

Double Identification Attendance System using HF RFID and Sensors

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Abstract

In this paper, the double identification attendance system integrated with High Frequency Radio Frequency Identification (RFID) and sensors is presented. This double identification system requires users to be detected by two different mechanisms. The first mechanism is by using the RFID reader identification. The users need to place the RFID card on the reader for the system to capture the user details such as name, time in and date. Once the user passed the RFID reader, they will need to be detected by the motion sensors within few seconds in order for their attendance to be captured by the system. This double identification system is proposed to overcome the problem of false attendance by the students who just stopped by to tag their student identification card without attending the class. The attendance system presented in this paper is able to capture the time in and time out of each student which will be automatically captured if the students successfully pass through both RFID reader and motion sensor. The proposed attendance system is designed to replace the manual attendance system which still implemented in this modern era. The unique features of the RFID system which able to capture and store the student attendance in the database system effectively and can reduce the time for the teachers to take the attendance daily. The Graphical User Interface (GUI) of the attendance system is developed by Microsoft Visual Studio and the database of the system using MySQL. The GUI built in this system is used to project the ID and detection status for each student. The GUI also can be used by the lecturer to monitor the student attendance based on the databased captured by the system. This double identification attendance system also will be useful for any event or training provider to record the attendance of the attendant effectively.

Keywords: Radio Frequency Identification system, attendance system, motion sensor, Visual Studio

1. Introduction

Attendance recording is an essential task in event which involve large participant number. It is common things to

be included as part of the teaching and learning record in all schools and universities. Attendance system helps the event organizers or teaching to keep a record of the students or attendees according to the dates, time, and

classroom location. In most of the educational institutions in Malaysia, the problem faced by the lecturer in taking daily attendance of students would be the difficulty to manage and monitor the attendance for large group of students. There are various of automatic identification have been develop such as Facial Recognitio¹⁻², Image Augmentation Technique³, finger print⁴ and temperature sensors⁵. However, these techniques usually require a lot of time for the system to recognize and process the data before it can be successfully recorded into the system.

Ref. 6 has presented the “Radio Frequency Identification (RFID) Based Attendance System” which accommodate the RFID technology to complete the system using a real time clock to improve the accuracy of the attendance record. Another similar system presented in Ref. 7 to monitor the attendance of the employee with RFID tags to communicate with an Arduino UNO connecting RFID Reader/Writer module. However, there are some limitations of using a single identification card because this can lead to unauthorize people to misused other person card to gain access or to false attendance record. In other words, the identification of a unique identification based on a single card scanning is still not effective for attendance monitoring system due to the lack the ability to distinguish between different users. Therefore, it is still common to practice the traditional method of calling the name of students one by one due to several case of false attendance when the auto-scanning attendance is applied⁸.

A survey was made by taking 52 first year B.Tech students of School of Engineering, Ajeenkya DY Patil University, Pune to calculate the average time taken by a faculty to take attendance through dedicated Enterprise Resource Planning (ERP). The study revealed that each faculty took approximately 8-10 minutes to complete the attendance of students, which accounts 20% of the assigned class time⁹. In this project, the RFID system implemented is a High Frequency (HF) RFID, with the operating frequency at 13.56 MHz. The maximum read range can be reached up to 1m. The movement of student entering to class can be detected by implementing passive infrared (PIR) motion sensor to the system, to ensure the attendance recorded is reliable. The objective of this project is to develop an attendance system that can capture time in, time out and measure the duration time

of each student in class, and integrate the system with HF RFID and sensors at the same time.

2. Methodology

2.1. Hardware Setup

Based on Fig. 1, the attendance system proposed in this paper is consist of five important components; the RFID system, motion sensor system, database and graphical user interface (GUI) and the host computer.

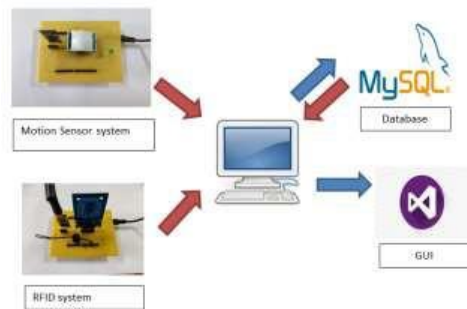


Fig 1 Block diagram of the attendance system.

The RFID system consists of RC522 RFID reader module, RFID tag and a buzzer, while a LED is added to motion sensor system for indication purpose. The GUI in this project is developed using Microsoft Visual Studio, the purpose of developing a GUI is to enhance the user experience and achieve user-friendly interface. It is the interface between hardware and the user. For database implemented in this project, it is developed with MySQL. The purpose of database in the attendance system is to store the student data and daily attendance record.

Next, a RFID reader will be placed far from the host computer in real life application, therefore, CC2530 Zigbee module is implemented into the system to allow wireless communication. As shown in Fig. 2, after the RFID system is initialized, it is ready to read the tag. If the ID of RFID tag read is stored in database, the attendance system will receive input from motion sensor for movement detected. If there is any movement, the attendance recorded will be “Detected” and “Not detected” if no movement detected. There will be a 5 seconds time delay after the tag is read during entrance, it allows the student to trigger the motion sensor during this period. In the case of the tag ID is not registered in datase, error message will be displayed on the interface.

The 5 second delay is apply to reduce the time for the next person to be detection to ensure smooth identification record to be performed.

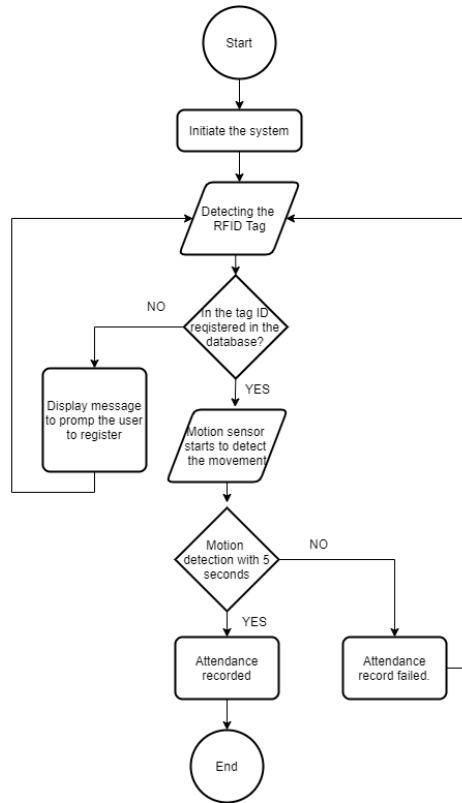


Figure 2: Flow chart of the double identification system using RFID and Motion Sensor.

2.2. Software Setup

The GUI of the attendance system is developed with Visual Basic programming language in Microsoft Visual Studio. The database is created using MySQL. The development of database will be the crucial factor in attendance system as the student will be recognized by the data stored in database. The GUI is designed in simple form so that the user can adapt to it easily. In order to integrate with RFID reader and motion sensor, the GUI is set to receive serial data transmitted from the reader and sensor, and then compare the data with database and resulting in showing necessary information at the GUI. Fig. 3 shows the flowchart of software. The GUI will not work properly without connecting to database. There are two modes can be selected from the attendance system, admin mode and take attendance. For admin mode, the

user will stay on the main windows and several actions can be done such as checking student data, registration or edit of student data, and check the attendance record. All these action can be done concurrently with the process of taking attendance, two branches all independent on each other. While in attendance recordin mode, a new windows of the GUI is set to receive input from RFID system and motion sensor system continuously. If the tag ID is not found in the system, an error message will be displayed. The attendance will be recorded after the GUI has received the data from motion sensor system.

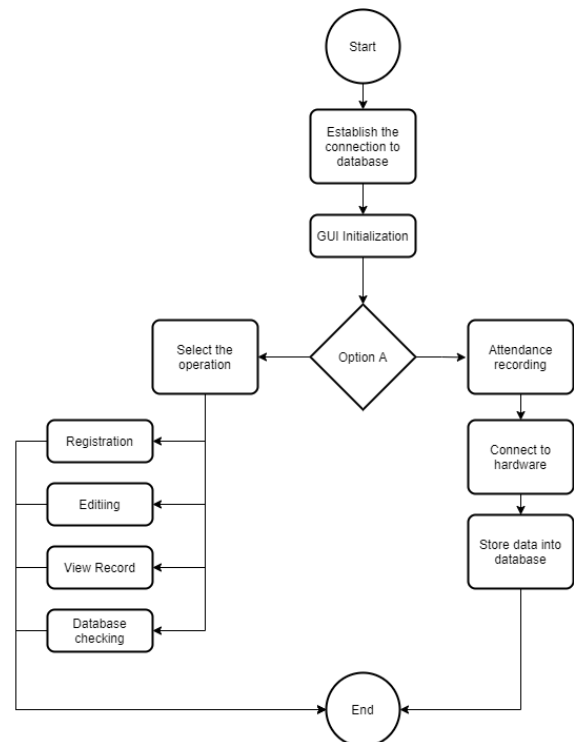


Fig. 3: Flow chart of the GUI

In Figure 3.13, the shows the procedure for the student to record their attendance, the size of room proposed is 8m x 6m x 3m. One of the RFID readers is installed at the wall at the entrance while another one is installed at the exit. There will be only one sensor system applied in this project to detect the movement of the student which is placed 30cm away from the RFID system at the entrance.

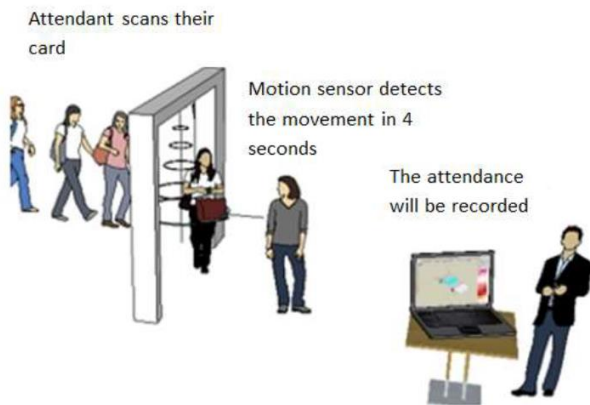


Fig.4 : The proposed setup of the attendance recording system using RFID reader and motion sensor.

3. Hardware and GUI Integration

Fig.5 shows two different prototypes included in this project; the High Frequency RFID system and the motion sensor system. Both of the hardware and the host computer will be connected to a CC2530 zigbee module to allow wireless serial communication. Fig. 5(a) shows the arrangement of microcontroller, Arduino UNO at the lower part of the printer circuit board (PCB) to minimize the size of 10cm x 8cm PCB. The same of connection of Arduino UNO to the PCB is also applied on the motion sensor system shows in Fig. 5(b).

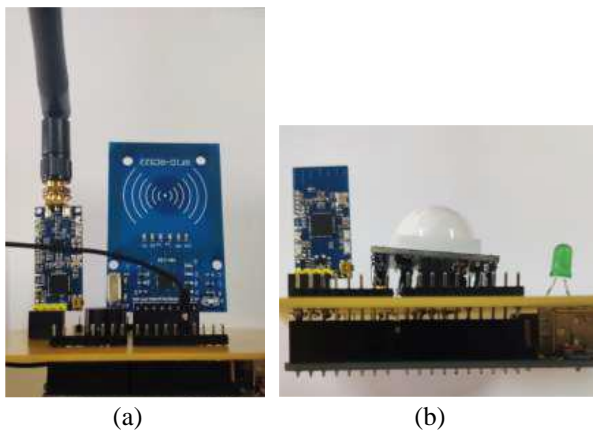


Fig. 5: (a) the arrangement of microcontroller, Arduino UNO and RFID reader and (b) motion sensor system on the Printed Circuit Board (PCB).

The development of the GUI plays an important role as communication medium between the user and the hardware systems. It allows the user to perform several operations such as checking the student data, registering

a new student or editing the data of the student, and recording the attendance.

The first GUI page initiated by the login page to prevent unauthorized person from exploiting the database system. Then, the connection to the hardware will be done by selection the correct connection setting between the computer system and the hardware using the com port connection. Once the connection with hardware is established, the user now can choose the option based on the menu displayed on the Welcome page.

The main part of the attendance system would be taking the attendance and record it to the database. This action can be done by clicking on the “Take Attendance” button located on the left panel, a new window will appear after the button is clicked. The reason of adding com port selection in the “Take Attendance” interface is to allow the user to use main interface and “take attendance” interface at the same time, which is closer to real world application and user-friendly. For example, the user needs to take attendance while registering or updating the data of the student, it can be done by connecting two interfaces to different com port. In other word, the process of taking attendance will not interrupt other action if two com ports are connected.

There are seven items to be displayed on the attendance recording page which includes; Student ID, Name, Programme, Time Log, Duration And Motion. The time Log will display the time where the student’s identification card is detected by the system. For two doors setup, the system can detect the time as time in and time out and the duration between the time in and time out will be calculated and displayed in the database. For the motion label, it indicate the successful movement detection for the student. If the motion sensor did not detect the movement of the student within the 5 second delay, the motion label will displayed “Not detected” as shows in Fig. 6(a). All this information will be recorded into the database table for checking and reference purpose. In the case of movement detected, “Detected” will be displayed as shown in Fig.6(b). For time out, the result will be the same if no movement detected condition, and the time log and duration time will be displayed. The duration time of each student in class is displayed in the form of “HH:MM:SS”. For non-registered user, the name label will display “Not Registered” and the student ID and program will not be displayed. A prompt message will be pop-up for the student to proceed with the registration. Once the process of taking attendance is

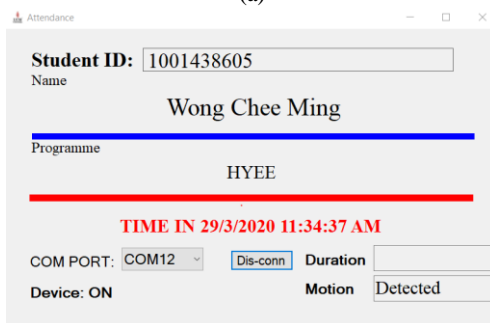
done, this connection can be closed and the computer will stop receiving data from the RFID reader. Table 1 shows the possible data of detection from the user based on the detection from RFID reader and motion sensor.

Table 1: Possible result for the attendance system.

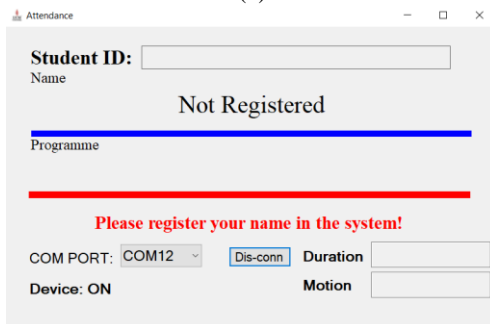
RFID Reader	Motion Sensor	Result
Yes	Yes	Duration time and “Detected” will be recorded in the table.
Yes	No	Duration time and “Not Detected” will be recorded in the table.



(a)



(b)



(c)

Fig. 6: GUI output for (a)Not detected, (b) Detected, and (c) non-registered user.

The development of the GUI proposed in the paper allows the user to check the total duration of the user based on the Tagin and TagOut time. This special features in proposed in the project to ease the lecturer to check the total time that the student spend in the class. This feature can allow the lecturer to identify those students who left the class early then the required class time for a certain lecture class. This features also can be apply to any training provider to provide the prove of attendance to any employer who send their employee for a certified training. For some training which require a minimum hours (or days) for the participant to attend, this special features may be useful for them to monitor the participants effectively.

UCESI University
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Course: EE418

id	name	programme	date	time_in	time_out	duration	motion
1001438605	Wong Chee	HYEE	2020-03-28	12:51:49	12:51:57	0:0:8	NoDetected
1001438605	Wong Chee	HYEE	2020-03-28	12:52:10	12:52:19	0:0:9	Detected
1001438605	Wong Chee	HYEE	2020-03-28	15:08:48	15:08:54	0:0:6	NoDetected
1001438605	Wong Chee	HYEE	2020-03-28	15:09:07	15:09:13	0:0:6	Detected
1001437370	Ng Joon	HYEE	2020-03-28	15:14:28	15:14:35	0:0:7	NoDetected
1001438210	Len Han Z.	HYEE	2020-03-28	15:14:48	15:14:56	0:0:8	Detected
1001438351	Lee Zhen	HYEE	2020-03-28	15:29:40	15:29:45	0:0:5	NoDetected
1001437370	Ng Joon	HYEE	2020-03-28	15:29:58	15:33:05	0:3:7	Detected
1001438351	Lee Zhen	HYEE	2020-03-28	15:33:17	15:33:23	0:0:6	NoDetected
1001438351	Lee Zhen	HYEE	2020-03-28	15:33:38	15:33:44	0:0:6	Detected
1001438605	Wong Chee	HYEE	2020-03-29	03:01:33	10:29:56	7:28:23	NoDetected
1001438605	Wong Chee	HYEE	2020-03-29	10:30:16	10:35:37	0:5:21	NoDetected
1001438605	Wong Chee	HYEE	2020-03-29	11:34:37	11:37:19	0:2:42	Detected
1001438605	Wong Chee	HYEE	2020-03-29	11:54:56			NoDetected

Fig. 7: Detection summary

4. Conclusion and Recommendations

As for conclusion, the double identification attendance system presented in the paper is a good initiative to replace the traditional attendance system in university. The unique function of capturing the time in and time out, and generating the duration of time of each student in class, which can highly reduce the number of fake attendance from students. In addition, this attendance system requires lesser effort to manage and monitor the attendance of the student especially for large group of students. The GUI develop in this project is easy to use even for the first-time user. The connection with the database system helps the user to store all the attendance for the whole semester into more strategic and effective data storage system. In conjunction with the sustainable development goals, this project has fully eliminated the use of papers for the attendance recording system. The rewritable RFID card, paperless and database system really support the SGD goals.

For the future recommendations, the notification function can be added to the system to alert the lecturer if there is student absent from the class or the absent rate of student is relatively high. In addition, the alert can be sent to the parents or guardians of the student so that they are able to monitor the activities of their child.

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