

AUTOMATIC STUDENT ATTENDANCE REGISTER USING RFID

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ABSTRACT

The purpose of this project is to investigate the application of Radio Frequency Identification, RFID, to automatic student attendance register. The aim is that the students in any class can be recorded when they carry their student cards with them without having to individually swipe the card or allocate special interaction time. The successful implementation of this proposal will facilitate such record keeping in a non-intrusive and efficient manner and will provide the platform for further research on the correlation between attendance and performance of the students. The opportunity for related research is identified regarding the range of the parameters involved, ensuring that individual identifications do not clash and interfacing challenges with the central record keeping are overcome.

Key words: RFID Application, Automatic Attendance Register, Student Records

1. INTRODUCTION

There are many circumstances where a register of personnel or products are needed. One such application is the attendance register in a class. Attendance registration is an important aspect in any educational institution; it is one area which is still being carried out manually by the educators of the institution. The disadvantages of the current system can be briefed as shown below.

- **Cumbersome-** A lecturer attending to a large class may find taking attendance as a very burdening aspect interfering with one's attention to the subject being presented.
- **Not fool proof-** Some students might do a "proxy" for their friend, i.e. he/she may sign for his friend although he is not present in class.
- **Human errors-**As the attendance sheets are passed around the class, some of the students may accidentally forget to fill in the form, or the lecturer might miss out on a student.
- **Loss of Data-** A Lecturer might loose track of the attendance sheet in his very tight schedule, which will create problems as he may not have a back- up copy of the attendance sheet/book
- **Waste of time-** In an environment like a university most lecturers will need to be trained in their subject to maintain a good output, and time wasted for this administrative work can be better utilized for increasing the productivity of the lecturers by sending them to learn developing trends in their respective fields.

Student attendance registration can be automated by incorporating existing resources with RFID technology. Existing resource refers to the Identification cards that are handed out to the students on enrolling into an institution, these are smartcards which are also called proximity cards and obey ISO 14443 [1] standard for smartcards. More explanation as to the working of these cards will be given after RFID technology is explained.

1.1 RFID Technology

RFID is an acronym for Radio Frequency Identification. RFID technology comprises of a Reader, a tag and a host system. The tag is a programmable microchip, which can be placed in the Identification card and can store data. The Reader emits radio frequency waves at a certain frequency creating a reception zone, once the tag is present in this zone, the tag will send the details requested by the Reader as radio waves, the Reader will send these data to the host system via an RS 232 interface.

1.2 RFID in Automatic Student registration

The student identification card, the existing resource, will be the RFID tag. It will hold the unique identification number of the student. As said earlier it obeys the ISO 14443 standard, it is also a proximity card, which means that it will only be able to transfer data if it is brought very close to the RFID Reader. Actual experimentation with these cards and Smart log Readers [3] has shown that the range is about 3.5-4.0 cm. So the interrogation zone for this particular Reader extends to about 4.0 cm.

Once the cards are brought into the reception or interrogation zone then the data from the card (unique student number) will be transferred to the Reader, the Reader will consist of a magnetic antenna which will emit radio waves at a certain frequency (usually 13.56 MHz).

The data present in the Reader can be transferred via RS 232 cable to the host system, where using JAVA tools and database manipulation techniques the unique identification number (data) can be entered along with date and time of entry into a database table there by registering the attendance of the student.

All this can be done as the student walks into his class and passes his card past the RFID Reader.

1.3 Advantages of the RFID system

- Very long Reader range- Theoretical Readers have a range from 10cm to up-to 10 metres, which means no card swiping or re-scanning the card under the scanner.
- RFID does not need the card to be swiped or passed under a scanner, a student can virtually have his id card in his wallet and walk past the Reader and his attendance be registered

- Late comers will no longer disturb the class as he/she can walk past the Reader and into their chair, without disturbing the rest of the class nor the lecturer for attendance.
- Once the student enters the interrogation, he/she is automatically entered into the host system, so RFID technology is not prone to error as the other available technologies.
- No card wear and tear-As the student rarely has to take the card out of his pocket, there will be no wear and tear to the card.

1.4 Research statement

With the existing student cards, which obey ISO 14443 the maximum range that can be obtained is 4.0 cm; this is the first area which can be researched. The ISO 18000[5], which is a standard for RFID Air Interface and is at present used in RFID tags used in cargo transportation in docks and sales monitoring in supermarkets extends the interrogation zone to about 6m, the first area of research will be to see if the range of the student card (“existing resource”) can be increased from 4.0 cm.

If this is made possible there will be cost saving as new cards do not have to be made to meet the requirements, instead the existing cards can be remodelled. When the tag enters the interrogation zone, the tag will be read by the Reader, but if one or more tags try to access the Reader at the same time, there might arise a problem called Collision, here the Reader will be in a state of confusion as to which tag to read first, in the worst case it might not read both the tags, this is detrimental to the automatic attendance register project as students who appeared for a class will not be registered. Research needs to be done to counter this potential problem.

The unique identification number which is passed from the student card to the Reader will need to be transferred to a host system. For experimental purposes an interface can be created with an RS232, but on a practical basis this would not be quite possible as that would mean a computer allocated to each classroom specifically for this purpose, which is a waste of resources. Moreover the data present in the host systems in different classrooms will have to be fed to the main server. Research can be done to see the possible solution here.

2. HYPOTHETICAL RESOLUTION

Research needs to be done to find a solid solution to the challenges mentioned under section 1.4, but some hypothetical solutions can be made at this juncture. More details of how the technologies mentioned below can be put together to automate student registration using RFID will be explained in section 3.0.

2.1 Extending the range of the student identification card

Extending the range of the student identification card (tag) can be achieved in two ways, the first method will be to change the ISO standard applied to the card from ISO 14443 (range up-to 10cm) to ISO 18000 [4] (range up-to 6 metres). This is a challenging proposal. However, its effective application will avoid the necessity of new student identification cards (tags) and the associated costs.

The second method will be to fabricate a new student identification card with the ISO 18000 standard. This will be the easier option on comparison to the first method, but then the old cards will become obsolete and also the initial expense that is needed for manufacturing the new identification cards have to be taken into account.

2.2 Anti-Collision

A solution to Collision is anti-collision, but anti-collision can be employed using many of the existing technologies like TDMA, FDMA and CDMA [5], however, the suitability of these technologies for this application and their relative merits will have to be examined. These technologies will be further explained under sections 3.1.1. to 3.1.3.

2.3 Transfer of data from the Host system to the Server system

All educational institutions usually have a Data Base Administrator (DBA) for controlling the information technology side of the institution, the DBA will also be responsible for electronic storage of the data of all the students, so the attendances recorded at the end of each day must reach the DBA who is responsible for the storage and tabulation of the attendance of all the students enrolled in the institution and since this project aims at automating the student attendance registration, the attendance of each day must automatically reach the DBA, and there are different ways to go about this.

Firstly Wireless LAN, this is an IEEE 802.11 standard in which the desktop computers and laptops can communicate with the main server without any wired interface, the communication is achieved using radio frequency waves. The working of wireless LAN will be better explained under section 3 (Methodology).

The second method that can be used to transfer data and one which is cheaper compared to Wireless LAN is ZIGBEE technology, it is an IEEE 802.15.4 standard, and this is relatively new technology, but works more or less similar to WLAN.

2.4 Data manipulation in the server system

Before the data reaches the DBA, it has to be put into a specific format. That is, if the student is indeed present in the class then his unique identification number along with the date and time of entry must be entered into a database table, it is this database table that has to reach the DBA, there are different data manipulation techniques available. Java and MySQL are among the options that are indeed available for the manipulation of data. On how they can be used to get the result is explained in section 3.2

3. METHODOLOGY

The research statements mentioned above can be further explained in this section. This portion can be subdivided into two parts;

- Hardware section
- Software section

3.1 Hardware Section

Research in the hardware section of the project involves those mentioned in sections 2.1, to 2.3.

3.1.1 Manipulation of the ISO 14443A card

The first area of research will be in extending the range of the tag, for these two types of RFID tags are taken into consideration, one in conformity with the ISO 14443 [1] standard and the other according to the ISO 18000 [4] standard, as discussed earlier, the tags abiding the ISO 14443 standard have a shorter range (up-to 10cm) and are the ones that are available in the form of student cards, these cards have to be scanned up-close with the Reader for the Reader to retrieve data from them.

On the other hand the ISO 18000 cards, which are presently used in automated toll junctions for prepaid card holders to pass through without stopping, have a range of up-to 7m. The aim of research here is to extend the range of the recognition of the student identification cards.

In order to go about this task, firstly the communication protocols that each of these cards follow must be known, once this is known then the next task will be to see if it is possible to rewrite the communication protocol of a card (in this case see if the communication protocol that is used in the ISO 18000 card can be written into the ISO 14443 card). If it is not possible to rewrite the protocol then a new student identification card has to be designed with ISO 18000 standards.

The whole idea here is to facilitate the recognition of the cards by the Reader; if the range is extended then the students can walk past the Reader and into the class with their student identification cards in their wallets.

The next area of research will be in the area of Anti-Collision, as indicated under section 2.2. TDMA, FDMA, CDMA are some of the available technologies that exist which can be modelled into the project to solve this problem, and they are discussed below.

3.1.2 Time Division Multiple Access

This is the multiple access technology whereby the frequency spectrum is shared with all the users (in this project the student cards), and each user is given a time frame to communicate with the Reader. Subsequent to this time period, another user communicates with the Reader, until a full rotation till it comes back to the first user [6]. In other words it is time sharing that occurs here. This is a very simple and cheap method to employ as compared to CDMA technology which will be discussed below.

3.1.3 Code Division Multiple Access

This is another multiple access technology where each user is encoded with a private key which can only be accessed by the Reader and thereby no tag can access the Reader at the same time as no two tags can contain the same private key, this is a preferred technology that can be used to tackle Collision, but the system design complexity and cost factors are the major disadvantages of this technology [7].

3.1.4 Frequency Division Multiple Access

This is the third available technology for multiple access. Here a certain frequency of the system is given to each of the tags for communication with the Reader. In this manner, the user can access the Reader at any needed time [8]. This is the simplest and easiest multiple access technique on offer, but, it wastes useful bandwidth and also with the increase in number of users there will be so little frequency allocated to each tag which can result in problems in the future.

All of the above mentioned techniques can be used for solving the problem of collision but as in the case with data modulation, cost, system design and operational success are some of the factors that should be taken into consideration in deciding which techniques is used for a specific project.

3.1.5 Data transfer from the Reader to the Server system

As indicated under section 2.3, this can be done by using Wireless LAN [9] or ZigBee [10].

A wireless LAN or WLAN is a “wireless local area network”, which is the linking of two or more computers without using wires. It uses radio communication to accomplish the same functionality that a wired LAN has. WLAN utilizes spread-spectrum technology based on radio waves to enable

communication between devices in a limited area, also known as the basic service set. This gives users the mobility to move around within a broad coverage area and still be connected to the network.

There will be an access point for the WLAN, to which the data from the Reader/mini host will be transmitted to, the access points are connected to the Server system via a Serial port, so the daily attendance data can be transferred over to the Server using the WLAN.

ZigBee is another type of wireless communication, but has the advantage of being considerably cheaper; it works on the same principals as the WLAN.

As to which of the two to use is an area which will need to be researched upon.

3.2 Software Section

Before the DBA finally stores the attendance record for a specific day, the data has to be correctly processed, as to how this is done will be discussed under this section.

The data from the mini host system reaches the server system as discussed in section 3.1.2, by wireless method. In the Server system, there will be a database table which contains the list of all the students enrolled into a specific class. Therefore, data from a specific class will be compared with the database present in the Server system and if there is a match between the two, then the unique identification number of the student and the current date will be entered into another database table. This will be the final data which the DBA has to store into the Server system and will serve as the attendance record.

As to how the above said can be done will comprise the research into the software section. This is where Java tools and MySQL will come into use.

MySQL is a data manipulation software which can be used to create database tables and manipulate the data in them. MySQL can be used for creating a table comprising of all the students enrolled into a classroom. This table can be created on enrolling a student into the institution, but, for the purpose of daily attendance registration another table needs to be created containing the date and time of entry of the students into the classroom and their unique identification number. This table has to be entered automatically.

It is for the automatic entry of data into the attendance registration table that Java tool is needed. Java sockets [10] are special tools provided by Java that can be used for retrieving data from the serial port of a computer.

Once the table containing the attendance register details arrives at the Serial port of the Server system then it can be stored by the DBA in a location allotted to that classroom.

4. CONCLUSION

The development of automatic personnel and product management system is a significant contribution to the niche area of automatic material handling. One application that has been considered here is automatic student attendance register. However, the development may be applied to many other similar applications. The student attendance register using RFID will reduce administrative time and effort wherever keeping the attendance register is needed. In addition, this will provide a platform for RFID related research activity in many other applications of RFID to trace material or people, and encourages research in the correlation between class attendance and the performance of the students in various subjects as well as in the laboratories.

5. REFERENCES

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