

The Implementation of a Bluetooth and GSM Module-Based Student Attendance System

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Abstract: The goal of this research is to develop and build a portable student attendance system for use in educational facilities as well as to design a user-friendly attendance mechanism, particularly for the lecturer, that includes security standards for the stored data. When the system is turned on, it will first display the SD card by saying "SD card is OK," and then it will also display the project's title (Attendance). Also included are the time, date, and year. Every student has been given an identifying number ranging from 01 to 50. If a student with the registration number 01 is called and you see him, you will then dial 01 using the implemented systems or serial monitor with the help of the Bluetooth device used in the system. Likewise, if another number is called, the same procedure will be followed as mentioned above. The SD Card used in the research is used to store the date recorded for future use. At the same time, the GSM Module is used to send messages to the registered mobile number in order to prove the student is present in the class at that particular time of lectures.

Keywords: SD Card, GSM Module, Arduino Microcontroller, Bluetooth Module, LCD

1. Introduction

Most colleges and other institutions make use of simple-to-game attendance systems. If a professor had to mail each student a paper attendance list in order to record their attendance, think about how it might function. In this instance, the student only needs to complete the attendance sheet and then sign it. Some students could imitate their friends' signatures even when they are not in class. Most institutions have procedures called "barring" that forbid students from taking exams if their attendance percentage drops below 75%. One alternative is to call out the students' names to register their attendance. However, it takes a long time to use this approach. Hence, a novel method of

monitoring attendance.

2. Literature Review

Since many years ago, radio frequency identification (RFID) technology has been in use. The British Army used this technique to help detect enemy aircraft in the 1940s, laying the foundation for its use [1-4]. In addition, Leon Theremin created a surveillance device for the Soviet Union in 1945 that helped send radio waves including audio data. Sound waves cause the diaphragm in this device to oscillate, changing the resonator's shape. The fact that this device was

a covert listening device rather than an identification tag made it a prototype for RFID technology [5]. The gadget functioned as a passive device that was energized by electromagnetic waves (EM) produced by an external source. The identification-of-friend-or-foe (IFF) transponder was created in 1915 to aid in the identification of aircraft during World War II. Harry Stockman also investigated RFID technology in his 1948 paper, "Communication employing reflected power." Similar to the advent of the compact disc, which was envisioned in the 1960s but did not achieve sufficient popularity until the 1980s, nuclear material safety and security concerns led to the further development of RFID in the late 1960s. Mario Cardullo asserted that the first real forerunner of the current RFID system was his passive radio transponder with memory in 1973 [6]. Furthermore, the Los Alamos Scientific Laboratory performed the first RFID tag demonstration in 1973 [7]. In the 1980s and 1990s, RFID tracking achieved significant advancements. In the 1980s, RFID was first used by Compaq computers to track parts during industrial assembly. The increasing momentum of the RFID system has been greatly aided by advancements in chip compactness and increases in computer performance with complicated network topologies. Most importantly, during this phase of development, standards are benchmarked to make sure that consumers can benefit from the technology's compatibility and ease of use [8]. The impending storms of potentially distracting technology have discovered methods to make our lives more comfortable by making use of the development of technology in various ways. The term "smart tags" is a generic one for this technology. We call this contemporary technology RFID technology. Radio waves are typically used to identify, detect, and trace products and people using RFID tags that are fixed within or on them. The data kept in the radio RFID tags can be read by the RFID reader. Utilizing the contemporary technologies that currently affects our personal lives can help us maintain our privacy. A rapidly developing technology, RFID is utilized in a variety of applications. The quickest and most accurate way to identify something is by this strategy. The interrogator, also known as the RFID reader, and the transponder, sometimes known as the RFID tag, are the two essential parts of an RFID system. While the transponder RFID tag is attached to the object, the interrogator, which is the RFID reader, typically transmits and receives the signal. An RFID reader in the RFID system queries the RFID tags. The tag reader creates a radio frequency interrogation that connects to the system-registered tags. This reader also features a receiver that catches and decodes a reply signal produced by the tags. The information content of the tags is reflected in this reply signal from the tags. An antenna and a small microchip are the typical components of an RFID tag [1]. While RFID has many uses on its own, when paired with an Arduino, its limitations become even more apparent. Wider reading ranges, faster processing, and higher memory capacities are all results of ongoing advancements in RFID technology. Even with the anticipated drop in raw material costs and economies of scale, there is a strong likelihood that

the technology will eventually replace barcodes because a radio frequency (RF) tag's integrated circuit (IC) will never be as expensive as a bar code label. Nevertheless, RFID will keep growing in areas where it is considered to be more successful than barcodes or other optical technologies. In the current system in both institutions, businesses, schools, and universities, attendance or daily attendance of employees or pupils in a place of work has become a lively assessment viewpoint. The unoriginal attendance-monitoring plan has certain challenges as new technologies is developed. For instance, it is exceedingly unsafe and impairs the consideration of the students or members of that particular class or organization to distribute the daily attendance sheet to a huge number of employees, students in a class or organization, industries, and places of work [2]. This is viewed as a waste of time and effort since students or individuals may purposefully record the names of those who are not in the class or at their places of employment on the attendance sheet. All crucial attendance records will without a doubt be lost if the lecturer or organization accidentally loses these papers. In order to realize the goal of linking the objects around us to the internet, the RFID innovation has a big task to complete. These include individuals, animals, plants, and even their obvious body parts, as well as large structures, aircraft, contemporary plants, automobiles, any kind of products, and explicit bits of a larger framework. The internet of things (IoT) is the concept behind all of this [3]. A wireless fingerprint-based attendance system was created and put into use to collect and store attendance data using fingerprints, a type of biometric [9]. creating a time management and access monitoring system employing a microprocessor card to track staff and student movements using information stored in the database for administrative use on the campus, in the office, or in a particular location. By fully leveraging the Mykad features available via the internet and intranet facilities, headmasters, teachers, and parents may access all the data collected by this system [10]. A program that could generate reports, see student and professor profiles, record attendance via interactive input, and give students access to timetables A barcode scanner is used by the system to record attendance [11]. In a different spectrum, using RFID technology to enter and exit parking lots without stopping cars prevents traffic delays while parking is allowed. By comparing the current data in the database with prior data, this sort of system is typically used to identify automobiles through internet facilities [12]. The RFID-based automated attendance system is a system that was created. The software for the attendance system was created utilizing a database and Visual Basic. NET (VB. NET) (Microsoft Access). An RFID tag is affixed to each employee's or student's identity (ID) card. The computer, the RFID reader, and the computer system are all connected serially. The lecture hall door or the organization's front door is where the RFID reader is situated. The RFID reader reads the RFID tags whenever students or staff members enter the classroom or business. It then stores all of the information (entry time, name, etc.) about them into the database and

keeps the system running. Unlike the conventional approach of recording names on the attendance sheet or piece of paper, the administrator of this system can inspect all the documents using the software interface and quickly retrieve the data from the database [13]. Create and build a web-based attendance system that uses RFID technology. The RFID tag and RFID reader are used by this system to read the student's information and track their attendance. The reader then links to Arduino, which acts as the research's central nervous system because it provides all instructions. The Arduino shield is then used to transmit the RFID reader response to the web server. Finally, PHP and MySQL can be used to store student attendance data on the web server. By logging into this specific web-based application, the administrator of the implemented system may now examine all the student's documents and can view all the information that has been registered or stored using a liquid crystal display (LCD) [14]. an automatic attendance system that employs RFID and pose-invariant facial verification. Two-factor verification is used by the system to function. The pupils must utilize the RFID tag that the RFID reader can read in the first stage. The process proceeds to the second step of verification if the first step is successful. Otherwise, the student loses recognition. Face verification is the next step. The database records the student's attendance if the face matches the information contained in the RFID tag. The system will automatically identify fake students. Due to the fact that they are not registered in the system database, this two-factor automatic approach prevents the exploitation of identity theft to obtain attendance [15]. A two-factor verification system is integrated into a student attendance management system based on RFID and fingerprint reader technologies. The computer and RFID reader are connected, and the computer is equipped with specialized software designed by Microsoft Visual Basic Studio and structured query language to track students' attendance automatically (SQL). The student's RFID tag and fingerprints must first be registered, and they are then saved in the system's database. Once the pupils have used the RFID tag to enter the classroom, the RFID reader will read it and check the system's database to see if the tag has been registered. He moves on to the next level of verification if it is registered or accurate. The student's fingerprint is then validated in the next phase. If the information matches that of the student who registered, the student's attendance will be saved on the server. Additionally, in order to utilize the system, lecturers or teachers must be authenticated. Additionally, they have the power to manage the entire system [16]. The system development employs an SD card module with an RFID tag that carries various voice codes. The SD card module houses the tag identification card and the voice greeting code. The student's RFID tag is read as soon as they walk through the classroom door. The details of the student or individual must be provided using the voice greeting if the identification card of the student matches the data contained on the SD card. If they match, the door will be left open and the student's attendance will be recorded in the excel sheet. The LCD utilized in the study allows the

students to examine information on their attendance. The SD card module, RFID reader, liquid crystal display, and other research-related components are all connected by the Arduino. Due to the system's overall design and the system's use of extremely basic components, it also has fairly simple schematics when compared to other systems. Additionally, you can receive prompt responses and precise outcomes [17]. The worldwide system for mobile phones (GSM) and the RFID system were used to design a prototype system known as the microcontroller-based attendance system. Three ATmega16 microcontrollers, positioned between the computer, the global system for mobile modem, and the RFID reader, make up the system. Each of the employed microcontrollers serves a certain function. The system will begin whenever a teacher or lecturer enters the lecture hall or classroom using his or her RFID tag, and within five minutes the students will enter the classroom by exchanging their RFID badges. The first microcontroller will evaluate the signal from the RFID reader and use an infrared ray (IR) signal, which is influenced by a motor, to open the classroom door after the RFID reader reads the RFID tag. The microcontroller momentarily stores this signal. The system will determine automatically that the class is over once the lecturer or teacher switches the RFID tag back to the RFID reader after finishing the lesson. The microcontroller will therefore send the signal that was momentarily recorded to the computer database as the attendance. The global system for mobile phones and modems will receive a signal if a student is absent, and it will convey this message to the parents of the students who were not present during the lectures or lessons in the lecture hall or the classroom. The system will not count any students as present if they leave before the lecturer or teacher. The system itself is useful and trustworthy as a security system. Therefore, pupils are unable to cheat the school or their parents [18], a system that will utilize both a global mobile phone network and RFID technology. They used a microcontroller to serve as a bridge in their investigation between global networks for mobile modules and RFID technology. As students enter the lecture hall or classroom, the RFID scanner reads their tags and sends the data to the global system for the mobile module. If the information on the identity card or tag does not match the information that has been put in the database, the student or person is considered to be an unauthorized person. The administration and the parents of the children will be notified that they have been tagged if the tag is accepted by the global system for the mobile module. A system with a four-tier design that uses web-based attendance as well as RFID and biometrics. The RFID tags used by students, lecturers, and professors in their system each have a special code that is kept in the institution's or school's database. The entrance door to the lecture hall or classroom is where the RFID reader and the fingerprint reader are located. Every time a student wants to enter the classroom, they must use an RFID tag. An RFID reader will read the tag and verify the student's identity by comparing it to the data in the database to decide whether it matches or not. Only if the first level of

verification is successful will the second stage be permitted. The second stage of the system involves fingerprint verification; if the student's fingerprint matches the information in the database, the attendance will be recognized and recorded; however, if his or her record is not recorded or captured in the database, there will be no attendance for that student. Only ten minutes, including the five minutes before and after the scheduled class start time, are required for the fingerprint verification. If a student arrives late, attendance will not be given to that student; however, the student may still attend lectures and study even though attendance will not be given for that particular class. Finally, if the students are present in the lecture hall or classroom, a short message service (SMS) will be delivered to their parents [20]. The room has a server application that is maintained by a laptop and a prototype of the attendance management system with the placement of more RFID readers. With the assistance of a wireless router or local area network (LAN) connection, the radio frequency identification reader and the laptop or personal computer (PC) are connected. The RFID tag, which is read by the RFID reader and transmits the student's attendance to the server through a wireless or LAN connection, must be worn every time a student or other individual enters the lecture hall or classroom. A higher level of efficiency can be achieved than with the conventional method or just one radio frequency identification reader due to the widespread placement of RFID readers [16]. Additionally, he suggested a solution that utilizes RFID technology and the Telegram communication program. In their system, the students must appear before their professors or instructors so that their RFID tags can be tapped. If the tags match the tag data in the database, it will transmit the attendance to the principle or management of the school in the form of an excel sheet and send a message to the parent of that particular student via Telegram messenger. Facial verification, however, costs about the same as other biometric verification. While designing an automatic attendance system, it could also be taken into consideration for a more efficient system. The RFID systems with a facial recognition system and a fingerprint recognition system are very comparable. Each table attribute gives notions that are equivalent, with the exception of price. Fingerprint technology are much less expensive than iris and retina biometric devices. But Visual Studio and SQL-based software is highly pricey. The system gradually becomes more renowned and is seen as a costly system [17]. A low-cost portable smartcard-based attendance system uses RFID and fingerprint biometric technology to boost the security and precision of the data. The institution's efficiency in terms of staff and time is increased by this design system, which also makes system design simpler. This technology streamlines the taking of attendance procedure, reduces the likelihood of human error, and expedites the process of verifying student attendance [18]. It also requires less human

interaction. The Smart Attendance Monitoring System is a face recognition-based attendance system for classrooms (SAMS). In order to construct a portable device that may be used to control student attendance using face recognition technology, several widely available components were combined [19]. a radio frequency identification (RFID)-based attendance system with short message service (SMS) backup. In order to determine whether a student is eligible to take an exam or attend class, this research aims to develop techniques for automatically tracking student attendance, saving student data on a PC and backing it up across a global mobile communication system [20-22, 24].

3. The Impact of the Student Attendance System

- 1) Its mobile and cloud-based attendance management system eliminates paperwork and saves time and money.
- 2) It eliminates inaccurate time and attendance entries and duplicate information entry.
- 3) It offers transparency to monitor and control student attendance and absence across many campuses or institutions.
- 4) Monitoring the status of leave requests in real-time.
- 5) Automatic computation of accumulated leave and reward points.
- 6) RFID and biometric-based attendance solutions allow for simple attendance registration.
- 7) Manage allocation, allocate tasks, and keep track of staff and teacher attendance.
- 8) Send email and SMS alerts to parents informing them of the student's performance.
- 9) Automate the generation of various reports on student or class attendance.
- 10) Enhanced security and secrecy thanks to user permissions that are role-based [23].

4. The Implemented Result of the Student Attendance System

The images below illustrate how the whole system operates. If the system is powered on by the switch, it will display the title of the project (Attendance). It also shows that the SD Card is okay. It will then display the real-time clock and date. If you connect the serial monitor to the system with the help of the Bluetooth module, you can now use it to press the numbers of the students. From this process, you will be able to know the number of students present in the class that particle class. The SD Card used in the research is used to store the date recorded for future use. At the same time, the GSM Module is used to send messages to the registered mobile number.

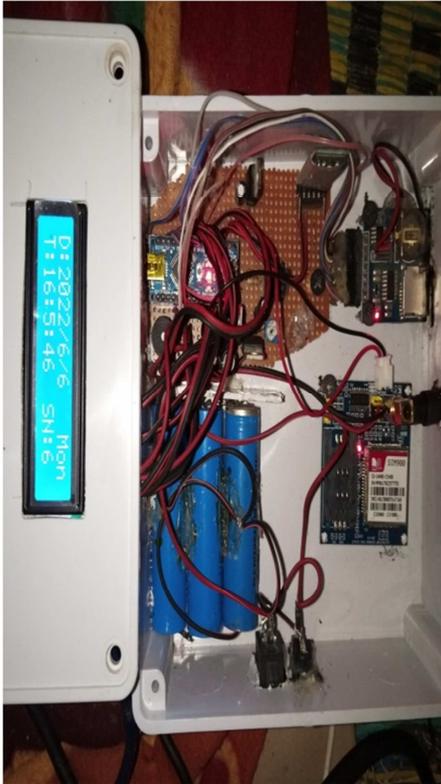


Figure 1. The complete implemented system.



Figure 3. Displaying SD Card is OK.



Figure 2. The Implementation result displays the research title.



Figure 4. The implementation result displays the real time and year.



Figure 5. The implementation results show serial number 03 present.



Figure 6. The implementation results show serial number 04 present.



Figure 7. Sending SMS from the implemented system to the registered phone number.

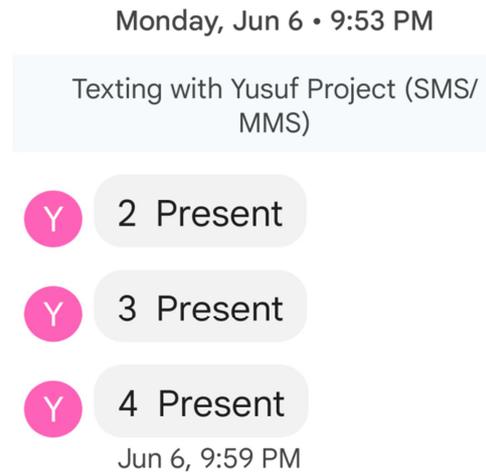


Figure 8. The result from the registered phone number displays the numbers present in the class (SMS).

5. Conclusion

The materials used in this study are affordable and readily available. Because of this, the net deployment cost is extremely low and within the means of the typical consumer, particularly those from Africa. This inexpensive plan aims to determine the number of students present in a certain class and makes it possible for their parents or guidance to determine whether the students are actively enrolled in the class and attending lectures. The study can be improved by including a camera for picture capture of the system and by building a face recognition module.

References

- [1] E. Orji, C. Oleka, U. I. Nduanya, "Automatic Access Control System using Arduino and RFID," *Journal of Scientific and Engineering Research*, vol. 5, no. 4, pp. 333-340, 2018. [Online] Available: <http://jsaer.com/download/vol-5-iss-4-2018/JSAER2018-05-04-333-340.pdf>
- [2] K. Vandana, K. Anil Kumar, G. Sivani, G. Devanand, E. Venkatanarayana, "Examination Room Guidance System Using RFID and Arduino," *International Research Journal of Engineering and Technology (IRJET)*, vol. 5, no. 4, pp. 642-645, Apr. 2018. [Online] Available: <https://www.irjet.net/archives/V5/i4/IRJET-V5I4142.pdf>
- [3] M. Cavas and M. A. Baballe, "A Review Advancement of Security Alarm System Using Internet of Things (IoT)," *International Journal of New Computer Architectures and their Applications*, vol. 9, no. 2, pp. 38-49, Nov. 2019, doi: 10.17781/P002617.
- [4] Z. Yongqiang and L. Ji, "The Design of Wireless Fingerprint Attendance System," 2006 International Conference on Communication Technology, 2006, pp. 1-4, doi: 10.1109/ICCT.2006.341990.
- [5] M. Man and L. Y. Kyng, "Utilizing MYKAD Touch N Go features for Student Attendance System (TITO)," *Proceeding of 1st International Malaysian Educational Technology Convention*, Nov. 2007, pp. 114-120.

- [6] J. Sidi, S. N. Junaini, and L. S. Ling, "ISAMS: Tracking Student Attendance Using Interactive Student Attendance Management System," Proceedings of the 3rd Malaysian Software Engineering Conference, Dec. 2007, pp. 218-223.
- [7] Z. Pala and N. Inanc, "Smart Parking Applications Using RFID Technology," 2007 1st Annual RFID Eurasia, Sep. 2007, pp. 1-3, doi: 10.1109/RFIDEURASIA.2007.4368108.
- [8] A. A. Olanipekun and O. Boyinbode, "An RFID-Based Automatic Attendance System in Educational Institutions of Nigeria," International Journal of Smart Home, vol. 9, no. 12, pp. 65-74, Dec. 2015, doi: 10.14257/ijsh.2015.9.12.07.
- [9] H. D. Rjeib, N. S. Ali, A. Al Farawn, B. Al-Sadawi, and H. Alsharqi, "Attendance and Information System using RFID and Web-Based Application for Academic Sector," International Journal of Advanced Computer Science and Applications (IJACSA), vol. 9, no. 1, pp. 266-274, 2018, doi: 10.14569/IJACSA.2018.090137.
- [10] S. Pss and M. Bhaskar, "RFID and Pose Invariant Face Verification Based Automated Classroom Attendance System," 2016 International Conference on Microelectronics, Computing and Communications (MicroCom), 2016, pp. 1-6, doi: 10.1109/MicroCom.2016.7522434.
- [11] M. M. M. Thein, C. M. New, and H. M. Tun, "Students' Attendance Management System Based on RFID and Fingerprint Reader," International Journal of Scientific & Technology Research, vol. 4, no. 7, pp. 30-38, Jul. 2015.
- [12] Y. Mishra, G. K. Marwah, and S. Verma, "Arduino Based Smart RFID Security and Attendance System with Audio Acknowledgement," International Journal of Engineering Research & Technology (IJERT), vol. 4, no. 1, pp. 363- 367, 2015.
- [13] A. K. Shukla, "Microcontroller Based Attendance System Using RFID and GSM," International Journal of Emerging Technologies in Engineering Research (IJETER), vol. 5, no. 8, pp. 127-131, 2017. [Online] Available: <https://www.ijeter.everscience.org/Manuscripts/Volume-5/Issue-8/Vol-5-issue-8-M-21.pdf>
- [14] S. Konatham, B. S. Chalasani, N. Kulkarni and T. El Taeib, "Attendance Generating System Using RFID and GSM," 2016 IEEE Long Island Systems, Applications and Technology Conference (LISAT), 2016, pp. 1-3, doi: 10.1109/LISAT.2016.7494157.
- [15] R. Roy, "A Web Enabled Secured System Designed for Attendance Monitoring Applying Biometric and Radio Frequency Identification (RFID) Technology," 2014 International Conference on Signal Propagation and Computer Technology (ICSPCT 2014), 2014, pp. 653-657.
- [16] T. Sanjay, "Attendance Management System," International Journal of Emerging Technology and Advanced Engineering, vol. 4, no. 7, pp. 541-543, 2014.
- [17] M. B. Chaniago and A. Junaidi, "Student Presence Using RFID and Telegram Messenger Application," 8th Widyatama International Seminar on Sustainability (WISS 2016), 2016.
- [18] V. M. Vinod, G. Murugesan, V. Mekala, S. Thokaiandal, M. Vishnudevi, and S. M. Siddharth, "A Low-Cost Portable Smart Card Based Attendance System," IOP Conference Series: Materials Science and Engineering, 2021, vol. 1012, p. 012046, doi: 10.1088/1757-899X/1012/1/012046.
- [19] S. Bhattacharya, G. S. Nainala, P. Das and A. Routray, "Smart Attendance Monitoring System (SAMS): A Face Recognition Based Attendance System for Classroom Environment," 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT), 2018, pp. 358-360, doi: 10.1109/ICALT.2018.00090.
- [20] U. K. Nkalo, E. O. Agwu, and E. C. Stanley, "Radio Frequency Identification (RFID) Based Attendance System with Short Message Service (SMS) Backup," IOSR Journal of Computer Engineering (IOSR-JCE), vol. 21, no. 2, pp. 1-8, 2019, doi: 10.9790/0661-2102010108.
- [21] M. A. Baballe, F. A. Nababa, "A comparative study on radio frequency identification system and its various applications", International Journal of Advances in Applied Sciences (IJAAS) Vol. 10, No. 4, December 2021, pp. 392~398 ISSN: 2252-8814, DOI: 10.11591/ijaas.v10.i4.pp392-398.
- [22] M. B. Ahmad, F. A. Nababa, "The need of using a Radio Frequency Identification (RFID) System", International Journal of New Computer Architectures and their Applications (IJNCAA) Vol. 11, No. 2, pp. 22-29, The Society of Digital Information and Wireless Communications, 2021.
- [23] Sriram, "Top 10 advantages of automatic student attendance system", [Online] Creatrixcampus.com, Available at: <https://www.creatrixcampus.com/blog/top-10-advantages-automatic-student-attendance-system>, [Accessed 16 August 2022], 13/05/2019.
- [24] M. A. Baballe, "A Study on the Components used in RFID System and its Challenges", Global Journal of Research in Engineering & Computer Sciences Vol. 01, No. 01, pp. 21-27, Journal homepage: <https://gjrpublication.com/journals/>, Sep-Oct | 2021.