INDIVIDUAL ENTRY GATE

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Graduation project document submitted to fulfillment of the requirements for an intermediate qualification degree

(Information Technology)

Egyptian-Korean Faculty of Industrial and Energy Technology, Beni Suef Technological University. Bani Suef. Egypt

2024

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~~*This book was compiled by Eng. Fatima Atef and reviewed by Eng. Shahd Ahmed*~~

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Acknowledgement

We have helped many people during the past four months, which is the period of the project's work. I would like to send them a message of thanks and gratitude for their effort and assistance. There are many doctors, engineers, and some colleagues who have provided assistance to us in all ways without any compensation.

They helped us with love and welcome.

First, we would like to thank the President of the Korean Technological University of Industry and Energy, who is Dr. Jean Henry, the President of the University of Technology, and we would like to thank the administrators for their cooperation, follow-up, and providing all forms of assistance at the university.

Secondly, Dr. Ahmed Fathi, who is a doctor, teaches students in the Information Technology Department at the university, and we would like to offer him a letter of thanks for his interesting effort, guidance, and assistance in devising solutions to all existing problems.

Thirdly, we thank our fellow engineers
Eng. Fatima Atef, Eng. Shahad Ahmed, and we offer them a certificate of thanks and gratitude for the effort made in helping them work together, move around, and meet the requirements of the project.

Fourthly, we would like to thank Dr. Osama Mukhtar, head of the department, has a lot of knowledge, and we offer him a letter of thanks and gratitude for his efforts in helping within the university and cooperating with us while implementing and testing the project.

Fifthly, we would like to thank the administration of security personnel and the university security personnel and offer them all thanks and appreciation for providing all assistance and security guidance for our project.

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Nomenclature

=> **SPI** <> **Serial Peripheral Interface**

=> **SLCK** <> **Serial Clock**

=> **MOSI** <> **Master Out Slave In**

=> **MISO** <> **Master In Slave Out**

=> **SS** <> **Slave Selec**

=> **RFID** <> **radio frequency identification**

=>**VCC** <> **Voltage Common Collector**

=>**GND** <> **Ground**

=>**VIN** <> **Voltage Input**

=>**V3** <> **3.3 Volts**

=>**5V** <> **5 Volts**

=>**TX** <> **Transmit**

=>**RX** <> **Receive**

=>**SCL**<> **Serial Clock Line**

=>**I2C.SDA** <> **Serial Data Line**

=>**I2C.MISO** <> **Master In Slave Out**

=>**SPI.MOSI** <> **Master Out Slave In**

=>**SPI.SCK** <> **Serial Clock**

=>**SPI.CS** <> **Chip Select**

=>**SPI.PWM** <>**Pulse Width Modulation**

Abstract

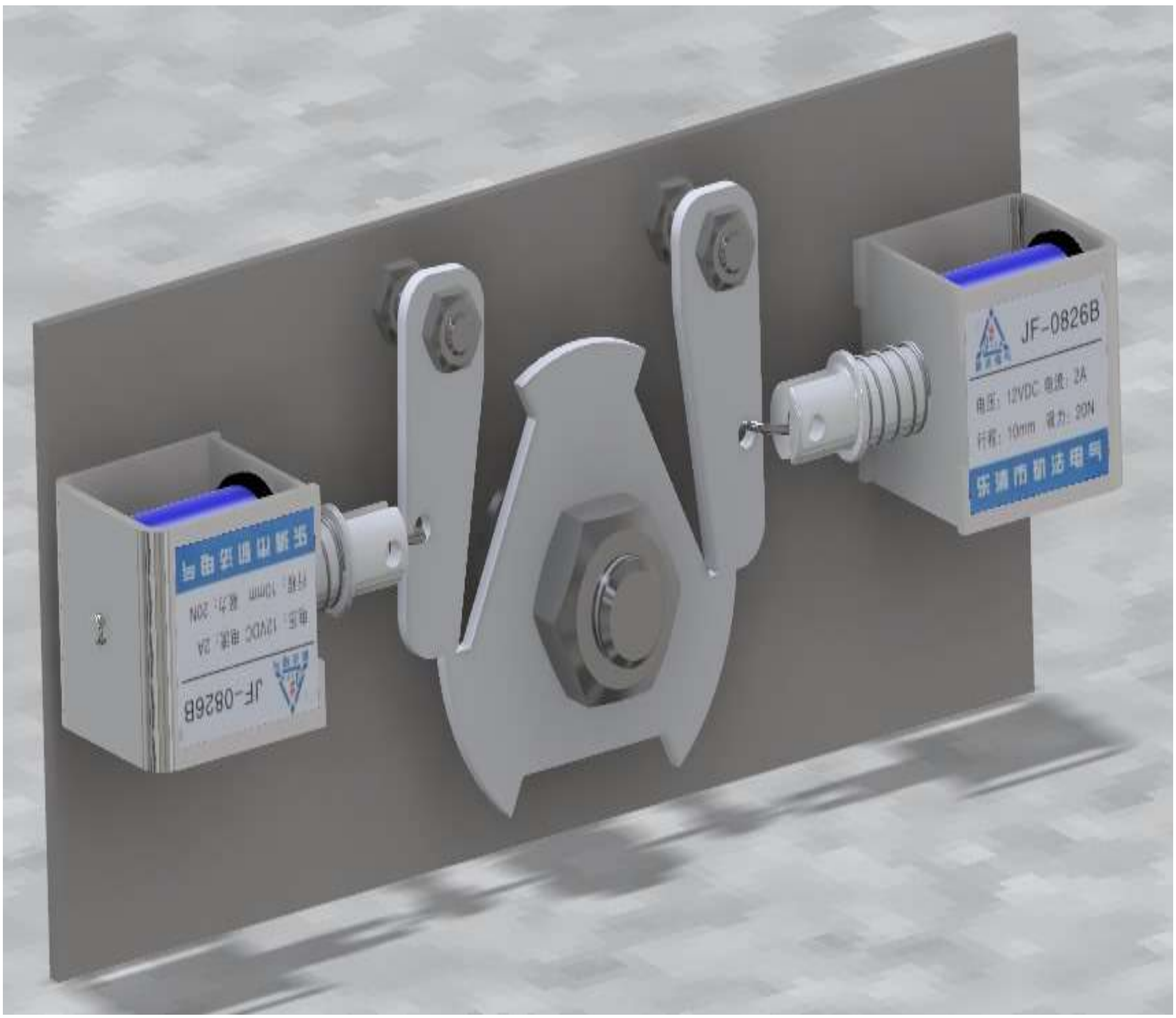
Electronic portals for individuals to enter the university

Our project is to create an advanced electronic portal aimed at facilitating the entry of individuals to the university, whether they are students, teaching assistants, doctors, or any other worker who has data registered within the university.

The portal seeks to replace the traditional manual method that requires registering the national number of all individuals wishing to enter, and preventing entry to anyone who does not have registered data.

The idea of the project is based on individuals logging in using an advanced technological system.

CHAPTER1: PROJECT DESCRIPTION



1.1. <Introduction>

Electronic portals for individuals to enter the university

Our project is to create an advanced electronic portal aimed at facilitating the entry of individuals to the university, whether they are students, teaching assistants, doctors, or any other worker who has data registered within the university.

The portal seeks to replace the traditional manual method that requires registering the national number of all individuals wishing to enter, and preventing entry to anyone who does not have registered data.

1.2. <Project Idea>

The idea of the project is based on individuals logging in using an advanced technological system that includes:

Individuals database: contains all data of individuals registered within the university.

RFID Cards: Every individual has a card that contains an RFID chip bearing a unique ID.

RFID Reader: Reads the card data when it comes close to it.

SD Card: Used to store the database.

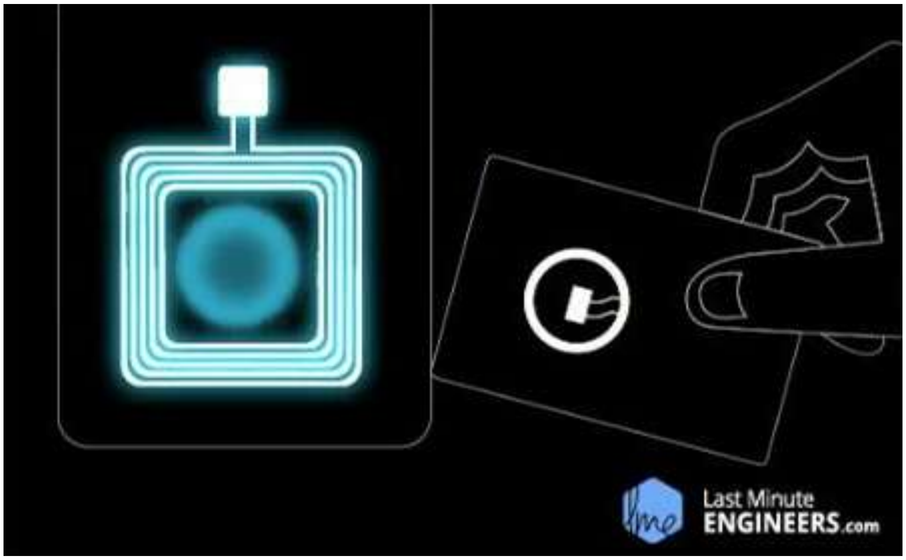


Figure 1.2

1.3. <Mechanism of Action>

Each individual has his or her data registered at the university, and let us assume that students hold a university card that contains an ID and a national number. When the student arrives at the entry gate:

The student brings his card closer to the RFID reader.

The RFID reader reads the data in the card and recognizes the unique ID.

The ID is matched with the database stored on the SD card.

If the dat a is found in the database:

If a person is allowed in: The gate opens automatically for half a minute and then closes.

If the person is on the blacklist: The portal will not open.

If the data is not found in the database:

The person will not be allowed to enter.

Exceptional entry

If there is an individual from outside the university allowed to enter:

He can only enter through security personnel.

The security staff has a Master VIP card that opens the gate at both ends.

Any individual not registered in the database can enter and exit only through security personnel.

1.4. <Conclusion>

This system provides greater security and effectiveness, as it ensures the entry of only registered individuals, prevents the entry of unwanted persons, while providing exceptional solutions for individuals authorized to enter from outside the university.

We are confident that this electronic portal will bring a positive change to the university entry system and provide a smooth and safe experience for everyone.

CHAPTER2: BEFORE THE ELECTRONIC PORTAL

2.1. <The traditional system for individuals entering the university>

In the traditional university access system, security and access control rely on manual procedures that require a lot of effort and time. When individuals enter the campus, each person must provide a national number or proof of identity to the security staff at the gate.

Security staff verify a person's identity and match it to their list of registered data, which requires time and delays entry.

2.2. <Disadvantages of the traditional system>

Manual procedures and time-consuming effort, lack of security and burden on security staff.

2.3. <What was facilitated by the electronic portal>

2.3.1. ❖Reducing the need for security personnel:

By using the electronic entry portal, reliance on security personnel to conduct manual checks is reduced, which reduces the burden on them and enables them to focus on Other tasks are more important.

2.3.2. ❖Increased efficiency:

Electronic gates operate quickly and efficiently, reducing the time it takes individuals to enter the college, and preventing congestion at entry points.

2.3.3. ❖**Enhancing security:**

Electronic entry gates rely on technologies such as smart ID cards, fingerprints, and secret codes, which reduces the chances of unauthorized entry and increases the level of security.

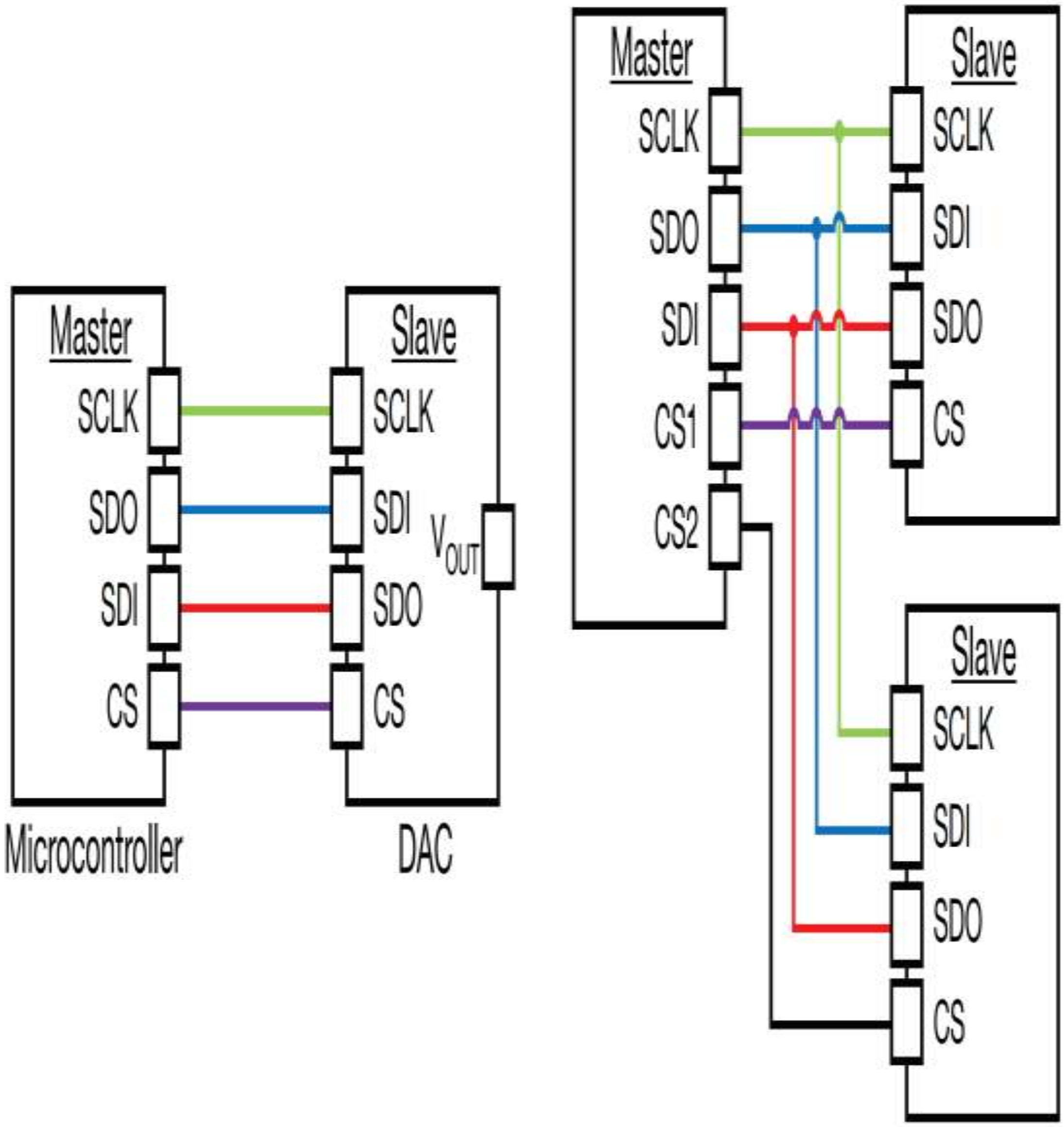
2.3.4. ❖**Reducing forgery:**

Adopting electronic portals reduces the chances of forgery and illegal entry using forged cards or identities. In general, the electronic entry portal contributes to making the college entry process more streamlined, secure and effective.

2.3.5. ❖**Integration with other systems:**

Electronic gates can integrate with other systems such as alarm systems and protection systems, which enhances the overall safety level in the coll.

CHAPTER3: SPI PROTOCOL



Serial Peripheral Interface - SPI is a serial and synchronous serial data protocol used by controllers to communicate with one or more peripherals or with another controller with high data transfer speeds and over short distances. One of the main advantages of SPI is that it offers a higher data transfer rate than UART and I2C and is used when a high-speed serial connection is needed.

Hardware:

In the SPI there is always one main device (usually the controller) that controls the peripherals. There are usually three lines common to all devices:

3.1. <PinOut>

<SCLK>

Serial Clock The watch sets the data transfer rate and this line transmits the clock pulses that synchronize the data transfer generated by the main party. Each bit of data transmitted on this line coincides and corresponds to a single signal or pulse of the clock. The aim is to enable the recipient to receive bits in the message at the same rate at which they were transmitted to ensure that no bits are lost and that the receiver can interpret them correctly

<MOSI – MastermOut Slave In>

The master device uses it to send data to peripherals. The most significant bit is sent first.

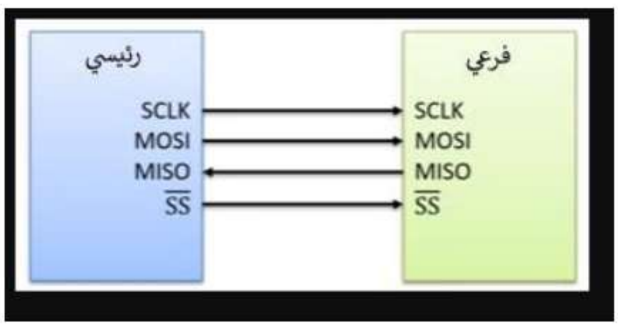
<MISO – Master In Slave Out>

The main device receives data from peripherals over this line. The most significant bit is received first. There is one line for each sub-device that is connected to the main device:

<SS - Slave Select>

The subsidiary body is informed on this line that it must be prepared to receive the data and that it is the one concerned with receiving this data. There is a separate pin for each sub-device connected to the main device. In the normal case, the signal of this line is high (1) and whenever we want to communicate with one of the parties, all we have to do is make the line value of the terminal low (0) and then raise it again after completing the transmission process.

The following illustration represents the connection between a primary device and a single submachine:



<clasck>

• SPI is a "synchronous" data bus, which means it uses separate data lines and a clock line to keep both sides in sync. Since the watch is transmitted in a separate line with the data, we do not have to standardize the transfer speed of the transmitter and receiver.

• A clock is a continuously oscillating signal that tells the receiving party when exactly to sample the bits on the data line. The sample may be taken at a high (low to high) or drop (high to low) clock signal edge. When the receiver detects this edge, it will immediately look at the data line to read the next bit.

• Only one end that generates the clock signal is called the "master" end, and the other side is called the "slave" end. There is always only one main party (which is always your controller), but there can be many sub-parties. Since only the main party can generate the clock, it is the one who determines when all operations on the data occur.

• When data is sent from the main party of the subordinate, it is sent on a data line called MOSI, or "Master Out/Slave In". If the sub-party needs to send a response to the parent, the sub-party will continue to generate a predetermined number of clock cycles, and the sub-party will place its data on a third data line called MISO, or "Master In/Slave Out".

• The terminal cannot send the main device data however it wants, but it must be specified and known in advance by the main device whether the terminal will answer a message sent by the main device and what is the size of this data. This is because only the main device generates the watch. This scenario is very different from asynchronous transmission, where random amounts of data can be sent in any direction and at any time. In practice, however, this is not a major obstacle, as SPI is typically used to communicate with sensors that have a predefined command structure. For example, if you send a command to "read data" to a device, you'll know that the device will always respond to you with 2 bytes of data in return. In cases where you may want to return a variable amount of data, you can always return one byte specifying the length of the incoming data, so the parent party can retrieve the entire data sent to it.

3.2. <SPI patterns>

• When two devices communicate together via SI, there are two important things that they must agree on:

• What is the clock mode in periods of inactivity?

• When are data sampling supposed to be taken?

*** These two properties are commonly referred to as the clock polarity and the clock phase respectively.**

• The clock polarity determines whether the clock is low 0 or high 1 when data is not transmitted (inactive state), i.e. is the clock inactive when it is high or low? If polarity is set to 0, the clock mode will be low to 0 when it is inactive. When polarity is 1 it will be 1 o'clock mode when it is inactive.

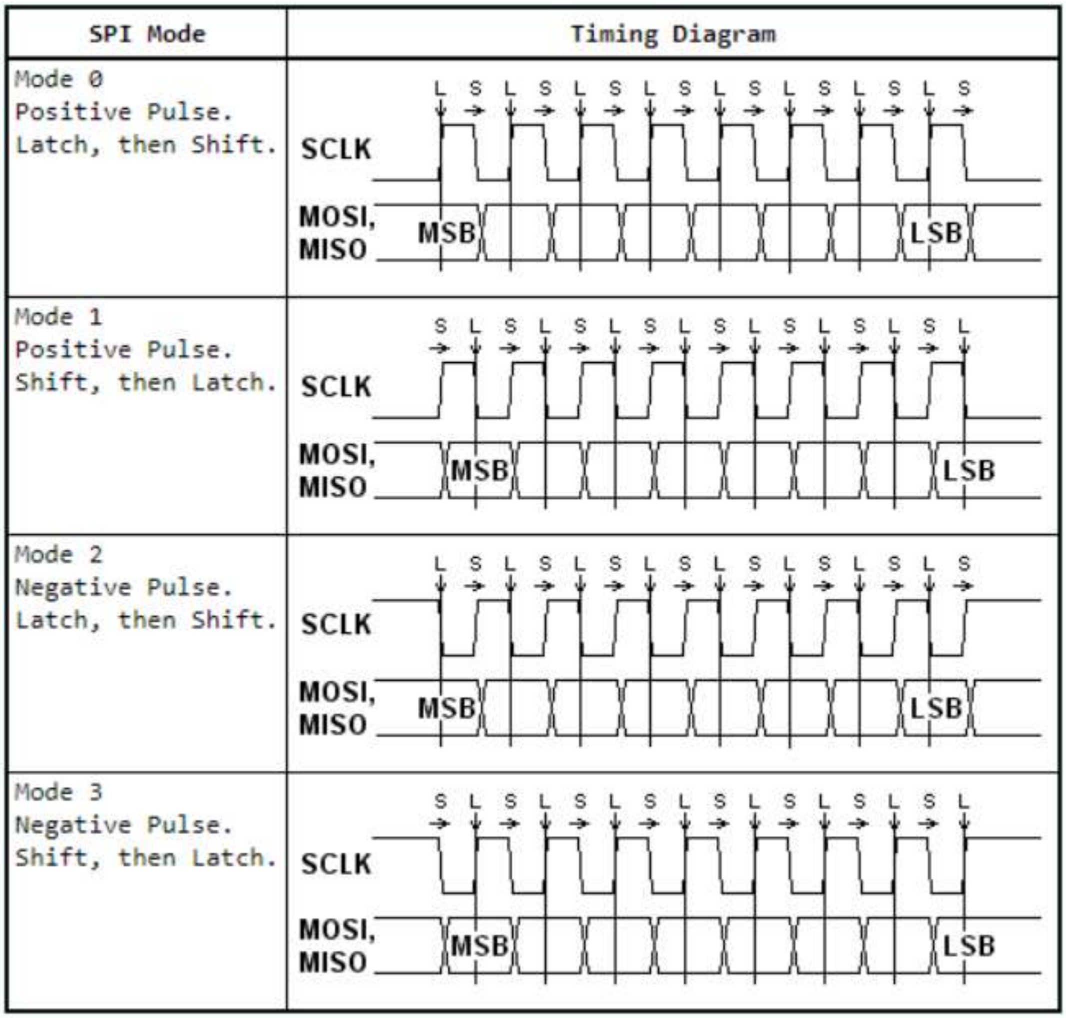
• The clock phase indicates the edge at which the device will preview the first byte of data. Whether the data transfer is on the rising or falling edge of the clock signal. If phase is 0, the data is previewed on the first edge of the watch. If phase is 1, the data will be previewed on the second edge of the watch.

• There are 4 different modes in SPI which are MODE0, MODE1, MODE2 and MODE3. It depends on the fact that you can determine exactly how the bit is previewed based on the position of the clock mark. There are two parts of the watch you should keep in mind, the polarity of the CPOL and the CPHA phase.

• When CPOL = 0 it means that the clock will be set to a low level and when it actually starts transmitting, the signal will start from low mode, then high, then low, and so on. When CPOL = 1 it means that the clock will actually be set to high, and when we actually start transmitting, the signal will go down, go up, go down, and so on.

• CPHA determines whether to preview the signal in the first change of the clock or the second change of the clock. So when CPHA = 0 means that the bit is determined on the first

change of the clock. When CPHA = 1, the bit will be previewed on the second change of the clock when the signal goes from high to low or vice versa.



CHAPTER4: MAIN COMPONENTS.

4.1. <Arduino>

4.1.1. ❖ what is the Arduino?

• Arduino is a small electronic board, cheap price and easy to use. It acts as a controller and link between the different electrical components. The way it works is controlled by its programming.

✓ Example of entrances: button panel, light meter, temperature sensor.

✓ An example of exits: bulbs, motors, sound, screen.

• Arduino was developed in 2005 to help teach students electronics and programming. That was in Italy.

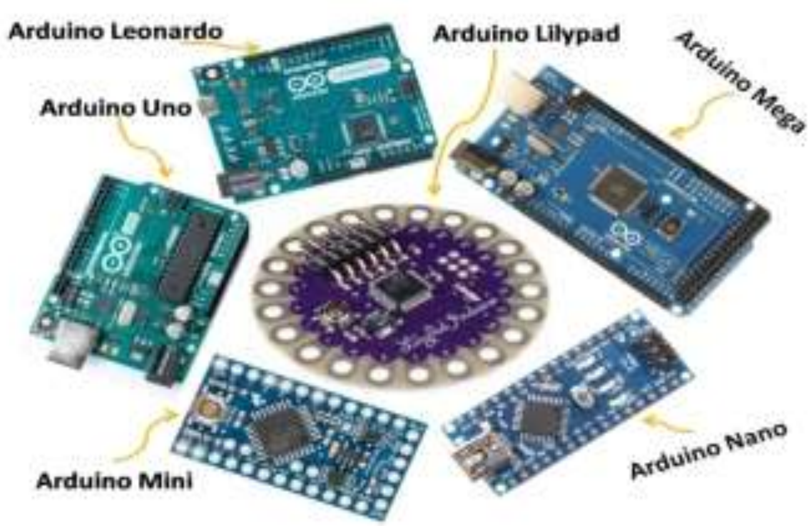
• Its ease of use, low cost and reliability made it spread quickly around the world. The other reason for the spread of Arduino is that it is (open source).

4.1.2. ❖ what is open source?

• This means that you can view and edit Engineering designs and source codes for each of the different Arduino Arduino Boards IDE that suits you. You can also develop the Arduino C programming language with complete freedom and view its source codes. Also, all of these features and software are completely free, similar to some development environments such as Mikro C, which requires you to purchase an expensive license that sometimes amounts to thousands dollars to use.

4.1.3. ❖ what is types of Arduino?

• Arduino UNO, Arduino Mega, Arduino Nano, Arduino Mini, Arduino Lilypad, Arduino Demulive.



4.1.4. ❖ <u>Which is his use?</u>

• It acts as a controller and link between the different electrical components.

<u>• used for building digital devices and interactive objects that can sense and control objects in the physical world Such as:</u>

➢ Home Automation:

✓ Controlling lights, appliances, and security systems.

➢ Robotics:

✓ Building and controlling robots and automated systems.

➢ IoT (Internet of Things):

✓ Creating connected devices that can communicate over the internet.

➢DIY Projects: ✓ Hobby projects involving sensors, motors, and displays.

4.1.5. ❖ <u>What type of Arduino is used in this project and why did we use it?</u>

• The Arduino Uno is one of the most well-known and widely used Arduino boards due to its ease of use, affordability, and versatility.

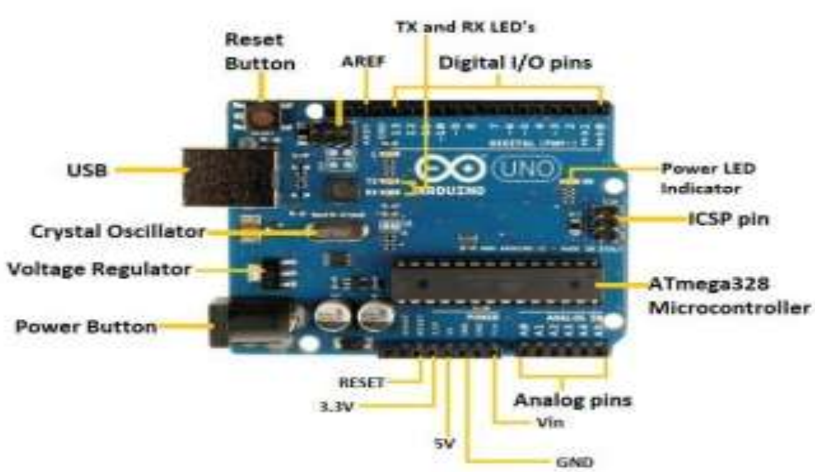
• Arduino Uno can be connected with many different components such as SD card and RFID reader to build advanced projects that require data storage and identification using RFID technology.

4.1.6. ❖ Arduino Uno circuit overview

• A small electronic circuit used in programming an Atmel ATmega328 microcontroller. This circuit provides ports for connecting electronic components directly to the controller via 14 inputs | (Output) of the digital type (Digital In/out) Of these 14 there are 6 that can be used as PWM outputs or what is known as digital modulation based on pulse width (Pulse-Width modulation). We will talk about this feature in an entire chapter called Analog Inputs & Outputs.

• The circuit also contains a crystal vibrator16 MHz with Crystal Oscillator frequency In addition to a USB port for Communication with the computer and there is an entrance For separate power, in addition to ICSP header, which is an additional method Controller programming while still connected With a board other than the USB) and you can consider this Arduino board as a development and programming board. Miniature and ready for direct use, the Development Board contains almost everything You need to operate it either via the USB port or via an external power source Like a battery.

4.1.7. ❖Components and Pins of Arduino Uno.



4.1.8. ❖ What distinguishes Arduino boards from other development boards for other microcontrollers?

• The electronic circuits were of a fixed design, and changing or modifying a simple part of them meant a lot of complex operations, such as welding, cutting wires, reviewing electronic diagrams, and many other annoying things, which led to the task of developing electronic products being limited to a group of Professional engineers only.

Thanks to technological development in the field of semiconductors and the invention of integrated circuits (IC), it has become possible to place a complete electronic circuit on a small chip whose size may not exceed the head of a pin.

To the point that at the present time there are electronic circuits whose size is estimated at nanometers and which cannot be seen. Unless I use special optical magnifiers The development of Integrated Circuits also led to the emergence of a special generation of electronic circuits called Micro Controllers, which are more like a miniature computer that can be programmed to perform a set of functions such as reading the control temperature of an electric motor or even managing production lines in large factories, and all of this is done simply by Programming commands: Thus, the technology of manufacturing electronic circuits and systems has transformed from purely electronic design based on solid components only to programming commands that any individual can write and design himself with ease.

• Microcontrollers also feature the ability to change and modify At any time, simply if you want to change something in..You can do this by modifying the programming lines in your project Replace the new commands on the microcontroller Try it more than once and so on until you achieve your project For the desired goal.

• It is how easy it is to work with Micro Controllers Development Boards The simplicity of the programming language, which a team from Italy worked on developing since 2005 until Now, the Arduino programming language has been derived from the processing language

and the C language, which It is the foundation of modern programming languages and the owner of the software technology revolution.

• Microcontrollers are like a small computer unit that contains a microcontroller.

• ATmega328 P-MEMORY on a 16 MHz processor and a total memory of 32 Kilo Bytes:

• Boot loader- 0.5 Killobyte: The software responsible for how the circuit understands the Arduino C language.

• SRAM- 2 Killobyte: is the memory used to record variables temporarily.

• Flash Disk- 29 Killobyte: A storage space used to store the program that we will writeTo operate the controller, at first glance this number may seem very small, but in reality it is sufficient to write many commands, as we will see in the following examples.

• EEPROM- 1 Killobyte: The memory responsible for recording some variables permanently inside the controller, and it maintains its value even after the power is turned off. We can consider it like a hard disk drive in a personal computer.

4.1.9. ❖ Electrical power outlets and inputs for the controller Power Inputs/Outputs:

• Vin: Input voltage when we use External power source, we can supply the voltage through this input, if we are supplying the power to the circuit through the transformer input we can You can also access it through this entrance.

• 5V: Regular voltage used to secure power the elements used on the circuit, and we will use it to provide power for the electronic parts that we will add, this voltage may come through Vin via an internal voltage regulator or supplied through the USB port or any regular voltage source with a value of 5 volts.

• 3.3V: 3.3V voltage supply It is secured by the circuit's internal voltage regulator and the maximum value of current drawn through this line is 50 mAh.
• GND: land line

4.1.10. ❖ i/o ports Ports pins:

• There are 14 digital ports...they are numbered (0 - (13). In the code, you can determine the operation of each port. When ports act as outlets; Depending on the code, you can output 5 or 0 You can also make these ports work as digital inputs to sense the status of a button (for example), the digital port can supply the load (the thing connected to the port) with 5 and 20mA. This current is sufficient to power an LED, but it is definitely not enough to power a motor.

• There is a small LED indicator next to port 13. It works when port 13 is Hi. Using port 13 as an input is more difficult, due to the LED connected to it. Try using another port. The GND pin serves as ground for the electronic circuit. Ov. The "~" mark means that this pin is suitable for outputting an analogue voltage value. It is also called PWM The two ports (01) are called TX and RX and are used to communicate with the computer (Note: If you use the Serial.begin command in the code, you cannot use ports 0.1 as digital ports).

The AREF port is rarely used and is used to set the highest value in the voltage range of the analogue inputs (0-5).

• There are 6 (A0-A5) of them and they can measure voltage (analogue) - and they can be dealt with by connecting them to the required wire Measure its voltage, then control it in the program.

• Note: These pins can be used as digital inputs or digital outputs.

4.1.11. ❖ The difference between analogue signals and digital signals:

• in short, the ON/OFF digital signal is an example: light On or off only.

• While the analogue signal can be controlled by the voltage value 0v, 1v, 3.3v 4.9: for example With this, the lamp can be turned on gradually (high light, low light ,Too low, and so on...).

• Example of the difference between digital and analogue:

• Digital: Regular lights (ON-OFF) only.

• Analogue: lights that accept lighting intensity control.

4.1.12. ❖ Power Button:

• For external power supply (7-12V).

4.1.13. ❖ Reset Button:

• Resets the microcontroller.

4.1.14. ❖ USB Connector:

• Used for programming the board and providing power.

4.1.15. ❖ ICSP (In-Circuit Serial Programming) Header:

• Used for programming the firmware on the microcontroller.

4.1.16. ❖ Serial Communication Pins:

• TX (1): Transmit pin for serial communication.

• RX (0): Receive pin for serial communication.

4.1.17. ❖ LEDs:

• L: Connected to digital pin 13. Useful for debugging.

• TX/RX LEDs: Indicate data transmission and reception.

• Power LED: Indicates the board is powered.

4.1.18. ❖ Crystal Oscillator:

• Provides a clock signal to the microcontroller, typically 16 MHz.

4.1.19. ❖ Voltage Regulator:

• Ensures the microcontroller receives a consistent 5V supply.

4.1.20. ❖ Supplying the circuit with power?

• You can supply the circuit with power either through the USB port only, or by using an external source of electricity such as an ACIDC converter to supply the circuit with the voltage necessary to work, or even through a 9-volt battery or four 1.5-volt batteries, where the two ends of the battery are connected to the ground input, Gnd and Vin, in Circle.

• The circuit can work on a voltage ranging between 206 volts, but care must be taken that if we provide a voltage of less than 7 volts, the 5 Pin controlled output may not be able to provide an output voltage that reaches the required 5 volts, and this may lead to instability of the circuit. However, if we supply The circuit has a voltage higher than 12 volts, as this may affect the voltage regulator element and lead to an increase in its temperature, which leads to damage. The board, so the voltage range that is preferable to use is from 7 to 12 volts.

4.1.21. ❖ The Arduino can be powered and connected in three ways:

• From the computer or charger to the USB port.

• The power input is 5.5mm-2.1mm jack and you must search for the appropriate adapter 7V-12V.

• Apply input voltage 7- 12 directly to pins Vin and GND.

4.1.22. ❖ Calculating the current drawn by the Arduino and the rest of the circuit:

• As you know, not all chargers are equal in electrical voltage and current. See, for example, (the iPhone charger and the charger ipad)

• The Arduino Uno usually draws 45mA. But the more you work

• More accessories the current draw will increase (lighting, sound, relays...)

• The current consumed by the circuit can be measured using suitable devices.

• Note: The current that the Arduino can output from the single digital port is about 20mA, and the current that can be drawn from the Vcc and GND pins is about 200mA.

4.1.23. ❖ Arduino supports several communication protocols, which allow it to interact with various sensors, modules, and other devices. Some of the main protocols include:

• Serial Communication (UART):

➢ Utilizes RX (receive) and TX (transmit) pins.

➢ **Commonly used for communication between the Arduino and a computer or other serial devices.**

• I2C (Inter-Integrated Circuit):

➢ **Uses two wires: SDA (data) and SCL (clock).**

➢ **Allows multiple devices to be connected to the same bus.**

➢ **Each device has a unique address.**

• SPI (Serial Peripheral Interface):

➢ **protocol uses four main wires for communication between devices. These wires are typically assigned to specific pins on different Arduino boards: ✓ MOSI (Master Out Slave In), MISO (Master In Slave Out), SCK (Clock), and SS (Slave Select).**

➢ **Faster than I2C and used for high-speed data transfer.**

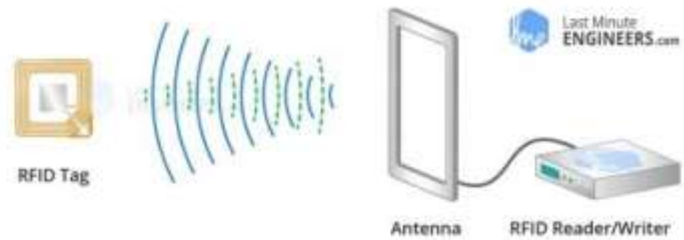
4.2. <Rfid>

4.2.1. ❖ What is RFID :

RFID (radio frequency identification) is a form of wireless communication that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object, or person.

4.2.2. ❖ How does RFID work?

• Every RFID system consists of three components: a scanning antenna, a transceiver and a transponder. When the scanning antenna and transceiver are combined, they are referred to as an RFID reader or interrogator. There are two types of RFID readers -- fixed readers and mobile readers. The RFID reader is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data.



• The transponder is in the RFID tag itself. The read range for RFID tags varies based on factors including the type of tag, type of reader, RFID frequency and interference in the surrounding environment or from other RFID tags and readers. Tags that have a stronger power source also have a longer read range.

4.2.3. ❖What are RFID tags ?

RFID tags are made up of an integrated circuit (IC), an antenna and a substrate. The part of an RFID tag that encodes identifying information is called the RFID inlay.

There are two main types of RFID tags:

• Active RFID. An active RFID tag has its own power source, often a battery.

• Passive RFID. A passive RFID tag receives its power from the reading antenna, whose electromagnetic wave induces a current in the RFID tag's antenna.

There are also semi-passive RFID tags, meaning a battery runs the circuitry while communication is powered by the RFID reader.

• Low-power, embedded non-volatile memory plays an important role in every RFID system. RFID tags typically hold less than 2,000 KB of data, including a unique identifier/serial number. Tags can be read-only or read-write, where data can be added by the reader or existing data overwritten.

4.2.4. ❖What are the types of RFID systems?

There are three main types of RFID systems: low frequency (LF), high frequency (HF) and ultra high frequency (UHF). Microwave RFID is also available. Frequencies vary widely by country and region.

- **We use Low frequency RFID systems. These frequencies range from 30 kHz to 500 kHz, although the typical frequency is 125 kHz. LF RFID has short transmission ranges, generally ranging from a few inches to less than six feet.**

1. VCC supplies power to the module. This can be anywhere from 2.5 to 3.3 volts. You can connect it to the 3.3V output from your Arduino. But remember that connecting it to the 5V pin will probably destroy your module!

2. RST is an input for reset and power-down. When this pin goes low the module enters power-down mode. In which the oscillator is turned off and the input pins are disconnected from the outside world. Whereas the module is reset on the rising edge of the signal.

3. GND is the ground pin and needs to be connected to the GND pin on the Arduino.

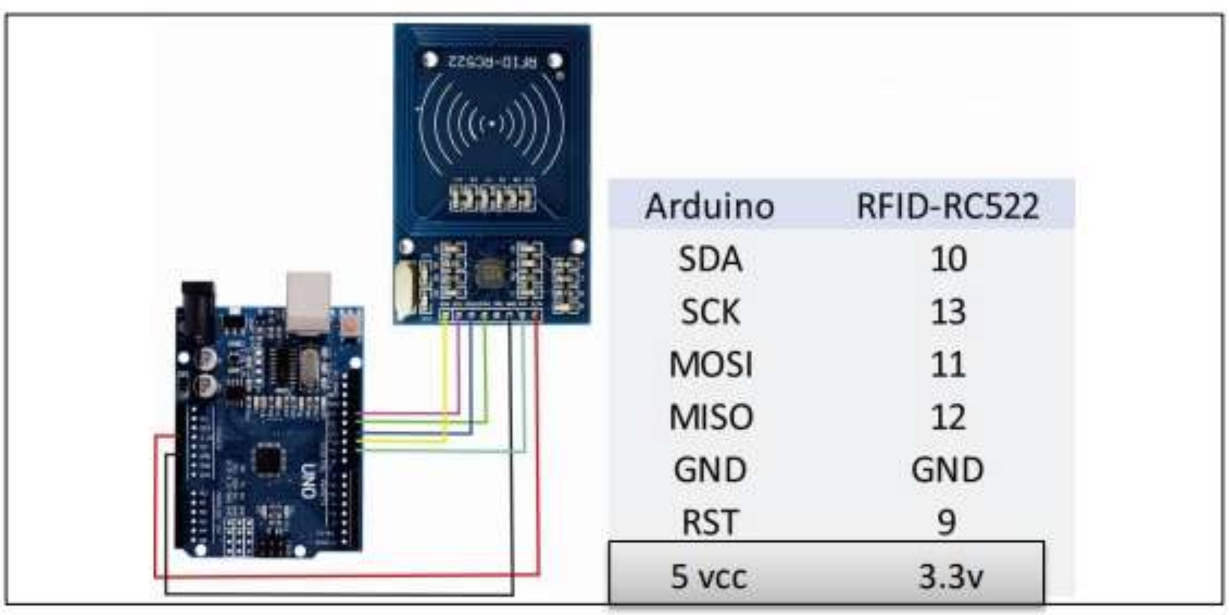
4. IRQ is an interrupt pin that alerts the microcontroller when an RFID tag is in the vicinity.

5. MISO pin acts as master-in-slave-out when SPI interface is enabled.

6. MOSI (Master Out Slave In) is the SPI input to the RC522 module.

7. SCK (Serial Clock) accepts the clock pulses provided by the SPI bus master i.e. Arduino.

8. SS pin acts as a signal input when the SPI interface is enabled.



Select Board

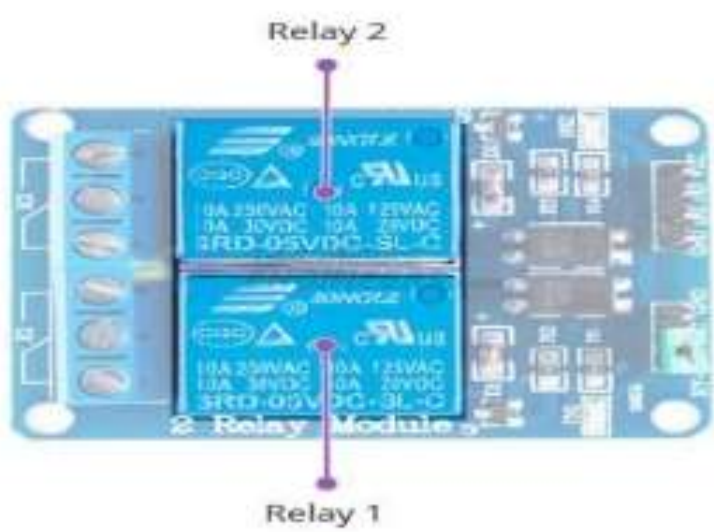
sketch_jun7a.ino

```
#include <SPI.h>
#include <MFRC522.h>

#define SS_PIN 10
#define RST_PIN 9
MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create MFRC522 instance.

void setup() {
  Serial.begin(9600);  // Initialize serial communications with the PC
  SPI.begin();         // Init SPI bus
  mfrc522.PCD_Init();  // Init MFRC522
  Serial.println("Place your card to the reader...");
  Serial.println();
}

void loop() {
  // Look for new cards
  if (!mfrc522.PICC_IsNewCardPresent()) {
    return;
  }

  // Select one of the cards
  if (!mfrc522.PICC_ReadCardSerial()) {
    return;
  }

  // Dump debug info about the card; PICC_HaltA() is automatically called
  Serial.print("Card UID: ");
  for (byte i = 0; i < mfrc522.uid.size; i++) {
    Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
    Serial.print(mfrc522.uid.uidByte[i], HEX);
  }
  Serial.println();
```

4.3. <Relay>

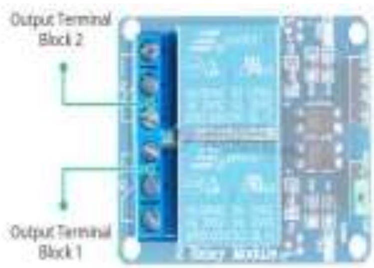
4.3.1. ❖<u>Interface Two Channel Relay Module with Arduino.</u>

The two-channel relay module is designed to allow your Arduino to control two high.powered devices. It has two relays, each with a maximum current rating of 10A at 250VAC or 30VDC.



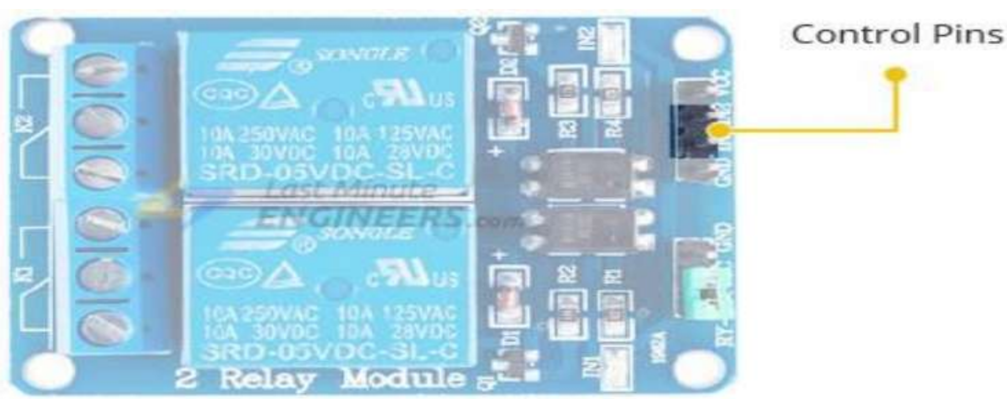
4.3.2. ❖ Output Terminal Blocks

The high voltage terminals (NC, COM, and NO) of each relay are broken out to two screw terminals. The device you want to control can be connected across them.



4.3.3. ❖ Module Control

On the other side of the module, there are two input pins, IN1 and IN2, for controlling the relay. These pins are 5V logic compatible, so if you have a microcontroller like an Arduino, you can drive a relay with any digital output pin.

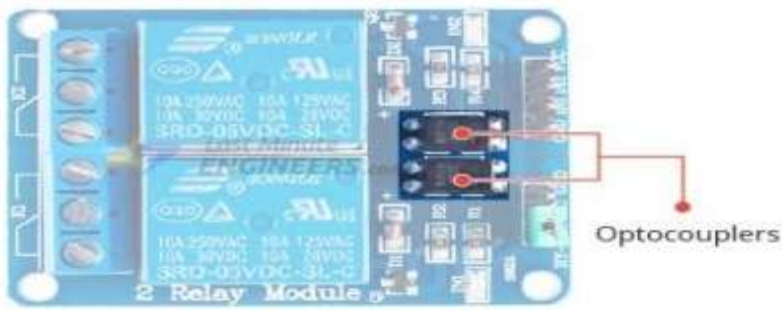


- **The input pins are active low, which means that a logic LOW activates the relay and a logic HIGH deactivates it.**

- **The relay module has two LEDs that indicate the status of the relay. When a relay is activated, the corresponding LED lights up.**

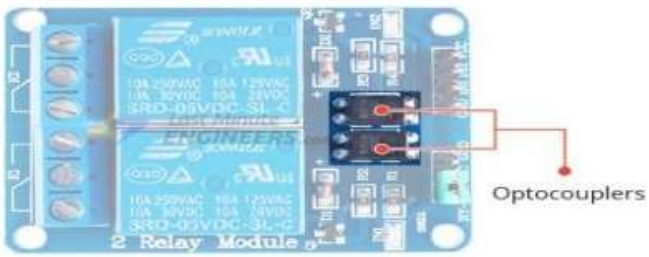
4.3.4. ❖Built-in Optocouplers :

One of the best features of these modules is the inclusion of two optocouplers on the logic inputs.



Optocouplers offer complete electrical isolation between the logic control input and the relay power as an extra layer of protection in the event of a major failure on the relay's AC load, such as a lightning strike.

4.3.5. ❖Two-Channel Relay Module Pinout:



Control Pins:

- **VCC** pin provides power to the built-in optocouplers and, optionally, the relay’s electromagnet (if you keep the jumper in place). Connect it to the 5V pin on the Arduino.

- **GND** is the common ground pin.

- **IN1 & IN2** pins control the relay. These are active low pins, which means that pulling them LOW activates the relay and pulling them HIGH deactivates it. Power Supply Selection Pins:

- **JD-VCC** provides power to the relay’s electromagnet. When the jumper is in place, JD-VCC is shorted to VCC, allowing the electromagnets to be powered by the Arduino’s 5V line. Without the jumper cap, you’d have to connect it to a separate 5V power source.

- **VCC** pin is shorted to the JD-VCC pin with the jumper cap on. Keep this pin disconnected if you remove the jumper .

- **GND** is the common ground pin.

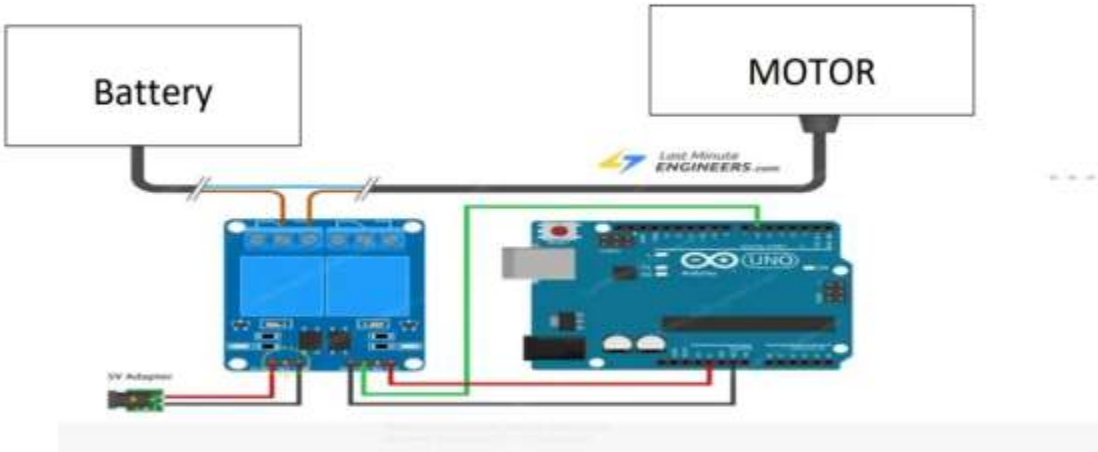
Output Terminals:

- **COM** terminal connects to the device you intend to control.

- **NC** terminal is normally connected to the COM terminal, unless you activate the relay, which breaks the connection.

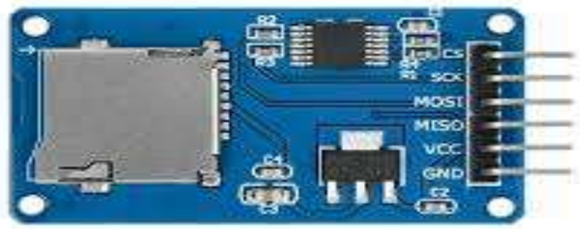
- **NO** terminal is normally open, unless you activate the relay that connects it to the COM terminal.

4.3.6. ❖Arduino Example Code

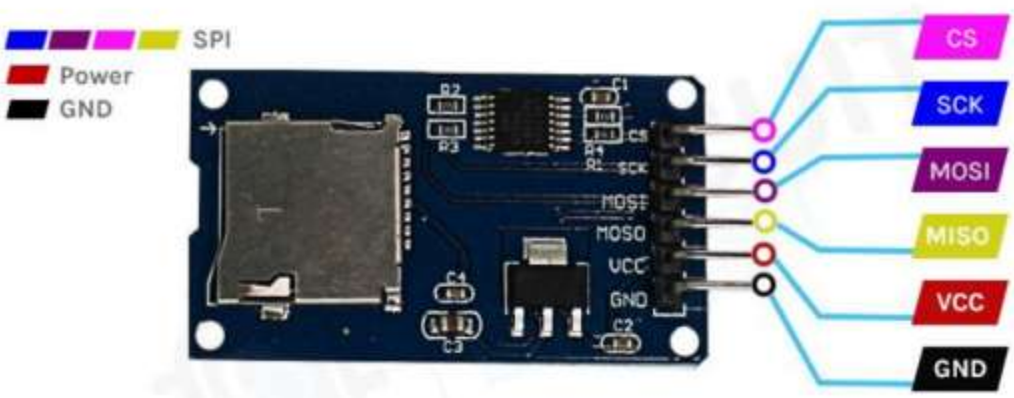



```
int RelayPin = 6;

void setup() {
        // Set RelayPin as an output pin
        pinMode(RelayPin, OUTPUT);
}

void loop() {
        // Let's turn on the relay...
        digitalWrite(RelayPin, LOW);
        delay(3000);

        // Let's turn off the relay...
        digitalWrite(RelayPin, HIGH);
        delay(3000);
}
```

4.4. <SD Card master>



SD cards or Micro SD cards are widely used in various applications, such as data logging, data visualization, and many more. Micro SD Card Adapter modules make it easier for us to access these SD cards with ease. The Micro SD Card Adapter module is an easy-to-use module with an SPI interface and an on-board 3.3V voltage regulator to provide proper supply to the SD card.



4.4.1. ❖micro sd card module PinOut:

GND is the ground pin of the micro sd card module and it should be connected to the ground pin of the Arduino.

VCC is the power supply pin of the micro sd card module that can be connected to 5V or 3.3V of the supply.

MISO Stands for Master In Slave Out. This is the SPI data out from the SD Card Module.

MOSI Stands for Master Out Slave In. This is the input pin of the SD Card Module.

SCK Stands for Serial Clock as the name implies it is the data synchronization pulse generated by the Arduino.

CS Stands for Chip Select, this pin can be controlled by the Arduino to enable or disable the module.

4.4.2. ❖**Features and Specifications of Micro SD Card Adapter Module**

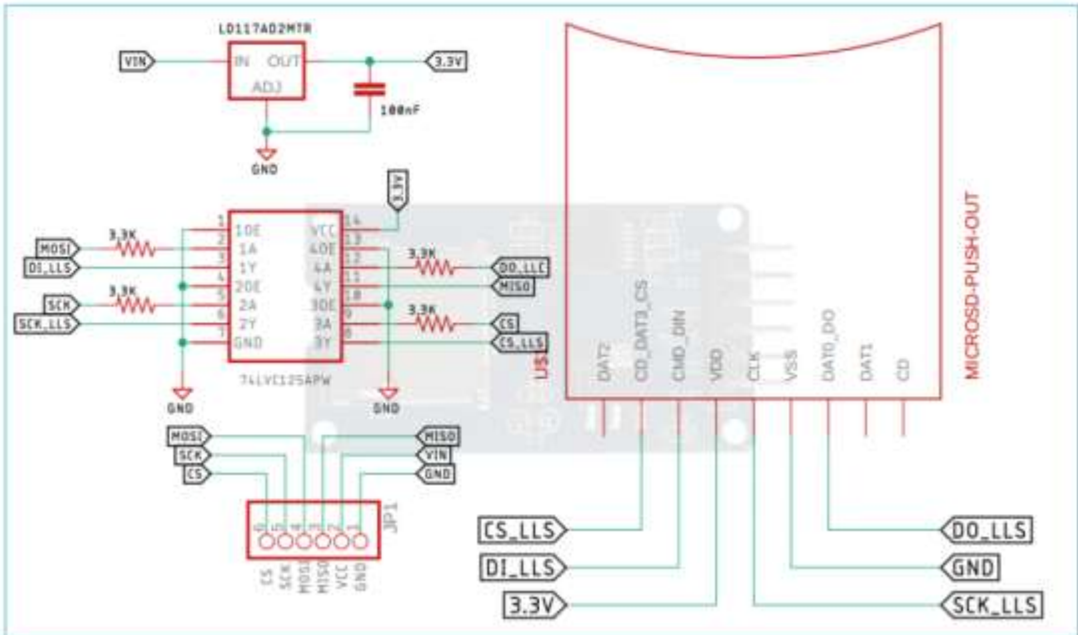
This section mentions some of the features and specifications of the Micro SD Card Adapter Module.

1. **Operating Voltage: 4.5V - 5.5V DC.**
2. **Current Requirement: 0.2-200 mA.**
3. **3.3 V on-board Voltage Regulator.**
4. **Supports FAT file system.**
5. **Supports micro SD up to 2GB.**
6. **Supports Micro SDHC up to 32GB.**

4.4.2.1. Micro SD Card Module – Parts:

If you take a close look at the Micro SD Card module, there is not much on the PCB itself. There are only three components that are significant, first is the Micro SD Card Holder Itself. This holder makes it easy for us to swap between different SD card modules. The second most important thing is the level shifter IC as the SD card module runs only on 3.3V and it has a maximum operating voltage of 3.6V so if we directly connect the SD card to 5V it will definitely kill the SD card. Also, the module has an onboard ultra-low dropout

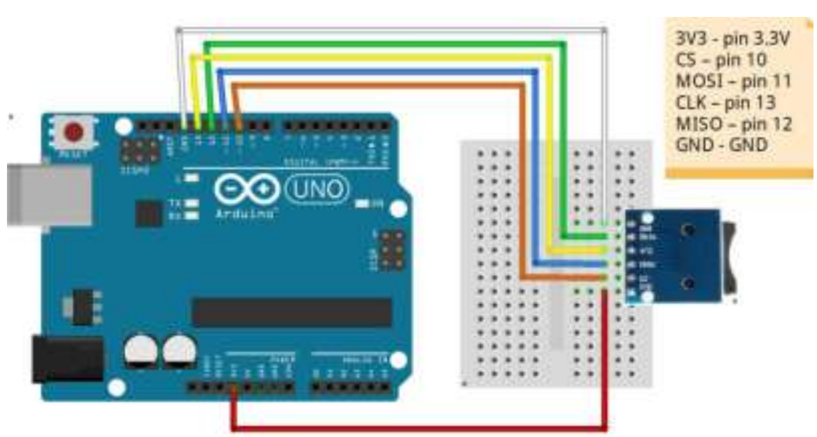
regulator that will convert the voltage from 5V to 3.3V. That is also why this module can operate on 3.3V power.



As you can see in the above schematic, we have the Micro SD Card connector which is a push-out type connector and the connector is connected to a logic level shifter IC. The maximum operating voltage of the module is 3.6V so the logic level shifter IC becomes very important. To power the SD card and the logic level converter, we are using a LM1117 LDO which is why this module can work with both 3.3V and 5V logic levels. The connector JP1 at the bottom of the schematic represents the connector at the bottom of the micro SD card module.

Arduino Micro SD Card Module Circuit Connection Diagram.

Now that we have completely understood how a Micro SD Card Module works, we can connect all the required wires to the Arduino and write the code to get all the data out from the sensor. The Connection Diagram of the Micro SD Card Module with Arduino is shown below-



4.4.3. ❖**Preparing the Micro SD Card Module**

Before inserting the SD Card into the SD card reader module, you need to properly format the card before you can actually work with it, otherwise, you would have problems because the SD card reader module can only read FAT16 or FAT32 file systems. If your sd card is new then chances are that the card is factory formatted, that may also not work because a pre-formatted card comes with a FAT file system, either way, it's better to format the old card to reduce issues during operation.

The most important functions of the main SD card library.

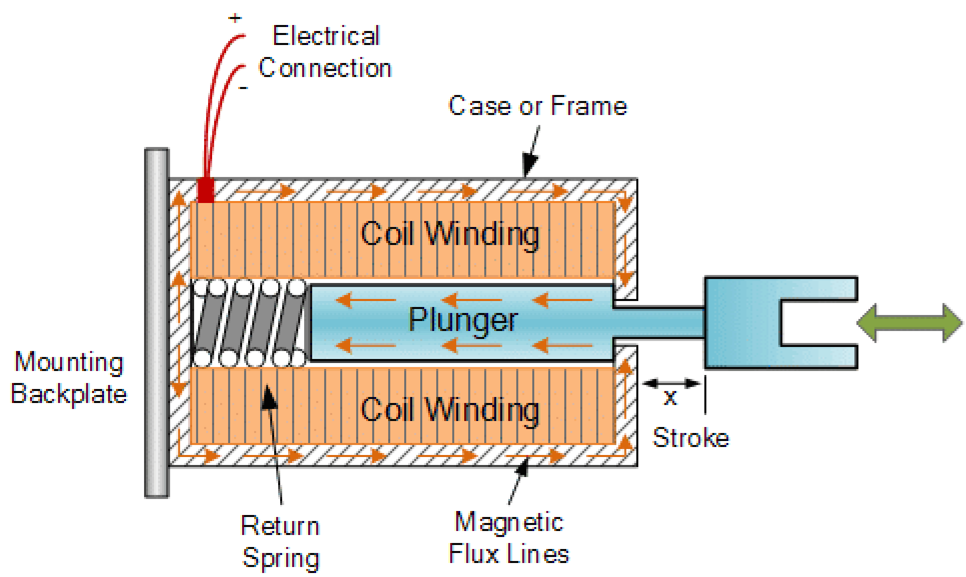
```
#include <SPI.h> // تضمين مكتبة SPI للتواصل مع بطاقة SD
#include <SD.h>  // تضمين مكتبة SD للتعامل مع بطاقة الذاكرة SD

const int chipSelect = 4; // تحديد رقم التعريف لـ Chip Select لبطاقة SD

void setup() {
 Serial.begin(9600); // تهيئة الاتصال التسلسلي بسرعة ٩٦٠٠ بود
 while (!Serial) {  // انتظار حتى يتم فتح المنفذ التسلسلي
  ; // لا تفعل شيئاً، مجرد انتظار
 }

 // تهيئة بطاقة SD
 if (!SD.begin(chipSelect)) {
  Serial.println("SD card initialization failed!"); // طباعة رسالة فشل التهيئة
  return; // إذا فشلت التهيئة إنهاء الدالة setup
 }
 Serial.println("SD card initialized successfully!"); // طباعة رسالة نجاح التهيئة

 // فتح ملف "data.txt" للقراءة
 File dataFile = SD.open("data.txt", FILE_READ);
 if (dataFile) {
  Serial.println("data.txt contents:");

  // قراءة البيانات من الملف وطباعة كل سطر
  while (dataFile.available()) {
   String line = dataFile.readStringUntil('\n'); // قراءة سطر حتى الوصول إلى نهاية السطر
   Serial.println(line); // طباعة السطر المقروء
  }
  dataFile.close(); // إغلاق الملف بعد الانتهاء من القراءة
 } else {
  Serial.println("Error opening data.txt for reading!"); // طباعة رسالة خطأ في فتح الملف
 }}
```

CHAPTER5: ANOTHER COMPONENTS

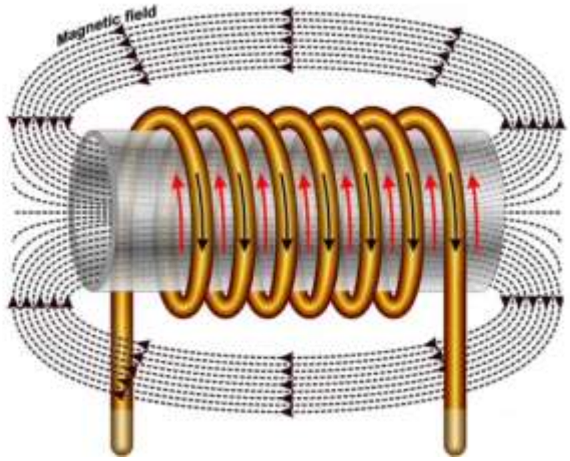
5.1. <Solenoid>

5.1.1. ❖How Does a Solenoid Work?

A solenoid is an electromechanical device that converts electrical energy into linear motion. It consists of a coil of wire wound around a cylindrical core, usually made of iron or steel. When an electric current flows through the coil, it creates a magnetic field that pulls in a movable plunger. Once the current stops, a spring pushes the plunger back out. See the picture below.



The basic principle behind the operation of a solenoid is Ampere's law, which states that a magnetic field is produced around a current-carrying conductor. In the case of a solenoid, the coil acts as the conductor, and the current flowing through it generates a magnetic field.



When the current flows through the coil, the magnetic field lines concentrate inside the coil, creating a strong magnetic force. This force attracts the plunger, causing it to move towards the center of the coil. When the current is turned off, the magnetic field collapses, and the plunger returns to its original position due to a spring or other mechanical means.

Solenoids are commonly used in various applications, such as door locks, valves, actuators, and relays. They provide a reliable and efficient way to control mechanical

movements using electrical signals. Below a picture of a small solenoid valve.

In the next sections, we will explore the different types of solenoids and discuss the circuits and code required to control them using an Arduino.

5.1.2. ❖<u>Types of Solenoids</u>

Solenoids come in various types, each designed for specific applications. Understanding the different types will help you choose the right solenoid for your project. Here are some common features of solenoids to take into account:

Motion

- Linear solenoids: These solenoids produce linear motion, where the plunger moves in a straight line.
- Rotary solenoids: These solenoids produce rotary motion, where the plunger rotates around an axis.
- Push-pull solenoids: These solenoids are Linear Solenoids that provide both pushing and pulling forces.
- Proportional solenoids: These solenoids are designed to provide variable force or motion control.

Intermittent vs Continuous

- Intermittent solenoids: These solenoids can only be powered for a short time. A few seconds, typically before they get very hot and potentially burn out!
- Continuous solenoids: These solenoids can be powered continuously without getting too hot.

AC vs DC

- AC solenoids: These solenoids are designed to operate with alternating current (AC) power supply.
- DC solenoids: These solenoids are designed to operate with direct current (DC) power supply.

It's important to note that solenoids can have combinations of these characteristics. For example, a solenoid can be a linear, non-latching, intermittent solenoid that operates with DC power. Also there are many more types for specific applications than the few coarse categories described above.

In the next section we highlight what to watch out for when switching inductive loads such as solenoids (or motors, or relays).

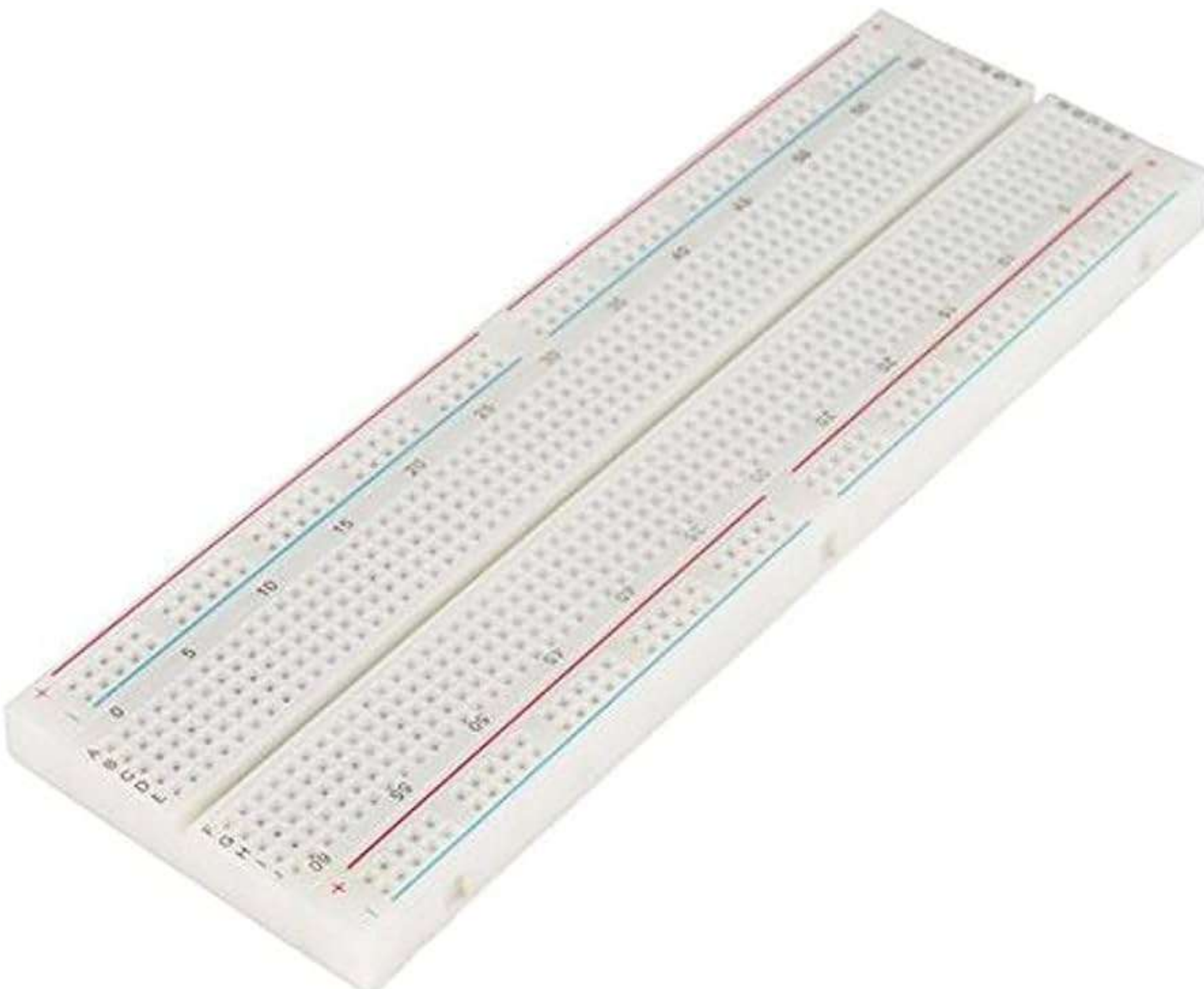
5.2. < Auxiliary components>

5.2.1. ❖Dupont Wire Set

An electrical wire, or bundled group of wires, with a connector or pin at each end that is used to connect components without soldering.

5.2.2. ❖Breadboard

It is a flat board used as a base for connecting electronic components to build electronic circuits.



5.2.3. ❖USB Cable for Arduino UNO

USB cable A-B. Specifications. USB cable A-B is used to connect the Arduino

to the computer

5.2.4. ❖Resistor & LED kit

5.2.4.1. *LED*

LED is used when entering or denying entry.

5.2.4.2. *Resistor*

Resistor used to adjust SPI connection.

5.2.4.3. Buzzer

How to use a Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It

is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

5.2.4.4. Battery

IFR22650 LiFePO4 batteries are an excellent choice for Arduino applications due to their many advantages such as high voltage stability, long cycle life, and high safety. By connecting three batteries in proportion to the project requirements, reliable and stable performance can be achieved for various Arduino projects, contributing to efficient and

sustainable results.

CHAPTER6: PROBLEMS AND SOLUTIONS

6.1. <Data collision problem>

When a single peripheral device (Slave) is connected to the Master controller in an SPI system, communication occurs smoothly and with high efficiency.

However, when more than one peripheral device is connected, the problem of data collision between the peripheral devices arises while the data is responding to the main controller.

This problem represents a challenge that requires an effective solution to ensure continuity and efficiency of communication.

Here we will explain the problem we encountered and the solution we applied to overcome it.

6.1.1. ❖the problem:

In a multi-peripheral SPI system, the master controller selects the target peripheral by activating its CS (Chip Select) pin. Next, data is sent from the master controller to the peripheral via the MOSI (Master Out Slave In) pin. Once the peripheral receives the data, it sends the responsive data to the master controller via the MISO (Master In Slave Out) pin.

When there is more than one peripheral device, data received from different devices may collide when sent to the main controller, as the devices try to send their data at the same time. This collision results in communication failure and the running process stops.

6.1.2. ❖the solution:

To avoid data collision between peripheral devices in the SPI system, we have implemented the following solution:

Adjust data transmission timing:

Data transmission from peripherals via the MISO pin must be timed to avoid collision. This can be achieved by delaying or advancing the timing of data transmission from different devices.

Use anti-delay:

We used a 330 ohm resistor to delay data reception from the peripheral to the main controller. This delay helps regulate data flow and prevent collisions when receiving data from more than one peripheral device.

6.1.3. ❖**The result:**

By applying this solution, we were able to solve the data collision problem in the multi-terminal SPI system, improving the communication efficiency and ensuring its continuity. These steps ensure better regulation of data flow and prevent collisions, thus improving the performance of the system as a whole.

6.1.4. ❖**Detailed steps to apply the solution:**

Defining peripheral devices and determining the timing of data transmission:

For each terminal, a different timing is set for sending data. Timing can be set via programming or by modifying the delay circuits.

Connecting resistance:

Connect a 330 ohm resistor between the MISO pin and the terminal. This connection delays data transmission slightly, which helps avoid collisions.

System testing:

After implementing the changes, the system was tested to ensure that there were no collisions between the data received from the terminals and to achieve a stable and reliable connection.

6.1.5. ❖ Conclusion:

Regulating the timing of data transmission and using delay resistors is an effective solution to the data collision problem in a multi-peripheral SPI system. This solution contributes to stable and efficient communication between the main controller and multiple peripheral devices, ensuring reliable performance and high efficiency of the system.

6.2. <Data storage problem in Arduino>

6.2.1. ❖The problem:

The problem you encounter when using an Arduino to store a database that includes the IDs of all individuals allowed into the university is mainly related to the available storage space. The Arduino, by itself, comes with very limited memory, making it difficult to store large amounts of data needed for the project. Here's why in detail and why using an SD card is the perfect solution:

6.2.2. ❖Why is there not enough storage space on the Arduino? Limited memory space?

Most microcontrollers used in Arduino come with a small flash memory of between 32KB and 256KB, depending on the model. For example, the Arduino Uno has only 32 KB of flash memory.

RAM is also very limited, for example, the Arduino Uno only has 2KB of SRAM.

Permanent storage restriction:

The Arduino uses EEPROM to store data permanently, but its capacity is also limited and is usually only around 1KB to 4KB.

This means that storing a large database containing many individual identifiers becomes impractical due to the severe limitations on available space.

Limitations on data types:

Data in the Arduino has to be stored very efficiently due to the small storage space. Storing complex texts or data becomes a big challenge and requires compact and complex ways of encoding the data.

Inability to expand memory:

The Arduino's memory is fixed and cannot be expanded by adding additional memory modules as is the case in other systems such as computers.

This makes it difficult to adapt a project to store larger amounts of data once the number of people or data to store increases.

6.2.3. ❖Why is using an SD card the best solution?

SD cards come in storage capacities ranging from 2GB to several terabytes, providing enough space to store a large database that includes individual IDs and other relevant information.

This gives you the ability to store millions of records if necessary, without worrying about running out of space.

Easy storage and retrieval:

Arduino libraries like the SD library make it easy to read and write data to the SD card, making big data handling simple and efficient.

You can store data in different file formats such as text (txt) or tables (CSV), making it easier to analyze later.

Portability and data transfer:

SD cards are removable and move easily between devices, allowing you to copy data to a computer for analysis or backup.

This makes it ideal for transferring data between project and development or data analysis environments.

Support permanent data storage:

Data stored on the SD card remains safe even when the power is off or the card is removed from the system.

This ensures data integrity and continuity, which is very important for applications such as university admission systems.

Flexibility in data management:

SD cards allow you to organize data into different folders and files, making it easier to manage and update data.

You can also use techniques such as data segmentation to distribute large data across multiple files, which enhances efficiency and ease of data access.

Low cost and easy availability:

SD cards are low-cost and readily available in the market, making them an economical solution for projects that need to store large amounts of data.

You can easily upgrade your storage capacity by replacing the card with a larger one as needed.

Extensive library support:

The SD library available for Arduino supports a wide range of file operations, including creating, opening, reading, writing, and closing files.

This makes it a powerful tool for processing big data in a reliable and efficient manner.

6.3. < The problem of using traditional RFID>

6.3.1. ❖Introduction:

RFID technology has become a popular tool in many applications such as entry systems, inventory management, and asset tracking, thanks to its ability to read data wirelessly from long distances without the need for direct sight. Most traditional systems rely on RFID cards with frequencies such as 125 kHz and 13.56 MHz, which contain a fixed unique identifier (UID - Unique Identifier) that cannot be changed after manufacturing. Despite the many benefits of this technology, the use of fixed UID cards brings with it a set of challenges that may affect security and operational flexibility. In this article, we will review the problems associated with using traditional RFID cards with a fixed UID, and possible solutions to overcome these challenges.

6.3.2. ❖The problem:

6.3.2.1. Lack of flexibility

Traditional RFID cards come with a fixed unique identifier that is assigned at the manufacturing stage, and cannot be changed later. This means that the card cannot be reused for a different identity or application, reducing its flexibility and increasing management and operating costs. In large organizations such as universities or companies, it becomes difficult to manage a large database of users without the ability to update or reset card IDs.

6.3.2.2. Security risks

A persistent unique identifier makes the card vulnerable to cloning or tampering. Hackers can use simple RFID readers to copy the card ID and use it for unauthorized activities. This puts the system at risk of being hacked, as anyone with a copy of the card ID could access protected areas or sensitive data without detection.

6.3.2.3. Expansion and modernization problems

As systems expand and the number of users increases, managing and updating persistent card IDs becomes more complex. The inability to change the card ID means having to issue new cards to users every time the system changes or requires an upgrade. This increases operational costs and complicates the maintenance and management process.

6.3.2.4. Incompatibility with future systems

Modern systems require greater flexibility and integration with different technologies. Fixed UID cards may not be compatible with systems that require updateable or

customizable IDs. This hinders the ability to expand and innovate in the future, as moving to a new technology may require replacing all cards in use.

6.3.3. ❖Possible solutions

6.3.3.1. Use UID-changeable RFID cards

Reprogrammable RFID tag technology such as the EM4305 and T5577 provides a solution to this problem. These cards allow users to change their unique identifier using custom hardware and software, giving them the ability to reuse and update the card according to changing needs.

Advantages:

Reuse the card for different purposes.

Reducing costs in the long term.

Improve security by being able to update IDs regularly.

6.3.3.2. Adopting advanced safety technologies

Using data encryption techniques and implementing advanced security protocols can help protect card data from being cloned or tampered with. Technologies such as AES (Advanced Encryption Standard) ensure that information transmitted between the card and reader is encrypted and cannot be easily read by unauthorized parties.

Advantages:

Protect sensitive data from hacking.

Improve system security against cloning and tampering.

6.3.3.3. Integrate central identity management systems

Portal system integration with central identity management systems such as LDAP or Active Directory can make it easier to manage users and their permissions. These systems allow user IDs to be updated and allocated centrally, which simplifies management and improves security.

Advantages:

Centralized and effective management of identities and access permissions.

Improve integration with other systems and facilitate expansion.

6.3.3.4. Use multi-factor identification techniques

Integrating a gating system with multi-factor identification technologies such as fingerprint or facial recognition can enhance security and reduce reliance on static UID cards alone. These technologies provide an additional layer of security by verifying the user's identity based on multiple criteria.

Advantages:

Enhance security by confirming user identity in multiple ways.

Reduce the risk of unauthorized access.

6.3.4. ❖Conclusion

The problem of using traditional RFID cards with fixed UID is a major challenge facing modern systems that require high flexibility and security.

By adopting UID changeable cards, implementing advanced security technologies, integrating centralized identity management systems, and using multi-factor identification technologies, these challenges can be overcome and a more secure and effective system can be achieved.

These solutions not only provide immediate improvements but also lay the foundation for future expansion and sustained innovation in identification and access control systems.

CHAPTER7: PROJECT DEVELOPMENT

To develop an electronic gate system based on 125 kHz RFID tags, overcoming current limitations while looking toward future expansion, you can implement a number of technical improvements. This includes updating components and functionality to make the system more flexible

, safer, and more capable of dealing with present and future requirements. Below we will review the functions and components that can help you develop and scale the system , in addition to the types of tags whose UID can be changed.

7.1. <Using more advanced RFID cards and technologies>

7.1.1. ❖NFC cards

The use of *NFC* (Near Field Communication) cards can provide more diverse functions and higher reading speed compared to traditional *RFID* cards. *NFC cards* are used in many applications such as payment and identification systems, making them an excellent option for scalability.

- *Working frequency:* 13.56 MHz
- *Read/write speed:* Very high

- *Additional features:* Support for advanced security protocols and multiple storage capabilities.

7.1.2. ❖RFID UHF Cards

RFID UHF* (Ultra-High Frequency) technology provides a wider reading range and higher data transfer speed. They can be used to track people and equipment over long distances, making them ideal for large applications such as universities and factories.

- *Working frequency:* 860-960 MHz
- *Reading range:* Up to several metres

- *Applications:* Asset tracking and access management on a large scale.

7.2. <Expanding the database and integrating with other systems>

7.2.1. ❖Central database system

Use a central database system that can store and manage large amounts of data relating to authorized users and cards. You can choose database solutions such as *MySQL* or *PostgreSQL* that provide large storage capacity and high performance.

- *Capacity:* It can accommodate millions of records

- *Security:* Provides robust encryption and access management techniques

- *Integration:* It can be easily integrated with other systems such as university management systems.

7.2.2. ❖Integration with identity management systems

Portal system integration with identity management systems such as *LDAP* (Lightweight Directory Access Protocol) or *Active Directory* can provide centralized management of user identities and access permissions.

- *Central Administration:* Ease of managing and updating access permissions

- *Security:* Support advanced security protocols

- *Expansion:* The ability to easily expand to include multiple locations.

***Secure communications: protect data from tampering during transmission**

***Integration: Compatible with modern systems and databases.**

***Integration with biometric systems:**

The system can be integrated with biometric systems such as fingerprint readers or facial recognition to increase the level of security and better ensure the identity of users.

***Increased security: ensuring accurate identity verification**

***Ease of use: facilitating the entry process and reducing reliance on cards only..**

7.3. <Improved security functionality and scalability>

7.3.1. ❖Data encryption

Using encryption techniques to protect data transferred between cards and readers increases system security. Encryption protocols such as *AES* (Advanced Encryption Standard) can be used to ensure that data cannot be intercepted or tampered with.

***Data security: protecting data from manipulation and hacking**

***Compatibility: It can be easily applied to modern devices compatible with encryption technologies.**

7.3.2. ❖Use HTTPS protocol

Secure communications between network components of the system using *HTTPS* (Hypertext Transfer Protocol Secure) to ensure that the transmitted data is encrypted and safe from interception.

Secure communications: protect data from Manipulation in transit Integration:

Integration: Compatible with modern systems and databases

7.4. <Improved user interface and management>

7.4.1. ❖Web management interface

Develop a web-based management interface that can facilitate system administration and monitoring. Administrators can access the system from anywhere via the Internet to make necessary updates and modifications.

Ease of access: possibility of remote management

Integration: It can be easily integrated with existing systems

Updates: Ease of applying security and functional updates.

7.4.2. ❖ Smart notifications and alerts

Adding a smart notifications system that can send immediate alerts to system administrators in the event of any suspicious activity or hacking attempt.

Rapid response: enabling officials to take the necessary measures immediately

Integration: Can be integrated with email or mobile applications.

7.5. <Improving devices and equipment>

7.5.1. ❖Multi-Frequency Readers

The use of multi-frequency RFID readers can support various types of cards, facilitating future expansion without the need to change hardware.

Compatibility: Support a wide range of cards and technologies

Easy integration: It can be added to the existing system without major modifications.

7.5.2. ❖Using advanced devices to control gates

Using advanced devices such as programmable controllers *(PLC)* to control gates can provide high performance and greater ability to expand and adapt to various scenarios.

Performance: Support complex applications and high security requirements

Flexibility: The ability to adapt to different types of gates and precise control.

7.6. <Use of UID-changeable RFID cards>

7.6.1. ❖Types of cards that can be changed UID_EM4305 (T5577)

EM4305* or *T5577

***EM4305* or *T5577* cards are 125 kHz reprogrammable cards that allow changing the UID. These cards are ideal for use in systems that require the ability to change the unique identity (UID).**

-*Working frequency:* 125 kHz

- *Reprogrammable:* Yes

- *Change UID:* Yes

ATA5577

***ATA5577* cards are similar to EM4305 cards but provide more flexibility in programming and changing the UID. These cards are widely used in applications that require identity reuse.**

- *Working frequency:* 125 kHz

- *Reprogrammable:* Yes

- *Change UID:* Yes

7.6.2. ❖Tools and software required to change UID:

Compatible RFID Reader/Writer

You will need an RFID reader and writer that supports programming and changing the UID of 125 kHz cards. These devices can be found in electronic markets or online.

Custom software

Some devices require custom software for programming. Make sure the software is available from the device manufacturer.

7.7. <Conclusion>

By modernizing the components and technologies used in your portal project, you can ensure a flexible and scalable system that meets current and future security and performance requirements. By using advanced RFID tags, expanding the database, and improving security functions, you can develop an integrated and efficient system that meets the needs of the university and provides a safe and reliable user experience.

. UID changeable RFID tags such as EM4305 and ATA5577 can be used to provide greater flexibility and customization as needed, contributing to efficient system development and scaling.

CHAPTER8: REFERENCES

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Conclusion

In concluding this book, we hope we have provided you with a comprehensive and in-depth overview of how to create an electronic personnel portal, from initial planning to practical implementation and operation. We reviewed various technologies and tools, such as the use of RFID modules and sensors, as well as programming embedded systems to ensure security and efficiency.

Electronic entry gates are an important step towards improving security and facilitating entry and exit management in various institutions. By adopting these innovative solutions, we can provide safer and more organized environments, which contributes to enhancing confidence and comfort for users.

We encourage you to follow ongoing technological developments in this field and explore possible improvements to develop more integrated and intelligent systems. Innovation and creativity are the main keys to achieving excellence in this field, and we hope that this book will be a valuable reference that supports you in your journey towards achieving this.

We thank you for your interest and look forward to seeing your successful and inspiring applications for this project.

TEAM SHARKS