

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590018



Mini-Project Report on

## **RFID BASED SECURITY SYSTEM**

*Submitted in partial fulfilment for the completion of 6<sup>th</sup> semester*  
**Bachelor of Engineering**  
**in**  
**Electronics and Communication Engineering**

*Submitted by*

**Preeti Hombalmath**  
**Shobha Goudar**  
**Tulasi Valluru**

**2TG21EC041**  
**2TG21EC048**  
**2TG21EC059**

Under the Guidance of  
**PROF. LOHIT JAVALI**  
Assistant Professor



**Department of Electronics & Communication Engineering**  
**TONTADARYA COLLEGE OF ENGINEERING**  
Mundaragi Road, Gadag – 582101

**2023 – 24**

S.T.S.K.K's  
**TONTADARYA COLLEGE OF ENGINEERING**  
Mundaragi Road, Gadag – 582101



Department of Electronics & Communication Engineering

**CERTIFICATE**

Certified that the mini-project work entitled

**RFID BASED SECURITY SYSTEM**

is a bonafide work carried out by

**Preeti Homabalmath-2TG21EC041**

**Shobha V Goudar-2TG21EC048 , Tulasi Valluru-2TG21EC059,**

student of Tontadarya College of Engineering, in partial fulfilment for the completion of 6<sup>th</sup> semester of Bachelor of Engineering in **Electronics and Communication Engineering** , Visvesvaraya Technological University , Belagavi during the year 2023–24 . It is certified that all corrections/ suggestions indicated for Internal Assessment have been incorporated in the Report. The report has been approved as it satisfies the academic requirements in respect of mini-project work prescribed for the said Degree.

Name & Signature of Guide  
**Prof. Lohit J**

Name & Signature of HOD  
**Dr. Madhusudan K**

Signature of Principal  
**Dr. M M Awati**

# **ABSTRACT**

This paper RFID based security system is developed to build a security system for a use in hostel. Most educational institution administrators are concerned about student security especially in girls' hostels. The system RFID technology is used to accomplish the required task. When the RFID reader installed at the entrance of the girl's hostel that detect the number and scan the database for a match. Its ability to uniquely identify each person based on the RFID tag type of an ID card make a process of allowing security access easier, faster and secure as compared to conventional method. The RFID tag gives unique id whenever it reads the card information. This id information is sent to the microcontroller to check the correct card. If the card ID matches with the original information, is belong to a registered user access is granted.

# ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of any task would incomplete without the mention of the people who make it possible whose constant guidance and encouragement crown all the efforts with success.

I express my deep gratitude to our renowned institute, **Tontadarya College of Engineering, Gadag** which provided us an opportunity and platform for fulfilling our dreams, and desire to reach my goal. I sincerely thank our respected principal **Dr. M. M. AWATI**, who is the constant source of inspiration, throughout the academics.

Though it may appear that the following exposition is a monotonous boat of an unusual acknowledgement assert beyond the confines of the simple sense of the owned gratitude to pass on our deep felt thanks on our beloved HOD **Dr. MADHUSUDAN KULKARNI** on his excellent guidance.

I would like to place on record our heartiest gratitude to our guide **Prof. LOHIT JAVALI** for having taken us under his guidance. He continuously helped with his invaluable suggestions and excellent guidance.

I am grateful to my **Parents** who have been great support throughout the development of the mini-project. Last but not least I would like to extend my thanks to the **teaching and non-teaching staff** of our department, **friends** and **well wishers** for their timely help either directly or indirectly for the completion of the mini-project.

<b>1.Preeti Hombalmath</b>	<b>2TG21EC041</b>
<b>2.Shobha Goudar</b>	<b>2TG21EC048</b>
<b>3.Tulasi Valluru</b>	<b>2TG21EC059</b>

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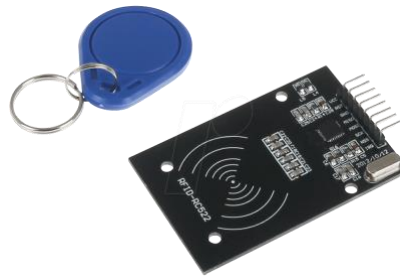
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## CHAPTER – 1

### INTRODUCTION

Radio Frequency Identification (RFID) is a form of wireless communication. It uses radio frequency to search, identify, track and communicate with items and people. It is a method that is used to track or identify an object by radio transmission over the web. In real life applications RFID can be used in various areas for extra security measures like in main doors of residential buildings, offices, hotels etc. See Fig 1.1



**Fig 1.1 RFID reader,card**

#### **RFID reader:**

An RFID reader is a radio frequency device that emits a signal through an antenna. This signal is received by RFID tags that respond to interrogation by the reader. Responses are read by the reader, and through a variety of protocols the reader can communicate with all the RFID tags in its field.

Readers are also called as interrogators, are devices that transmit and receive radio waves in order to communicate with RFID tags. RFID readers are typically divided into two distinct types – Fixed RFID readers and Mobile RFID readers.

#### **RFID tags:**

RFID tags are a type of tracking system that uses smart barcodes in order to identify items. The radio waves transmit the information to an RFID computer program. An RFID tag works by transmitting and receiving information via an antenna and a microchip – also sometimes called an integrated circuit.

Radio Frequency Identification (RFID) is a technology that uses radio waves to passively identify a tagged object. It is used in several commercial and industrial



applications, from tracking items along a supply chain to keeping track of items checked out of a library.

Radio Frequency Identification (RFID) is a type of passive wireless technology that allows for tracking or matching of an item or individual.

The system has two basic parts: tags and readers. The reader gives off radio waves and gets signals back from the RFID tag, while the tag uses radio waves to communicate its identity and other information.

The technology has been approved since before the 1970s but has become much more prevalent in recent years due to its usages in things like global supply chain management and pet microchipping.

## CHAPTER – 2

### LITERATURE SURVEY

This project explained how the RFID system was used for security purpose overcoming the old techniques . The author clearly pointed out RFID's typical applications and how can it be implemented . Explanation about the comparison of bar codes and RFID was discussed in this paper .Inth is paper, experiment study was conducted to study the architecture of RFID and its components . This paper pointed out to optimize the cost of security system using RFID. L. Bolotnyy and G. Robins, “PHYSICALLY UNCLONABLE FUNCTION-BASED SECURITY AND PRIVACY IN RFID PERVASIVE COMPUTING AND COMMUNICATIONS” has explained that it is impossible to create a RFID tag with same unique identification code of another RFID tag.

#### **2.1 RFID and Face Recognition Verified Contactless Attendance System**

The institutions and organization generally use fingerprint recognition and signature-based attendance system to mark the attendance. The fingerprint recognition system is secure and reliable but in both the process user has to get in contact with the surface of the attendance system, which can cause the spread of viruses and bacteria among the people, for example, diseases like COVID-19, influenza and the common cold can spread through getting in contact with a contaminated surface.

The behaviour of workers in a company is judged on the basis of their job performance, particular assessment role which is tracked by their daily attendance. Members will be kept responsible for observing their proper work schedule in order to ensure adequate service, good workplace ethics, and to achieve expected productivity and functional expectations within the organization.

#### **2.2 Multi-Security System Based on RFID Fingerprint and Keypad to Access the Door**

It is necessary to prepare for the increasing crime rate of household theft with a modern home security system that allows customers to monitor home security remotely. This can be accomplished by replacing the standard lock with a solenoid door lock, which is more difficult to duplicate and reduces the likelihood of theft when the house is

unoccupied. Researchers developed a three-tiered home security system prototype that includes fingerprint, RFID, and keypad biometric sensors.

### **2.3 RFID and GSM Based Three Level Security System**

Constant technological advancements have been made in the field of developing security systems over the past few years. 'Radio frequency identification' (RFID) and 'Global system for mobile communication' (GSM) are a few fields in which security systems have propelled to new heights. RFID has been used widely for database management in places like malls and office areas. GSM is also used as a medium of interaction between the customer and back end devices in various fields. The individual needs to have the pre-defined card, an RFID tag and a mobile phone whose contact number is given beforehand.

### **2.4 Attendance and Information System Using RFID and Web-Based Application for Academic Sector**

Recently, students attendance have been considered as one of the crucial elements or issues that reflects the academic achievements and the performance contributed to any university compared to the traditional methods that impose time-consuming and inefficiency. Diverse automatic identification technologies have been more in vogue such as Radio Frequency Identification (RFID)

### **2.5 Student Presence Using RFID and Telegram Messenger**

RFID Reader is used as a medium for reading data transmitted through the RFID card and processed into a variety of data through radio signals. Using Telegram Messenger at school is expected to provide data on student attendance accurately through a system that can be monitored such as student attendance, the data of circular activity from the beginning to the end of the studying process. After that, the information obtained from the processing of Telegram Messenger is processed into a report for parents. Data that has been saved into computer will be then processed into weekly and monthly reports for the principle, management and parents.

## **CHAPTER-3**

### **PROPOSED WORK**

Passing the everyday in and out details a huge number of students in a hostel is risky as students can miss their mentioning there out and in time and it can hamper students security and safety .

It is waste of time as well as a student can give a false information and cheat on the record in the day-by-day record sheet. If the warden or watchman loses these documents, if all the significant records are lost without doubt of getting it back .

- To provide very higher accuracy and speed than a traditional paper-based system.
- To provide security and easy tracking of data.
- Implement fully automatic process.

There will high security given to girls and beliefs to the parents

## CHAPTER – 4

### REQUIREMENTS

The design and development of this mini-project requires hardware and software tools as listed below.

#### Hardware requirements:

- Node MCU –ESP8266
- MFRC522 RFID Reader
- Jumper wires
- RFID Tag
- Micro USB cabel

#### Software Requirement:

- Arduino IDE
- Google Form
- Google Sheet
- Php and Mysql

More details about these requirements are discussed here.

#### 4.1 Node MCU-ESP8266:

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

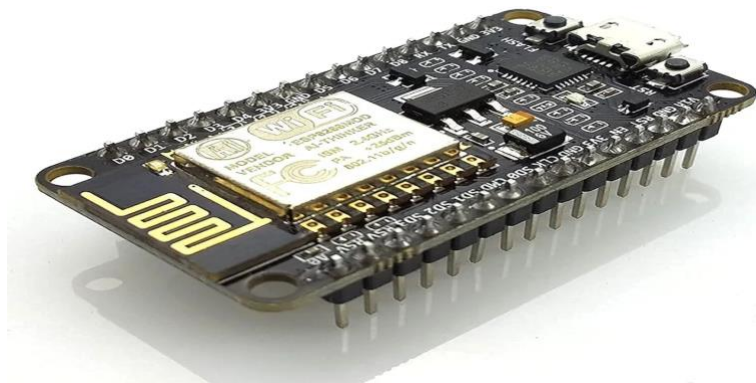


Fig 4.1 Node MCU- ESP8266 Board

#### Features of Node MCU-ESP8266 Microcontroller

**Memory:**

- Microcontroller ESP-8266 32bit
- NodeMCU Model- Amica
- ADC Range 0-3.3 v
- 4 MB Flash
- 64 KB SRAM
- Temperature Range -45C to 125C
- WiFi Built-In-802.11 b/g/n
- UART/SPI/I2C-1/1/1
- Operating Voltage-3.3 v
- USB Connector-Micro USB
- Clock Speed-80MHz
- Pin Spacing-0.9”(22.86mm)
- Input Voltage-4.5 to 10v

**Peripherals:**

- Power Pins: There are four power pins. VIN pin and three 3.3V pins. VIN can be used to directly supply the NodeMCU/ESP8266 and its peripherals. Power delivered on VIN is regulated through the onboard regulator on the NodeMCU module – you can also supply 5V regulated to the VIN pin 3.3V pins are the output of the onboard voltage regulator and can be used to supply power to external components.
- GND :are the ground pins of NodeMCU/ESP8266
- I2C Pins: are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.
- GPIO Pins: NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance. When configured as an

input, it can also be set to edge-trigger or level-trigger to generate CPU interrupts.

- **ADC Channel:** The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.
- **UART Pins:** NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) can be used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log.
- **SPI Pins:** NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:
  - 4 timing modes of the SPI format transfer
  - Up to 80 MHz and the divided clocks of 80 MHz
  - Up to 64-Byte FIFO
- **SDIO Pins:** NodeMCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.
- **PWM Pins :** The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000  $\mu$ s to 10000  $\mu$ s (100 Hz and 1 kHz).
- **Control Pins:** are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.
- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
- **RST:** RST pin is used to reset the ESP8266 chip.
- **WAKE:** Wake pin is used to wake the chip from deep-sleep.

## 4.2 Board Topology:

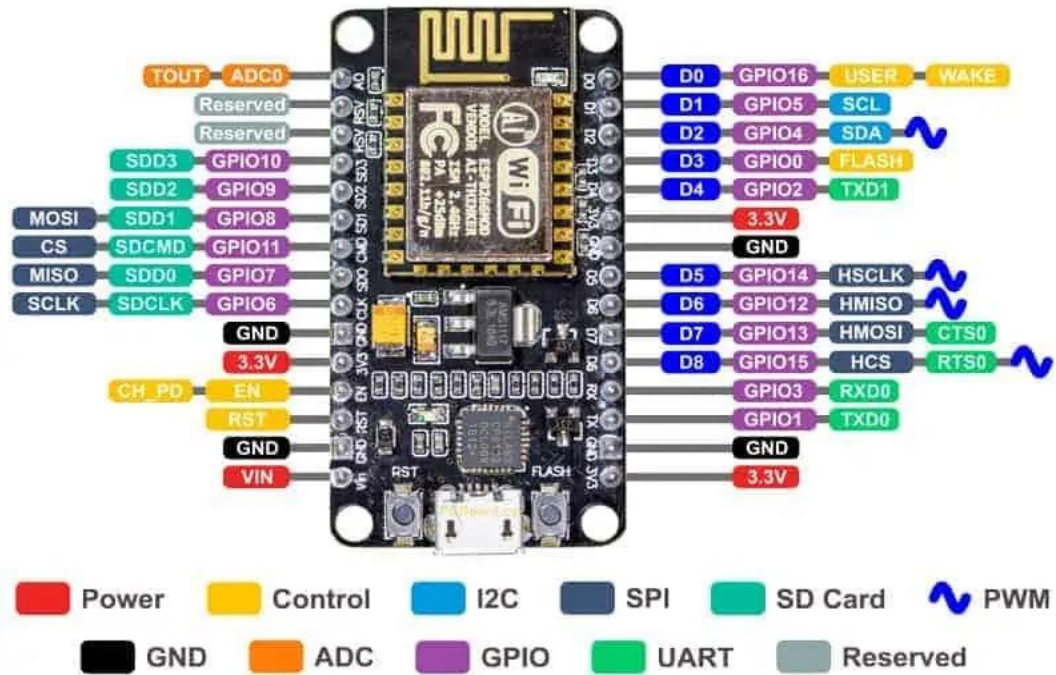


Fig 4.2 Board Topology

## Connector Pinouts and their description:

Table 4.1 Pinouts of Board

Pin Type	Pin Name	Pin Description
Power	Micro-USB, 3.3V, Vin, GND	<b>Micro-USB:</b> It can power the NodeMCU. <b>3.3V:</b> A regulated 3.3V supply can also power the NodeMCU. <b>Vin:</b> External power supply pin <b>GND:</b> Ground pins
Control pins	EN, RST	The button and pin can reset the microcontroller.
Analog pins	A0	It measures analog voltage within the range of 0-3.3v.
GPIO pins	GPIO1 to GPIO16	There are sixteen general-purpose input-output pins on the NodeMCU board.
SPI pins	SD1, CMD, SD0, CLK	There are four pins that work for SPI communication on NodeMCU.
UART pins	TXD0, RXD0, TXD2, RXD2	NodeMCU features two UART interfaces including UART0 (RXD0 and TXD0) and UART1 (RXD1 and TXD1). You can use UART1 to upload programs or firmware
I2C pins.		You can get I2C functionality support on NodeMCU. However, you have to find the I2C pin because of these pins' internal functionality.



### **Processor:**

The ESP8266EX microcontroller integrates a Tensilica L106 32-bit RISC processor, which achieves extra-low power consumption and reaches a maximum clock speed of 160 MHz. The Real-Time Operating System (RTOS) and Wi-Fi stack allow about 80% of the processing power to be available for user application programming and development.

### **4.3 RFID Reader:**

Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked. This is the advantage over Bar-code.



**Fig 4.3 RFID Reader**



**Fig 4.4 RFID Cards**

A RFID reader is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. A passive tag is an RFID tag that does not contain a battery, the power is supplied by the reader. When radio waves from the reader are encountered by a passive rfid tag, the coiled antenna within the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag.

## Specifications

1. Input voltage: 3.3v
2. Frequency: 13.56MHz

### 4.4 Jumper Wires:

Jumper wires are used to inter connect components perfectly. The resistance offered by these wires is up to 3 megaohms. There are three types:

- Female-Female (Fig 3.5)
- Male-Male (Fig 3.6)
- Male-Female (Fig 3.7)



Fig 4.5 Female-Female Connector



Fig 4.6 Male-Male Connector

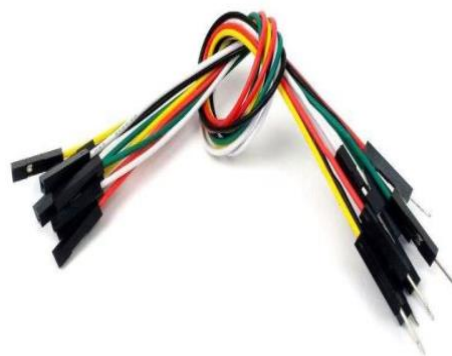


Fig 4.7 Male-Female Connector

### 4.5 Micro USB Cabel:

Micro- USB. Micro-USB used to be the most common USB port and is still found on many older models. This type of connection allows data to be read without

needing a computer. For example, you can connect Flash Drives, or Memory Sticks, directly to your mobile device



**Fig 4.8 Micro USB Cabel**

### **4.6 Arduino IDE:**

Before we start controlling the world around us, we need to set up the software to program our board.

The Arduino Software (IDE) allows us to write programs and upload them to our board. In the Arduino Software page we will find two options:

If we have a reliable Internet connection, we should use the online IDE (Arduino Web Editor). It will allow us to save our sketches in the cloud, having them available from any device and backed up. We will always have the most up-to-date version of the IDE without the need to install updates or community generated libraries.

If we would rather work offline, we should use the latest version of the desktop IDE.

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

### **Arduino IDE Versions:**

- Arduino IDE 1.8.19
- Previous Release 1.8.18

#### 4.7 PHP:

**PHP (Hypertext Processor)** is a general-purpose scripting language and interpreter that is freely available and widely used for web development. The language is used primarily for server-side scripting, although it can also be used for command-line scripting and, to a limited degree, desktop applications. The acronym PHP was originally derived from Personal Home Page Tools, but it now stands for PHP: Hypertext Preprocessor, which the PHP Group's documentation describes as a "recursive acronym."

When used for server-side scripting, PHP is added to a webpage for the purpose of generating dynamic content when the page is accessed through a client browser. The web server runs the script before transmitting the page to the browser. To support this process, the web server requires PHP to be installed on the server, along with a PHP parser -- either a Common Gateway Interface (CGI) parser or a server module.

When a user requests a webpage from the server, the parser interprets the PHP portion of the page, performs the operations called for in the PHP script, and generates the Hypertext Markup Language (HTML) that results from those operations. The HTML is then sent to the client browser, along with any other HTML on the page, providing a seamless rendering of the content. Webpages that contain PHP script are considered to be dynamic HTML pages because content varies based on the results of interpreting the script.

#### 4.8 Mysql:

The full form of MYSQL is **My Structured Query Language**. It is a popular open-source relational database management system (RDBMS) that is used for storing and managing data. MySQL is known for its speed, reliability, and ease of use, which makes it a popular choice for web applications, online stores, and other applications that require a database.

MySQL is a popular open-source relational database management system (RDBMS) that is used for storing and managing data. It is named after co-founder Michael Widenius's daughter, My. The "SQL" in MySQL stands for Structured Query Language, which is the standard language for managing and manipulating databases. MySQL is known for its speed, reliability, and ease of use, which makes it a popular choice for web applications, online stores, and other applications that require a database.

## CHAPTER – 5

### IMPLEMENTATION

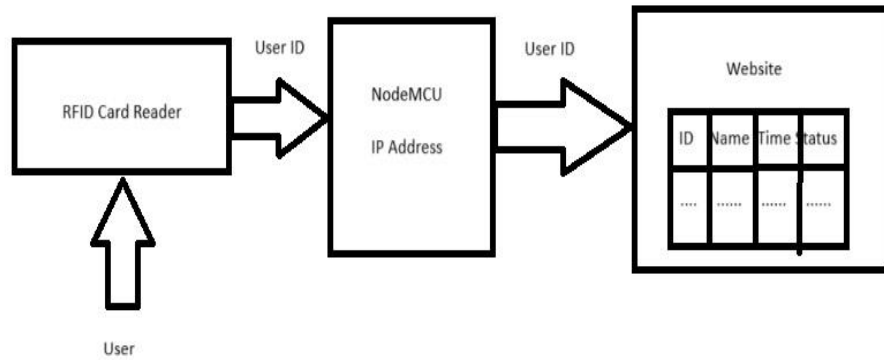


Fig 5.1 Block Diagram

#### 5.1 RFID Reader

RFID, or Radio Frequency Identification, is a system for transferring data over short distances (typically less than 6 inches). Often only one of the two devices needs to be powered, while the other is a passive device. This allows for easy use in such things as credit cards, key fobs, and pet collars as there is no need to worry about battery life. The downside is that the reader and the information holder (i.e credit card) must be very close, and can only hold small amounts of data.

The RFID system is comprised of two components: the RFID reader and the tags. They are also called PCD (Proximity Coupling Device) and PICC (Proximity Integrated Circuit Card).

The RFID reader consists of an antenna to emit high-frequency EM waves and a reader/writer. MFRC522 from NXP is an example of such an integrated circuit. Since we are using high-frequency waves in the megahertz range, the size of the antenna can be small.

The RFID tag can be either passive or active. Active tags are powered by batteries while the passive RFID tags are powered by energy from the reader's interrogating EM

waves. The tags are available in different forms or shapes like cards, tags, key forbs, or stickers. Whatever the shape, the RFID tag will consist of an antenna and the RFID chip, which will store all the data. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader, the tag will transmit data back to the reader. The reader will then analyze this data to identify the tag. Unlike a barcode or a QR code, the tag does not need to be within the reader's line of sight. This makes it easier to process and can be used for tracking objects in closed space.

### 5.2 Wiring a RFID Reader to a NodeMCU-ESP8266

Now that we have a complete understanding of how the RFID Reader works we can start connecting it to our NodeMCU! Connecting the RFID Reader to Arduino is very easy.

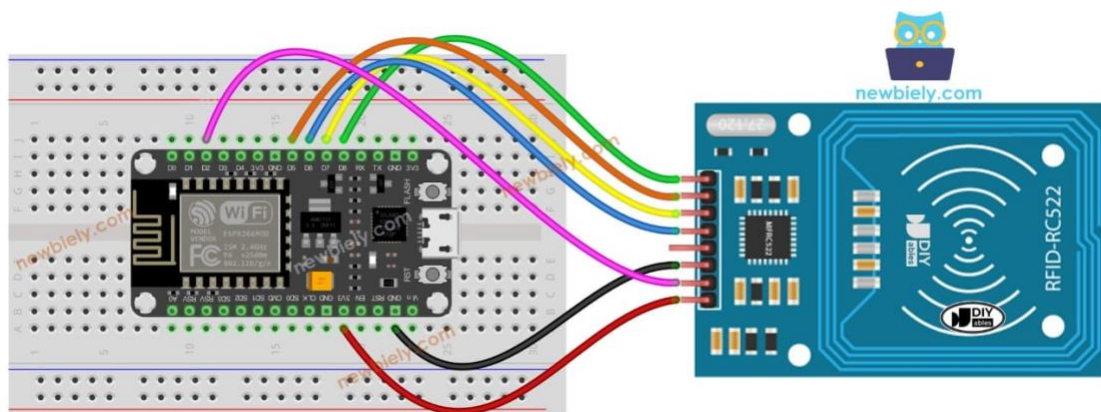


Fig 5.2 Connecting the RFID Reader to NodeMCU-ESP8266

Start by Connect the VCC (3V) pin to the 3.3V pin on the NodeMCU and the GND pin to the ground pin. Now connect the SS pin and RST pin to D8 and D2 pin on NodeMCU respectively. When you are done you should have something that looks similar to the illustration shown in Fig 4.1.

NodeMCU	MFRC522
D8 (GPIO15)	SDA (SS)
D5 (GPIO14)	SCK
D7 (GPIO13)	MOSI
D6 (GPIO12)	MISO (SCL)
GND	IRQ
D 2 (GPIO4 )	GND
3v	RST (FLASH)
	3.3v

Table 5.3 Pin Wiring

**Code of MFRC522 RFID Reader :**

```
#include <SPI.h>

#include <MFRC522.h>

#define SS_PIN D8 // The ESP8266 pin D8

#define RST_PIN D2 // The ESP8266 pin D2

MFRC522 rfid(SS_PIN, RST_PIN);

void setup() {

  Serial.begin(9600);

  SPI.begin(); // init SPI bus

  rfid.PCD_Init(); // init MFRC522

  Serial.println("Tap an RFID/NFC tag on the RFID-RC522 reader");

}

void loop() {

  if (rfid.PICC_IsNewCardPresent()) { // new tag is available

    if (rfid.PICC_ReadCardSerial()) { // NUID has been readed

      MFRC522::PICC_Type piccType = rfid.PICC_GetType(rfid.uid.sak);

      Serial.print("RFID/NFC Tag Type: ");

      Serial.println(rfid.PICC_GetTypeName(piccType));

      // print UID in Serial Monitor in the hex format

      Serial.print("UID:");

      for (int i = 0; i < rfid.uid.size; i++) {

        Serial.print(rfid.uid.uidByte[i] < 0x10 ? " 0" : " ");

        Serial.print(rfid.uid.uidByte[i], HEX);

      }

    }

  }

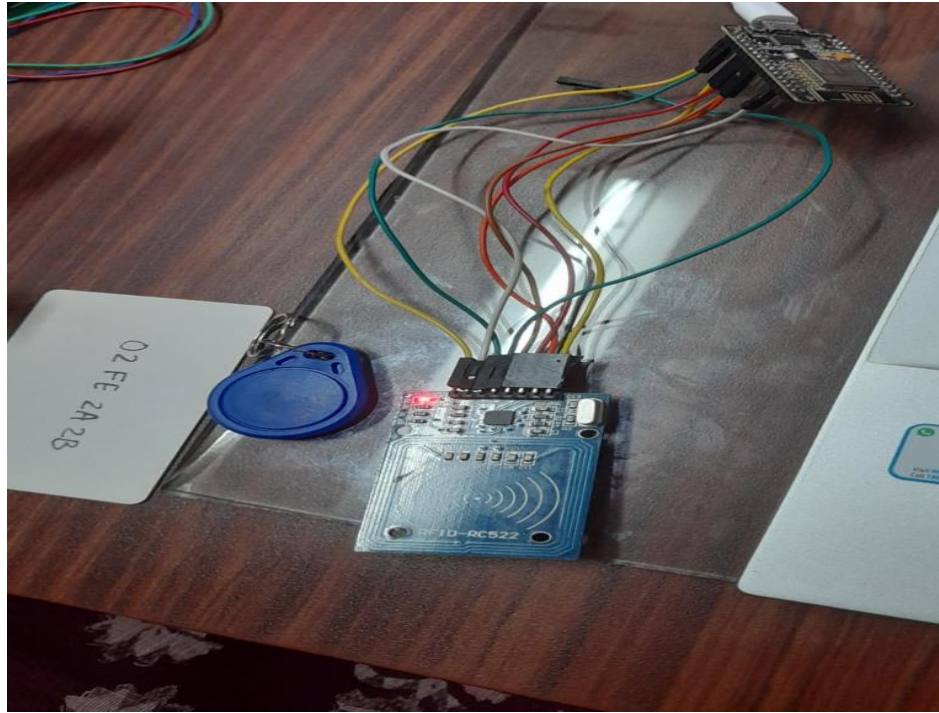
}
```

```
    Serial.println();  
  
    rfid.PICC_HaltA(); // halt PICC  
  
    rfid.PCD_StopCrypto1(); // stop encryption on PCD  
  
    }  
  
    }  
  
    }
```



## CHAPTER – 6

### RESULTS



**Fig 6.1 Making of mini-project on the board**

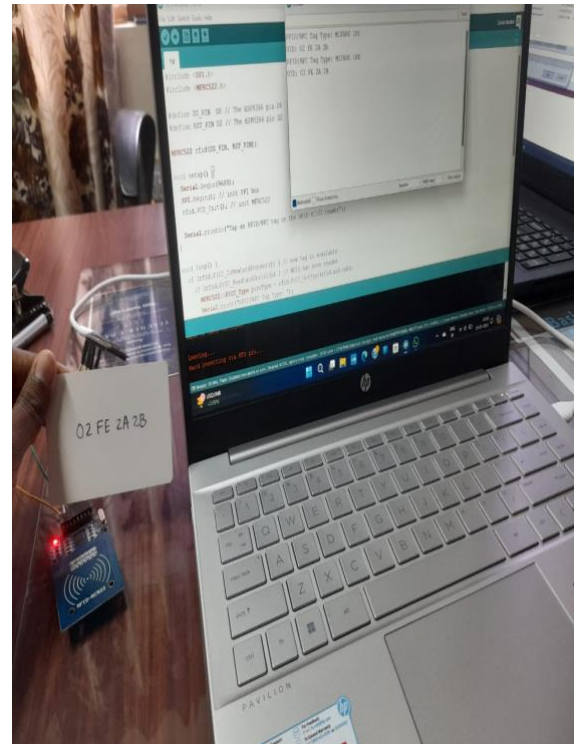
Fig 5.1 is explaining the on board connections made to perform

- 1) Collect all components
- 2) Connect Node MCU-ESP8266 board to PC
- 3) Write program in Arduino IDE development platform
- 4) Upload the program on to microcontroller at Node MCU kit
- 5) Do connect RFID Reader as per circuit designed
- 6) Observe results for test, record, rebuild and etc procedures to achieve accurate results

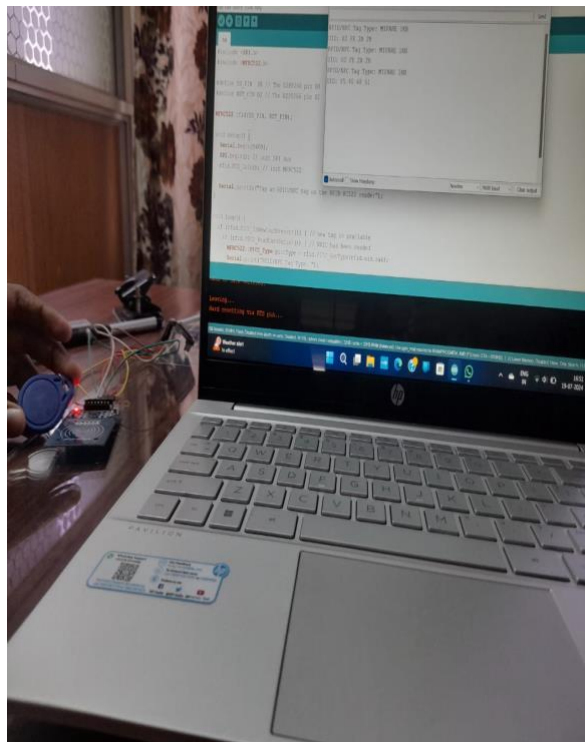
Here the results obtained by testing first card-1 to identify whether the user id matches with the registered user id.

Matching → Shows user id

Not Matching → Shows Unknown



**Fig 6.2 Testing on card - 1**



**Fig 6.3 Testing on card - 2**

Here the results obtained by testing first card-2 to identify whether the user id matches with the registered user id.

Matching → Shows user id

Not Matching → Shows Unknown

### Results on Website page:

This shows our website home page which stores the data or information .when we scan the card it will shows status as OUT, if the student is again scan the card before coming inside it will automatically delete the status of that student . The data which consist of user id, name of student, date/time and status.



Fig 6.4 Home Page

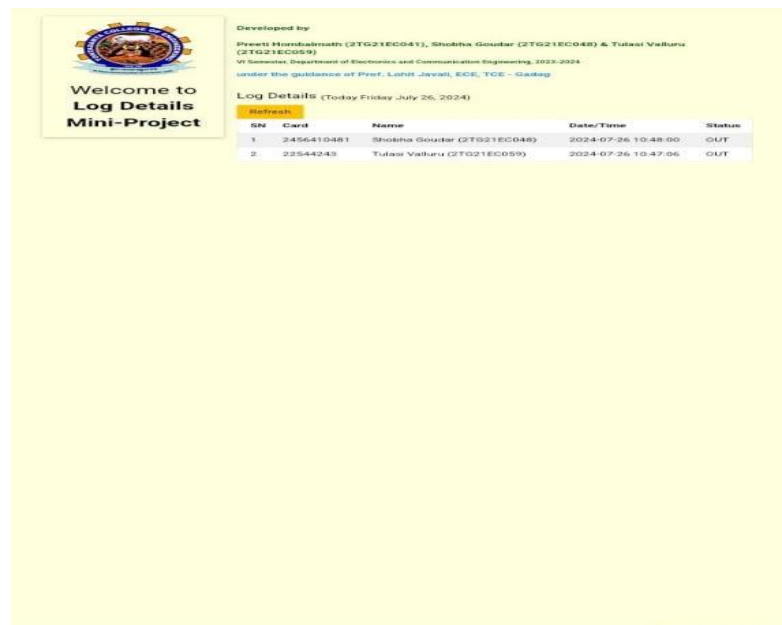


Fig 6.5 After scanning the card

## **CHAPTER-7**

### **APPLICATIONS**

#### **RFID applications and use cases**

RFID dates back to the 1940s; however, it was used more frequently in the 1970s. For a long time, the high cost of the tags and readers prohibited widespread commercial use. As hardware costs have decreased, RFID adoption has also increased.

#### **Some common uses for RFID applications include:**

- Pet and livestock tracking
- Inventory management
- Asset tracking and equipment tracking
- Inventory control
- Cargo and supply chain logistics
- Vehicle tracking
- Customer service and loss control
- Improved visibility and distribution in the supply chain

#### **Application of this project:**

- Provides security for the girls are in the hostel
- It helps to maintain attendance in systematic manner
- It helps to parents and warden to see the student is IN/OUT of the hostel

## CHAPTER – 8

### CONCLUSION & FUTURE SCOPE

RFID based security and access control system is more secure and fast responded as compared to the other system like biometric. The advantage of the RFID system is contact-less and works without-line-of-sight. By using arduino it is easy to access and works very quickly while burning the code it is like plug and play device. Users can change the function accordingly by using arduino. It is easier to use and accurate also. Hence this project can be useful for implementation of access control application for tracking system as well as providing the security benefits. This project can improve by raising the range of reader in which the tag read.

#### **Future Scope:**

It depends upon how original one could be to enhance the use of this project. But for us this project is practical for future uses such as Smart cart can be interfaced with wireless technologies to make it completely portable in the near future. Payment of bills using mobile can be implemented. A low cost RFID scanner can be manufactured and used which can scan multiple tags (products) simultaneously for faster processing and lesser resources. Automatic scanning & availability of products can be introduced. Pay preparation feature will be the latest trend in upcoming years due to the boost in the ecommerce industry.

1. In malls for generating bills without standing in a queue.
2. Gaming zone
3. Environmental problems to control and make nature friendly.
4. Uses in ATM machines

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