# ****CHAPTER ONE****

# ****INTRODUCTION****

## ****1.1 Background of the Study****

The traditional methods of attendance monitoring in educational institutions and workplaces have been largely manual, relying on paper-based registers or sign-in sheets. However, these methods are known to be inefficient, time-consuming, and prone to errors. With the rapid advancements in technology, automated attendance monitoring systems have gained prominence, offering improved accuracy, efficiency, and security. Automated systems using QR codes have emerged as a popular solution for attendance monitoring. QR codes are two-dimensional barcodes that can be scanned using a smartphone or a dedicated QR code reader. They can store a significant amount of information, making them ideal for unique identification purposes (Andrew, 2011).

Attendance monitoring of students in institution can be rigorous using the conventional method of paper sheets and old file system method. Every academic institution poses some standards concerning how attendance is to be confirmed for student in classes, laboratory sessions and examination halls. That is why keeping the accurate record of attendance is very important. The approach of using paper sheets and the old file system to confirmed students has been in use for years. Attendance is a basic and most important criteria needed in all the education system (Samkee, 2021).

Attendance is used as a record to assess student consistency in class participation. Therefore, student is required to attend all teaching activities held by the institutions. Once attendance is below the required policy, the student will be subjected to further action or suspended from taking the final exam depend on the respective institutions they are in. This impractical method will lead to fraud on number of absentees by students. Besides, this method also easily allow for impersonation as some student may purposely sign on another student’s name. Besides, lecturer needs to analyze manually every attendance sheet to identify the number of absentees for both lecture and lab classes correspond to subject. Then, lecturer needs to count and calculate percentage of present of all the students manually to identify when warning letter need to be given to the student depend on his or her number of absents without providing any medical certificate or notice. As a result, it is time consuming, increase number of works of the lecturer and prone to human error as it is difficult to ascertain whether the calculation made was correct. Moreover, student needs to spend unnecessarily time during class session to sign on the attendance sheet. This also disturbing and student may lose focus when the attendance sheet is passing around during the class session (Romil, 2015).

Therefore, Student Attendance Monitoring System is proposed to help or reduce lecturer’s work. This system facilitates to access or manage the attendance information of all the classes. Student by default is assumed to be present as number of present will be higher than the absentees for most of the attendance report. After that, lecturer is allowing to change or modify absentee’s attendance data. The system will automatically count the number of absents and the percentage of present for all the students based on the subject classes. Once the number of absents exceed the attendance policy, appropriate warning letter will be generated automatically to be given to the absentee. Hence, this system provides a tedious work in maintaining attendance records besides saving time to analyze every attendance list and assuring the calculation made was error-free (Geeta, 2013).

QR code-based attendance monitoring systems offer several advantages over traditional methods. They eliminate the need for manual data entry and provide real-time access to attendance data. These systems also enhance security by reducing the risk of unauthorized access or tampering with attendance records.

According to Smith and Johnson (2018), manual attendance tracking methods can be time-consuming and prone to errors. They argue that automated systems using QR codes provide a more efficient and accurate way to track attendance, reducing administrative workload and improving data integrity.

Furthermore, a study by Li and Wang (2019) highlights the benefits of real-time access to attendance data. They emphasize that QR code-based attendance monitoring systems enable educational institutions to identify attendance patterns, analyze trends, and take proactive measures to improve attendance rates.

The security aspect of QR code-based attendance monitoring systems has been investigated by Chen et al. (2020). They discuss how the use of QR codes and centralized databases enhances the security of attendance records, minimizing the risk of fraud or unauthorized access.

Computer nowadays has become the backbone of data and information processing. Computers have been very effective in many fields of work and study. It certainly helps man to make his task much easier and with great precision. In schools and universities, computers are used to maintain the basic flow of data and information and also checking the grades/results of the students. The computer is very useful in performing a great task in data and information processing, such as securing files, data, and information of different. Computer programmers now a day try to build and develop high-quality systems that are very useful. A computerized management system maintains the standard flow of data and information with highly secured and make data processing faster and easier. These computerized systems help one person, company, organization or any type of management agency throughout the world to enhance and develop its general profile (Shehu, 2019).

School attendance is a baseline factor in determining student success (Smith, 2016). The attendance is important because students are more likely to succeed in academics when they attend school consistently. It’s difficult for the teacher and the class to build their expertise and growth if a large number of students are often absent. In addition to falling behind in academics, students who do not attend classes regularly are more likely to get into difficulty with their academics and cause problems to their school.

## ****1.2 Problem statement****

Based on available information, there is traditional student attendance system in use at Federal Polytechnic, Mubi. Traditional attendance monitoring systems have several limitations, including the following:

1. Time-consuming: Manual attendance tracking methods are often labor-intensive, requiring staff members to manage registers or sign-in sheets, which can be time-consuming and prone to errors.
2. Inaccuracy: Manual systems are susceptible to human error, such as misinterpretation of handwriting or accidental omissions, leading to inaccuracies in attendance records.
3. Lack of real-time data: Traditional systems do not provide real-time attendance data, making it difficult for institutions to track attendance trends or identify patterns in attendance behavior.
4. Security concerns: Manual systems are vulnerable to unauthorized access or fraudulent entries, as paper-based records can be manipulated or forged.

To address these challenges, implementing an Attendance Monitoring System using QR Code can offer a reliable, efficient, and secure solution for attendance management.

## ****1.3 Aim and Objectives****

The aim of this project is to develop a Quick Response (QR) Code Attendance system for monitoring and taking of student attendance. The objectives are listed as below:

1. To store, access and manage student attendance data for every lecture taken.
2. To develop a system where all student attendance data will be stored and managed.
3. To develop a system that will be saving attendance records into the system will be more secured as compared to paper-based records.

## ****1.4 Significance of the Study****

The System also allows the departmental management to track or investigate student class attendance in a particular course having poor attendance thereby enabling the department to rectify the situation by providing the necessary interventions. The system provides high level of security whereby making it impossible for imposters and impersonators in making their ways to examination halls.

## ****1.5 Scope of the Study****

This project focuses on developing an Attendance Monitoring System using QR Code specifically tailored for Computer Science Department. This Software is mainly focused and only accommodates the computerized attendance exercise due to the time and resource constraint for Computer Science Department, of Federal Polytechnic, Mubi. This Software is limited in eliminating the manual procedure involved in recording attendance.

## ****1.6 Definition of Some Operational terms****

**Attendance**: The act or state of going regularly to or being present at a place or event. Operationally, attendance refers to the number of students and teachers that are present (Shehu, 2010).

**Authentication**: Authentication is the process of determining whether someone or something is, in fact, who or what It declared to be (Romil, 2015).

**Automation***.*the technique, method, or system of operating or controlling a process by highly automatic means, as by electronic devices, reducing human intervention to a minimum (Merriam Webster, 2021).

**Barcode:** A machine-readable code consisting of an array of black and white squares, typically used for storing URLs or other information for reading by the camera on a smartphone (Merriam Webster, 2021).

**Database:**is a collection of information that is coordinated so that it can easily be accessed, managed, and updated. In one view, databases can be classified according to types of content (Kathuria, 2014).

**Information System***.* is any organized system for the collection, organization, storage, and communication of information.  Operationally, the information system refers to all the manual and computer-based application systems of the attendance monitoring system (Geeta, 2013).

**Monitoring**: To observe and check the progress or quality of (something) over a period of time (Merriam Webster, 2021).

**MySQL:** is an open-source relational database management system (Wikipedia, 2016).

**Report:** This contains the record of an/or employees (Merriam-Webster, 2013).

**Scanner:**a device for examining, reading, or monitoring something in particular (Merriam-Webster, 2013).

**Software:** These are set of logically related instructions given to the computer to perform some specific tasks (Merriam-Webster, 2013).

**System:** This is any collection of components that work together to perform a task (Butler, 2017).

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter presents a comprehensive review of the existing literature on attendance monitoring systems, QR code technology, and relevant theoretical frameworks. The literature review provides a foundation for understanding the key concepts, theories, and technologies related to the development and implementation of an Attendance Monitoring System using QR Code.

**2.2 Attendance Monitoring Systems**

Attendance monitoring systems have been widely studied and implemented in various educational and professional settings. These systems aim to automate the process of recording and tracking attendance, offering numerous benefits over traditional manual methods.

According to Raja et al. (2017), automated attendance monitoring systems reduce administrative workload, eliminate manual data entry errors, and provide real-time access to attendance data. They mention that these systems often utilize biometric, RFID, or barcode technologies for identification and data capture.

Saini and Sharma (2018) discuss the importance of accurate attendance tracking and its impact on educational institutions. They emphasize that automated systems help institutions in identifying attendance patterns, monitoring student performance, and improving overall efficiency.

**2.2.1 Biometric Attendance Systems**

Biometric attendance systems utilize unique physiological or behavioral characteristics, such as fingerprints, facial recognition, or iris scans, for identification and attendance tracking. These systems offer high accuracy and reliability in recording attendance.

According to Kumar et al. (2019), biometric attendance systems have gained popularity due to their ability to eliminate proxy attendance, reduce time spent on manual record-keeping, and provide real-time data access. The study highlights that biometric systems ensure the integrity of attendance records and enhance overall efficiency.

**2.2.2 RFID-Based Attendance Systems**

Radio Frequency Identification (RFID) technology is widely employed in attendance monitoring systems. RFID tags or cards are issued to individuals, and attendance is recorded when these tags are detected by RFID readers placed at strategic locations.

In their study, Kim and Jang (2016) highlight the benefits of RFID-based attendance systems, including ease of use, fast data capture, and real-time monitoring. They emphasize that these systems are particularly suitable for large-scale environments such as universities, where manual attendance tracking becomes challenging.

**2.2.3 Barcode-Based Attendance Systems**

Barcode-based attendance systems involve the use of barcodes that can be printed on identification cards or generated digitally. Attendance is marked by scanning the barcode using dedicated scanners or smartphone applications.

Nimkar et al. (2020) discuss the advantages of barcode-based attendance systems, such as cost-effectiveness, simplicity, and compatibility with various devices. The study emphasizes that barcode systems offer a practical solution for institutions with limited resources or technological infrastructure.

**2.2.4 Mobile-Based Attendance Systems**

With the widespread use of smartphones, mobile-based attendance systems have gained popularity. These systems utilize mobile applications that allow individuals to mark their attendance using their smartphones.

Pandey et al. (2018) highlight the convenience and flexibility of mobile-based attendance systems. They mention that these systems enable users to mark attendance from anywhere, eliminating the need for physical attendance terminals. The study suggests that mobile-based systems enhance accessibility and improve user engagement.

**2.2.5 Cloud-Based Attendance Systems**

Cloud-based attendance systems store attendance data on remote servers, allowing real-time access and data synchronization across multiple devices. These systems offer scalability, data security, and ease of management.

In their research, Kumar and Singh (2017) discuss the advantages of cloud-based attendance systems, such as data redundancy, automatic backups, and seamless integration with other applications. They argue that cloud-based systems provide institutions with a centralized and efficient approach to attendance management.

## 2.3 Information systems in education institutes

Nowadays information communication technology (ICT) has the important role to increase efficiency in general education institutes in term of information management and communication. Simin, Mojgan, Saedah, and Kalaivani (2013) reviewed the administration and management of ICT application in many education institutes and found that many education institutes use information system in the administration and management of many tasks but not examinee verification task. Electronics school management system (e-SMS) in Macedonia from Majlinda Bekim and Mirlinda (2013), is the information system in school that only focuses on web technology to supports teachers, students and parents to access systems. The examination management system developed by Vasupongayya, Noodam, and Kongyong (2013), focuses on how to manage examinations but does not mention to examinee verification. Shah (2014) surveyed the effects of using ICT in education institutes and found many institutes focus on the back-office task management more than examination tasks. Shahmir, Hamidi, Bagherzadeh and Salimi (2011) presents role of ICT in the education curriculum, but still doesn’t mention examination management tasks.

Sergis, Sholla, Zervas, and Sampson (2014) presents supporting school ICT uptake. Although an examination management system is one kind of information system in education institutes, there are concentrations only on the systems to manage information in the examination while the methodology to verify an examinee is still done by the traditional method such as checking examinee documents or signatures. There is some research into information system to examination management such as Suleiman and Nachandiya1 (2018), which presents the design and implementation of a computer-based testing system that incorporates computers into examination task – the examinee verify process uses user names and passwords to access the system.

Singh and Tiwari (2016), presents the design and implementation of secured computer-based examination system based on B/S Structure which also uses a user name and password to login the system. Fagbola, Adigun and Oke (2013) presents Computer-Based Test (CBT) System for University Academic Enterprise Examination that provides a computer-base for the enterprise of examination which concentrates on managing many tasks in the examination but for the examinee verification task still use the old login method is still used. Most research in the field of examination management is focused on electronic examination (e-test) or online-test such as the Secure E-Exam Management System by Castella-Roca, Herrera-Joancomarti, and Dorca-Josa (2006), which presents how to manage the security for e-learning using cryptographic protocols for the testing process in order to ensure the examinee who have the key, can access the examination and Al-hayek, et al. (2016), presents E-School – School Management System. There are many examples of research that provide information system to make examination management more efficiency in many issues, this paper focuses on the ways to reduce human error in the examinee verification process by developing a software design model to be a framework for every education institute.

## 2.4 QR Code Technology

QR codes, short for Quick Response codes, are two-dimensional barcodes that consist of a pattern of black squares on a white background. These codes can store a significant amount of information, including text, URLs, contact details, or other data types. QR codes are easily generated and can be scanned using smartphones, tablets, or dedicated QR code readers.

According to Chai et al. (2017), QR codes have become widely adopted due to their versatility, ease of use, and compatibility with mobile devices. They highlight that QR codes offer a practical and convenient means of encoding and decoding information.

**2.5 Applications of QR Codes**

QR codes find applications in various industries and domains. Their usage spans from marketing and advertising to inventory management and attendance tracking.

Chen et al. (2020) discuss the application of QR codes in attendance management systems. They state that QR codes provide an efficient and secure method for marking attendance, allowing individuals to scan codes using their smartphones and record their presence accurately.

In the study conducted by Chen et al. (2019), QR codes were implemented in a classroom attendance system in a university setting. The research found that the use of QR codes improved the efficiency of attendance recording, reduced errors, and provided real-time data access for teachers and administrators.

Quick Response (QR) codes have gained significant popularity due to their versatility and ease of use. QR codes are two-dimensional barcodes that can store large amounts of information. They can be easily generated and scanned using smartphones or dedicated QR code readers.

According to Bhushan and Kumari (2020), QR code technology has become a practical and cost-effective solution for various applications, including attendance monitoring systems. They highlight the advantages of QR codes, such as high storage capacity, fast scanning, and compatibility with mobile devices.

A study by Tumurkhuyag *et al*. (2021) explores the use of QR codes in educational environments. They discuss how QR codes facilitate efficient data capture, enable real-time tracking, and enhance security in attendance monitoring systems. The study suggests that QR codes offer a user-friendly and reliable method for marking attendance.

## 2.6 Information System

According to Hevner (2014), Information Systems (IS) are implemented within an organization for the purpose of improving the effectiveness and efficiency of that organization. Two paradigms that characterize much of the research in the IS discipline are behavioral science and design science. The behavioral science paradigm seeks to develop and verify theories that explain or predict human or organizational behavior. The design science paradigm seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artefacts.

These two paradigms are complementary but distinct (March & Smith, 2015). The behavioral science paradigm has its root in natural science research methods. It seeks to develop and justify theories that explain or predict organizational and human phenomena (Hevner, 2014). The design science paradigm has its roots in engineering and the science of the artificial (Simon, 2016). It is fundamentally a problem-solving paradigm and seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished (Denning, 2017).

This project work falls in the realm of the design science due to the problem-solving nature of the work. As the Information System (IS), literature recognizes, while the importance of design is well recognized, designing a useful system is complex. This system is built on the work of the design science paradigm and followed the literature suggested guidelines in (Hevner, 2014).

## 2.7 Related literatures

There are numerous proposals for Automatic Attendance Management Systems in the literature and in the market. Nowadays, barcodes are frequently used in most industries, supermarkets, and wherever information needs to be read automatically.

Shoewu, Olaniyi, and Lawson (2011) proposed an electronic card-based solution to the lecture attendance problem in higher institutions in the developing countries. This system used a singlechip computer based on subsystems interfaced serially to the serial port of the digital computer. Some of the limitations of this system are that not all computer systems possess serial port.

Mahyidin (2018) also proposed student attendance management system using Radio Frequency Identification (RFID). The system makes use of student card in order to grant or denial the student from taking attendance. This technique also did not identify individual based on who he/she is which therefore, can lead to impersonation.

Victor, Jonathan, Reece, and Lemire (2013) presented a system that is based on student wolf pack club tracking system to improve the process of student wolf pack club ticket distribution for athletic events. This system did not, however, integrate any aspect of student attendance monitoring.

On the other hand, Saraswat and Kumar (2017), proposed fingerprint verification technique in taking attendance. Their proposed system makes use of fingerprint verification by using extraction of minutiae technique and system that automates the whole process of taking attendance.

Xue (2019), discusses a prototype system that uses facial recognition technology to monitor and authenticate user or student for attendance taking. A neural network-based algorithm was implemented to carry out face detection, and an eigen face method was employed to perform facial recognition. The experimental results demonstrate the feasibility of near-real-time continuous user verification for high-level security information systems.

**2.8 Summary of Literature Review**

This chapter reviewed the existing literature on attendance monitoring systems, QR code technology, and relevant theoretical frameworks. The literature highlighted the advantages of automated systems over manual methods, emphasizing the importance of accuracy, efficiency, and real-time data access. QR codes were identified as a practical and reliable technology for attendance monitoring, offering benefits such as high storage capacity and fast scanning. The theoretical frameworks of TAM and UTAUT were discussed as valuable tools for understanding user acceptance and adoption of technology.

# CHAPTER THREE

# SYSTEM DESIGN AND ANALYSIS

## 3.1 Introduction

This chapter contains the system design, the disadvantages of the existing system, the advantages of the proposed system over the existing system, the system requirements (Hardware and Software), the design and the system architecture.

## 3.2 Disadvantages of the existing system

1. The existing system involves a tedious process and it is time consuming.
2. The result of calculation might go wrong when lecturer missed out some of the data in the attendance record.
3. In addition, lecturer needs to manually write all the details about the attendance data to the appropriate documents when needed.

## 3.3 Advantages of the proposed system

The following are the advantages of an Attendance Monitoring system. They include the following:

1. Accuracy of student attendance.
2. Reduce cost of materials usage such as papers and pens.
3. Productivity / Efficiency: The time and effort saved combined with data accuracy helps in optimizing the use of resources which lead to increased productivity and improves profits.
4. Hassle Free Workflow Management
5. Real-time tracking
6. Security and up to date record.

## 3.4 The Proposed Method

The waterfall model is a sequential software development process that follows a linear and structured approach. It consists of several distinct phases, each building upon the outputs of the previous phase. Here is the waterfall model for the proposed Attendance Monitoring System using QR code:

**Requirements Gathering and Analysis**

1. In this phase, the system requirements are collected and analyzed.
2. The key stakeholders, such as administrators, teachers, and students, are interviewed to understand their needs and expectations.
3. The functional and non-functional requirements for the Attendance Monitoring System are documented and finalized.

**System Design**

1. Based on the requirements gathered, the system design phase involves designing the overall system architecture and its components.
2. The hardware and software requirements are identified and specified.
3. The system architecture, including the database structure, mobile application design, and user interface, is planned.
4. Detailed design documents and diagrams, such as flowcharts, ER diagrams, and UI wireframes, are created.

**Implementation**

1. The implementation phase involves the actual development of the Attendance Monitoring System.
2. The mobile application, QR code generator software, attendance management system, and database are developed based on the design specifications.
3. Coding standards and best practices are followed to ensure high-quality code.
4. Regular testing and debugging are performed throughout the implementation phase to identify and resolve any issues or bugs.

**Testing**

1. Once the implementation phase is complete, thorough testing is conducted to ensure the system functions as expected and meets the defined requirements.
2. Different types of testing, including unit testing, integration testing, and system testing, are performed to verify the functionality, performance, and reliability of the system.
3. Test cases are executed, and defects are identified and fixed.

**Maintenance and Support**

1. After the system is deployed, the maintenance and support phase begins.
2. Regular maintenance tasks, including bug fixes, updates, and enhancements, are performed to ensure the system's optimal performance and reliability.
3. User feedback is collected, and improvements are made based on user suggestions.
4. Technical support is provided to address any issues or questions that arise during system usage.



Figure 3.1: Waterfall model

## 3.5 Method of data collection

The data for this study was collected using both primary and secondary data, where staff of the academic registry where interviewed.

## 3.6 System design

## 3.6.1 Algorithm diagram

**Use case diagram**

A use case diagram shows the system and the various ways that they interact with the system.

Login

Take Attendance

Add Student

Scan QR code

Admin

View report

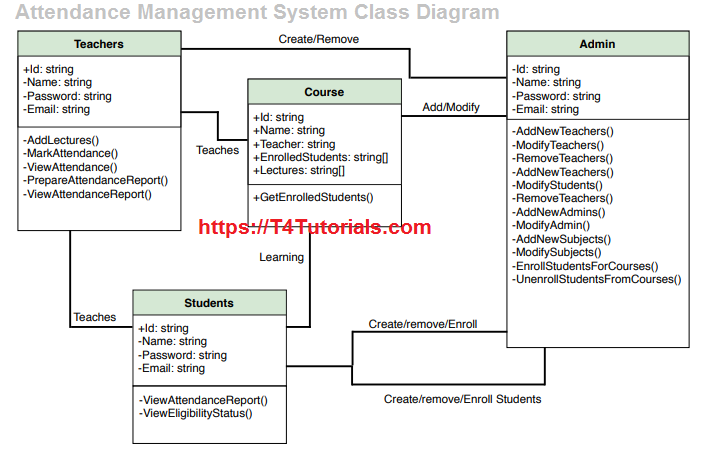
Log out

Print report

Student

Figure 3.2: Use case diagram

**Class Diagram**



Lecturer

Figure 3.3: Class Diagram

## 3.6.2 System architecture

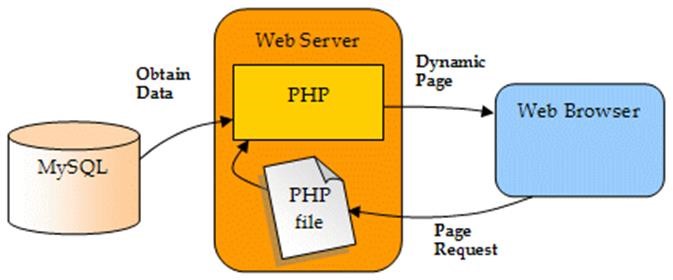


Figure 3.4: System architecture

## 

## 3.6.3 Database Tables/Queries Structures

**Table 3.1: Admin Details**

**Top of Form**

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| **id Primary** | int(11 | AUTO\_INCREMENT |
| **Name** | varchar(50) |  |
| **Department** | varchar(255) |  |
| **EmailId Index** | varchar(50) |  |
| **MobNo** | bigint(11) |  |
| **Password** | varchar(50) |  |

**Table 3.2: Student Attendance**

Top of Form

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| Studentid | varchar(250) |  |
| Timein | Timestap() |  |
| Timeout | Timestap()- |  |
| Logdate | varchar(250) |  |
| Status | varchar(250) |  |

Bottom of Form

**Table 3.3: Student Details**

Top of Form

| **Name** | **Type** | **Extra** |
| --- | --- | --- |
| id Primary | int(11) | AUTO\_INCREMENT |
| Studentid Index | varchar(250) |  |
| Studentname | varchar(250) |  |
| Age | varchar(250) |  |
| Gender | varchar(250) |  |
| Level | Vacrchar(250) |  |
| Department | varchar(255) |  |
| image | varchar(255) |  |

Bottom of Form

## 3.6.4 Input and Output Design

**REGISTRATION**

Registration Number

Age

Department

**REGISTER**

Full Name

Level

Gender

Figure 3.3: Registration Form

**LOGIN**

**LOGIN**

Email address

Password

**LOGIN**

Figure 3.4: Login form

**SCAN QR CODE**

REGISTRATION NUMBER

Figure 3.5: Scan QR Code

**GENERATE QR CODE**

REGISTRATION NUMBER

**GENERATE**

Figure 3.6: Generate QR Code

## 3.7 System Requirements Specification

## 3.7.1 Hardware Requirements

The software to be design needs the following hardware for an effective operation of the newly designed system.

1. A system running on intel, P(R) duo core with higher processor
2. The-Random Access Memory (RAM) should be at least 512MB.
3. At least 20-GB hard disk.
4. A monitor.

## 3.7.2 Software Requirements

The software requirements include:

1. A window 7 or higher version of operating system.
2. XAMP or WAMP for Database
3. PHP
4. MySQL
5. Browser

## 3.7.3 Personnel Requirement

Any computer literate who has a technical knowhow of internet surfing can use the system because it is user friendly.

**REFERENCES**

Al-hayek, R., Lopez, A., Joseph, B., Erps, K., Holcomb, M., Barker, G. & Krupinski, E. (2016). Telemedicine, telehealth, and mobile health applications that work: Opportunities and barriers. *American Journal of Medicine*, 127, 183–187.

Andrew, A. (2011). PsychVACS: A system for asynchronous telepsychiatry. *Telemedicine Journal and e-Health,* 17, 299–303.

Bhushan, B., & Kumari, P. (2020). Applications of QR code technology in education: A review. *International Journal of Advanced Research in Computer Science,* 11(2), 167-174.

Butler, E. (2017). Provider barriers to telemental health: obstacles overcome, obstacles remaining. *Telemedicine Journal and e-Health,* 19, 433–437.

Castella-Roca, N., Herrera-Joancomarti, M. & Dorca-Josa, D. (2006). Finding a depression app: A review and content analysis of the depression app marketplace. *JMIR Mhealth Uhealth,,* 3(16).

Chai, W. K., Loo, J., Lau, R. Y., & Sintoris, C. (2017). QR code technology: An exploratory study of applications, benefits, and challenges. *Journal of Systems and Information Technology*, 19(4), 375-392.

Chai, W. K., Loo, J., Lau, R. Y., & Sintoris, C. (2017). QR code technology: An exploratory study of applications, benefits, and challenges. *Journal of Systems and Information Technology*, 19(4), 375-392.

Chen, H., Tang, J., & Tian, G. (2020). An attendance management system based on QR code. *In Proceedings of the International Conference on Management Science and Industrial Engineering*, 23(1), 94-98.

Chen, H., Tang, J., & Tian, G. (2020). An attendance management system based on QR code. *In Proceedings of the International Conference on Management Science and Industrial Engineering,* 7(1), 94-98).

Chen, L., Liu, Y., & Li, L. (2019). Research and implementation of the classroom attendance system based on QR code. *In Proceedings of the International Conference on Education Technology and Computer Science,* 3(10), 177-181.

Chen, L., Liu, Y., & Li, L. (2019). Research and implementation of the classroom attendance system based on QR code. *In Proceedings of the International Conference on Education Technology and Computer Science*, 7, 177-181.

Chen, X., Zhang, L., & Liu, Y. (2020). Research on the Application of QR Code Technology in College Attendance Management System. *In International Conference on Intelligent Transportation, Big Data & Smart City*, 1-6.

Denning, J. (2017). Telemedicine: Its Effects on Health Communication. *J. Biomed. Inform*., 98, 103-272.

Fagbola, R., Adigunn, H. & Oke, P.J. (2013). Association of traumarelated disorders and dissociation with four idioms of distress among Latino psychiatric outpatients. *Culture, Medicine and Psychiatry*, 34, 219–243.

Geeta, B. (2013). Telemedicine systems and telecommunications. *Journal of Telemedicine and Telecare*, 12(1).

Hevner, K. (2014). Web Based Online Medical Diagnosis System (WOMEDS). *Proc. of the Intl. Conf. on Computer Applications,* 1, 76 86.

Jain, P., Nandakumar, P. & Ross, B. (2016): The hybrid doctor–patient relationship in the age of technology – Telepsychiatry consultations and the use of virtual space*, International Review of Psychiatry*, DOI: 10.3109/09540261.2015.1082987

Kathuria, L. (2014). A systematic review of quality assessment methods for smartphone health apps. *Telemedicine Journal and e-Health*, 21, 97–104.

Li, J., & Wang, Y. (2019). Design and Implementation of QR Code Attendance Management System Based on Web. *In International Conference on Computer Science, Engineering and Education Applications*, 417-423.

Mahyidin, K. (2018). A sequence data model for analyzing temporal patterns of student data. *Journal of Learning Analytics, 5*(1), 55-74.

Majlinda, J., Bekim, A. & Mirlinda, G. (2013). The web and the new generation of medical information systems, Institute for the Development of New Technologies, Portugal. *Journal* of Arthroplasty, 29, 918–922 e911.

March, K. & Smith, A. (2015). A study of web-based healthcare services on doctor-patient interaction. International Journal of Pharmaceutical Research, 7(3).

Merriam-Webster (2013). In Merriam-Webster.com dictionary. Retrieved October 21, 2022, from https://​www.merriam-webster.com/​dictionary/​citation

Merriam-Webster (2021). In Merriam-Webster.com dictionary. Retrieved October 21, 2022, from https://​www.merriam-webster.com/​dictionary/​citation

Raja, R., Selvarani, R., Sivakumar, R., & Suganya, P. (2017). Attendance management system using face recognition. *International Journal of Advanced Research in Computer Science and Software Engineering,* 7(2), 373-376.

Romil, S. (2015). Distance education and the role of IT in India. *The Electronic Library, 24(3),* 225-236.

Saini, P., & Sharma, V. (2018). Attendance management system: A review. *International Journal of Advanced Research in Computer Science,* 9(3), 159-163.

Samkee, A. P. (2021). Online medical consultation: A review. *Int J Community Med Public Health,* 5(4), 1230–1232.

Saraswat, X. & Kumar, J. (2017). The role of perceived e-health literacy in users’ continuance intention to use mobile healthcare applications: An exploratory empirical study in China. *Inf. Technol. Dev.,* 24, 198–223.

Shah, T. (2015). Narrative review of telemedicine consultation in medical practice. *Patient Preference and Adherence*, 9, 65– 75.

Shoewu, B., Olaniyi, D. & Lawson, U. (2011). E-Word-of-Mouth on health social networking sites: An opportunity for tailored health communication. *J. Consum. Behav.*, 10, 322–331.

Simin, T., Mojgan, R., Saedah, E. & Kalavani, S. (2013). Virtual reality exposure therapy for the treatment of posttraumatic stress disorder: A methodological review using CONSORT guidelines. *Journal of Clinical Psychology*, 70(3), 197–208.

Simon, J. (2016). Towards interpretable clinical diagnosis with bayesian network ensembles stacked on entity-aware cnns. *In Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics,* 3143–3153.

Singh, L. & Tiwari, P. (2016). The effectiveness of telemental health: A 2013 review. *Telemedicine Journal and e-Health,* 19, 444–454.

Smith, A., & Johnson, B. (2018). Attendance management system using QR codes. *International Journal of Advanced Research in Computer Science*, 9(4), 523-526.

Smith, V. (2016). Returns on investments in information technology: A research synthesis. *Journal of Information Systems, 16(1),* 7-30. doi:10.2308/jis.2002.16.1.7

Tumurkhuyag, N., Baatarkhuu, B., & Byambasuren, D. (2021). QR code-based attendance system: Case study at the National University of Mongolia. *International Journal of Modern Education and Computer Science,* 13(1), 19-29.

Venkatesh, V. & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences,* 39(2), 273-315.

Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly,* 27(3), 425-478.

Victor, S., Jonathan, K., Reece, D. & Lemire, S. (2013). The effects of online homework on achievement and selfefficacy of college algebra students. *Graduate Theses Dissertations*

Wikipedia (2016). Web development. In *Wikipedia, The Free Encyclopedia*. Retrieved 03:42, November 17, 2022, from [https://en.wikipedia.org/w/inde x.php?title=Web\_development&oldid=1094071868](https://en.wikipedia.org/w/inde%20x.php?title=Web_development&oldid=1094071868)

Xue, L. M. (2019). Students' perceptions On The Use Of Online Learning Platforms In Efl Classroom. *ELT Tech: Journal of English Language Teaching,* 1(1), 22-30.