RFID Attendance System

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Abstract: For colleges and corporations, there is a growing demand for attendance systems that are both trustworthy and quick to respond. RFID (Radio Frequency Identification) is a quick and efficient way to identify any material thing. Their major benefit is that they can be read wirelessly, hold more information than barcodes, and are more durable due to their non-line-of-sight technology. RFID tags can read in any tough environment, rendering other read technologies such as barcode or optical card readers worthless. In this paper we purposed a system that quick and easy device for identifying people. Also, we purpose a system that can access control system and a system that goes beyond only RFID detection attendance. In this system when card brought near to the RFID module it reads the card information and displays is it user is early or late to the class. The system operates with scanning the body temperature of student, if the student below 37 degree Celsius then they can scan their student ID, if higher than 37 degree Celsius then the alarm will make beeping sound continuously. After scanning student ID, this system marked the attendance corresponding to that code id and save in SD card and after that display it's all information on the LCD like card ID, date, time and student code number and welcome message if early and late message if user were late. In addition, a lot of time is saved as all the students attendance is directly stored in the data base.

Keywords: Radio Frequency Identification (RFID), Identification (ID), Secure Digital (SD), Liquid Crystal Display (LCD).

1.0 INTRODUCTION

The RFID scanner system has been existed for a long time. The RFID scanner system is not new in the society. Yet it is more use in the toll payment system and parking payment system. The RFID scanner have been applied in student attendance system but not widely use and this will be new to this section. The RFID attendance system is adapted from this RFID scanner from the toll payment system method [1].

RFID attendance system used to design a quick and easy device for attendance system. It is to design to help student and lecturer in taking the student attendance. Most lecturer are very tended to find the way on how to solve this student attendance system method because many of them want the student attendance system that can record the attendance of the student systematically and practically.

Generally, RFID systems are used to develop prototype that can access control system that will facilitate the lecturer to take student attendance. Student use an access student ID with an RFID chip for access control. An electromagnetic field is utilised to exchange information between the reader and the chip, allowing for accurate authentication and tracking [2].

In this project, we want to test and evaluate a system that is more complex than only RFID detection and punching approved admission attendance. The new plan is to implement a feature known as "scanning body temperature". So, whenever the student wants to enter the classroom, they need to scan their body temperature first before they enter the classroom. The buzzer will be beeping when the student temperature is high. So, with the feature we have mentioned above it makes a great ATTENDANCE system with its unique feature of scanning the body temperature of student.

A number of related works exist in literature, application of RFID Technology to different areas and specifically to the area of academic attendance monitoring problem. Author in [8] presents the remote monitoring of human body temperature (HBT) wirelessly by means of Arduino controller with different sensors and open source internet connection. The proposed monitoring system uses MLX90614 temperature sensor to design a contactless body temperature measurement system which is can be implemented in this RFID attendance system. Author in [9] review a student attendance system using Near-Field Communication (NFC) Technology. In this system the Author proposed to improve the manual attendance system by adding the new features replace the existing manual attendance system.

The Author in [10] aims to provide a new model for conducting of presence, a presence system that uses RFID technology. On the RFID card, there is a radio frequency mounted affixed to the reading machine, the system will automatically send student data into the database. Next, Author in [11] proposed to provide the customized microcontroller its own time and date system. This system used Real Time Clock (RTC) module to get the exactly sharp time and date which is can be implemented in RFID attendance system that can record the student time and date.

Keywords— RFID scanner, Identification (ID), Human Body Temperature (NBT)

2.0 MATERIALS AND METHODS

The components that were used in this system architecture as follows:

    a.   Arduino UNO
    b.   RFID Reader
    c.   SD Card Module
    d.   LCD
    e.   LED
    f.   RTC Module
    g.   Buzzer
    h.   Temperature Sensor (MLX90614)
    i.   Power Supply

Figure 1 shows the flow chart of the proposed system in this first temperature sensor will scan the body temperature of student. If below 37 degree Celsius then they can scan their Student ID, if higher than 37 degree Celsius then they cannot enter the classroom. After they tag the Student ID that have RFID chip, RFID reader will decrypt the code and send to the Arduino to decide whether they are early or late. Then, if early, green LED will light up, if late, red LED will light up. Both early or late, the buzzer still makes the sound. Next, LCD will display the UID card, time and date right after the LED indicator light up. Lastly, they can enter the classroom and data will be saved in the micro SD card.

a. Arduino UNO

The most important component of this project is Arduino Uno. The function of Arduino UNO in this project is to get the information from 2 process that were have in this project. The first process is Arduino will get all the information from RFID sensor then it will send to LCD to display all the information. The second process is Arduino will get the information from the temperature sensor and give the permission to the user. It is microcontroller kits or we called

it as a brain for this project for building digital devices and interactive objects that can sense and control objects in the physical world [3]. It is an Atmel Pico power 8-bit AVR RISC microcontroller with outstanding performance. It has 32KB ISP flash memory with read-write capabilities, 1KB EEPROM, 2KB RAM, 23 general purpose input–output lines, 32 general purpose working registers, three flexible timer/counters with compare modes, serial programmable USART, SPI serial connection, and 6-channel 10-bit A/D converter. The voltage range for this controller is 1.8V to 5.5V.
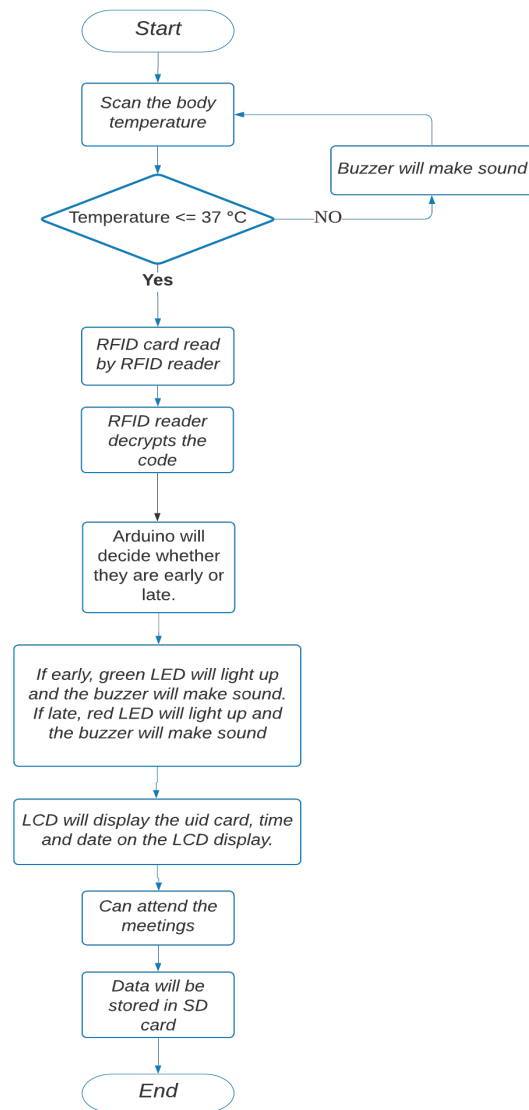

Figure 1 Flow chart of Design System

b. *RFID Reader*

RFID reader is important sensor to make this attendance system project successful. It come with the RFID card which is react as a student card and also save the information of the individuals. The purpose of RFID reader is to decrypt the code and get all the information on the card and it will send to Arduino to ensure that the student is the right person and also to know whether the student is early or late to the class [4]. RFID Readers, also known as Proximity Coupling Devices (PCDs), read data from RFID tags at a specific frequency [5]. In the case of a passive tag, the reader generates a radio signal that energizes the tag and transmits a signal that the reader can read. The reader converts the received data and sends it to the forwarding system via wired or wireless communication. Multiple frequency-based tags can be read by a single reader.

c. *SD Card Module*

The micro SD Card Module is used in this project is to put the SD card which is to save the student data that comes to the class and it will store the student information. The information of student that will come to the class will be save first in the SD card then after the student touch the card into the RFID reader, SD card will give the information whether the student is the right person or not. The SD card also is known as a database in this system. Another information that will be save in this SD card is information about the time of that student coming to the class. With this SD card, lecturer will be easy to access the record of student attendance.

d. *LCD*

The main purpose of LCD in this proposed design is to display the information like student code and name, welcome message that stored on the SD card when tag match with the based code. The configuration of the LCD used is 16x2.

e. *LED*

The used of LED is just for the indicator to show the student whether it is early or late to the classroom. Green LED is for early student and red LED is for late student.

f. *RTC Module*

g.

RTC is most well known as real time clock. The function of this RTC module is to get the exact date and time of student that attends the classroom [6]. RTC module will record time and date of the student and then it will send to database which is SD card to store the information. This RTC module time and date is always up to date and this device can keep the accurate date and time all the time.

h. *Buzzer*

The purpose of the buzzer is to make the beeping sound when the student tag their student card onto the RFID reader. The main purpose is to make beeping sound continuously when the student body temperature is higher than 37 degree Celsius.

i. *Temperature Sensor (MLX90614)*

The temperature sensor that use in this device is MLX90614. The purpose of this temperature sensor is to take the body temperature of the user after they punch the RFID card and scan their face to know whether they have fever or not. Due to the Covid-19 pandemic all people have to scan their body temperature before enter any places, this is one of the reasons that this project has to put this temperature sensor. This temperature sensor measurement is very accurate and it can measure the temperature from -20C until 120C [8].

j. *Power Supply*

The proposed design supplied through the regulated supply unit that is using a voltage regulator (7805-IC). Which takes input as 9-volt battery and get output as 5 volts? So, after this pure direct current voltage obtained from the regulator applied to the proposed design [7]. The figure 2 show the RFID Attendance System block diagram to show the project process flow of the hardware of this project.
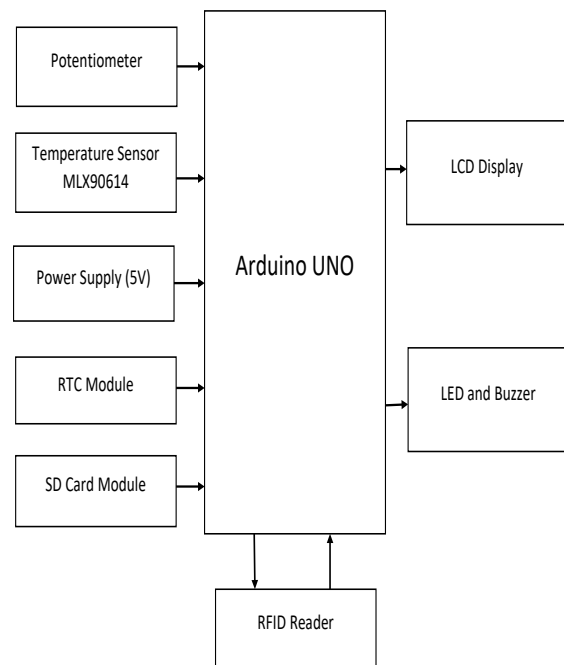

Figure 2 RFID Attendance System Block Diagram

To ensure that the device can be switched on with the detection all of the components. The entire system consists of RFID reader, temperature sensor, power supply, RTC module and SD card module as an input to this system. For the output it consists of LCD display, LED and buzzer. The input and output of this system are control by the processor which is Arduino UNO.

2.1 Simulation setup

There are six experiment that have been conducted in this project. These six experiments have been divided by three which is for the first type of experiment was conducted on the MLX90614 temperature sensor for experiment 1, 2, and 3. Next type of experiment was conducted on RFID sensor for experiment 4, and 5. For the last experiment was conducted to test the function of RTC module and SD card module. All this experiment was done on the testing process of this project and will be explain on the result section under the result of the testing. The following experiment are undertaken:

Experiment 1: Detect the present of student to scan their body temperature between MLX90614 temperature scanner and normal temperature scanner.

Experiment 2: Detect the present of heat, which is the heat must be higher than normal body temperature such as 38 – 40 degree Celsius.

Experiment 3: Detect the different ambient temperature.

Experiment 4: Conduct experiment on 20 student that own the student RFID card and tag their card at the RFID reader before the actual time that was setting on the Arduino to detect LCD display that they were early to the classroom.

Experiment 5: Conduct experiment on 20 student that own the student RFID card and tag their card at the RFID reader after the actual time that was setting on the Arduino to detect LCD display that they were late to the classroom.

Experiment 6: Record the date, time and card UID in a manual write datasheet and compare with all the data in the SD card whether it is same or not.

3.0 RESULTS

A. Result of Circuit Diagram

Figure 3 shows the circuit diagram of this project which is contain all the components that needed and the connection between it. All of this circuit then implemented on the real breadboard to get the result whether is it the circuit is correct

or not. After the circuit is completely build onto the real breadboard, the coding was insert into the Arduino UNO microcontroller to get the final result.
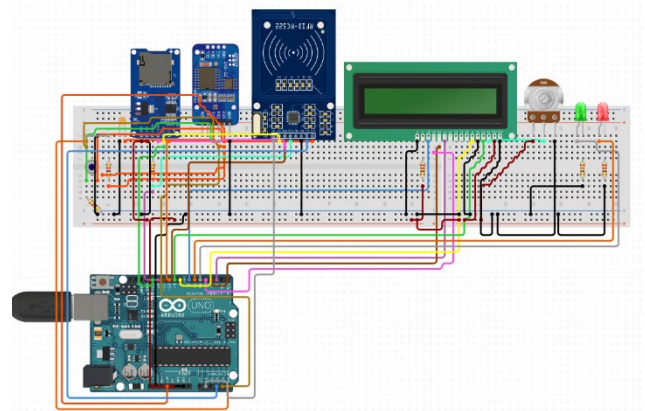

Figure 3 Circuit Diagram of Proposed Design

The final result of this project is the circuit is running based on what had been design and follow all the step in the flow chart. The first step was the user need to scan their body temperature. If it is higher than 37 degree Celsius, the buzzer will sound. Then, the RFID card was tag on the RFID reader then it will decrypt the code and send it to the Arduino UNO to make sure is it the user is early or not to this system. Then the LED indicator will light up based on the user, if the user is early then the green LED will light up, and if the student is late then the red LED will light up. All the data such as date, time, student ID, and early or not will be saved on the memory card in the SD card module and also will show in the LCD display and serial monitor in the Arduino IDE.

After the real simulation is done and working as planned, some of the active components will connected to the jumper wire and some parts of the wire will be solder into the strip board. Figure 4 and figure 5 show the view of the strip board of this project that have been solder. The wire that have been solder on the strip board was wire ground, 3 Volts and 5 Volts power supply, and 10,11,12,13 Arduino pins. The wire is soldering together because some of the components is sharing the same pins from Arduino.
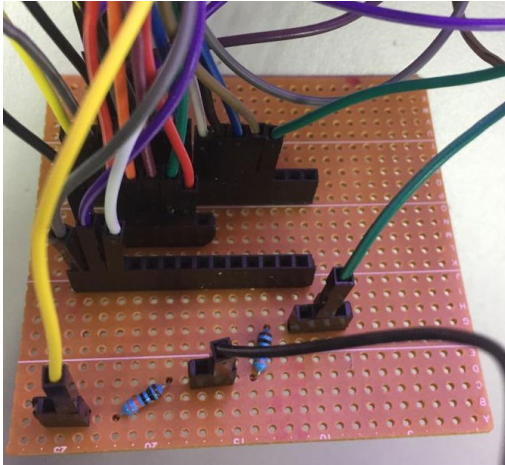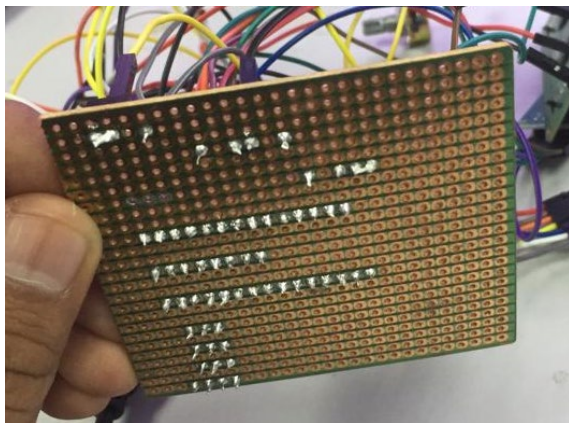
Figure 4 The top view of the strip board

Figure 5 The bottom view of the strip board

Figure 6 Front view of the prototype

It demonstrates a temperature sensor and RFID sensor mounted on top of the casing as shown in the above figure. The RFID sensor is connected to the Arduino and display to make sure it is easy for the user to tag their card. The green and red LED is placed below the RFID reader to show whether the student is early or late to the classroom after they tag their student card. The location of the buzzer is put under the LED to make sure the sound of alarm will be hear clear and loud by the user.

The location of the temperature sensor is placed in contrast with the RFID reader because the student needs to scan their body temperature at the first place before they scan their student card. The SD card module were placed at the side of the casing because it is not important to student but it is very important to the lecturer to check the data of the student that attend the class.

The location of the 16x2 LCD display is located in front of the prototype to make sure the user can see all their information. The potentiometer was mounted under the LCD display to make the user easier to setup the brightness directly if they cannot see the information.

A.   Result of the Prototype

This section defines the overall design of the project prototype. Each component's placement in this project has been specified. The project consists of several parts, such as the sensor for the Arduino Uno, RFID sensor, SD card module, RTC module, temperature sensor, LCD display, LED, buzzer and potentiometer.

B.   Result of the Testing

Testing on Temperature Sensor

The first tests that were performed on the temperature sensor is shown on the table above. The table displays the body temperature of 20 students that has been taken by using MLX90614 temperature sensor and normal temperature scanner. The table show the comparison between two temperature scanner and the rate of accuracy of the sensor. The result show that the temperature sensor MLX90614 is able to detect the present of student with high rate of accuracy which is 99 % and above. The result is taken by the student scan their hand or forehead in front of the temperature sensor MLX90614 and record the result. After that the student scan again their temperature sensor by using normal temperature scanner and record it to compare with the body temperature that was scanned by MLX90614. Next, the rate of sensor sensitivity was calculated to see the accuracy of the sensor.

Name of student	Student body temperature taken by using MLX90614	Student body temperature taken by normal temperature scanner	Rate of sensor sensitivity (%)
Satar	35.8	35.9	99.72
Nadzmi	36.2	36.4	99.45
Abdul	36.4	36.3	99.72
Baihaqi	35.9	36.0	99.72
Jai	36.1	36.2	99.72
Nazirul	37.0	36.8	99.45
Atiqah	36.6	36.7	99.72
Mursyid	37.2	37.0	99.45
Arsyad	36.5	36.4	99.72
Nami	35.8	35.8	100
Faiz	36.0	36.0	100
Din	36.8	36.7	99.72
Aiman	36.7	36.6	99.72
Afiq	37.1	37.0	99.72
Amin	36.0	36.0	100
Mad	36.2	36.1	99.72
Aisya	36.9	36.9	100
Sara	36.7	36.6	99.72
Man	36.3	36.5	99.45
Ahmad	37.0	37.2	99.45

Table 1 Result of Comparison between MLX90614 temperature sensor between normal temperature scanner

Figure 7 Testing on temperature sensor by using lighter

Based on the figure 7, the second types of tests that were taken on the temperature sensor is the ability to detect the present of heat. The test that were taken by using the heat is higher than normal body temperature such as 38 – 40 degree Celsius. The test is taken to test the ability and the sharpness of the sensor when taking the result of the student. The result of the test shown that the MLX90614 sensor can scan the heat temperature up to 100 degree Celsius and it also can take the sharp reading of the temperature. The reason why this test is important because when the sensor is implemented on this project, it will scan the higher body temperature of the student and will not allowed them to enter the classroom.

No. of places	Types of places	Actual temperature of the places (degree Celsius)	Temperature of the places taken by MLX90614 temperature sensor (degree Celsius)
1	Cold Temperature	15	15
2	Room Temperature	23	22
3	Hot Temperature	33	34

Table 2 The result of the ambient temperature at 3 different places

The third tests were to test the ability to detect the different ambient temperature. This test has been carried out in 3 different places as shown in the table 2. The first place is in the refrigerator to make sure the sensor can catch up the cold condition environment. The second place is room temperature because it is the normal temperature that use in daily condition which is very suitable ambient temperature to set up this project. The third place is under the sun to make sure the ambient temperature is hot to test whether it can adapt or not with the hot condition. All the test on the temperature sensor MLX90614 has been running smoothly and can recorded the data very well.

Testing on RFID Sensor and Data Storage

The first test that was done on RFID sensor was to test the ability of 20 student that own the student RFID card to tag their card at the RFID reader before the actual time that was setting on the Arduino to show that they were early to the classroom. The reason of the test is to determine whether the system is working as planned or not. The result show that all of 20 student that was set up to use this system before the actual time was working as planned which is the LCD display show the sign 'You are welcome' and the green LED will light up when they were early to the classroom.
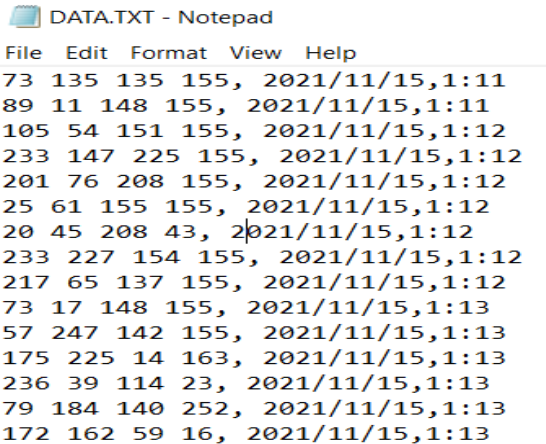
Table 3: 20 students that early to enter the classroom and their time. (The actual time was set at 9am)

Name of student	Time enter the classroom	LCD Display	LED indicator (Green/Red)
Satar	8.15 am	You're Welcome	Green
Nadzmi	7.41 am	You're Welcome	Green
Abdul	7.23 am	You're Welcome	Green
Baihaqi	8.20 am	You're Welcome	Green
Jai	8.41 am	You're Welcome	Green
Nazirul	7.15 am	You're Welcome	Green
Atiqah	7.30 am	You're Welcome	Green
Mursyid	8.01 am	You're Welcome	Green
Arsyad	8.06 am	You're Welcome	Green
Nami	8.45 am	You're Welcome	Green
Faiz	7.00 am	You're Welcome	Green
Din	8.43 am	You're Welcome	Green
Aiman	8.59 am	You're Welcome	Green
Afiq	8.05 am	You're Welcome	Green
Amin	8.50 am	You're Welcome	Green
Mad	8.55 am	You're Welcome	Green
Aisya	8.46 am	You're Welcome	Green
Sara	8.33 am	You're Welcome	Green
Man	8.47 am	You're Welcome	Green
Ahmad	8.34 am	You're Welcome	Green

Name of student	Time enter the classroom	LCD Display	LED indicator (Green/Red)
Aziz	9.15 am	You're Late	Red
Syamin	9.41 am	You're Late	Red
Nad	9.23 am	You're Late	Red
Muadz	9.20 am	You're Late	Red
Kamal	9.41 am	You're Late	Red
Naz	10.15 am	You're Late	Red
Atiq	9.30 am	You're Late	Red
Mus	9.01 am	You're Late	Red
Syad	10.06 am	You're Late	Red
Nadi	9.45 am	You're Late	Red
Faizal	10.00 am	You're Late	Red
Aziddin	9.43 am	You're Late	Red
Apik	9.59 am	You're Late	Red
Ali	9.05 am	You're Late	Red
Aman	9.50 am	You're Late	Red
Madri	9.55 am	You're Late	Red
Aisyah	9.46 am	You're Late	Red
Sarah	9.33 am	You're Late	Red
Osman	9.47 am	You're Late	Red
Saat	9.34 am	You're Late	Red

Table 4 20 students that late to enter the classroom and their time. (The actual time was set at 9am)

This test was done to test the ability of 20 student that own the student RFID card to tag their card at the RFID reader after the actual time that was setting on the Arduino to show that they were late to the classroom. The reason of this test was held is to detect whether the system such LCD, LED and the RFID sensor is working as planned or not. The result show that all of 20 student that was set up to use this system after the actual time was working as planned which is the LCD display show the sign 'You are late' and the red LED will light up when they were late to the classroom.

Figure 7 Data in the SD card

Figure 7 show the data in the SD card after the 15 students tag their card on the RFID reader. The third test in this section was to test the ability of the date, time and card UID to record all the data in the SD card whether is it correct or not. The test that were taken was involved with 15 student that use this attendance system randomly, then the actual time was set at 8 am. The data was recorded in 2 ways, the first way was recorded by using manual record and the second way is by using this system auto record in the SD card. Next, the manual record data will be compared to the data that the system was taken in the SD card. The reason was to check, whether the data that was taken in the SD card was correct or incorrect. The final result of this test was successful and all the data of 20 students that used this system is correct and got no problem.

4.0 DISCUSSION

In this section, we identify some limitations and discuss future plans for our system. For this prototype, due to SD card module limitations, we can put only 32 GB memory card because of the maximum capacity of the SD card module. However, with that capacity of memory card, it still can store student data by placing the RFID card almost 900 million times. In addition, this system also cannot link MySejahtera apps that have been made by our government to assist in managing the Covid-19 outbreak in the country.

If this system can link with the apps it is also can assist in managing the Covid-19 outbreaks not only in the country but also in the university and campus.

5.0 CONCLUSION

The RFID based security and attendance system is quicker and fast responded as compared to the other system such as manual attendance system. This project has been successfully designing a quick and easy device for attendance system. In this project a prototype has been developed to access control system so it will facilitate the lecturer to take student attendance. A few tests have been conducted and evaluated a system that goes beyond only RFID detection attendance. This system helps to improve the current attendance system. The achievement and successful rate of this system has been successfully got 98% function as the flow chart. Lastly, this system can help administrators save time and money. Such a system also reduces staff workload and increases efficiency.

Future Scope: If we talk about future scopes then it depends upon how innovative one could be to enhance the use of this project. But for this project is very useful for future e.g. –

1) To set up the project to accept higher memory card up to 64 GB and above.
2) Use cloud to store the data to save more cost on buying the SD card.
3) To link with MySejahtera apps to assist in managing the COVID-19 outbreaks in the university and country.
4) For tagging animals.
5) Uses in ATM machines.
6) To save students by tracking their attendance.
7) Use in car lock keys and engine start by placing the card in front of reader.
8) Make things environment friendly.
9) Gaming zone and many more future uses.

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