



Students' Attendance Authentication System Using QR Code Technology

Muti Ganiyu¹ and Odewale Abdullah Opeyemi²

^{1,2}Department of Computer Science, Federal Polytechnic, Ile Oluji, Ondo State, Nigeria
mutganiyu@fedpolel.edu.ng; opeyemiabdullah02@gmail.com

Abstract

Managing students' attendance during lectures and computing attendance percentage at the end of the semester manually are always tedious tasks to be carried out. To address the identified challenges, the study aims to design a secured Attendance Authentication System (AAS) using Quick Response Code technology. The Quick Response Code (QR Code) system has gained popularity as an authentication technique due to its high storage capacity and speed of readability when compared to other barcode types. It can repair errors, is impervious to dirt and damage, and can be viewed in 360 degrees from any angle.

Keywords: Attendance, Authentication, QR Code

Citation

Ganiyu, M. & Odeyemi, A. (2023). Students' Attendance Authentication System Using QR Code Technology. *International Journal of Women in Technical Education and Employment*, 4(2), 16 – 22.

ARTICLE HISTORY

Received: Oct. 23, 2023
Revised: Nov 15, 2023
Accepted: Nov 24, 2023

Introduction

Authentication is the act of confirming the truth of an attribute of a datum or entity. In its most basic form, authentication takes the form of usernames and passwords, which are the most widely used means of verifying an individual's identity. The acronym QR denotes "Quick Response." It is a two-dimensional or matrix bar code that can hold specific data and be scanned by certain smart devices is the QR code. White background with black square-shaped modules makes up the code. Either text, a URL, or other types of data could be encoded. When compared to a traditional barcode, it is better suited to hold more data because it can encode data in both the vertical and horizontal directions. QR code encrypted data can be accessed by utilizing a camera or a QR code scanner (Tiwari, 2016; Hussaasin & Nachappa, 2020).

Identity verification using QR Code is gaining wide acceptance and usability in operations that require authentication because of its dynamics in information

encryption. Valid evidence via a secure process wherein only legitimate clients should be allowed to provide assistance of any kind after receiving authorization from the server using the generated data. It is always a difficult and time-consuming task to take attendance of a large size of class manually (Nandhini *et al.*, 2019). The flexibility of QR code will make students' authentication easier in attendance management.

Several means of identification and authentication have been in existence for various purposes with strengths and weaknesses associated with each method (Akinduyite *et al.*, 2013). These techniques include but not limited to manual checking, username and password, biometrics, e.t.c. Some of the problems associated with the above methods are time consuming, difficulties in features extractions and so on. QR code is a new technology that can store text data in many ways.

Also, Sun *et al.* (2012) presented an SMS-based authentication system using a cellphone for students'



attendance. A user provides a phone number and an account ID during the registration stage of this method. For a series of One-Time Password (OTP) generation that will occur on consecutive logins, the user will also set up a long-term password. Entering one's ID into an untrusted web browser allows one to access internet services. An OTP generated by the software is sent straight to the server by SMS, where it is used to verify the user's identity.

Using security tokens is an additional method of authentication. A physical object, such as a smart card or even a cell phone, can serve as a token. For instance, the Rivest-Shamir-Adleman Security Identity (RSA SecurID) method uses a security token to produce authentication codes based on an initial seed value at predetermined intervals. It has been noted, meanwhile, that this strategy is not resistant to online phishing or session hijacking. Li *et al.* (2011) presented a hardware token-based PIN/TAN system that is inexpensive and can be used to secure online banking. This device performs user, server, and transaction authentication through the use of a physical USB token that must be plugged into an untrusted computer.

The MP-Auth method uses a trusted personal device to carry out cryptographic computations. The user and the server must exchange a long-term password that has been predetermined. Password data is input into the personal device rather than the untrusted terminal in order to secure it. Because cryptographic computations carried out on the personal device are relayed to the computer, which then passes them to the server, MP-Auth requires a connection between the computer and the personal device before authentication can take place. A connection between the trusted cellphone and the untrusted browser is required for the strategy to function. When a user needs to access an online account, they must always establish the connection using a secure bookmark that is kept on their phone. The phone will then point the browser to the relevant URL (Chow *et al.*, 2017).

Furthermore, Clarke *et al.*, 2017 proposed a camera-based authentication method that needs a dedicated gadget to continuously monitor user interactions with untrusted computers by observing the data that is shown on the screen. The objective of the method is to identify any instances of tampering with the data shown on the computer screen. This method's necessary monitoring can need a significant amount of processing power.

The QR code-based method necessitates an active connection to the camera on your cellphone. A QR code is a two-dimensional barcode that is also a matrix code. Up to several times more data may be stored in this way than with a traditional barcode as information is encoded both vertically and horizontally. Data is obtained by taking a picture of the code with a camera or a QR code scanner. (Hussain & Nachappa, 2020). Quick Response Code system is becoming a popular authentication method because it has fast readability and great storage capacity compare to other types of barcode. Saad *et al.* (2023) presented online student attendance system using QR code technology while Krihsna *et al.* (2023) adopted RFID technology to develop an attendance management system. Amirulloh *et al.* (2020) proposed QR-based teaching attendance for teachers. The software was intended to make it easier for senior officers to monitor teachers who teach in class in real-time.

Methodology

This section shows the design model of the developed system, the integration and interaction of different components that work together as a whole to achieve the system objectives. The operations of the system are illustrated in architectural and use case diagrams. The architecture of the proposed system is shown in Figure 1. In the architecture, three major components are defined which are input design, process design and output design.

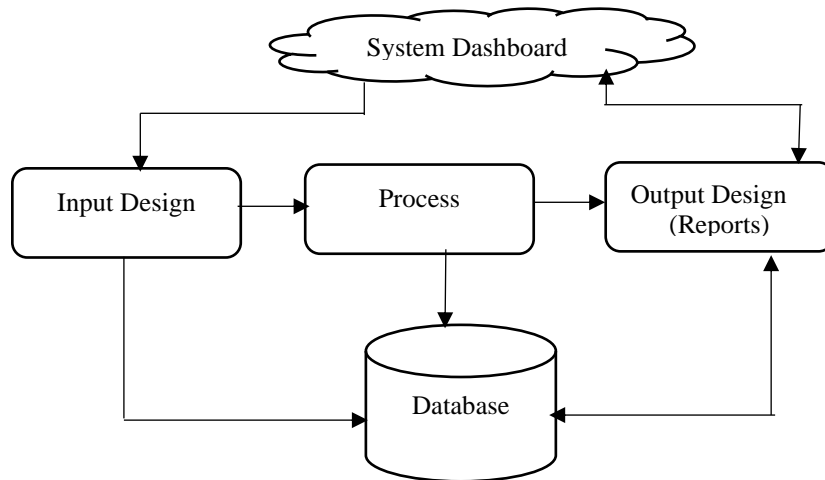


Figure 1: Architecture of the System

From the architecture, the input design is concerned with the procedures to be follow in entering data into the system for processing. The designs of the input

include student registration and profiling. In the phase, the basic information about the students are captured.

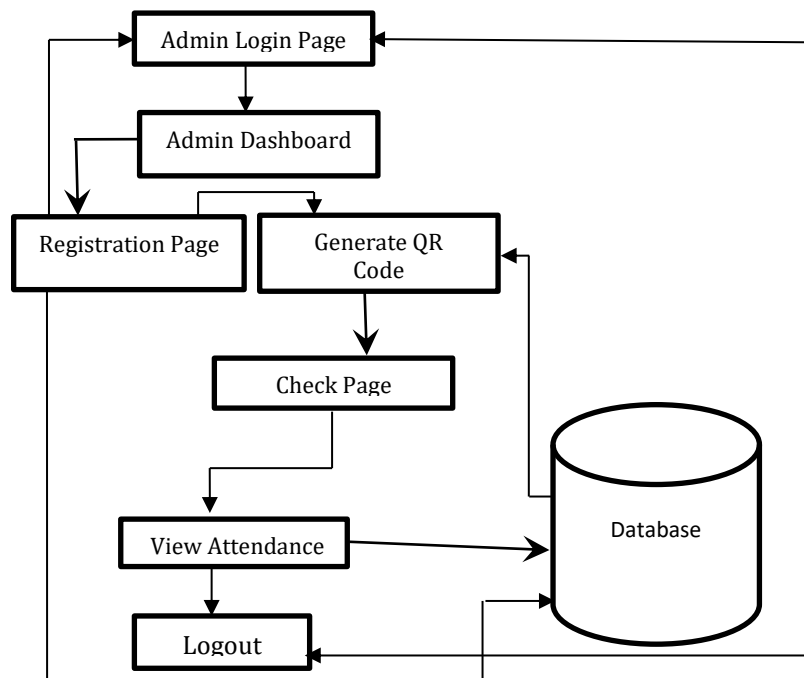


Fig. 2: System representation

activities

At the process phase, the QR Code is generated from the registration data and make ready for the output phase. The output design shows the result of the processed data on the screen. The output files comprise of students’ report and attendance report. The students’ report gives information about the students that are captured on the system while the attendance report shows record of students based on the parameters of query.

The activities that are carried out in each of the components are further represented in Figure 2. The use case diagram in Figure 3 shows a graphical illustration of the interactions among the elements of the system. Use case diagrams are employed in UML (Unified Modeling Language), standard notation for the modeling of real- world objects and systems. In this case, the actors are the Lecturer and Student.

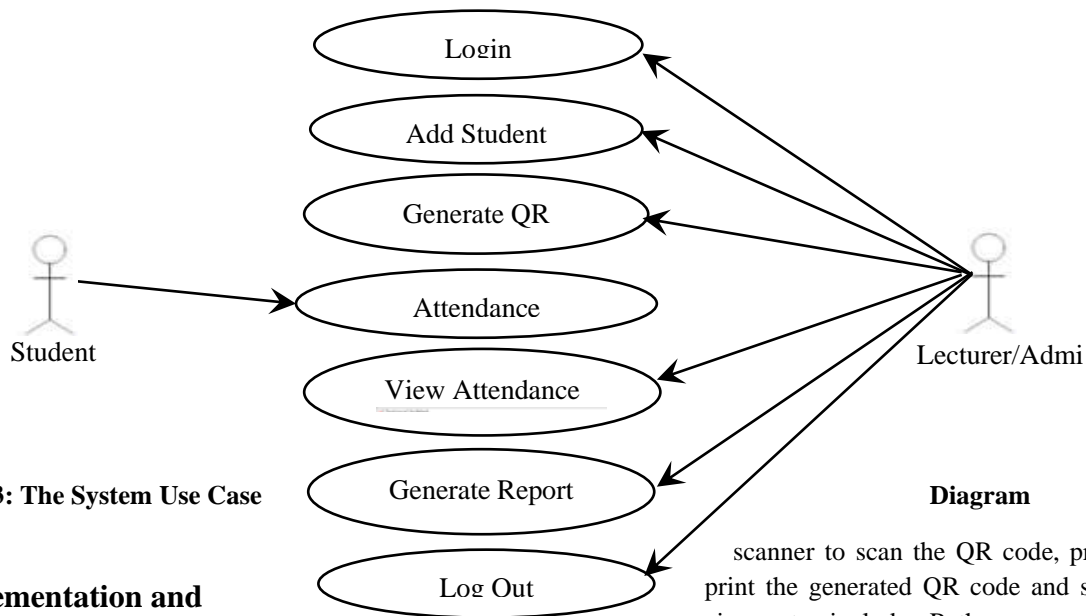


Fig. 3: The System Use Case

Implementation and Discussion

This section discusses the hardware and software requirements, implementation and testing of the functionalities of the system components. The hardware requirements include a computer system with minimum of 4 GB RAM, Windows 10 OS, Intel Processor 2.4GHz, disk space of 500 GB, QR code

scanner to scan the QR code, printer to print the generated QR code and software requirements include Python programming language to develop the system because of its rich library content, PHP for server side connection to database, HTML,CSS, BOOTSTRAP AND JAVASCRIPT for interface design and functionality development and MySQL to serve as database engine. The screen shots that show the system’s user interfaces are as presented in Figure 4.



Fig. 4: Login page

Figure 4 allows lecturers that are registered on the system to login for attendance management of their classes. Lecturers are registered or profiled by the administrator of the system. At successful login, lecturers can proceed to perform all the operations that are allowed on the system.

At successful login, the user is taken to an interface where functions like scanning a new QR code for attendance taking and downloading of attendance

report can be performed as shown in Figure 5. If the scanned QR code matches with the record in the database (Student Table), it will mark the attendance for that particular student and save the record into the database.



Fig. 5: QR code scanning interface.

A sample of generated QR code for already profiled students for a particular class is as shown in Figure 6.

The QR code has the matriculation number and full name of the students encrypted in the image



Fig. 6: Sample of generated QR code and their Matriculation numbers

At the users’ interface, lecturers can download the attendance report either during the semester or at the end of the semester. The sample of the scanned result of generated QR code in Figure 6 is as shown in Table

1. The full name, matriculation number, time and the date the attendance was taken are all captured in the attendance report.

Table 1: Attendance Sheet for COM 121 recorded on 2023 – 10 -19

NAME	MATRIC NUMBER	TIME	DATE
ABDULLATEEF MARYAM AJOKE	FPI/CSC/22/002	16:17:34	10/19/2023
ADEBAYO Daniel Ayomide	FPI/CSC/22/003	16:17:41	10/19/2023
ADEBISI HANNAH ALABA	FPI/CSC/22/004	16:17:48	10/19/2023
ADEFISOYE VICTOR OKECHUKWU	FPI/CSC/22/006	16:17:55	10/19/2023
ADEGBOYE AYODEJI GOODNESS	FPI/CSC/22/007	16:18:02	10/19/2023
ADELEYE SAMSON OLANREWAJU	FPI/CSC/22/008	16:18:09	10/19/2023
ADEMOLA SUCCESS ADEOLA	FPI/CSC/22/009	16:18:16	10/19/2023
ADENIJI VINCENT ADEKUNLE	FPI/CSC/22/010	16:18:23	10/19/2023
ADEWUMI AYODELE JOHN	FPI/CSC/22/011	16:18:30	10/19/2023
AFOLABI RAFIU OLAMILEKAN	FPI/CSC/22/012	16:18:37	10/19/2023
AIKU MICHEAL OLUWATOSIN	FPI/CSC/22/013	16:18:44	10/19/2023
A.JAYI MOSES OLUWATOBILOBA	FPI/CSC/22/014	16:18:51	10/19/2023
AJIBADE Blessing Ayokanmi	FPI/CSC/22/015	16:18:58	10/19/2023
AKINDUNTIRE IFEOLUWA OPEOLUWA	FPI/CSC/22/016	16:19:05	10/19/2023
AKINGBULUGBE OMOTOLA	FPI/CSC/22/017	16:19:12	10/19/2023
AKINJISOLA MAYOWA FRANCIS	FPI/CSC/22/018	16:19:19	10/19/2023
AKINMOLADUN OLUWASEGUN EMMANUEL	FPI/CSC/22/019	16:19:26	10/19/2023
AKINMUTIMI FAVOUR AYOMIDE	FPI/CSC/22/020	16:19:33	10/19/2023
AKINOLA SEGUN BAMIDELE	FPI/CSC/22/021	16:19:40	10/19/2023

The manual system of attendance taking is subject to easy manipulation and it can easily get lost during any little eventuality. However, digital records are more secured with higher credibility and portability. As shown in Figure 7, it is difficult to inject the records of any student that was not available during attendance taking.

Conclusion

Technology has become part of our daily lives therefore, it is imperative to adopt and deploy it for improved service delivery. The technology of QR code is implemented in this study for authentication of students for attendance purpose during lectures on mobile hand held devices. The system allows only the administrator to add students and generate QR Code for individual students which makes it impossible to register an impostor. At every scanning of the QR code, the record is updated in the database for future reference. The flexibility and ease of use make the system a reliable means of authentication during attendance taking. The full deployment of the proposed system is highly recommended to our educational institutions.

References

- Akinduyite, O., Adetunmbi, A. O., Olabode, O. & Ibidunmoye, O. E. (2013). Fingerprint-Based Attendance Management System, *Journal of Computer Sciences and Applications*, 100-105.
- Amirulloh, I., Iskandar, I. D., Apriyani, Y., Warnilah, A. I., Purnia, D. S. & Surahman, M. (2020). Teacher Attendance Monitoring System Teaching with QR-Code and Geo Location using Android Platform, *Journal of Physics: Conference Series*.
- Chow, Y., Susilo, W., Yang, G., Phillips, J. G., & Pranata, I. (2016). Exploiting the error correction mechanism in QR codes for secret sharing, *In J. K. Liu and R. Steinfeld, editors, ACISP*, volume 9722 of Lecture Notes in Computer Science, pages 1–17.
- Clarke, D. E., Gassend, B., Kotwal, T., Burnside, M., Dijk, M., Devadas, S. & Rivest, R. L. (2017). The untrusted computer problem and camera-based authentication, *In F. Mattern and M. Naghshineh, editors, Pervasive, volume 2414 of Lecture Notes in Computer Science*, 114–124.
- Hussain, A. & Nachappa, M. N. (2020). E-Authentication System with QR Code & OTP, *International Journal of Trend in Scientific Research and Development* 4 (3) (IJTSRD) e-ISSN: 2456 – 6470.
- Krihsna, P. G., Subbarayudu, Y., Rao K. M., Jyoshna, V., Aman, J., & Reddy, G. V. (2023). An Efficient, Novel, and Sustainable IoT-Based Approach for Attendance Detection through RFID Module and IR Sensor. *E3S Web of Conferences*, 1 – 10.
- Li, S, Sadeghi, A. R., Heisrath, S., Schmitz, R & Ahmad, J. J. (2011). A lightweight and low-cost e-banking solution against untrusted computers, *ING. Danezis, editor, Financial Cryptography*, volume 7035 of Lecture Notes in Computer Science, 235–249.
- Nandhini, R., Duraimurgan, N., & Chokkalingam, S. P. (2019). Face Recognition Based Attendance System, *International Journal of Engineering and Advanced technology (IJEAT)* 8 (3).
- Saad, M. N., Muda, T. Z. T., Oulaganathan, N, & Kaliappan, R. (2023). Online Student Attendance System Using QR-Code for Kolej Komuniti Segamat, *Online Student Attendance System*, pp 364 – 375.
- Sun, H. M., Chen, Y. H., & Lin, Y. H. (2012). A User Authentication Protocol Resistant To Password Stealing and Password Reuse Attacks, *IEEE Transactions on Information Forensics and Security*, 7(2), 651–663.
- Tiwari S. (2016). An Introduction to QR Code Technology. *International Conference on Information Technology, IEEE*, pp 39 – 44