

Automation of Attendance System using RFID, Biometrics, GSM Modem with .Net Framework

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Abstract:

The purpose of this paper is to develop a wireless system to detect and maintain the attendance of a student and locate a student. For, this the students ID (identification) card is tagged with an Radio-frequency identification (RFID) passive tag which is matched against the database and only finalized once his fingerprint is verified using the biometric fingerprint scanner. The guardian is intimated by a sms (short message service) sent using the GSM (Global System for Mobile Communications) Modem of the same that is the student has reached the university or not on a daily basis, in the present day every guardian is worried whether his child has reached safely or not. In every classroom, laboratory, libraries, staffrooms etc. a RFID transponder is installed through which we will be detecting the location of the student and staff. There will be a website through which the student, teacher and the guardians can view the status of attendance and location of a student at present in the campus. A person needs to be located can be done by two means that is via the website or by sending the roll number of the student as an sms to the GSM modem which will reply by taking the last location stored of the student in the database.

Keywords: *RFID, Biometric, GSM Modem, Attendance.*

I. Introduction:

This paper focuses on implementing the Automation of Attendance System using RFID, Bio – metric, GSM Modem with .Net framework. An RFID system comprises three components that is an antenna, a transceiver and a transponder. The antenna uses radio frequency waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna. Using the RF the RFID tag can be read, the RFID reader can read from a distance, it can read through your wallet, clothes, purse or backpack. Every RFID tag has a unique ID. Biometric is a method for uniquely identifying human being based on some physical characteristic and in this system we will be using the fingerprint. In this system we will be recording a template of the student fingerprint in the database with a specific RFID tag ID and when this fingerprint is verified once in the whole day his attendance will be finalized and stored in the database this is required because otherwise a student can fool the system by giving his ID card to his friend and showing that he is present whereas actually he is absent and if the student's fingerprint is not identified he will be sent an warning sms thirty minutes before closing time of the university and if not

verified the student and the guardian will be informed that the student was not present and was trying to cheat the system. There will RFID transponders installed in every classroom, laboratory, staffrooms, libraries etc. and when a student enters any of them the transponder will detect and store the student's last known position in the database. The software managing all these will be designed using VB.net and the website using ASP.net which will share a common database of MsSQL. The complete process will be automated and no one needs to be monitoring the system. If a failure occurs for example a RFID transponder is not functioning properly then the system using the GSM modem will send a sms to the person in-charge of the system to go and handle the problem with that RFID transponder. On the website there will be the map on the university and if you drill down to a particular classroom or laboratory then you will be able to see the number of student present out there. A search feature will also be provided through which by just entering the roll number of a student his position will be mapped. This feature will also be available by sms that is you can locate a particular student by just sending the roll number of the student to the mobile number which is in the GSM modem and when the sms is received by the GSM modem it will pass it to the server the server application will look for its last position and pass the data to the GSM modem which will forward it back to the number it came from. My managing the database easily we can figure out a student attendance and biweekly the guardian will be emailed a detailed report of the attendance and if the student is lacking behind the attendance criteria he will be informed on a weekly basis to cover up his attendance. The complete overview of the process is also explained in Figure 1.

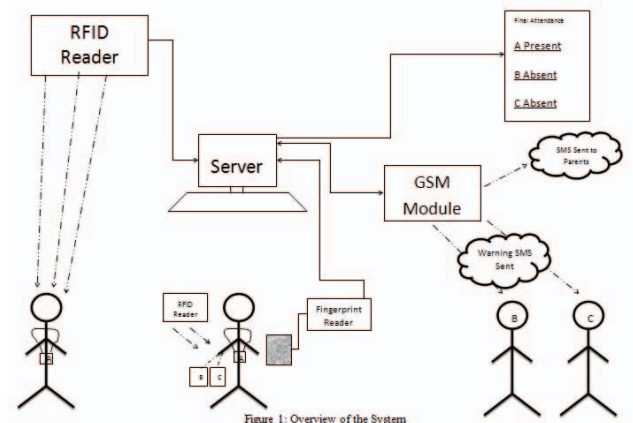


Figure 2: Overview of the System

I. The Basics of RFID

RFID is commonly used to transmit and receive information without wires. RFID readers and tags communicate through a distance using radio waves. There are a lot of advantages in RFID system, included their price, size, memory capacity and their capability. The pure memory-based RFID chip without a co-processor is cheap, and its footprint is small and usually use in car immobilizer applications where the IC has to fit in a tiny glass tube buried in the key. RFID fast processing speed is also essential. There are many different types of RFID systems, and it's important to choose the right type of RFID system for a particular application. The vast majority of RFID tags or transponders use a silicon microchip to store a unique serial number and usually some additional information. There are two broad categories of RFID systems – passive (figure 2) and active (figure 3) systems [2].

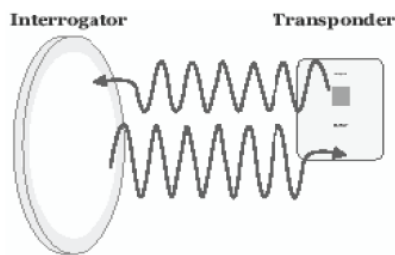


Figure 2: Passive RFID System

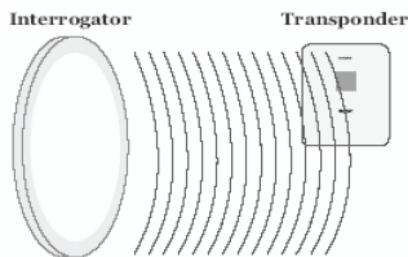


Figure 3: Active RFID System

Radio frequencies of these systems range from very low frequency (VLF), which has a range of 10 to 30 kHz, to extremely high frequency (EHF), which has a range of 30 to 300 GHz. These frequencies are grouped into four basic ranges and are given in Table 1.

		Range	Uses
LF	Low Freq	30 kHz to 300 kHz	125 kHz
HF	High Freq	3 MHz to 30 MHz	13.56 MHz
VHF	Very High Freq	30 MHz to 300 MHz	Not used for RFID
UHF	Ultra High Freq	300 MHz to 3 GHz	866 MHz, 915 MHz

Table 1: RFID Frequencies

II. The Basics of Biometric

Biometric is a method for uniquely identifying human being based on some physical characteristic and in this system we will be using the fingerprint. The fingerprint is an impression left by friction ridges of a human finger. Fingerprint image capturing is considered to be one the most critical step in an automated authentication system [5]. It needs to be of high a high quality image and the basic idea is to measure the distance between ridges and valleys. There are two major categories of fingerprint scanner that are solid-state fingerprint and optical fingerprint readers for this system we will be using a optical fingerprint system which connected to the system using an universal serial bus (USB 2.0) (figure 4). The top layer of the sensor, where the finger is placed, is known as the touch surface. Beneath this layer is a light-emitting phosphor layer which illuminates the surface of the finger. The light reflected from the finger passes through the phosphor layer to an array of solid state pixels (a charge-coupled device) which captures a visual image of the fingerprint. A scratched or dirty touch surface can cause a bad image of the fingerprint. A disadvantage of this type of sensor is the fact that the imaging capabilities are affected by the quality of skin on the finger [5].

III. The Basics of GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone [6].

When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

IV. Using RFID in the Attendance System:

In the attendance system we will be using passive tags in the ID cards of the students and there will be a RFID transponder at the university gate when the student enters the university gate then the transponder will detect the RFID passive tag in the students ID card and will forward it to the server which will detect that this information has been received first time for the day and has been received from the transponder which is at the gate, it will then look for the students mobile number and the guardians mobile number and sms them that they have been detected and that they have reached respectively. RFID transponders will also be present in each classroom, laboratory, libraries, staffrooms etc. and when the student enters the server will be informed

and will be stored in the database same will occur on exiting. The server will also ping all the RFID transponders regularly to check if they are properly working or not. If the RFID transponder does not respond then the person in-charge will be informed by a sms to check the particular RFID transponder.

A. Why RFID Technology?

RFID is a very promising technology with significant impact. Following are the reasons for us to use this technology for students' administration application.

- No line of sight required.
- Tags can be read from significant distances.
- Multiple tags can be read at the same time.
- Because tags must be enclosed, they are much more difficult to tamper.
- Many tags are read / write capable, rather than read only. [1]

V. Using Biometric in the Attendance System

In this system we will be using a fingerprint scanner as the biometric device. Fingerprint is an unique human characteristic and hence this will be used in the attendance system to make it fool proof. This will be installed at a secure location where the student needs to get the finger swiped once in the day to make sure that the student himself is present. When the student will swipe the finger which would be same as the one which was swiped while registering than the swiped finger will be matched with the finger database, once matched the attendance of the student for the day will be finalized and stored completely. The student will be notified by a sms for the confirmation of the same. For this we will be using an optical finger print scanner.

A. Advantages:

i. Physical resistance: they are physically more resistant than systems based on semi-conductors, in terms of resistance to impacts, scratches, corrosion and durability. This resistance is very useful for outdoor systems

ii. Maintenance low costs: fingerprint recognition systems based on semi-conductors chips have greatest maintenance costs due to its fragility.

iii. Non-electrostatic problems: semi-conductor systems are susceptible to electrostatic energy damages. Moreover, electrostatic energy can start a fire

B. Disadvantage:

A disadvantage of this type of sensor is that the image capturing capabilities are affected by the skin quality of the finger. For example, a maker or dirty finger is difficult to be

captured properly. It is also possible for an individual to erode the outer layer of skin on the fingertips till a point where the fingerprint is no longer visible. It can be fooled by an image of the fingerprint if it is not connected with a live finger detector. [5].

VI. Using GSM Modem in the Attendance System:

In the system we will be using a GSM Modem to send and receive sms. When the student enters the campus of the university then the student will be notified a welcome message for the confirmation that the student was detected and a sms to the guardian notifying the arrival of the ward. The same will occur when the student leaves the gate. This will only occur once a day and not as many times the student enters or leaves the gate. The welcome message and the exit message will only occur after the server matches it with the student's time table of the university. The GSM modem will also be used in the locating service of a student when a sms is sent in a particular format for example search space roll number then the GSM Modem will transfer it to the server and the server as programmed will look up the database for the roll number last recorded position and message back the location of the student on the same number.

VII. Using .Net Framework in the Attendance System

The server application will be built using Vb.net and the website will be built using Asp.net as integrity between them is very strong.

A. Advantages of .Net Framework

i. Consistent Programming Model

For doing a task different approaches are there for different programming languages. For example, accessing data with a VB 6.0 application and a VC++ application is totally different. When using different programming languages to do a task, a disparity exists among the approach developers use to perform the task. The difference in techniques comes from how different languages interact with the underlying system that applications rely on [9].

With .NET, for example, accessing data with a VB .NET and a C# .NET looks very similar apart from slight syntactical differences. Both the programs need to import the System. Data namespace, both the programs establish a connection with the database and both the programs run a query and display the data on a data grid. The VB 6.0 and VC++ example mentioned in the first paragraph explains that there is more than one way to do a particular task within the same language. The .NET example explains that there's a unified means of accomplishing the same task by using the .NET Class Library, a key component of the .NET Framework.

ii. Direct Support for Security

Developing an application that resides on a local machine and uses local resources is easy. In this scenario, security isn't an issue as all the resources are available and accessed locally. Consider an application that accesses data on a remote machine or has to perform a privileged task on behalf of a nonprivileged user. In this scenario security is much more important as the application is accessing data from a remote machine.

With .NET, the Framework enables the developer and the system administrator to specify method level security. It uses industry-standard protocols such as TCP/IP, XML, SOAP and HTTP to facilitate distributed application communications. This makes distributed computing more secure because .NET developers cooperate with network security devices instead of working around their security limitations.

iii. Simplified Development Efforts

Let's take a look at this with Web applications. With classic ASP, when a developer needs to present data from a database in a Web page, he is required to write the application logic (code) and presentation logic (design) in the same file. He was required to mix the ASP code with the HTML code to get the desired result.

ASP.NET and the .NET Framework simplify development by separating the application logic and presentation logic making it easier to maintain the code. You write the design code (presentation logic) and the actual code (application logic) separately eliminating the need to mix HTML code with ASP code. ASP.NET can also handle the details of maintaining the state of the controls, such as contents in a textbox, between calls to the same ASP.NET page. Another advantage of creating applications is debugging. Visual Studio .NET and other third party providers provide several debugging tools that simplify application development. The .NET Framework simplifies debugging with support for Runtime diagnostics. Runtime diagnostics helps you to track down bugs and also helps you to determine how well an application performs. The .NET Framework provides three types of Runtime diagnostics: Event Logging, Performance Counters and Tracing.

iv. Easy Application Deployment and Maintenance

The .NET Framework makes it easy to deploy applications. In the most common form, to install an application, all you need to do is copy the application along with the components it requires into a directory on the target computer. The .NET Framework handles the details of locating and loading the components an application needs, even if several versions of the same application exist on the target computer. The .NET Framework ensures that all the components the application depends on are available on the computer before the application begins to execute.

VIII. Conclusion and Future Work

This paper demonstrates how an automation of attendance system can be implemented using RFID, Biometric, and GSM Modem with .Net Framework can be implemented in a university or an educational institution. There are although a few limitations that are as follows:

- The system would fail if it is not kept on always.
- If a student gets hurt on the finger he has put in the system he will have to get it changed otherwise he will not be marked present.
- The security of biometric device is a must.
- The location of the student will only be known till the student is in campus.

The future enhancements in the system can be that the doors of the classrooms, laboratories etc. are managed by the system itself and are unlocked and locked accordingly. Software can be made for the mobile phones and then using the mobile phones GPS (Global Positioning System) the location of the student can be known all over the place and not only the campus. The same ID card can also be used for other functionality of the university like the library card for issuing of books and for example the exam identification card.

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