



## Implementation of a Bluetooth and GSM-Based Student Attendance System

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### Abstract

The objective of this study is to develop a portable student attendance system for use in educational facilities as well as a user-friendly attendance system, primarily for the lecturer, that includes security standards for the stored data. When the system is turned on, it will show the SD card and state, "SD card is OK," to show that it is in good shape before showing the project's name. In addition, the time, date, and year are given. Every child has been given an identity number, ranging from 01 to 50. In the event that a student with the number 01 is called and you happen to be present, you will dial 01 using the system's Bluetooth device or an Android serial monitor. In this research we have seen how the system is used to send messages to the registered mobile phone number and a lecturer has to see if the student is present in the class before he sends the message to the parents using the implemented system, which is different from using the RFID tags, which you can give to anyone to swipe for you even if you are not present in the class.

**Keywords:** SD Card; GSM Module; Microcontroller; Bluetooth Module

### Introduction

Most universities and other institutions make use of simple-to-game attendance systems. Consider how it might work if a professor had to mail a paper attendance list to every student in order to track their attendance. In this case, the student merely needs to fill out and sign the attendance sheet. Even outside of class, some students have been known to mimic their classmates' signatures. Most universities have "barring" policies that prevent students from taking tests if their attendance rate falls below 75%. Calling out the students' names is an alternate method of recording their attendance. However, using this method takes a while. Hence, a new technique for tracking attendance.

### Literature Review

Radio frequency identification (RFID) technology has been used for a long time. The British Army developed this method in the 1940s to aid in the detection of enemy aircraft [1-4]. Leon Theremin additionally developed a listening apparatus for the Soviet Union in 1945 that assisted in transmitting radio waves, including audio data. In this device, sound waves cause the diaphragm to vibrate, changing the form of the resonator. This gadget was a prototype for RFID technology because it was a covert listening device rather than an identification tag [5]. The device operated passively and was powered by electromagnetic waves (EM) emanating from an outside source. To help identify aircraft during World War II, the identification-of-friend-or-foe (IFF) transponder was developed in

1915. In 1948, Harry Stockman published a study titled "Communication employing reflected power" that examined RFID technology. Nuclear material safety and security concerns prompted the further development of RFID in the late 1960s, which is comparable to the introduction of the compact disc, which was envisioned in the 1960s but did not become sufficiently widespread until the 1980s. According to Mario Cardullo, his passive radio transponder with memory from 1973 was the first true precursor to the modern RFID system [6]. The first RFID tag demonstration was additionally carried out in 1973 by the Los Alamos Scientific Laboratory [7]. Significant breakthroughs in RFID tracking were made in the 1980s and 1990s. Compaq computers employed RFID for the first time to track components during industrial assembly in the 1980s. Increases in computer performance with complex network topologies and improvements in chip compactness have both significantly contributed to the RFID system's growing pace. Most significantly, standards are benchmarked throughout this stage of development to ensure that users may benefit from the technology's compatibility and simplicity [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. It belongs to the group of technologies known as automatic identification and data capture (AIDC) technologies, which includes automatic identification and data capture. 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]. Devised and constructed a wireless fingerprint-based attendance system to collect and store attendance data using the biometric fingerprints [9]. Creating a time management and access control system using a microprocessor card to track staff and student movements while storing the information in a database for administrative use on the campus, in an office, or in a specific 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 da-

tabase 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 stu-

dent 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 a student as present in the lecture hall or classroom 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 determine 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]. An alternative radio frequency identification (RFI)-based attendance system uses short messaging service (SMS). 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]. Bluetooth Smart Attendance with SMS Alert: Design and Simulation. To deliver messages to the registered mobile number, this system utilizes the GSM Module [25].

### Impact of the student attendance system

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

### The implemented result of the student attendance system



Figure 1: The complete implemented system.



Figure 2: The Implementation result displays the research title.



Figure 3: Displaying SD Card is OK.



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



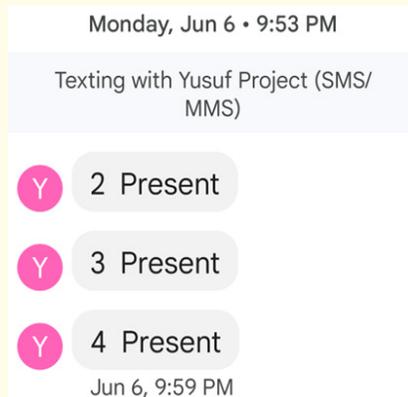
**Figure 6:** The implementation results show serial number 04 present.



**Figure 5:** The implementation results show serial number 03 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).

## Conclusion

The resources employed in this investigation are inexpensive and easily accessible. As a result, the net deployment cost is incredibly low and affordable for the average user, especially those from Africa. This low-cost program tries to count the students in a certain class and enables parents or advisors to ascertain whether the students are actively enrolled in the course and attending lectures. By incorporating a camera for system picture collection and by developing a face recognition module, the study may be made better.

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