iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VI **Month of publication:** June 2021

DOI: https://doi.org/10.22214/ijraset.2021.34904

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

RFID based Attendance Management System

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Abstract: ***This paper presents the Radio-Frequency Identification (RFID) based attendance management system for the employees of a company, institute, or organization. This system is developed for a daily purpose attendance recording system in every organization.***
In every corporate organization or company, a proper attendance management system plays a vital role in managing the salaries of employees. As we are all aware that proper maintaining of attendance will help the organization to track the regularity and sincerity of employees towards their occupation. And now in this digital world maintaining attendance manually using pen and paper has become outmoded. In earlier days, when the employees gave their attendance using pen and paper then discrepancies occurred in the entries by employees and for this during the time of entry even if the employee was late they are not marked accordingly, and there led to the improper evaluation of attendance. The time comes when the management analyses the record of each employee's attendance and there arises a big issue with date and time and that particular employee's attendance can be analyzed over the month.
To overcome these shortcomings we had developed a system that not only removes the tedious task for tracking attendance manually but also helps in maintaining a system of records that will also help the organization with the proper and appropriate evaluation of salary, regularity, and even punctuality of an employee's attendance. The main purpose of developing RFID based attendance management system is to computerize the attendance of each employee in an organized manner. Each employee of that organization will be having their ID card and the backside of the ID card is having an RFID tag and as employee scan their id card while entering, then their necessary details will automatically get stored in the database and which can be then computed.
Keywords: Radio-Frequency Identification (RFID), Arduino, Liquid Crystal Display (LCD), SD Card module, Real-Time Clock (RTC).

I. INTRODUCTION

Full form of RFID is "Radio-Frequency Identification" and it refers to a technology where the digital data are encoded in RFID tags. Generally, an RFID system contains three components: an RFID tag, an RFID reader, and an antenna. RFID tags contain a microcircuit and an antenna, which transmit data to the RFID reader. RFID systems use radio waves to enter the data directly into computer systems through an RFID reader. RFID systems are generally used in:

A. Access Control

RFID Readers are placed at entrances of every organization that require a person to scan their ID card (RF tag) so that the person can be accessed.

B. Contactless Payment System

RFID tags help to carry out the payments. It is done in such a way that the tags are attached to vehicles and when the vehicle reaches the toll station the RFID reader automatically identifies the RFID tags on the vehicles and accordingly toll taxes are charged. And payments are then accordingly deducted from the user's account, or information gets updated directly with help of the RFID tag.

C. Product Tracking System

RFID systems are commonly implemented to track and record the movement of ordinary items. For example, in libraries, each book's RFID tags are attached to it. As it is done to keep the record that which book is taken from which department and by whom at what time. Similarly, in clothes warehouses also or any shopping malls, electrical goods, and this product tracking system using RFID system gives us to track product in a computerized manner.

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Shown below in Fig 1. is a typical RFID system. In every RFID system, the transponder tags contain a single binary bit or a large array of bits representing every RFID tag which are known as an identification code or any type of information that can be stored in the digital binary format during the formation of RFID tags.

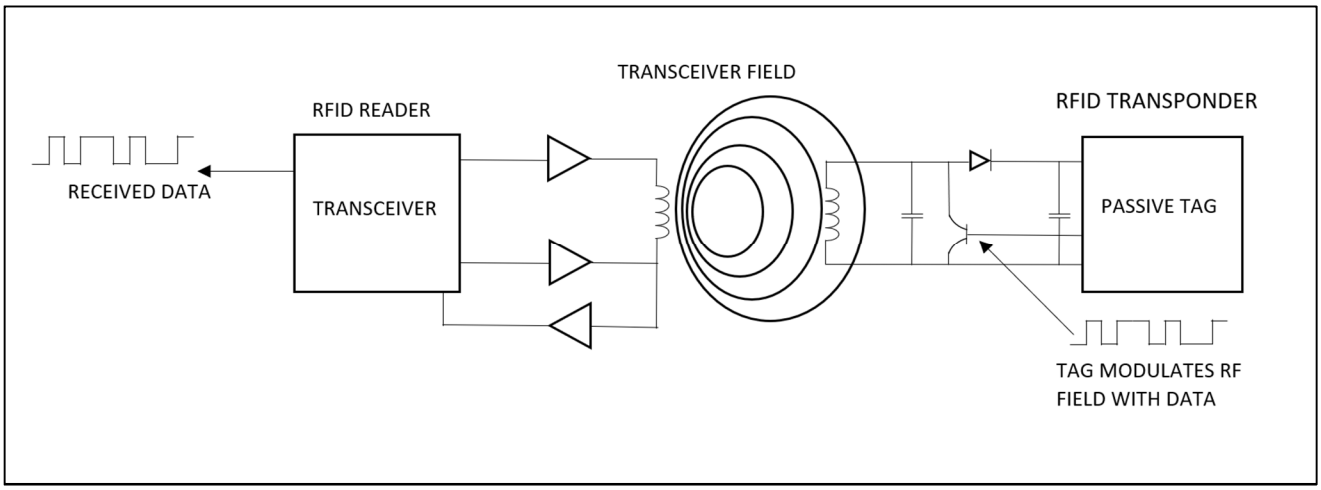

Fig. 1 RFID based system

The transceiver RFID communicates with a passive tag. Passive tags do not own any power source so; they derive power from the incident electromagnetic field. The most important part of a tag is the microchip. When the tag enters into the generated RF field it's ready to draw sufficient power from the electromagnetic field to access its internal memory and transfer its stored information. When the transponder tag draws power, by this way the interaction results of the RF fields cause the voltage at the transceiver antenna to fall in value. Now, this effect is handled by the Tag to convey its information to the reader. The amount of power drawn from the field is now able to be managed by the Tag and by doing so it can regulate the voltage sensed at the transceiver consistent with the bit pattern it wishes to transmit. A primary RFID system consists of three components: a coil or an antenna, a transceiver, and a transponder (RF tag).

II. SYSTEM ARCHITECTURE

In this system, each employee is issued an RFID card as their ID card, and their attendance is marked once they touch their card to the RFID reader. When the employees are scanning their card, then the date of entry, the time of entry, and the card ID number are recorded and saved in SD card during this process. When an employee enters at that particular time, his arrival time will be stored in the system using the command displaying “You’re Welcome” message on the LCD screen and green led will glow. When an employee enters late, his arrival time will be stored in the system using the command displaying the “You are Late” message on the LCD screen, and for that employee yellow led will glow.

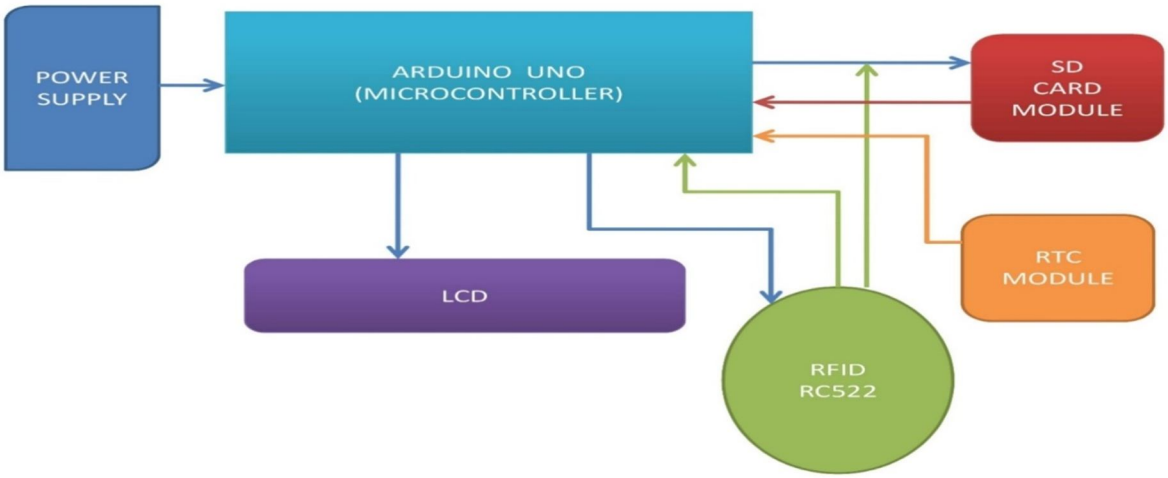

Fig. 2 Our Proposed System

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A. Circuit Design

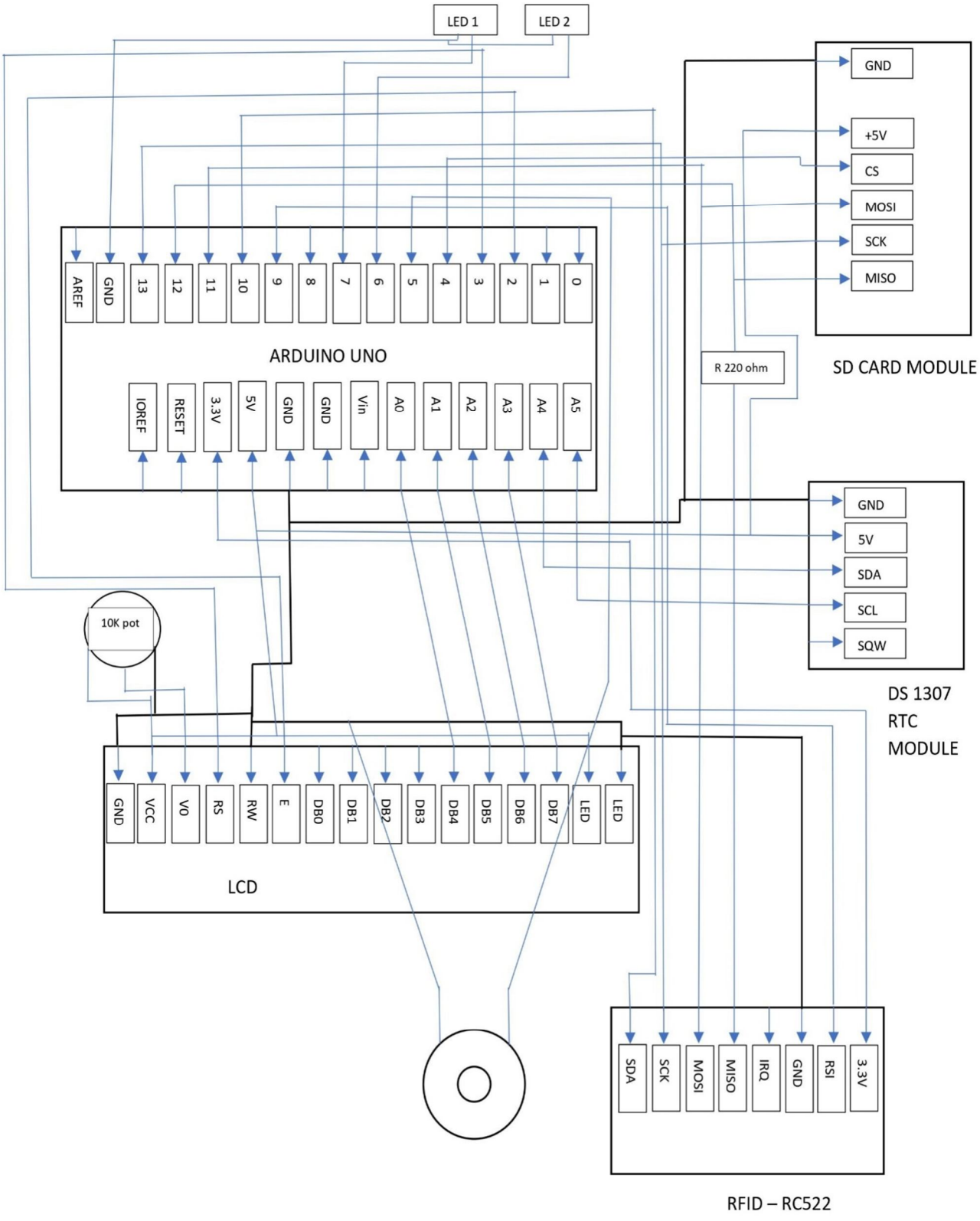

Fig. 3Circuit diagram of our proposed work

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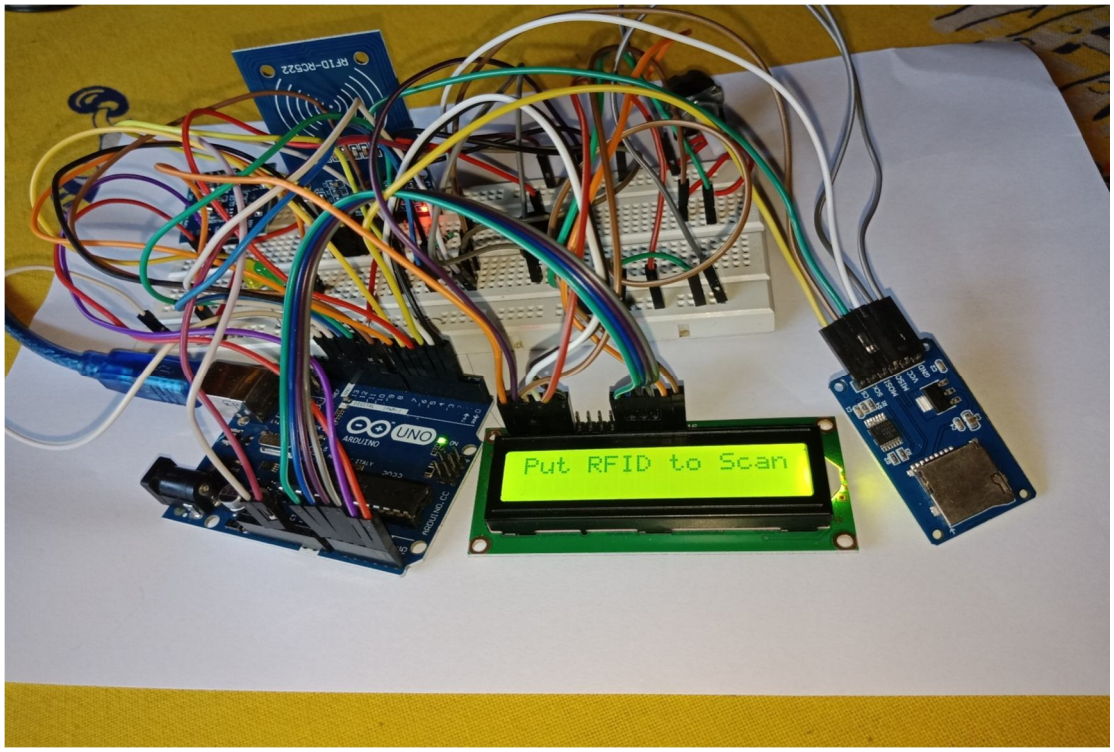

Fig. 4Our Experimental Setup

B. Arduino UNO

Arduino UNO which is shown in Figure 5 is a microcontroller board. It is based on the ATmega328P.

This Arduino UNO consists of –

Power USB - this pin is used for giving the power to Arduino Board from the Computer by using a USB cable.

Power (Barrel Jack) - this pin is used for giving direct power from the AC mains power supply to Arduino Board.

Voltage Regulator - The function of this pin is to control the given voltage in Arduino Board and stable the DC voltages.

Crystal Oscillator - Crystal Oscillator assists Arduino with time issues.

Arduino Reset - this pin is used to reset the Arduino Board.

Pins (3.3, 5 GND, Vin) - Supply 3.3 output voltage
Supply 5 output voltage
GND - used to ground the circuit
Vin - This Vin pin also used for giving the power to Arduino Board from outer power source like AC mains.

Analog Pins - Arduino UNO board has a total of six analog input pins, from A0 to A5.

Digital I/O - Arduino UNO board has a total of 14 digital I/O pins. Within these 14 pins, 6 pins can be used to provide PWM outputs. These pins can also be used to work as digital input pins to read digital logic values (0 or 1)

TX and RX LEDs - TX stand for Transmit and RX stand for Receive. As the digital pins 0 and 1 are responsible for serial communication, the TX led flashes with different flashing speeds while sending the data serially and the RX flashes during the data receiving process.

Power LED indicator - this LED lights up when the Arduino board is plugged with a power source to indicate the board is connected with the power supply successfully.

ICSP Pin - Basically ICSP is an AVR consisting of MOSI, MISO, SCK, RESET, VCC, and GND. These ICSP pins behave like an AVR programmer which assists to code the Arduino UNO.

AREF - AREF's full form is Analog Reference. Sometimes, it is used to set an outer reference voltage (from 0 to 5 V).

Main microcontroller - Every Arduino board must have its microcontroller. It is the main part of the whole Arduino board.

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C. RFID-RC522 Module

RFID stands for Radio Frequency Identification system which is shown in Figure 6.RFID-RC522 consists of two main components - (1) A Transponder or Tag which have to attach with an object to be identified, and (2) A Transceiver which is also known as an Interrogator/Reader. A Transceiver / Reader consists of Radio Frequency Module and an antenna for generates high-frequency emf. On the other side, the Transponder is a passive device. It contains a microchip which will be used to store and processes information and an Antenna for receive signal and transmits the signal. Tag is placed with very close nearness to Reader to read the information which is encoded on the Tag. The Reader generates an emf which causes the electron movement through the Transponder's antenna and then powers the chip.

The powered chip which is present inside the tag then gives its response by sending the information stored in it back to the reader in the form of a radio signal which is different from the original one. This is termed a back-setter. The reader then detects and interprets the back-setter or change in the electromagnetic/RF wave and then the data is sent to a computer or microcontroller.

RFID-RC522 has a total of 8 pins. The 8 pins are -

1) Pin 1 - VCC - It is the power pin of the RC522 module.
2) Pin 2 - RST - It is the reset pin of the module.
3) Pin 3 - GND - GND or Ground helps to make a common ground connection with every external device.
4) Pin 4 - IRQ - If the device goes into sleep mode to save power, then this IRQ pin helps to wake up it.
5) Pin 5 - MISO, SCL, TX - This pin helps to connect with the Arduino Board / Microcontroller Board for the SPI communication system. It helps to transfer data from the module to the Arduino Board. It can also port with I2C for CLOCK pulse and UART (Universal Asynchronous Receiver Transmitter) Serial to Data transfer from the module.
6) Pin 6 - MOSI - It is the data input pin for the RFID module in the SPI communication system.
7) Pin 7 - SCK - This pin i.e., SCK pins helps to send the required clock pulse for SPI communication.
8) Pin 8 - SS, SDA, RX - The SS pin is a chip enable pin for SPI communication. Then, it receives the signal when the Arduino makes the SPI communication.

The SS pin is also useable as the SDA in I2C communication.
The SS pin also helps to receive data during the UART communication.

D. LCD 16X2

The term LCD stands for Liquid Crystal Display. It is a type of electronic display module which is used in a wide variety of applications in various circuits and devices such as computers, mobile phones, calculators, television sets, and so on. These displays are more preferable for their multi-segment light-emitting diodes and seven segments. The chief advantages of using this module are that it is less expensive and it can be simply programmed, having no limitations for displaying custom characters, special and even limitations. LCD 16x2 is shown in Fig. 7.

E. SD Card Module

The Micro SD Card Adapter module is a Micro SD Card module as shown in Fig. 8. To enable the microcontroller system to complete the Micro SD Card read and write files, the SPI interface via the file system driver is implemented. The Arduino IDE associated with a DC Card is directly used by the users to complete the library card initialization and read-write.

F. DS 1307 RTC Module

The DS1307 serial is known as Real-Time Clock (RTC) which is shown in Fig.9. It is a complete binary-coded decimal (BCD), low power clock/calendar having 56 bytes of NV SRAM. A 12C, bidirectional bus facilitates the address and data to be transferred serially through it. The information regarding time, date, month, and year are provided by the clock/calendar. The end date of the months is automatically adjusted for months having less than 31 days, including adjustments for leap year. The clock functions either in a 12-hour or 24-hour format with an indicator for AM/PM. There exists a built-in power-sense circuit inside it that detects power failures and automatically switches to the backup supply.

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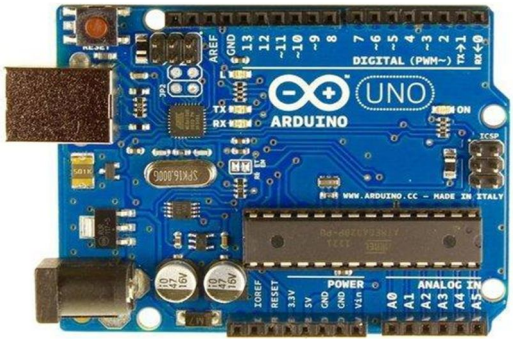

Fig. 5Arduino UNO

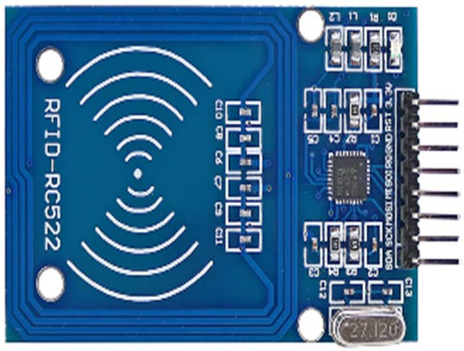

Fig. 6RFID-RC 522

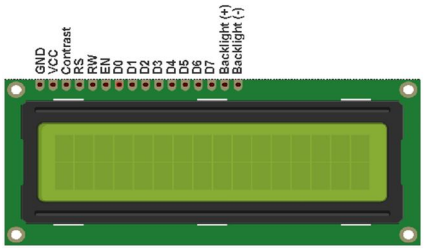

Fig. 7LCD 16 X 2

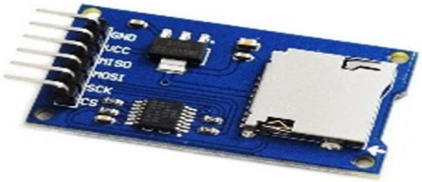

Fig. 8 SD card module

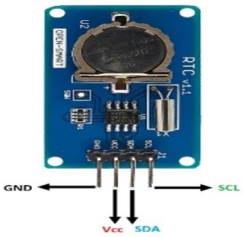

Fig. 9DS 1307 RTC Module

III. RESULT ANALYSIS

A. Time Period – 10:00 A.M to 11:00 A.M

1) Person 1

Tag UID – 119 223 196 105
Opening File…!! (The file on the SD card, where the data will get stored)
01:01:2021 10:20 (Current date and time provided by RTC module)
VERIFIED…!! (Person got successfully VERIFIED and he is good to go)
You are Welcome!
For on-time, the person will get himself entered. To indicate on-time GREEN light blinks along with a buzzer sound.

2) Person 2

Tag UID – 25 117 164 90
Opening File…!! (The file on the SD card, where the data will get stored)
01:01:2021 10:25 (Current date and time provided by RTC module)
VERIFIED…!! (Person got successfully VERIFIED and he is good to go)
You are Welcome!

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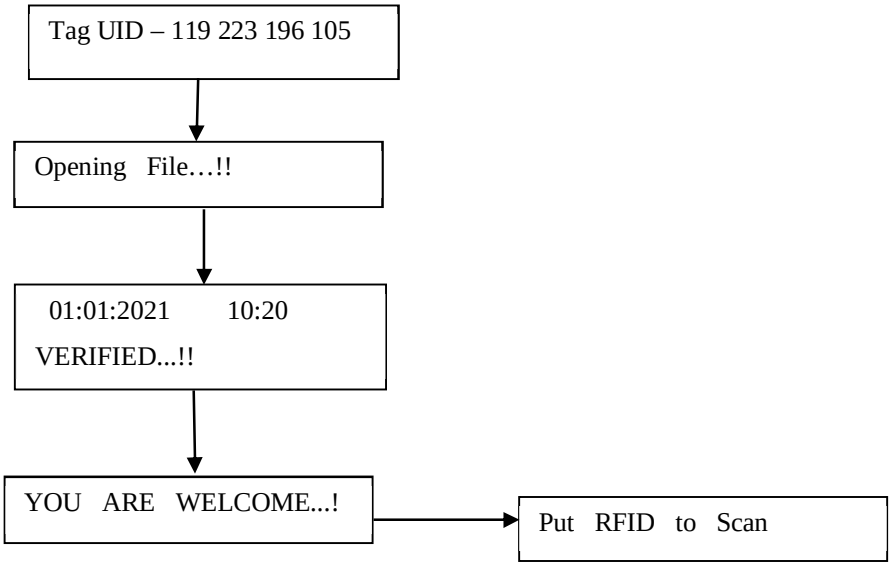
For on-time, the person will get himself entered. To indicate on-time GREEN light blinks along with a buzzer sound.



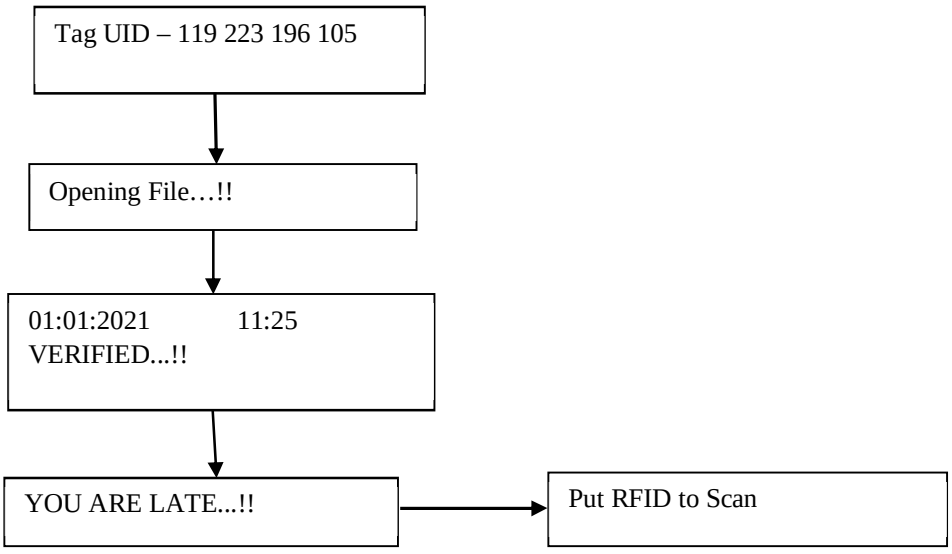
B. Time Period – After 11:00 A.M

1) Person 1

Tag UID – 119 223 196 105
Opening File…!! (The file on the SD card, where the data will get stored)
01:01:2021 11:20 (Current date and time provided by RTC module)
VERIFIED…!! (Person got successfully VERIFIED and he is good to go)
You are Late!
For off-time, the person will get himself entered. To indicate off-time YELLOW light blinks along with a buzzer sound.

2) Person 2

Tag UID – 25 117 164 90
Opening File…!! (The file on the SD card, where the data will get stored)
01:01:2021 11:25 (Current date and time provided by RTC module)
VERIFIED…!! (Person got successfully VERIFIED and he is good to go)
You are Late!
For off-time, the person will get himself entered. To indicate off-time YELLOW light blinks along with a buzzer sound.



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IV. CONCLUSION

In conclusion, the objective to build an RFID-based attendance system was accomplished. In terms of completion and efficiency, this project has provided a simple and suitable method of attendance marking compared to the traditional method of the attendance recording system. By using database technologies, the data becomes more organized. This system is also a user-friendly system for daily use as the data manipulation and retrieval can be done via the interface, making it a universal attendance recording system. Thus, it may be implemented in either an educational institution or in professional organizations. However, some further improvements may be made to this RFID to extend its reliability and effectiveness. An indicator can be incorporated into the system to indicate when any unregistered card is scanned at that time. Further, an IP camera may be integrated into it to observe the actions like buddy-punching wherein an individual cheats by scanning for someone else illegally.

V. ACKNOWLEDGEMENT

With a deep sense of gratitude, we thank all the people who have lit our path with their kind guidance. We are very grateful to those intellectuals who did their best to assist during our paper. It is our proud privilege to express a deep sense of gratitude to our B.Tech. Project Guide Ms. Rimpi Datta for her continuous guidance and support throughout our project and paper. It would never be possible for us to finish this project successfully without her guidance and support. We remain indebted to our H.O.D, Dr.Anilesh Dey, ECE Department, Principal, Dr. (Mrs.) M.R. Kanjilal for their comments and kind permission to complete this paper. We would also wish to thank them for the timely suggestions and valuable guidance. And lastly, we express our thanks to our friends and also the people those who are directly or indirectly associated with our paper.

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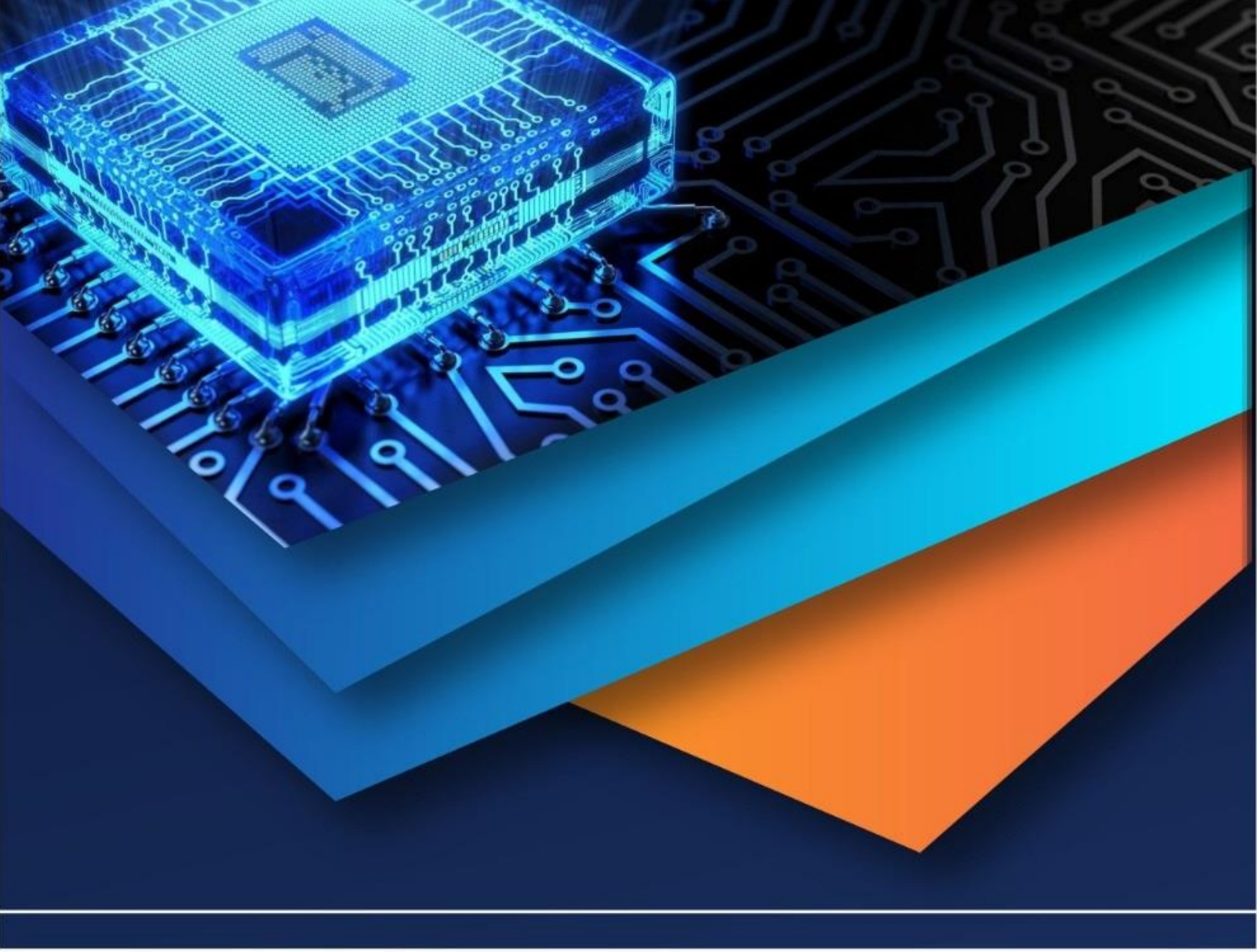

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