

Smart Attendance Tracking: QR Codes for Easy Classroom Management

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Abstract

This study introduces a simple yet powerful way to track attendance in schools and universities using QR codes. Instead of the traditional, often slow and error-prone manual methods, this digital QR-based system speeds up the process and makes it easier for both students and teachers. With a unique QR code for each person, students can quickly scan their code with their smartphones to mark their attendance. This approach reduces mistakes and prevents "proxy attendance," where friends might sign in for each other. One of the best parts is that the system is affordable, doesn't need much setup, and works smoothly with mobile devices, helping everyone stay connected. Plus, by cutting down on paper use, it supports environmentally friendly practices. To guarantee that no one's attendance is missed in the event of technological difficulties, such as bad internet, backup solutions, such as a temporary manual entry, can be employed. This flexible system works well in various educational settings, from classrooms and labs to online courses. And as technology progresses, it could incorporate new features like data tracking to monitor attendance trends or even biometric authentication for added security. All in all, this QR-based attendance system is a secure, effective, and scalable solution that meets the changing needs of modern education.

Keywords: Attendance, QR code, Student, Teacher, Admin

INTRODUCTION

IoT technology is being used everywhere, from businesses to schools, to make things safer, more automated, and easy to manage from a distance. With more devices getting connected to the internet every day, we need to do more research and improve how quickly and efficiently these systems work. Tracking attendance has always been important but time-consuming for schools and universities. Traditional methods like sign-in sheets or swipe cards can be slow and often lead to mistakes, making attendance records less reliable. With new technology, schools have started using digital solutions like biometric systems, RFID, and QR codes to make attendance easier and more accurate.

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QR code-based systems have become especially popular because they're simple, affordable, and easy to use. Each student or staff member gets their own QR code, which they can scan with their phone to mark their attendance instantly. This process saves time, reduces errors, and keeps everything organized in a database, making it a practical solution for modern attendance tracking [3].

The digital and physical worlds may easily collaborate because of the Internet of Things (IoT). It makes virtual classrooms function smoothly and effectively by assisting students in accessing online resources such as labs, libraries, course materials, assessments, announcements, and administration

tools. Since its inception in the 1980s, e-learning has used technology, including websites, applications, and software, to enhance the educational process.

This fingerprint-based attendance system uses IoT technology to link different devices, each with its own identity and address. With the ability to communicate with one another, these gadgets can exchange data about their surroundings or themselves [4-8].

As technology has progressed, new ways to track attendance have emerged, and QR code systems have become a popular choice because they're easy to use and very effective. This article talks about how QR code attendance systems simplify the process and help reduce errors, making attendance tracking more accurate.

Every student has a unique QR code in an attendance system that uses them. Students rapidly scan a QR code on a screen or printed page that the teacher displays at the beginning of each class with their phones to indicate that they are there. Without any additional procedures or paperwork, their attendance is properly and promptly recorded.

Due to its real-time attendance logging, which minimize errors, this system is more dependable than conventional techniques. Additionally, it is quick, and effective attendance can be taken in a matter of seconds, saving teachers and student's time.

LITERATURE SURVEY

In all universities students monitoring of attendance is very important matter. The students complain about tracking of attendance in conventional methods may lead to problems and waste of time management during lecture class. (Mittal et al. 2016) [1] discuss about the issue students facing and to rectify and correct the falsely attendance during lecture session.

For example, a study conducted by Zakaria N et al. (2021) [2] showed that, in comparison to conventional techniques, QR code-based attendance systems greatly increased the effectiveness of attendance tracking. To record attendance in real time, their study required creating a smartphone application that reads QR codes created specifically for each student. The authors stressed the value of intuitive user interfaces in raising student and teacher adoption rates.

The usage of QR codes that are shown before or at the start of each lecture and that students scan to verify their attendance was examined in a noteworthy study by Fadi Masalha et al [5]. This technology offers a straightforward, expandable solution for big classrooms when conventional approaches might not work well. The authors stressed that by using QR code-based attendance systems, teachers may instantly confirm students' attendance, reducing disruptions to the lesson and preserving accurate records.

The professors in the universities need an attendance system with more efficient and reliable (Kamaraju and Kumar et al 2017) [14] to continuously monitor the attendance for the whole lecture class. To call students is unnecessary and waste of time and lecture class.

Thus, the purpose of this work is to build a system for tracking student attendance that uses Near Field Communication (NFC) and the Global Positioning System (GPS) to continuously monitor students' positions in addition to verifying that they arrive at class by validating their identity. Because the suggested method uses no paper, it is environmentally benign in its pursuit of resolving the attendance monitoring issue Chew et al. [9]. When two mobile devices communicate with each other using NFC, data interchange occurs in both directions since a peer-to-peer mode is used. Two cell phones can exchange contact information (vCards) by using common applications (Apps). Ideally, fewer tools will be required to track students' attendance in less time.

Furthermore, indoor positioning made use of the AGPS (Assisted Global Positioning System). It is crucial to emphasize that there are positioning issues with the GPS/GNSS (Global Navigation Satellite System) in interior environments. Recently, certain satellites have lessened these issues, making it possible to see the constellation even in spaces with mediocre windows (Hay, Duffy, and Whitfield Citation 2017) [10]. In most cases, concrete buildings could also accommodate GNSS placement. It is generally acknowledged that smartphones nowadays are unable to properly receive and decode GNSS signals inside a multi-story concrete building, however practically speaking, GNSS signals may be observable at certain locations within a concrete building.

Additionally, four satellites are needed to obtain a three-dimensional location; however, three satellites will suffice if a two-dimensional position is required. Most GPS/GNSS applications that are loaded on mobile devices—such as all road navigation systems—use two-dimensional locations to enable placement even in areas with spotty coverage (Chiang et al.) [11]. It talks about a selective repeater system that requires infrastructure to be installed and adjusted. However, a cell phone's position accuracy was limited to five meters. This might make it possible to determine with accuracy whether the student is in the library next door or the classroom.

To make attendance tracking simpler and safer, Basheer K. P. Mohamed et al. [12] created a fingerprint-based method. Teachers no longer need to call out names thanks to their method, which uses a portable gadget that allows pupils to indicate themselves present by scanning their fingerprints. This method is reliable for tracking students' attendance because it saves time and minimizes mistakes.

Lex Fridman et al. [13] conducted an important study on behavioural biometrics by gathering and analyzing data from 200 people. Each person used their personal Android phones for at least 30 days. This dataset is unique because it's quite large, covers a long period, tracks a wide range of behaviors, and has no restrictions on the activities that were monitored.

According to Shinya Kinoshita et al.'s [15] research, FeliCa IC cards are used to identify students and their precise seat positions in an attendance management system. Under this approach, students in a classroom begin by tapping their personal Android cellphones' FeliCa student ID cards. Then, to record their attendance, they tap another FeliCa card that is mounted on their desk.

This review of the literature looks at different methods of managing attendance in classrooms, with an emphasis on the innovative system that Jun Iio [16] suggested that combines a mobile device and a web application. With this cutting-edge solution, students can take a photo or sign a digital document to document their attendance during lectures. We describe how this new framework is in line with the most recent developments in educational technology and examine earlier studies to determine the advantages and disadvantages of comparable systems. Furthermore, we point out areas that still need work.

The other papers are reviewed based on the output and section 3 reviews about the existing system followed by proposed methods and the system methodologies for attendance systems. Section 8 concludes the proposed system for the attendance monitoring system using IoT.

EXISTING SYSTEM

The existing system has a drawback; usually we take manual attendance by using sheets or register and take more time for this process, frequent maintenance is necessary for manual attendance. So, we designed QR based attendance system which reduces the time.

PROPOSED SYSTEM

Schools, colleges, and workplaces can manage attendance more easily and effectively with the help of the QR code-based attendance system. Attendance tracking is made easy with its usage of QR codes,

which are easily generated and scanned by smartphones. There are four primary parts in the process: making the QR code, scanning it, keeping track of attendance, and producing reports. Firstly, we should connect the hotspot to the pc to the mobile it will display the three connected devices which is ESP32cam, ESP8266, and the pc.

The adapter is given to the power supply and the USB cable is connected to the ESP8266, when the power is given to the ESP32 cam which produces amps current. The IP address of ESP32cam should enter in chrome, the net will display monitoring system. By scanning the QR code it can send data from the ESP32Cam to the ESP8266 which only allows 1 amp current it sends the data to the LCD display (see Figure 1).

The LCD display shows in Figure 1 the information when the person comes in and goes out and it also sends the information to the connected device (i.e mobile phone). In addition to saving time and eliminating the need for human labor, using QR codes for student attendance has other advantages.

BLOCK DIAGRAM

An LCD display, an ESP8266, an ESP32CAM module, and a power supply arrangement are all included in this Figure 2 system design. This is a concise written description:

1. *LCD Display Module:* Connected to the baseband system.
2. *Baseband Module:* Contains the ESP8266 microcontroller to facilitate communication or processing tasks.
3. *Adapter and Power Supply:* Provides electrical power to the ESP32CAM module.
4. *ESP32CAM Module:* Receives power through the adapter for functioning, likely for video capture or image processing.

This system appears to be intended for Internet of Things applications, potentially utilizing ESP8266 for wireless communication and LCD output, along with ESP32CAM for camera functionality.

DESCRIPTION

Normally manual attendance may take more time, and it may vanish due to certain circumstances. Due to this difficulty, we designed QR based attendance when it's connected to Wi-Fi it displays and sends the information to the connected device using their unique QR code. Hardware model of the attendance System (See in Figure 3).



Figure 1. QR code in LCD display.

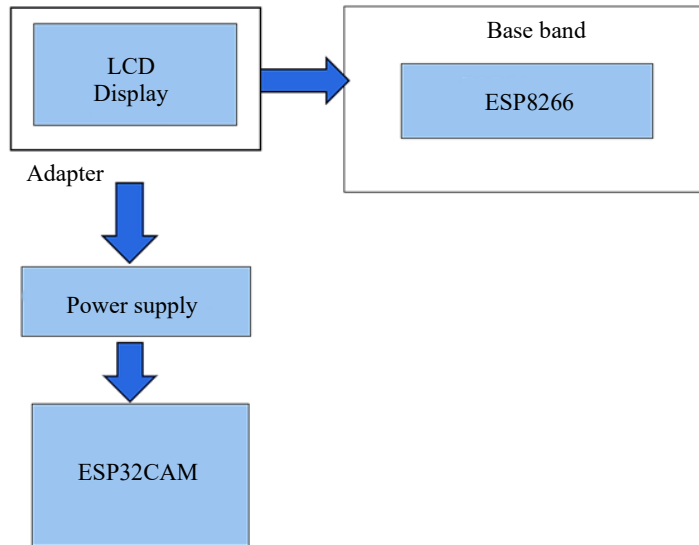


Figure 2. Block diagram QR code-based attendance system.

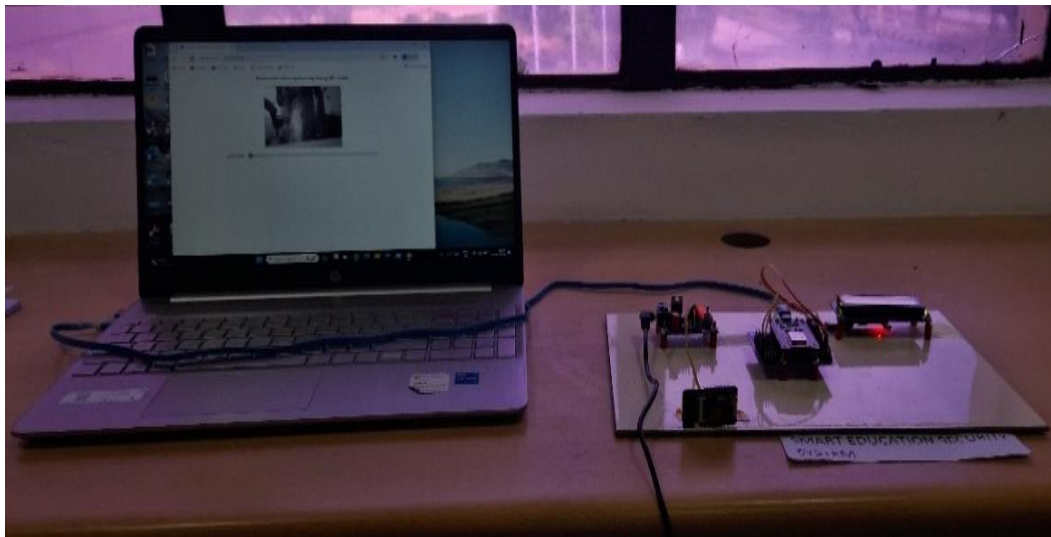


Figure 3. Overall attendance system hardware.

FUTURE SCOPE

The following factors indicate that the future of the QR-based attendance system is bright:

- *Increased Accuracy:* The manual attendance recording process is eliminated by the QR code-based system, which also lowers the chance of errors.
- *Timesaving:* It works much more quickly than more conventional techniques like paper-based or biometric systems.
- *Cost-effective:* It gets rid of paper-based systems and lowers biometric system maintenance costs.
- *System Integration:* This feature makes it possible to track attendance data easily and offers a comprehensive view of it.
- *Security:* Since it makes it less likely that attendance would be forged, it is more secure than a paper-based approach.

CONCLUSION

Much research related to attendance monitoring systems has developed but need additional device with require additional expenses. Based on methodology the systems are unattractive and uneconomical to universities. This paper conclusion highlights the significant advantages of implementation of an

IoT-based attendance system using QR technology. By successfully resolving the drawbacks of manual attendance methodologies, the proposed system offers a reliable, effective, and secure substitute. Thus, the users need only the smartphone with less time and cost effective in monitoring the attendance in universities and colleges.

REFERENCES

1. Mittal S, Rastogi I, Sharma S. Face Recognition System based on Smart Attendance using Hybrid Algorithm and Machine Learning. *Grenze International Journal of Engineering & Technology (GIJET)*. 2023 Jul 1;9(2).
2. Zakaria N, Nasir MA, Hamzah NH, Rubani SN, Ariffin A. Student's attendance system using QR code. *Research and Innovation in Technical and Vocational Education and Training*. 2021 Feb 21;1(1):133-9.
3. Asmat, Z. (2009). Information and Thesis Borrowing System at the Faculty of Computer Science and Information Resource Center, UTM. Bachelor's Project Report, Universiti Teknologi Malaysia.
4. Meutia, E.D. Internet of Things–Security and Privacy. In the 2015 National Seminar and Electrical Engineering Expo (Vol. 1, No. 1, pp. 85-89).
5. Masalha F, Hirzallah N. A students attendance system using QR code. *International Journal of Advanced Computer Science and Applications*. 2014;5(3).
6. Hasmin, A. I. (2008). Student Attendance System Using Fingerprint Technology. Bachelor's Thesis. Universiti Teknologi Malaysia.
7. Hussein, N. A. (2005). Smart Attendant. Bachelor's Project Report, Tun Hussein Onn University College of Technology
8. Chiang TW, Yang CY, Chiou GJ, Lin FY, Lin YN, Shen VR, Juang TT, Lin CY. Development and evaluation of an attendance tracking system using smartphones with GPS and NFC. *Applied Artificial Intelligence*. 2022 Dec 31;36(1):2083796.
9. Chew CB, Mahinderjit-Singh M, Wei KC, Sheng TW, Husin MH, Malim NH. Sensors-enabled smart attendance systems using NFC and RFID technologies. *Int. J. New Comput. Archit. Appl.* 2015 Jan 1;5:19-29
10. Hay L, Duffy A, Whitfield RI. The sustainability cycle and loop: models for a more unified understanding of sustainability. *Journal of environmental management*. 2014 Jan 15; 133:232-57.
11. Chiang TW, Yang CY, Chiou GJ, Lin FY, Lin YN, Shen VR, Juang TT, Lin CY. Development and evaluation of an attendance tracking system using smartphones with GPS and NFC. *Applied Artificial Intelligence*. 2022 Dec 31;36(1):2083796
12. Mohamed BK, Raghu CV. Fingerprint attendance system for classroom needs. In 2012 Annual IEEE India Conference (INDICON) 2012 Dec 7 (pp. 433-438). IEEE
13. Fridman L, Weber S, Greenstadt R, Kam M. Active authentication on mobile devices via stylometry, application usage, web browsing, and GPS location. *IEEE Systems Journal*. 2016 Mar 30;11(2):513-21
14. Kamaraju M, Kumar PA. Wireless fingerprint attendance management system. In 2015 IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT) 2015 Mar 5 (pp. 1-6). IEEE.
15. Kinoshita S, Niibori M, Kamada M. An attendance management system capable of mapping participants onto the seat map. In *Advances in Network-Based Information Systems: The 21st International Conference on Network-Based Information Systems (NBIS-2018)* 2019 (pp. 897-902). Springer International Publishing
16. Iio J. Attendance management system using a mobile device and a web application. In 2016 19th international conference on network-based information systems (NBIS) 2016 Sep 7 (pp. 510-515). IEEE.