Design of Classroom Access Control and Attendance Monitoring System Using Radio Frequency Identification (RFID)

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Abstract – **Nowadays security is a vital factor in our society. New design such as door, electronic lock etc has been developed and improved for building security and its occupant safety. RFID technology has been used to improve the management system. Universiti Teknologi MARA (UiTM) provides facilities such as classrooms, laboratories and many more for students and staff. This study aims to design an access control and attendance monitoring system in UiTM. The accessibility to most of facilities in UiTM is unlimited. RFID based access control system can be implemented in classrooms and laboratories where the facilities can be access by a group of authorized person at a specific time. An authorized person can access these facilities depend on the timeslot that has been fixed. The attendance monitoring system will automatically record the entrance of authorized person for future application. The system have been develop and tested for one classroom in faculty of electrical engineering (FKE) and the result is successful with 100 percent verification of authorized and unauthorized person. The attendance monitoring system also shows the successful result when the student's list appear in list box request from admin.**

Keywords: Radio Frequency Identification (RFID), access control system, attendance monitoring system

1.0 INTRODUCTION

Currently the safety of facilities and occupants in a building in UiTM is poor. To protect both the facilities ant the occupant is important to have access control system in the classroom and laboratory. Door access control is one of the important security systems for building security and occupant safety. The door access control is a physical security that assures the security of a room or building by means limiting access to that room or building to specific people and by keeping records of such accesses [1].

The method for access control such as door key can be duplicated, lost, stolen, and forgotten.

RFID technology provides an active RFID tag with many advantages over traditional access control badges and systems since, it allowed the user to enjoy easy access control [2]. Low security in the building parameter can cause more device, tools and equipment are being stolen. Lack information of people entering or leaving the building or location, no control on who is entering or leaving the classrooms will jeopardise the facilities and the occupants itself.

To overcome the problem of conventional door access control, this paper introduces classroom access control system for classroom or laboratory security.

Due to the high number of absenteeism and low punctuality of students in school it has become necessary to solve this problem of attendance. Lack information on the number of student in class at one time can affect the attendance list. This study aims to design a monitoring system base on the access control information.

This system is design to ensure the safety of the equipment in the classroom since no one are allowed to enter the classroom except for authorized person where their tag are registered to get into the particular class. This system also enables the lecturer to know the attendance and punctuality of the student for her/his class.

Francisco Silva was designed an automatic control of student's attendance in classroom using RFID find that the system can solve attendance problem in his university [3].

2.0 RADIO FREQUENCY IDENTIFICATION (RFID)

RFID stands for Radio Frequency Identification which is a wireless communication technology that is used to uniquely identify tagged objects or people [3]. RFID system use radio waves to transmit information from an integrated circuit tag through a wireless communication to host computer [4]. 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 [5]. RFID readers can be categorized into three different frequencies: low frequency (LF), high frequency (HF) and ultra high frequency (UHF). LF RFID ranges up to 125 kHz with maximum distance of 1cm between the tag and the reader. Figure 1.0(a) shows RFID reader. An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to

allow the RFID tag to be attached to an object to be tracked. RFID tags have 3 types: (1) Active tag, (2) Passive tag and (3) Semi active tag. The active tag have an internal power source e.g a battery, which limits the life time, otherwise a passive tag doesn't have a power source and obtain the energy from the magnetic field of the reader [6]. Figure 1.0(b) shows RFID tag. Compared to other automatic identification technologies, like optical barcode system, RFID has several advantages, such as: tag data can be read automatically without line or sight, thought some materials, simultaneously tag reading and from a range of several meters [7].

RFID tag contains an identity number that only can be read and cannot be change unless using RFID tag writer. 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 [8].

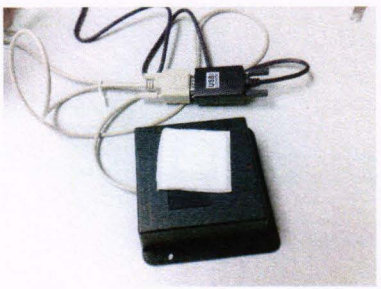

Fig. 1.0(a) RFID reader

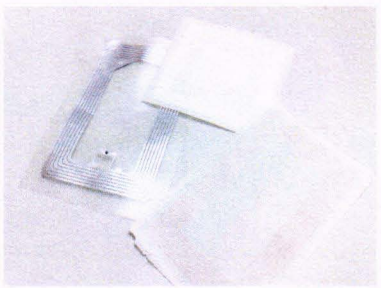

Fig. 1.0(b) RFID tag

3.0 PROPOSED TECHNIQUE

The system requirement is divided into hardware and software part. The hardware part is using a RFID component and a system was created for software part.

The system was created using Visual Basic 6. Visual Basic (VB) also acts as graphical user interface (GUI) for the overall system. All data displayed on the interface is designed and created using VB. The database was developed by using Microsoft Access 2003 for a specific subject. The data used will be the name of students, their ID number, the subjects conducted in that particular class and the schedule for the particular subjects. This database were used for both system i.e.; access control system and attendance monitoring system.

This programme is to enable the lecturer to know the attendance and punctuality of the student for her/his class (refer to the classroom) by clicking the button for their subject. The student which their schedule not on that time or that subject, they not allowed to enter that classroom. The system will show 'Student not found' if the others student who are not in that class tagging their tag. So this programme can control unauthorized person to that classroom. This programme also can ensure the safety of the equipment in the classroom because no one will allow to enter this classroom accept the tag which are programme for that class.

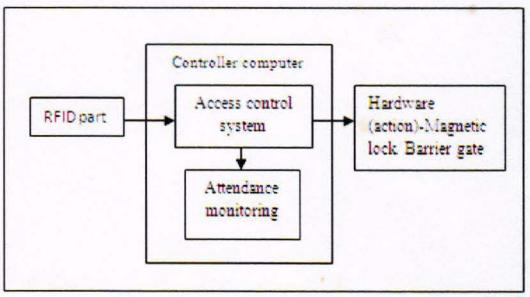

Figure 2.0: Basic diagram of access control and attendance monitoring system.

Refer to figure 2.0, RFID part consist of 2 component which are tag and reader that will support the system to access the classroom or laboratory by the authorized person. After the user manage to access the system, it will be automatically save in database and in the attendance system will list down the student's name that are entering the classroom. For the hardware part which such as magnetic lock was interfaced with the system.

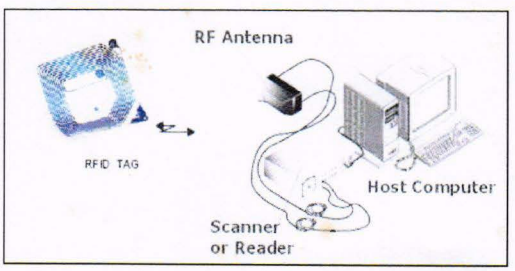

Fig. 3.0: System architecture of monitoring system

Refer to figure 3.0, RF antenna will receive the signal from RFID tag and then scanner will read and identify the id tag. The stored database in the host computer will compare the receive data with the store data. This system will only detect

the similar id tag in the database to achieve the objective of the system.

3.1 DATABASE DEVELOPMENT

The database was developed by using Microsoft Access that includes two parts i.e. student database and subject database. The student database consists of student's names, student ID numbers, tag ID and phone number of each student are represented in Figure 4.0. The student databases are taken from the administration that are contains of 120 student's data which are having the authority to access the classroom at the specified time and subject are being stored in the database.

Student : Table

Tagid	Studentname	Studentid	Nophone
AA 00 0C 00 01 00 00 FE 5B 4C 10 00 01 04 E0 39 BB	Fatimah	2006133345	0194567892
AA 00 0C 00 01 00 00 D0 5B 4C 10 00 01 04 E0 19 BB	Jeremy	2006133478	0198765432
AA 00 0C 00 01 00 00 4C 5B 4C 10 00 01 04 E0 A0 BB	Roy Melvin	2006145324	0168753421
AA 00 0C 00 01 00 00 E6 5B 4C 10 00 01 04 E0 09 BB	Tarmizi	2006132456	0193421567
AA 00 0C 00 01 00 00 B0 5C 4C 10 00 01 04 E0 60 BB	Hermi	2006133248	0176785432
AA 00 0C 00 01 00 00 B0 64 4C 10 00 01 04 E0 60 BB	Siti Karimah	2006687543	0192450097
AA 00 0C 00 01 00 00 A8 64 4C 10 00 01 04 E0 78 BB	Nor Idayu	2006668211	0192111890
AA 00 0C 00 01 00 00 EE 5B 4C 10 00 01 04 E0 01 BB	Siti Mahfuzah	2006687111	0193321678
AA 00 0C 00 01 00 00 06 5C 4C 10 00 01 04 E0 EE BB	Ili Aqilah	2006133311	0192510701
AA 00 0C 00 01 00 00 FF 5B 4C 10 00 01 04 E0 10 BB	Azizah	2006133285	0192787632

Figure 4.0: Student database

Subject : Table

Subjectid	Subjectname	JM	MM	JK	MK	Day
50000	ELE531(Mon)	10	20	12	20	Monday
50001	ELE531(Wed)	8	20	10	15	Wednesday
50002	EEE633 (Wed)	10	20	12	20	Wednesday
50003	EEE633 (Thus)	10	20	12	20	Thursday
50004	MGT451	13	50	15	50	Tuesday
50005	CRBI	4	0	6	0	Friday

Figure 5.0: Subject database

Figure 5.0 shows the subject database that includes the code of subject and timeslot for the subject and day. From the databases, we can verify whether the students can have their access to that classroom or vice versa.

Day/ Time	8.300 am – 10.20 am	10.30 am – 12.30 pm	2.00 pm- 3.50 pm	4.00 pm – 6.00 pm
Monday		ELE 531 EEB6A		
Tuesday			MGT 451 EE7AE	
Wednesday	ELE 531 EEB6A	EEE 633 EE7AE		
Thursday		EEE 633 EE7AE		
Friday				CRBI EE8AE

Figure 6.0: Time table provided by administrator

The access control system is designed based on the time table as in Figure 6.0 above. As an example referring to Figure 6, the class is occupied on Monday at 10.30 am till 12.30pm. As for Tuesday, it is utilized from 2.00 pm until 4.00 pm.

3.2 ACCESS CONTROL SYSTEM

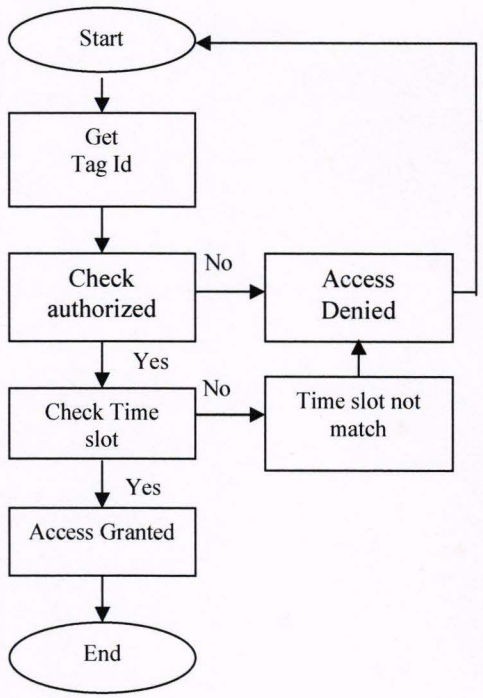

Figure 7.0: Flow chart of access control system

For the access control system, only students who are having class on that time will be allowed to enter the classroom. Classroom or laboratory is currently protected from unauthorized person. This system starts when a student tags their tag card, the RFID reader will identify it and verify it. If the tag identification does not match the tag identification (id) in the database, the message box in the system will display "Student not found" and access is denied. Then, when tag id is authorized (matches the id in the database), the system will verify the time slot which include the subject and time. If the data verified equals the present time slot, access is granted for the respective tag holder. The process ends here, and now is able for the next user.

3.3 ATTENDANCE MONITORING SYSTEM

The system also enable for administrator or lecturer. They can check the student's attendance or who are entering the classroom by using the attendance monitoring system.

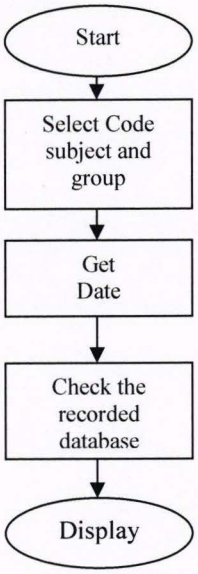

Figure 8.0: Flow chart of access control system

In this system, the lecturer can verify which students are attending to his/her classes in every session by only selecting the subject and date. Then the student's names who have attended each session will be displayed.

4.0 RESULT AND DISCUSSION

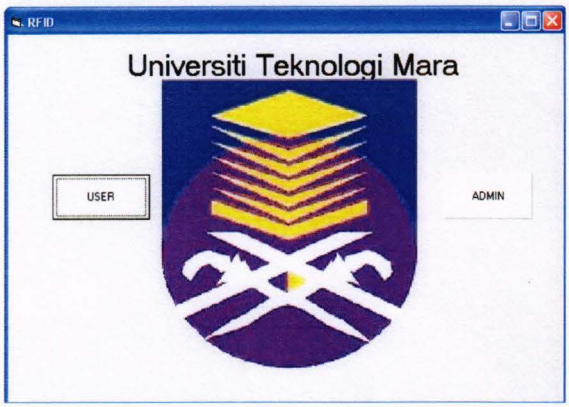

Figure 9.0: GUI for the main system

The proposed system can be installed in a classroom or laboratory whereby it can be placed at outside of the classroom. The students have to scan their identification tag first for verification before having permission to enter that classroom.

Figure 10.0: User interface of the proposed system for entry

Figure 10.0 shows the user interface that can be displayed at the monitor of the computer. Once the student has scanned their identification card, the user interface will automatically display the students ID and the name of that person. Since the number of tag has been embedded before in the system, it will verify the tag ID. Since the person have been recognized by the system, the student have to login to check whether the timeslot and the subject of that person are similar to the actual time. Figure below shows the display window that having access after tag ID verification.

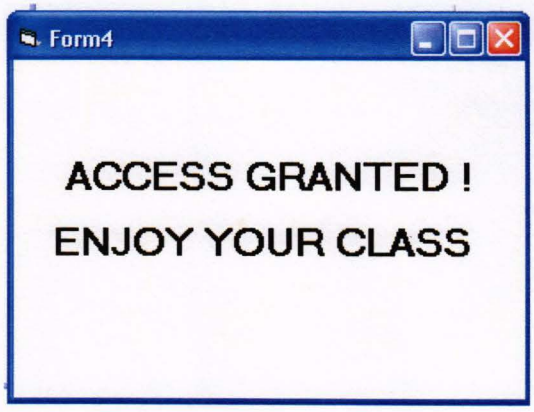

Figure 11.0 : Display window of the granted access upon verification.

Once this display window shows the granted access, magnetic lock which operates and the door can be opened. If the access of a student has been denied whether because of different time slot and subjects, the display window are shown as in Figure 12.0.

Figure 12.0: Display window showing access being denied.

For the administration part, the administrator is able to check the student's attendance and the punctuality of a student. Since the percentage of the attendance is quite important to sit for final examination, the system can also be used to determine that percentage. From here, the student can be detected whether the attendance is not satisfied.
The administrator will select the subject and the time slot and the student list that are attended for that class are displayed as in Figure 13.0.

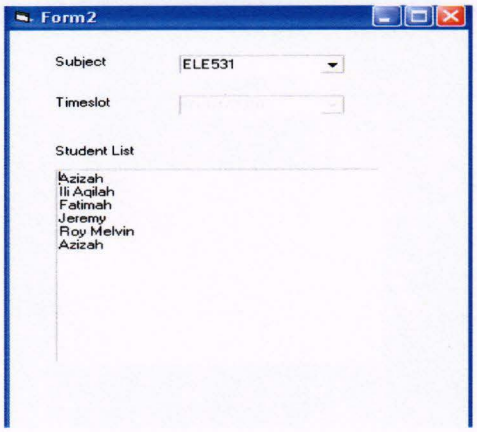

Figure 13.0: Administration interface of proposed system for attendance list

5.0 Conclusion

This paper has documented the development of RFID based classroom access control system. The Microsoft access and Visual Basic (VB) programming has been explored, learned and practiced to achieve project's goal. Visual basic is used as a tool to extract the serial number from an RFID tag. Microsoft access is used to build up the database of the authorized entry of a group of people. The objective of this project has been achieved by presenting the only authorized person will be accepted to the system and the proposed system produced a good performance. The results can differentiate between authorized an unauthorized person. Besides that, the results for attendance monitoring system shows a good performance since it is able to produce list of attendance for each class and it is also accurate.

In the future, it is possible to use microcontroller and the database are stored in the server. This system also can use active tag RFID for allowed the user to enjoy completes hand free access.

6.0 References

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