UiTM Smart Attendance Access Control System Using RFID

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***Abstract* – Traditional attendance recording system are still being used in most educational institutions. The traditional attendance recording method involves the distribution of attendance sheets, which are signed by students. This method of recording attendance wastes time, as well as disrupting the student's attention in class. Furthermore, the lecturers need to check the record and calculate the attendance manually. Consequently, this influences the quality of teaching system. UiTM Smart Attendance Access Control System is proposed as a solution to this problem. This system uses Radio Frequency Identification (RFID) to access the recording attendance system which is the easier, faster and in an efficient way. The attendance will be captured immediately once the students place their ID card on the reader and the system is automated calculation of the attendance. Minimum requirements for UiTM students to qualify to seat in examination is 80%, hence the system will view the status of the students for their eligibility. The system was developed using the PIC16F877A microcontroller by Microchip and integrated with the computer through RS232 or Universal Serial Bus (USB) port. Attendance is stored in a Microsoft Access database, using integration with Visual Basic 6.0 software. A prototype of the system has been successfully developed.**

Keywords – Attendance System, Smart Attendance Access, RFID, Microcontroller, PIC16F877A.

I. INTRODUCTION

The conventional procedure of taking attendance during a class wastes a lot of lesson's time, due to validation and insertion of data as it is being done manually. Moreover, the lecturers lack of knowing exactly whether students who attends a particular class because a large number of students are involved. Most of the lecturers have to take attendance by having an attendance sheet passed it around the classroom. For lecturers who are concerned with the attendance, they may call upon students one by one, which causes a lot of time to be wasted.

Because of this, an electronic recording system is proposed to record attendance automatically. The system will help and ease the lecturers' job in recording and calculating the students' attendance with minimum of error.

The system detects the presence of RFID cards. Students need to place their ID card on the reader and the system will be able to identify each student's card and record the attendance. The system becomes more efficient since the students do not need to look their name through the long list. The ID encoded inside the RFID card is scanned and stored in the memory. An error message will be displayed if the ID is not matched with the database. The system is also able to calculate the attendance percentage, to determine whether a student is qualified to seat in the examination (if the accumulated attendance meets the minimum requirements).

This paper is organized as follows: related works are presented in Section II, while the methodology is presented in Section III. Section IV shows the results and discussions. Finally, conclusions and future works are presented in Sections V and VI, respectively.

II. RELATED WORKS

There is much works related to the RFID attendance system. In [1], Radio Frequency Identification (RFID) refers to the use of radio frequency wave to identify and track the tag implemented into an object or a living thing. The performance of the RFID based attendance system was evaluated on a different tag positions and distance. The real time clock is included in the system whereby if the system is powered off, the time is still running. The system used HyperTerminal software to view the recorded attendance.

In [2], a framework for the future implementation of a student attendance system was presented. The system uses a barcode scanner to record the students' attendance automatically, and counts the number of attendance. The Charge-Coupled Device (CCD) scanner was able to read barcodes quickly and easily, but had limitations in terms of distance and dimensions of the barcode.

In [3], an automated attendance system was created based on RFID technology. The student's attendance weightage was also calculated in order to confirm their eligibility to sit in examinations [3]. However, the system did not generate the student attendance percentage.

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III. METHODOLOGY

The development is divided into two parts, hardware development (Section III-A) and software development (Section III-B).

A. Hardware Development

The hardware of the system consists of Microchip PIC16F877A Microcontroller, RFID reader and tag and 16x2 Liquid Crystal Display. The RFID hardware flow is shown in Fig. 1.

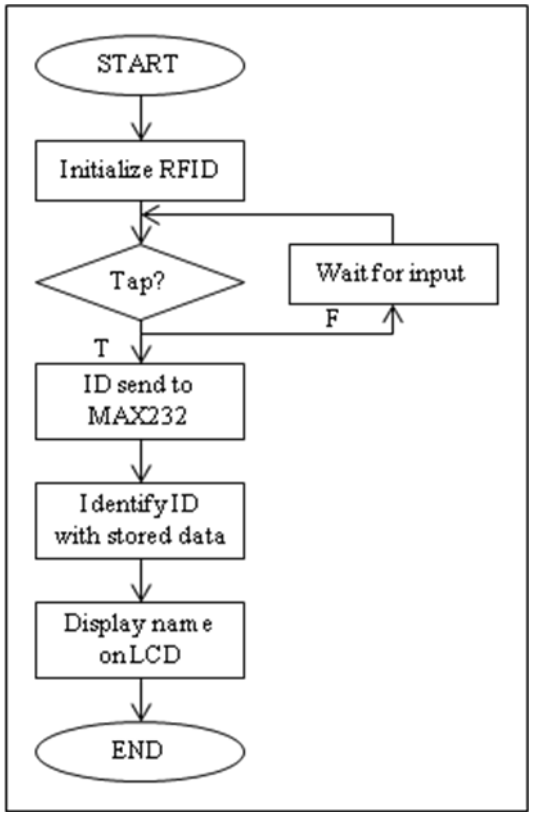

Fig. 1 The flow chart of hardware

The RFID reader used in the system verifies the RFID tags have unique ID or serial number. String compare function is used to check the tags being scanned with tags stored in the memory [1]. LCD will display the students' name that tap on the reader.

The PIC16F877A is programmed in the MPLAB IDE which is an integrated development environment. The functionality of the microcontroller was done in CCS PCWH compiler using C language. CCS provides a complete, integrated tool suite for developing and debugging embedded applications running on Microchip PIC. The programs were tested in Proteus ISIS software for simulation after compiled in the MPLAB IDE. The programs were then burnt into the PIC and executed.

1) PIC16F877A Microcontroller

Fig. 2 shows the PIC16F877A and the SK40B used for development of the attendance system. The PIC microcontroller was programmed to interface the LCD, RFID reader and serial output. The LCD was set in port D, and the RFID reader I/O port was set in port A. The serial output was set in port C.

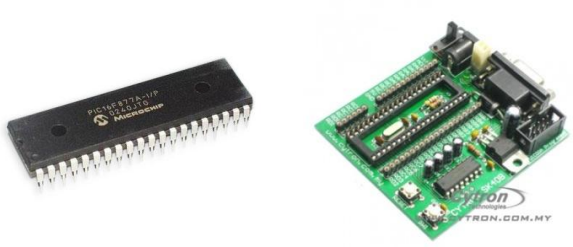

Fig. 2 PIC Microcontroller with SK40B Start-Up Kit

2) Wiegand RFID Reader and Tag

RFID (Radio Frequency Identification), as shown in Fig. 3, is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. An RFID system consists of three components: an antenna and transceiver (often combined into one reader) and a transponder (the tag).

Fig. 3 RFID reader and tag

The antenna transmits a signal that activates the transponder using radio frequency waves. After the reader receives the modulated signal from the tag, the output in Wiegand 26-bit format was sent to microcontroller through DATA0 that allows the scanning and verification function to be triggered when there is a change on output and DATA1 lines for further processing.

The result of the data that receives by microcontroller from the reader will be compared with the ID that has been stored in the microcontroller. The student's name will be displayed on LCD if the name is existence and all the information is transferred to PC by using RS232 cable.

When a student tags his/her card on the RFID reader, the microcontroller verifies the tag number by comparing it with predefined tag ID numbers already stored in the microcontroller ROM. The reader emits a sound when the

card is successfully read. After the card has been successfully read, the RFID reader establishes a communication with the RS232 cable in order to send the student card identification to the database system.

3) USB-to-RS232 Cable

RS232 stands for "recommended standard 232", a traditional method for transferring information between a computer and its peripherals (Fig. 4). This cable is most commonly used in order to successfully transfer data from one technological device to another. The RS232 standard has been largely replaced by other connections, like USB cables. These new cables are faster, more reliable and use less energy than the traditional standard, but they are digital and require the data to be sent in packets and then unpacked.

Fig.4 USB-to-RS232 Cable

In this project, the SK40B has a built in RS232 protocol through a DB9 connector. Due to personal computer that does not have serial DB9 connector, it has to be interfaced by a USB to serial converter.

4) Liquid Crystal Display (LCD) 16x2

Liquid Crystal Display (LCD), (Fig. 5) is a very important device in embedded system which can display information in many 'smart' appliances. It is usually controlled by microcontrollers. It makes complicated equipment easier to operate and offers high flexibility to user as he can display the required data on it. The system used LCD to display the student name based on the ID cards that has been tapped.

Fig. 5 Liquid Crystal Display (LCD) 16x2

B. Software Development

The software development involves of Visual Basic 6.0 as a graphical user interface (GUI). Visual Basic is a high level programming language and the program is made up of many subprograms, each has its own program codes, and each can be executed independently and at the same time each can be linked together in one way or another depends on the objective. Visual Basic is compatible with the Microsoft Access Database Management System (DBMS), which is the DBMS used in the system.

The database structure is shown in Fig. 6. Student information was stored in table Student, while class information was stored in table Class. Table Masuk links records in Student and Class using the primary keys from Student and Class.

Visual Basic 6.0 is the suitable software to design a user-friendly attendance system. The system enables to record the attendance of students for each class of a subject and keep the profile against unique IDs and also calculates the percentage of the accumulated attendance. This system provides option for searching students' profiles, viewing the attendance record where which students were attending specific class. This application also does not allow the IDs that tap more than once. Besides that, all the records are stored in the database system using Microsoft Access. The system can edit the information and automatically stored in the database.

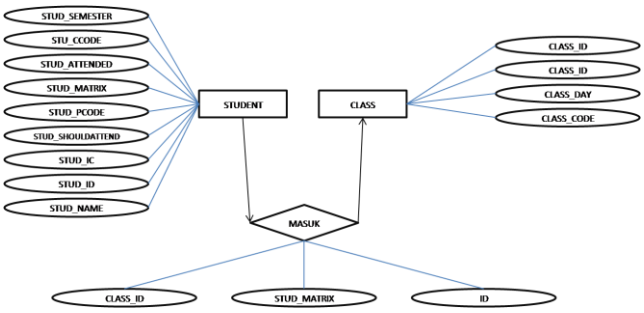

Fig. 6 Entity Relationship Diagram of Student Attendance System

The modules of each form in VB were tested to undergo test to pass data across forms. This is to ensure that interfaces between forms of data are stable.

IV. RESULTS & DISCUSSIONS

The purpose of the project is to record the students' attendance based on the IDs that they have been tapped and automatically calculates the percentage of accumulated attendance for UiTM students. This system accepts from two different levels of accesses which are Lecturer and Student.

Student is allowed for class registration access only while lecturer may access to view the attendance record as shown in Fig. 6. The system was designed such that it requires lectures' username and password to avoid deception from student. Fig. 7 shows the flow of login before proceeding to the next form as shown in Fig. 8.

Fig. 9 shows Main Menu after the lecturers log in their usernames and passwords. The students profile button is linked to the form as shown in Figure 10 while student attendance button will linked to form that view students who attend to class on specific day.

Fig. 10 shows the form where lecturers can view the student profiles after the lecturer key in the matrix number of a student. The system shows the percentage of the attendance for the student. The calculation of 80% attendance is what makes the project different standout from the previous research being done on attendance system.

The number of percentage will be coloured in black if the accumulated attendance meets the 80% minimum requirements. Otherwise, the percentage will be in red colour showing that the student has been barred for examination. In this form, the lecturers can edit the information and it is automatically updated in the database as the update button is clicked.

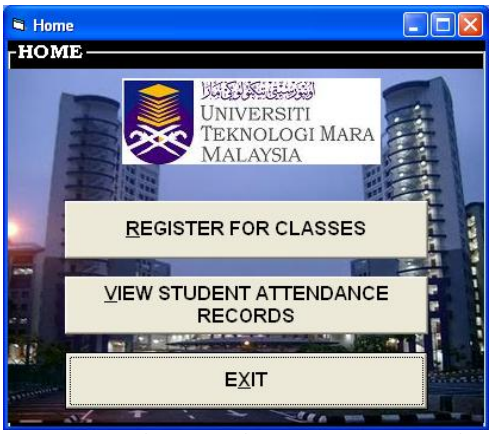

Fig.7 Snapshot of accessing for Lecturer and Student form

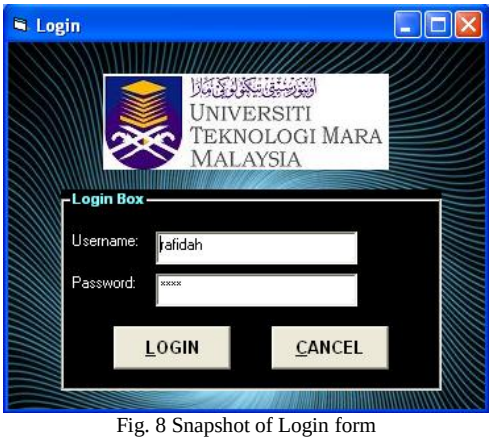

Fig. 8 Snapshot of Login form

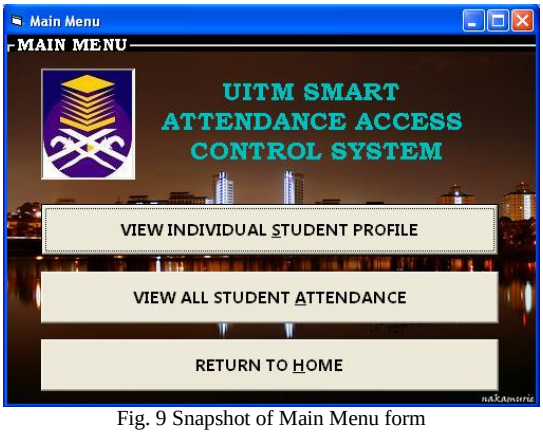

Fig. 9 Snapshot of Main Menu form

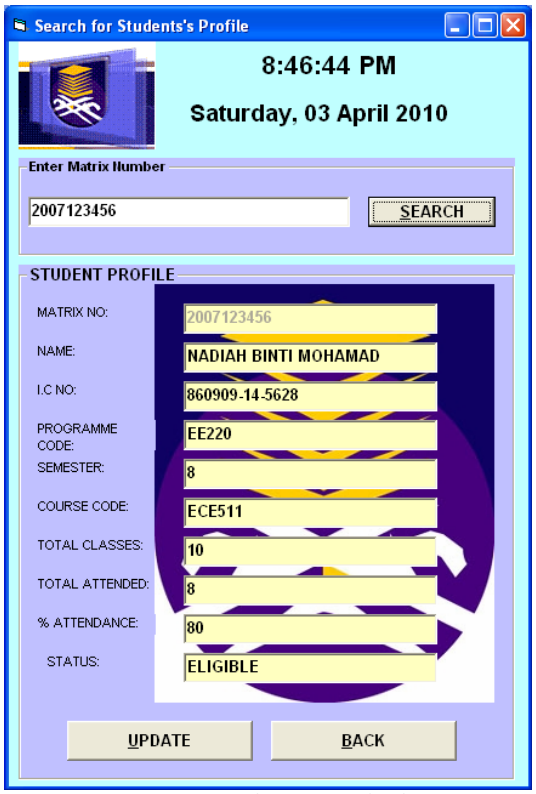

Fig.10 Snapshot of Student Profile form

Fig. 11 shows the Student Attendance List form. The list of students attended the classes can be viewed through the selection of the list of classes per subject in the combo box at the top of the form.

During the hardware development of the system, each of the components was put under test for reliability and limitations. Experiments had been done that the access part of the system (namely the RFID reader) is able to read the RFID smartcard in considerably quick time and effectively putting into considerations of the distance between the smartcard and the reader. Due to the nature of passive RFID reader, low cost and manufacturing settings, the distance test conducted unto the RFID reader was found

ineffective to read the smartcard after being put 5cm away from the reader.

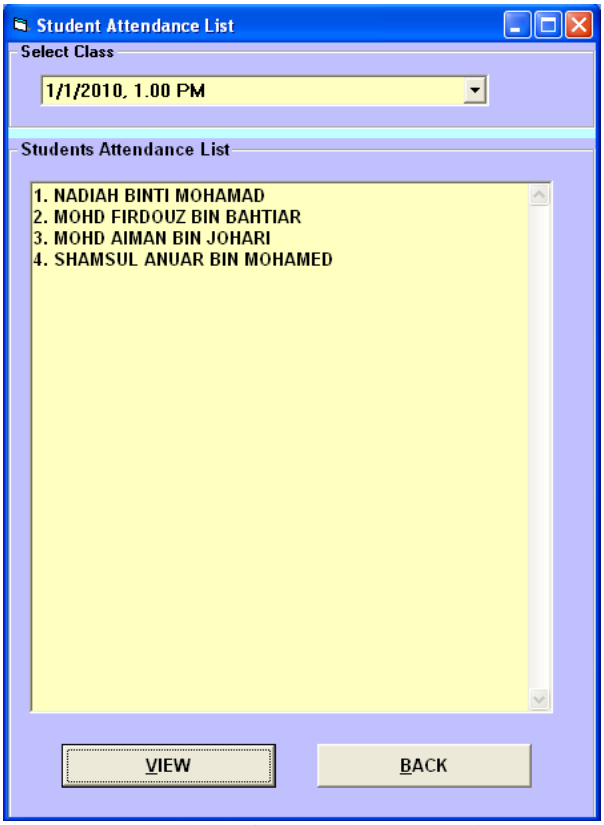

Fig. 11 Snapshot of Student Attendance List form

The Wiegand RFID reading protocol needs at least 0.5second to read from the passive smartcard. The reader gives an indication of 2 beeps during the reading of one passive smartcard. This protocol allows a single flashing. Multiple cards flashed will give confusion to the reader hence putting it into idle state.

Due to usage of serial to USB conversion and vice versa, the delays might cause the overlapping data read by the system. This too has to be put into consideration. Although the provision of parity can be done, it was concluded that by not including the parity may reduce the complexity of the receiving end of the system.

V. CONCLUSION

The beauty of the system provides automation to the system for cost reduction and by achieving the objectives to provide automation to the student's attendance record system integrated with RFID.

This project successfully achieved the objectives. The system can interface RFID with PC. The system is equipped with other modules that ease the process of recording attendance for surveillance purposes. The interconnection between forms bring the system achieves its goal where it can calculates the percentage of attendance and shows the status of 80% attendance.

VI. FUTURE DEVELOPMENT

The future development of the system can be done by improving both hardware and software aspects.

Through the hardware, the system delay can be reduced to quicken the read time by the RFID. The hardware can be modified to read multiple cards at once.

Through the software, the program can be modified and the system can be applied to both students and staff. The access to the system can be developed to be accessed through the internet too. The system can be hooked to a server so that the attendance can be viewed by lecturers and students through the internet. The system can be able to notify lecturers, students or parent through SMS or email.

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