR Code generation, attendance recording, and report generation. Non-functional requirements included system usability, accessibility, and data security.

System Design

In this stage, the system architecture and interface were designed based on the identified requirements. The system was designed as a web-based application that allows users to access the attendance system through a web browser. The database structure was designed to store student information, attendance records, and user data. The system design also included the creation of Unified Modeling Language (UML) diagrams such as use case diagrams and activity diagrams to illustrate the interaction between users and the system. Additionally, each student was assigned a unique QR Code that would be used for attendance identification.

System Development

The system development stage involved implementing the designed system into a functional application. The web-based attendance system was developed using web programming technologies, including HTML and CSS for the user interface, JavaScript for interactive features, and a server-side programming language for system functionality. A relational database was used to store and manage the attendance data. The QR Code generation feature was implemented to create unique QR Codes for each student, and the scanning feature was integrated to record attendance automatically when a QR Code was scanned using a camera-enabled device.

System Testing

After development, the system was tested to ensure that all features functioned correctly. Functional testing was conducted using the black-box testing method, where each feature of the system was tested based on its expected output. The tested features included login functionality, QR Code generation, QR Code scanning, attendance recording, and report generation. The testing process aimed to identify and correct any errors or system failures before implementation.

System Implementation

The final stage involved implementing the system in a real environment. Users such as administrators and teachers were given access to the system and trained on how to use it effectively. The attendance process was then conducted using the QR Code scanning feature, and attendance data were recorded automatically in the database. The implementation results were evaluated to determine the effectiveness of the system in improving attendance management.

Through these stages, the QR Code-based attendance system was successfully implemented as a web-based application capable of recording student attendance efficiently and accurately. The structured implementation method ensured that the system met user needs and functioned reliably in an educational environment.

In the implementation methods section, describe clearly and concisely the methods used to achieve the goals set out in the service activities. The results of the service must be measurable and the author was asked to explain the measuring instruments used, both descriptively and qualitatively. Explain how to measure the level of success of community service activities. The level of achievement can be seen in terms of changes in attitudes, socio-culture and economy of the target community

RESULTS AND DISCUSSION

Results

The implementation of the QR Code-based attendance system using web technology resulted in a functional application capable of recording and managing student attendance efficiently. The system was successfully developed and implemented according to the planned design and requirements. The main features of the system include user authentication, student data management, QR Code generation, QR Code scanning for attendance recording, and automatic report generation.

Each student was assigned a unique QR Code generated by the system. The QR Codes were used as identification for recording attendance. During the attendance process, the QR Code was scanned using a camera-enabled device, and the

attendance data were automatically stored in the database. The system recorded important information such as student identification number, name, date, and attendance status.

The web-based interface allowed administrators and teachers to access the system easily through a web browser. The system also provided an attendance report feature that automatically generated daily and periodic attendance summaries. These reports could be viewed and downloaded for administrative purposes.

Functional testing was conducted to evaluate the performance of the system. The testing results showed that all features operated as expected. The login system successfully authenticated users, QR Codes were generated correctly for each student, and the scanning process recorded attendance data accurately. Additionally, the system was able to generate attendance reports without errors.

Community service is an effort to disseminate science, technology and art to society. These activities must be able to provide added value to society, both in economic activities, policies and behavioral (social) changes. Explain that service activities have been able to provide change for individuals/society and institutions, both short and long term.
In this section, describe how the activities are carried out to achieve the goal. Explain the indicators for achieving goals and the benchmarks used to declare the success of the service activities that have been carried out. Reveal the advantages and disadvantages of the output or main focus of the activity if you see its suitability to the conditions of the community at the location of the activity. Also explain the level of difficulty in implementing activities and producing goods and opportunities for future development. Articles can be strengthened with relevant documentation regarding services or goods as outputs, or the main focus of activities. Documentation can be in the form of images of the implementation or implementation process, product prototype images, tables, graphs, and so on.

Table 1. shows the results of the functional testing of the system

No	Feature	Expected Result	Actual Result	Status
1	User Login	Successful login	Successful login	Passed
2	QR Code Generation	QR Code created	QR Code created	Passed
3	QR Code Scanning	Attendance recorded	Attendance recorded	Passed
4	Data Storage	Data saved correctly	Data saved correctly	Passed
5	Report Generation	Report generated	Report generated	Passed

The testing results indicate that the system functions properly and meets the specified requirements.

Discussion

The implementation of the QR Code-based attendance system demonstrated significant improvements compared to conventional attendance methods. The use of QR Code technology simplified the attendance process by allowing students to record their attendance quickly through scanning. This reduced the time required for attendance recording and minimized disruptions during class sessions.

Compared to manual attendance methods, the proposed system reduced the possibility of human errors such as incorrect data entry and missing records. The automatic data storage feature ensured that attendance records were stored securely in the database and could be accessed at any time. This improved the reliability and accuracy of attendance data.

The web-based nature of the system provided flexibility for users, as the system could be accessed from various devices connected to the internet. Teachers and administrators could monitor attendance data in real time and generate reports without needing to perform manual calculations. This feature improved administrative efficiency and reduced workload.

However, several limitations were identified during the implementation. The system requires a stable internet connection to function properly, and the QR Code scanning process depends on the quality of the camera used. In some cases, poor lighting conditions affected the scanning performance. Despite these limitations, the system still performed effectively under normal conditions.

Overall, the results indicate that the implementation of a QR Code-based attendance system using web technology provides an efficient and reliable solution for managing student attendance. The system improves data accuracy, reduces processing time, and simplifies attendance management compared to traditional methods.

CONCLUSIONS AND RECOMMENDATIONS

The implementation of a QR Code-based attendance system using web technology has been successfully developed and applied to support student attendance management. The system provides an efficient and accurate method for recording attendance compared to conventional manual methods. By utilizing QR Code technology, the attendance process becomes faster and minimizes errors caused by manual data entry. The web-based platform enables centralized data storage and allows users to access attendance information in real time. The results of system testing indicate that all main features, including user authentication, QR Code generation, attendance scanning, and report generation, function properly. The system also simplifies the process of managing attendance data and generating reports, thereby reducing the administrative workload for teachers and staff. Overall, the implementation of this system improves efficiency, accuracy, and accessibility in attendance management.

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