RFID BASED AUGMENTED CLASS ROOMS AUTOMATION WITH NETWORK MODEL

S.P.VIJAY VARDHAN REDDY,
Assistant Professor- Department of ECE
T.J.S.Engineering college, Chennai,
.E-MAIL ID: sp.vijayvardhan@gmail.com

M.KRISHNAMOORTHY,
Assistant Professor- Department of ECE
T.J.S.Engineering college, Chennai,
E-MAIL ID: ramesh.mgt@gmail.com

Abstract **—** The presence of students in classes is an important thing in all Educational institutions. Attendance is very important naspect for every student to improve his academic standards and also his commitment towards studies. Now a days it is very difficult to take the attendance every session of the day by the respective staff. .Attendance was taken to see the maximum number of attendees for allowing the student to face the final examination. This method is tedious process because lecturer must collect and checks by using the excel file.As well as one big problem arises when we think about power consumption whenever at the end of the day students leave the class rooms without switching off the electrical appliances like fan,lights,air conditioners etc…so that power is wasted. This factor makes me think of ways to take attendance and switch off the electrical appliances automatically.The main objective of this paper is to design a embedded based class room automation system by which we can easily update the attendance report of every individual student in every session by using RFID (Radio Frequency ID) and also we can easily warn on his/her poor attendance. Students can enter into the class with the help of the RFID tag as it sense the details of the student and also the number of the students. Depends on the count of the students the fans and the lights in the class automatically can switch on. The room temperature can be controlled automatically by switch on the air conditioner with the help of temperature sensor. Here temperature sensor compares the room temperature with pre assigned temperature value and switches on the relay when temperature value exceeds , with this power can be saved All this procedure can be done automatically with out any burden to the respective.This system consists of embedded systems, sensors, wireless transmitters and receivers and a PC based system.**(key word:RFID**-radio frequency identification**)**

1. INTRODUCTION

RFID stands for Radio Frequency Identification, which is a wireless communication technology that is used to uniquely identify tagged objects or people. RFID systems have been widely used in many application areas, such as: inventory control, product tracking through manufacturing and assembly, parking lot access and control, container/pallet tracking, ID badges and access control, equipment/personnel tracking in hospitals, etc.RFID systems use radio waves to transmit information from an integrated circuit tag through a wireless communication to a host computer . These systems consist of three components: the tag(transponder), the reader (interrogator) and the host computer (controller). The reader communicates with the tags in its wireless range and collects information about the objects to which tags are attached.

Compared to other automatic identification technologies, like optical barcode systems, RFID has several advantages, such as: tag data can be read automatically without line of sight, thought some materials, simultaneously tag reading and from a range of several meters .Most RFID systems on the market nowadays, are proprietary systems that lead to a barrier to widespread RFID acceptance and industry growth. So a worldwide effort is being made to standardize RFID systems, for emerging applications support inter-operation of products from different suppliers and even interoperation between RFID systems in different countries.

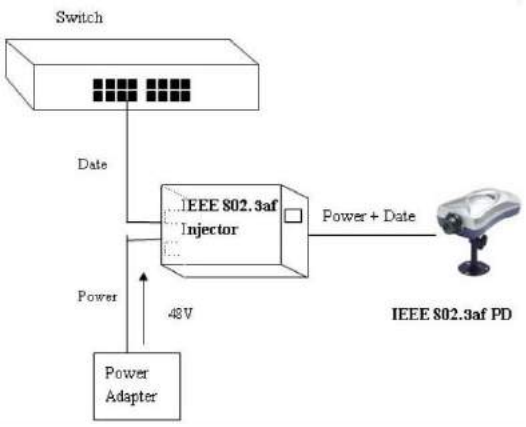
The major issues that held back the adoption of RFID can be spited into technology, standard, patent,cost, infrastructure, return on investment (ROI), and barcode to RFID migration challenges.One of the hot topics related to RFID technology is privacy and security. Currently, there are several protocols for RFID technologies to

achieve certain security and privacy levels. They can be classified into three main categories: security in basic tags, security in symmetric-key and security in public-key .The goals that RFID systems should reach regarding security and privacy are: maintaining data security, preventing counterfeiting, preventing illegitimate access, preventing unwanted recognition and tracking, and

coping with denial of service.In most access control applications there is a reader linked directly to a controller/computer and the communication of data from the reader to the computer is made through RS-232 or Wiegand or USB. This architecture is simple and economical, but if we want to link multiple readers to the same computer the architecture becomes more complex and reaches higher costs. The rest of this paper is organized as follows: describes the basic ideas around the concepts of students' attendance in classrooms and the whole attendance registration process of the institution. Section 3 presents the system architecture so as to contextualize and present the system architecture proposed for an automatic attendance registration process. Section 4 explains the implementation and describes the privacy concerns regarding this proposal,which is a delicate constraint for the success of this solution. Section 5 shows the results that were made in order to validate the success of the prototype. Finally, section 6 concludes the paper and presents the issues for further work.

2. Motivation

As motivating factor we expect to find a reader that works over Ethernet transmitting its RFID information in a distributed environment and also powered by Power over Ethernet (PoE). Each reader in each classroom will uniquely identify the physical location of the classroom so the server will know which class the student is trying to attend. All processing power has to be on the server and not on the readers or else the latter will have to be loaded with the entire information on classes, teachers, students and schedules. Moreover, these loading processes will have to be carried out every semester.



With the current Power over Ethernet standard (IEEE 802.3af), the RFID readers can also be powered by the Ethernet connection. This technology reduces the number of wires discarding the need for frequent charging or replacing batteries in readers .In this article a solution that seeks to minimize these problems using RFID technology is proposed. It all started by an extensive research on RFID technology, its components, its methods of operation, advantages and disadvantages.**(key word**:ROI-return on investment, POE: power over Ethernet **)**

3. System architecture

The main objective of this section is to describe the system overview and explain the proposed architecture.The main objective is to automate the whole system of studentsattendance registration using RFID.The proposal comprises converting the existing student debit cards for student cards tagged with an RFID tag. The proposed architecture is shown in Figure 1 and can be divided in two grouped parts. The first group consists of a middleware, an RFID server, a database server to record the attendance of students, a web services server, a frontend and the Data Base Management System (DBMS) of the institution. The other group is made up of various RFID readers installed in the classrooms of the institution. The bridge between these two groups is formed by the LAN of the institution, the same LAN to which all readers are connected. The RFID server is also connected to the LAN, to enable communication between them. The RFID server is responsible for managing establishing communication and handling the received data from all installed readers.once it receives the read data,and providing the latter os correct.this server inserts a new

attendance record in the rfid db server.The rfid db server stores the records of student attendance in particular, student number the lesson the subject identification.the dbms of the institution contain all the databases related to the students,trachers,the classrooms and the schedules of each subject.There is also frontned that is available from the internet with information about the attendance of students per class.the frontend is just one of the possible functions of the webservices server,therefore it can be used by internal applications of the institution.

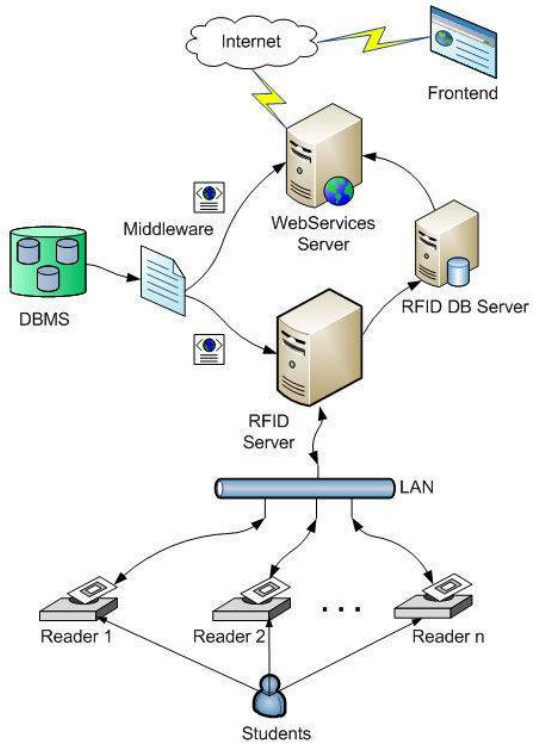


Figure 1 . Proposed system architecture

4. Implementation

Initially, the intention was to use one or more UHF readers distributed in the classroom, so students did not have to take out their cards and place them near the reader. The implemented solution is far from being a tracking application, i.e., the system only knows that a particular student has presented his card near a reader at particular day and hour. The system never knows were exactly is a particular student. Because of these considerations has been chosen for a LF (125 kHz) RFID reader, with a range of 10-15cm.

A high level specification for an RFID reader hardware was designed because no suitable one was encountered. This specification consists of several modules as shown in Figure 2.

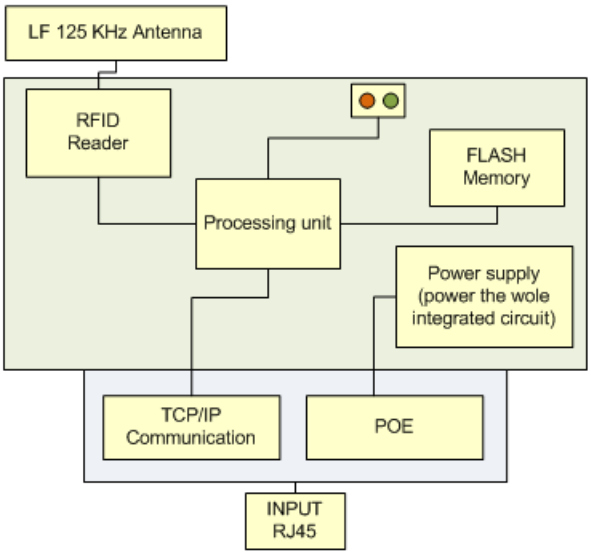


Figure 2 . RFID reader specification

The "LF 125 KHz Antenna" module is designed to power the tag and to allow communication between the tag and the reader module. The "RFID Reader" module reads the data from the tag and sends it to the "Processing unit" module. The "FLASH Memory" module aims to serve as a backup of attendance records in case of a network problem or a queue if the server cannot respond to all requests. The "Power supply" module aims to power the integrated circuit of this reader. The "TCP/IP Communication" and the "POE" modules are in the same segment because the power is supplied by the Ethernet cable. Finally the "Input RJ45" in the only input needed. For communication between the reader and the server, it will work through messages, i.e., when the reader detects the presence of a tag, it establishes a communication with the server at a given IP address/port to send the read data.This presented specification is being implemented so it can later be tested on our proposed architecture. From the many RFID readers available, only one was found to have a good price-features relationship. The chosen RFID reader was the model K300 Proximity Card Reader from ZKsoftware.

Although this reader possesses the minimum requirements, it has more features than those that are necessary. It should be noted that it runs through POE, so apart from the network cable no other external power

sources are necessary.The SDK supplied with the device is a library of functions (DLL), which was added as a reference in aC#.NET project. This SDK included the necessarymethods to connect to the reader and collect information like triggered events when some actions took place, i.e., a tagged card passes in reading range.The prototype that has been developed has the following functionalities: Add a reader per classroom choosing the building, the classroom number, the IP address, the network mask and the gateway; Monitor students' attendance by building and classroom, respectively (see Figure 4); Store the records of each student in the attendance DB per class, per building and per classroom number. The web service server has a method that provides all the students' numbers of a given discipline on a specific date, so the lecturer can easily access and confirm if all the students are really in the classroom.

5. Results

To verify the accurate functioning of the prototype, we have set up a test scenario. The scenario was composed by five classrooms with a RFID reader installed in each one, all connected to the institution LAN, some RFID tags, the RFID Server, the RFID DB Server and the WebServices Server. The DBMS has been replaced by some CVS files containing information about the classrooms and their lessons, the students and their tags.

The first test was to insert the five readers in the RFID Server and the related information of the classrooms. It was found that the system entered the several readers correctly and could establish a connection with all of them successfully. Another test consisted of simultaneously placing several cards in the reading range of one reader to see if the system could record all accesses. It was found that even when two cards were placed at the same second the system was able to register them. Another validation was that the system only registered one student from each class, regardless of the time he presented the card. Then we tried to place several cards near all readers at the same time and we have found that all students were registered on the RFID DB Server successfully. Were also tested the methods provided by the WebServices Server through its invocation in a browser. It was possible to obtain the number of students in a given class and also get all the students attendance at a given class.To perform these functionalities, the RDIF server, before inserting information in the attendance DB,invoked middleware queries in order to know if a certain student is enrolled in a certain class and if at that current time there is a lesson in progress

6. Conclusions and future work

This article demonstrates how a generic architecture can be used in order to create an intra-connected network of RFID readers within an educational institution. With the full development of this middleware it is possible to create a solid foundation that can be easily put into service in another institution of education, thus automating the process of recording and reporting students' attendance. Thus, a good proposal for RFID reader manufacturers is the development of a reader that can transmit data acquired over Ethernet in a distributed environment at a very attractive price.This new reader, instead of having more processing power, its own database to register accesses, allowing or denying accesses to a particular area and having a display and keyboard for manual insertions, should only focus on reading the data contained on an access card and sending it back to a specific IP/network mask/gateway.

For future work we are lacking the implementation and validation to the whole architecture with one reader for every classroom in a building and the use of the DBMS of the institution as data source. In the future it is also necessary to implement all kinds of web methods to include in the web services server, as providing services so the institution's applications may automate its processes.

7. References

[1] Aragones-Vilella.J,Martinez-Balleste.A, and Solanas.A, "A Brief Survey on RFID Privacy and Security," *WCE 2007: World Congress on Engineering 2007 Volume 2,* vol. 2, pp. 1488-1493.

[2]Clarke.R.H., Twede.D,Tazelaarl.J.R, and Boyer.K.K, "Radio Frequency Identification (RFID) Performance: The Effect o f Tag Orientation and Package Contents," *Packaging Technology & Science,2006,* vol. 19, pp. 45-54.

[3]Chawla.V and Ha.D.S, "An overview of passive RFID," *Communications Magazine, IEEE,2007,* vol. 45, pp. 11-17.

[4]Domdouzis.M,Kumar.B,andAnumba.C, "Radio-Frequency Identification (RFID) applications: A briefintroduction," *Advanced Engineering Informatics,2007,* vol. 21, pp. 350-355.

[5]Hunt.V. D., Puglia.A, and Puglia.M, *RFID: A Guide to Radio Frequency Identification*: Wiley- Interscience, 2007.

[6]Weis.S.A,Sarma.S.E, Rivest.R.L, and Engels.D.W, "Security and Privacy Aspects of Low-Cost Radio Frequency Identification Systems," *Security in Pervasive Computing,2003,* pp. 201–212.

[7]Wu N. C, Nystrom M. A, Lin T. R, and Yu H. C, "Challenges to global RFID adoption," *Technovation,2006,* vol. 26, pp. 1317-1323.

[8] Henrici .D and Müller.P, "Providing Security and Privacy in RFID Systems Using Triggered Hash Chains," in *Sixth Annual IEEE International Conference on Pervasive Computing and Communications* Los Alamitos, CA, USA: IEEE Computer Society, 2008, pp. 50-59.

[9]Sounderpandian.J, Boppana R.V ,Chalasani.S, and Madni A.M, "Models for Cost-Benefit Analysis of RFID Implementations in Retail Stores," *Systems Journal, IEEE,2007,* vol. 1, pp. 105-114.

[10] ZKSoftware, "Welcome to ZKSoftware: Advanced Biometric Solutions," 2008. 38959