

SSCM: A Smart System For College Maintenance

B. Rasagna,

M.Tech Student, Department of CSE,
Audisankara College of Engineering & Technology,
Gudur, Andhrapradesh, India,
bheemasagna@gmail.com

Prof. C. Rajendra,

Head, Department of CSE,
Audisankara College of Engineering &
Technology, Gudur, Andhrapradesh, India,
srirajendra.c@gmail.com

Abstract- A Smart System for College Maintenance (SSCM) aims to maintain attendance of students and to locate them automatically and also enhances smooth functioning of colleges. In today's busy world where often both parents are working or living far away from the institution, personal visits to the institution is really not an easy task. This System provides a report through SMS using GSM, so parents are possible to view their children's attendance. The primary goal was to automate the process of checking student attendances. To this concept the student will have a RF based ID card along with the finger print verification through biometric. When the student enters into the campus automatically his entry will be stored in the database. This solution provides a level of data security that has never been possible with attendance management systems using traditional paper rolls or physical data collection. This system includes 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. Radio Frequency Identification (RFID) system can be used to take attendance for student in school, college, and university. Its ability to uniquely identify each person based on their RFID tag type of ID card make the process of taking the attendance easier, faster and secure as compared to conventional method. SSCM can also perform multitasks in the organization.

Keywords:- Attendance, Biometrics, Multitasks, RFID

I. INTRODUCTION

A Smart System for College Maintenance (SSCM) focuses on implementing multitasks in educational organizations using RFID, Bio-metric, GSM Modem with .Net framework [1]. An RFID system comprises three components that is an antenna, a transceiver and a transponder (Figure 1). The antenna uses radio frequency waves to transmit a signal that activates the transponder. When activated, the RFID tag with unique ID transmits data back to the antenna. Using the RF the RFID tag can be read by the RFID reader. Biometric is used to scan the fingerprint for uniquely identifying a student. Fingerprint matching is done by a novel fingerprint matching algorithm using both ridge features and minutiae features. In this system we will 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 so that student cannot fool

the system by giving his ID card to his friends in their absence to college. If the student's fingerprint is not identified he will be sent a 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 Ms SQL. 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.

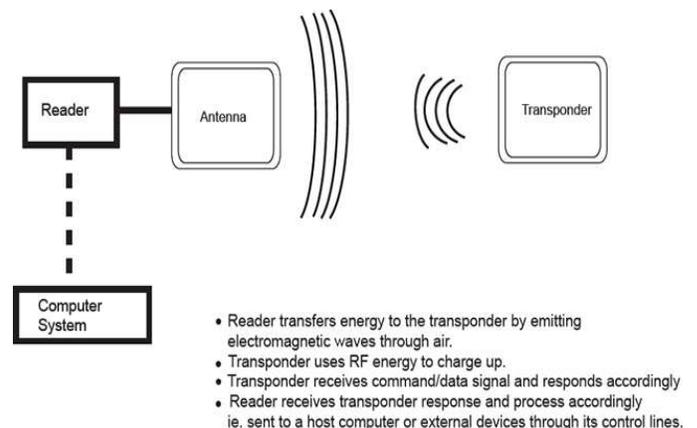


Figure 1: RFID system

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. By 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 2.

II. THE FUNDAMENTALS 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 3) and active (figure 4) systems [3].

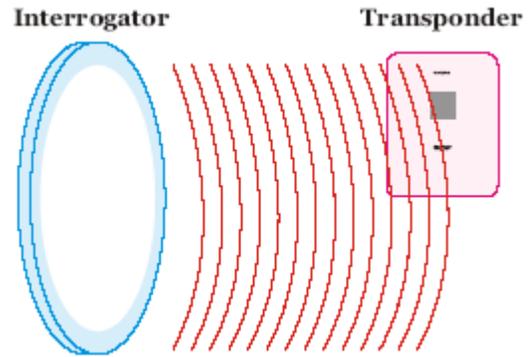


Figure 3: Passive RFID system

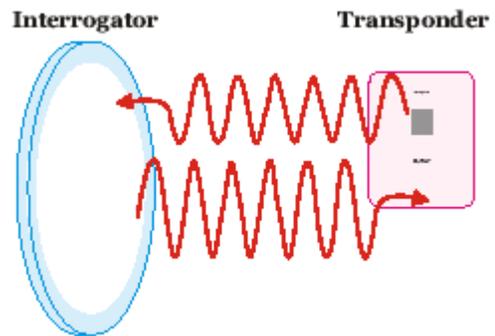


Figure 4: Active RFID system

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

III. THE IMPORTANCE OF BIOMETRICS

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 [6]. It needs to be of high a high quality image and the basic idea is to measure the

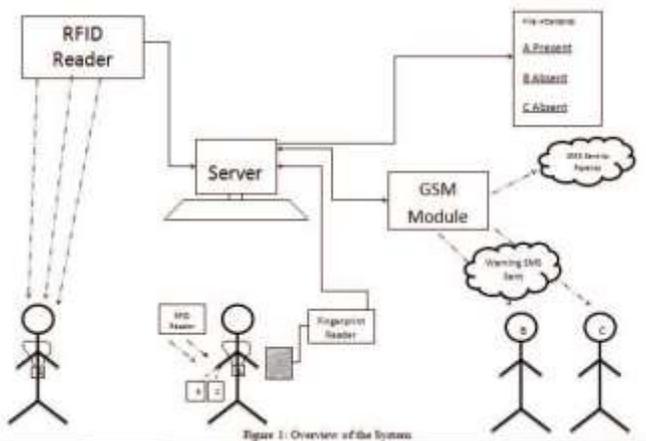


Figure 2: Overview of the System

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 an optical fingerprint system which connected to the system using an universal serial bus (USB 2.0). 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].

IV. THE NEED 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 [7]. 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.

V. THE ROLE OF RFID IN 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.

1) *Advantages of RFID Versus Barcodes*

RFID tags and barcodes both carry information about products. However, there are important differences between these two technologies:

- Barcode readers require a direct line of sight to the printed barcode; RFID readers do not require a direct line of sight to either active RFID tags or passive RFID tags.
- RFID tags can be read at much greater distances. The range to read a barcode is much less, typically no more than fifteen feet.
- RFID readers can interrogate, or read, RFID tags much faster; read rates of forty or more tags per second are possible. Reading barcodes is much more time-consuming; Barcode readers usually take a half-second or more to successfully complete a read
- Line of sight requirements also limit the ruggedness of barcodes as well as the reusability of barcodes. RFID tags are typically more rugged, since the electronic components are better protected in a plastic cover. RFID tags can also be implanted within the product itself, guaranteeing greater ruggedness and reusability.
- Barcodes have no read/write capability. RFID tags, however, can be read/write devices; the RFID reader can communicate with the tag, and alter as much of the information as the tag design will allow. . [2]

VI. THE ROLE OF BIOMETRICS IN 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. Disadvantages:

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. [6].

1) Fingerprint Matching Algorithm:

This paper introduces a novel fingerprint matching algorithm using both ridge features and the conventional minutiae feature [12] to increase the recognition performance against nonlinear deformation in fingerprints. The proposed ridge features are composed of four elements: ridge count, ridge length, ridge curvature direction, and ridge type. These ridge features have some advantages in that they can represent the topology information in entire ridge patterns existing between two minutiae and are not changed by nonlinear deformation of the finger. For extracting ridge features, we also define the ridge-based coordinate system in a skeletonized image. With the proposed ridge features and conventional minutiae features (minutiae type, orientation, and position), we propose a novel matching scheme using a breadth-first search to detect the matched minutiae pairs incrementally. Following that, the maximum score is computed and used as the final matching score of two fingerprints. The proposed ridge feature gives additional information for fingerprint matching with little increment in template size and can be used in conjunction with existing minutiae features to increase the accuracy and robustness of fingerprint recognition systems.

The nonlinear distortions, presented in touch-based fingerprint sensing, make fingerprint matching more difficult. As shown in below figure, even though these two fingerprint images are from the same individual, the relative positions of the minutiae are very different due to skin distortions. This distortion is an inevitable problem since it is usually associated with several parameters [13], [14], including skin elasticity, nonuniform pressure applied by the subject, different finger placement with the sensor, etc.

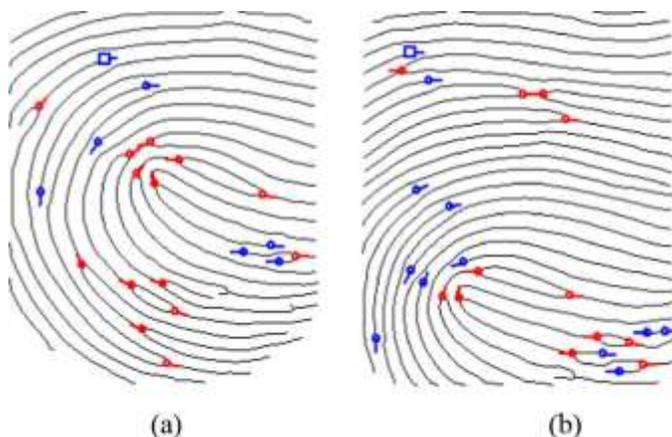


Figure: Example of skin distortions

VII. THE ROLE OF GSM MODEM IN 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.

VIII. THE RFID FOR LIBRARY

The RFID tag itself acts as a library card for the manipulation of all activities in the library. RFID is a combination of radio-frequency-based technology and microchip technology. The student information contained on microchips in the RFID tags helps to identify the student and enhances proper functioning of library.

The other use of RFID is to replace the barcodes on library items. The tag can contain identifying information or may just be a key into a database. An RFID system may replace or supplement bar codes and may offer another method of inventory management and self-service checkout by patrons. It can also act as a security device, taking the place of the more traditional electromagnetic security strip.

Since RFID tags can be read through an item, there is no need to open a book cover or DVD case to scan an item, and a stack of books can be read simultaneously. Book tags can be read while books are in motion on a conveyor belt, which reduces staff time. This can all be done by the borrowers themselves, reducing the need for library staff assistance. With portable readers, inventories could be done on a whole shelf of materials within seconds.

IX. THE NEED OF .NET FRAMEWORK IN SSCM

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 :

With .NET 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 grid [10].

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. The functionality that the .NET Class Library provides is available to all .NET languages resulting in a consistent object model regardless of the programming language the developer uses.

ii. Direct Support for Security :

When an application accesses data on a remote machine or has to perform a privileged task on behalf of a non-privileged user, security issue becomes 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:

In Web applications, a developer with classic ASP needs to present data from a database in a Web page. He has to write the application logic (code) and presentation logic (design) in the same file. ASP.NET and the .NET Framework simplify development by separating the application logic and presentation logic making it easier to maintain the code.

The design code (presentation logic) and the actual code (application logic) is written 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.

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.

X. CONCLUSION AND FUTURE WORK

This paper demonstrates how an automation of attendance system and multi tasks can be implemented using RFID, Biometric, and GSM Modem with .Net Framework in a university or an educational institution.

The limitation in this system is 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.

REFERENCES

- [1] Aamir Nizam Ansari, Arundhati Navada, Sanchit Agarwal, Siddharth patil, Balwant A. Sonkamble "Automation of Attendance System using RFID, Biometrics, GSM Modem with .Net Framework" IEEE 2011.
- [2] Whai-De Chen Hsuan-Pu Chang, Using RFID Technology to Develop an Attendance System and Avoid Traffic Congestion around Kindergartens, Ubi-Media Computing, 2008 First IEEE International Conference
- [3] Qaiser, A.; Khan, S.A., Automation of Time and Attendance using RFID Systems, IEEE-ICET 2006 2nd International Conference on Emerging Technologies Peshawar
- [4] Yeop Sabri, M.K. Abdul Aziz, M.Z.A. Mohd Shah, M.S.R. Abd Kadir, M.F., Smart Attendance System By Using RFID, Applied Electromagnetics, 2007. APACE 2007
- [5] Lim, T.S. Sim, S.C. Mansor, M.M. , RFID Based Attendance System, Industrial Electronics & Applications, 2009. ISIEA 2009. IEEE Symposium
- [6] <http://en.wikipedia.org/wiki/Fingerprint>
- [7] "What is a GSM Modem?" <http://www.nowSMS.com/faq/what-isa-gsm-modem>
- [8] "RF GSM Modem", <http://www.electriccurrent.net/tag/playingcards/>
- [9] "Nitgen Hamster I - PC/Server Fingerprint Reader", <http://www.nitgenltd.com/nitgen-hamster-1-entry-level-pcfingerprint-reader>
- [10] ".NET Framework Advantages", <http://www.webdotdev.com/nvd/content/view/1025/>
- [11] Shafi, Q. Khan, J. Munir, N. Baloch, N.K., Fingerprint Verification over the Network and its Application in Attendance Management, 2011 2nd International Conference on Electronics and Information Engineering, IEEE 2010.
- [12] Heeseung Choi, Kyoungtaek Choi, and Jaihie Kim, "Fingerprint Matching Incorporating Ridge Features With Minutiae" *IEEE Trans. Inf. Forensics Security*, vol. 6, no. 2, June 2011.
- [13] A. Ross, S. Dass, and A. K. Jain, "A deformable model for fingerprint matching," *Pattern Recognit.*, vol. 38, no. 1, pp. 95–103, 2005.
- [14] X. Chen, J. Tian, X. Yang, and Y. Zhang, "An algorithm for distorted fingerprint matching based on local triangle feature set," *IEEE Trans. Inf. Forensics Security*, vol. 1, no. 2, pp. 169–177, Jun. 2006.
- [15] *Advantages of RFID Versus Barcodes* <http://www.technovelgy.com/ct/Technology-Article.asp?ArtNum=60>