ABSTRACT :

In the era of embedded systems time, security, privacy and efficiency are a matter of priority. RFID (Radio Frequency Identification) emerges as one of the converging technologies and it is a catalyst for being a major base technology for today's database backed security system, which is highly cost effective as well as time efficient. RFID plays a major role in auto ID applications like RFID contact less smart cards used for attendance registration, super markets and book identification. This project aims to demonstrate the benefits of RFID technological possibilities to increase the personal security of personal homes. The main objective of this paper is to design and implement a digital security system which can deploy in a secured zone where only authentic person can be entered. We implemented a security system containing door locking system using passive type of RFID which can activate, authenticate, and validate the user and unlock the door in real time for a secure access.

INTRODUCTION :

Radio Frequency Identification (RFID) is a method that is used to track or identify an object by radio transmission. Data which is digitally encoded in an RFID tag is read by the reader. This device works as a tag or label through which data is read from tags that are stored in the database through the reader as compared to traditional barcodes and QR codes. It is often read outside the line of sight either by passive or active RFID readers. RFID technology can work in a variety of harsh environments without human intervention. Block diagram of RFID System is shown in Figure 1.

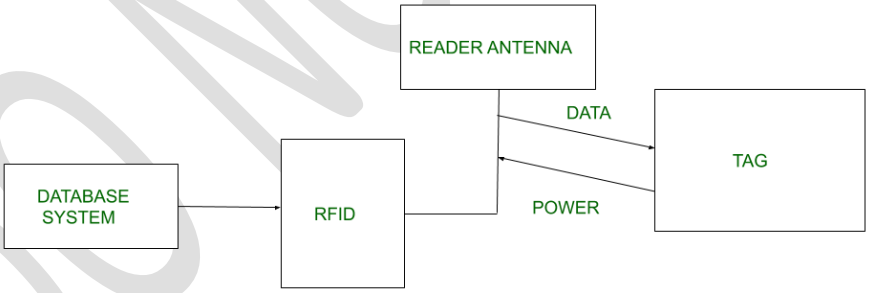

Figure 1: Block diagram of RFID System

PRINCIPLE :

An antenna is a device which converts power into radio waves which are used for communication between reader and tag. RFID readers retrieve the information from the RFID tag which detects the tag and reads or writes the data into the tag. It may include one processor, package, storage and transmitter and receiver unit.

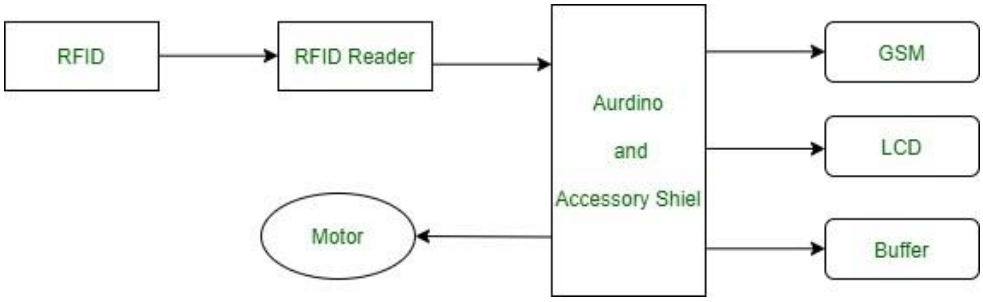

Figure 2: Flow Chart of Working Model

Generally, RFID uses radio waves to perform AIDC function. AIDC stands for Automatic Identification and Data Capture technology which performs object identification and collection and mapping of the data. Flow Chart of Working Model is shown in Figure 2.

USES :

- 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.

TYPES OF RFID SENSOR :

1. Based on frequency :
    A. UHF RFID (125 KHz, 2.45 GHz, 5.8GHz)

        i) EM-18
        ii) ILA-12,
        etc.

    B. LF RFID (125 KHz, 13.5 MHz)

        i) MFRC
        522 ii) SM130

2. Based on power :
    A. Active RFID (own power source)
    B. Passive RFID (simply reflect energy)

HARDWARE USED :

1. Arduino uno board :

Figure 3: Arduino uno board

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Arduino uno board is shown in Figure 3.

Technical specifications :

i. Micro-controller : ATmega328P.
ii. Operating Voltage: 5V. iii. Input Voltage (recommended) : 7-12V. iv. Digital I/O Pins: 14 (of which 6 provide PWM output).
v. Analog Input Pins: 6.

2. MFRC522 RFID sensor :

Figure 4: MFRC522 RFID sensor

MFRC522 is a highly integrated reader/writer IC for contactless communication at 13.56MHz and communicate with RFID tags (ISO 14443A standard tags).. It is a less

costly, low voltage, and small-sized non-contact card chip. It is the best choice for intelligent instrument and portable handheld devices. The reader can communicate with a microcontroller over a 4-pin SPI with a maximum data rate of 10 Mbps. It also supports communication over I2C and UART protocols. MFRC522 RFID sensor is shown in Figure 4.

Technical specifications :

i. Working current：13 – 26mA / DC 3.3V
ii. Standby current：10 – 13mA / DC 3.3V
iii. Sleep current：<80uA iv. Peak current：<30mA
v. Working frequency：13.56MHz
vi. Card reading distance ：0～60mm （Mifare1 card）
vii. Logic Inputs: 5V Tolerant

3. SG90 Servo motor :

Figure 5: SG90 Servo motor

Micro Servo Motor SG90 is a tiny and lightweight server motor with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. SG90 Servo motor is shown in Figure 5.

Technical specifications :

i. Weight: 9 gm
ii. Operating voltage: 3.0V~ 7.2V
iii. Servo Plug: JR
iv. Stall torque @4.8V : 1.2kg-cm v. Stall torque @6.6V : 1.6kg-cm

SOFTWARE USED :

1. Arduino IDE :

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information.

2. Tinker cad :

TinkerCAD is a free online service for creating basic 3D shapes and developing digital prototypes of electronic components. It runs in a web browser. These prototypes include basic circuits with LED lights, buzzers, switches, and even light sensors. These prototypes can include a microprocessor as part of the design

CIRCUIT DIAGRAM :

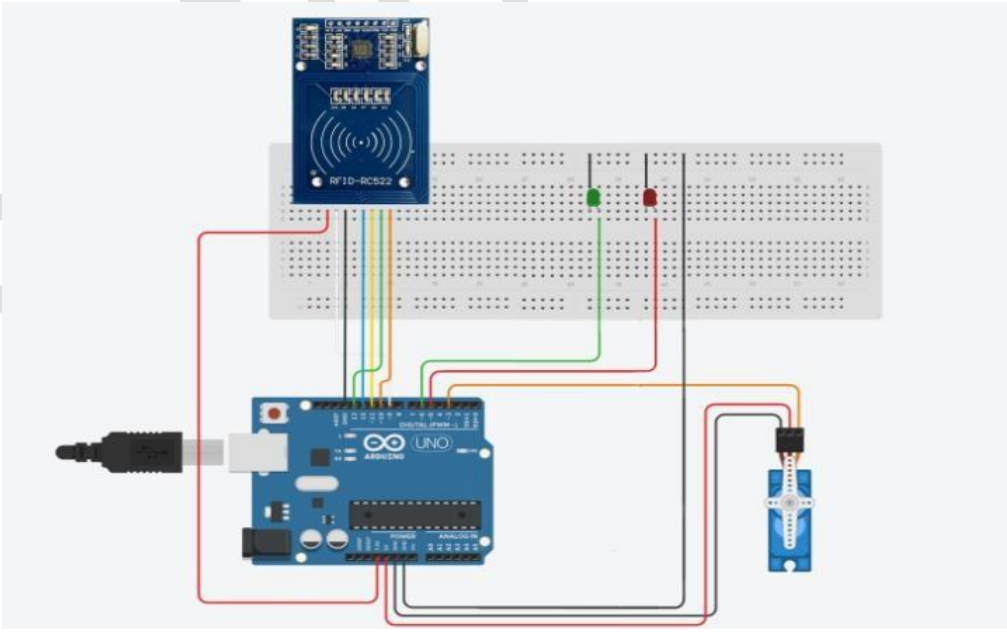

Figure 6: Schematic circuit diagram

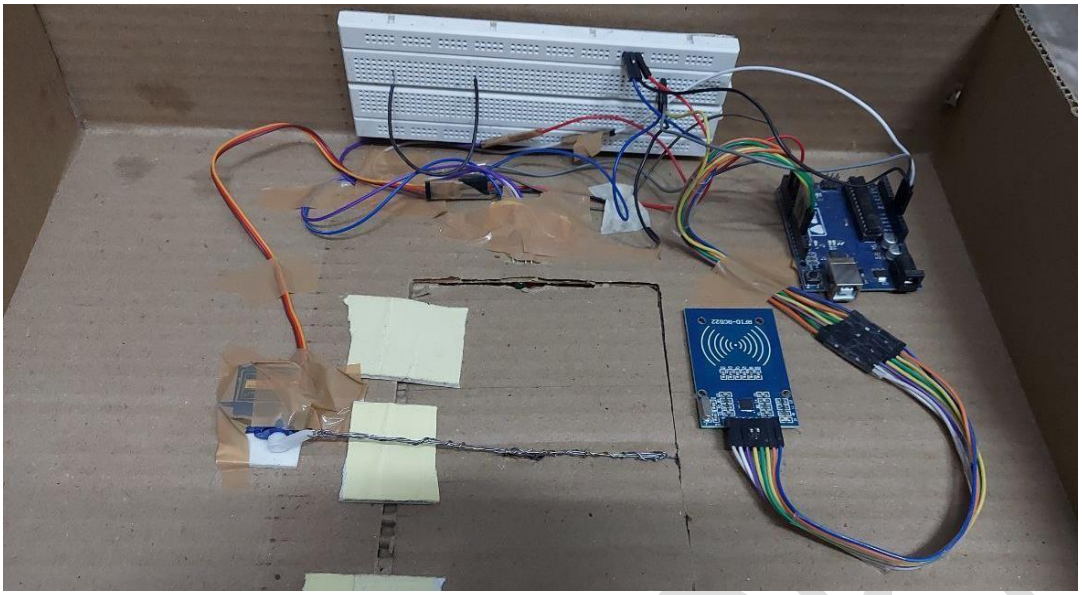

Figure 7: Prototyping circuit diagram

CIRCUIT DESCRIPTION :

The RC522 sensor is going to be connected to our Arduino using the SPI interface. We are then going to connect a green LED which will flash to show that a tag has been read and access has been granted and a red LED which will flash to indicate that a tag has been read an access has not been granted. Lastly, a micro servo will be used to open and close the locking mechanism. The LEDs and micro servo are connected using typical Arduino circuits. Schematic circuit diagram and Prototyping circuit diagram are shown in Figure 6 and Figure 7 respectively.

RESULT :

Figure 8: Unlocked door with green light

Figure 9: Locked door with red light

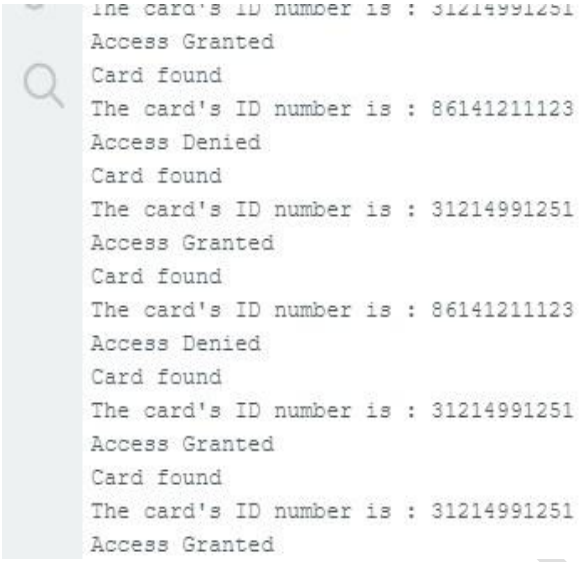

Figure 10: Arduino IDE output result

When the correct RFID tag is shown in front of the reader. The green led blinks and the door opens up. This is shown in Figure 8. Again, if you want to close the door, the tag is shown again so that, the door closes.When the incorrect RFID tag is used, The red led blinks and door stays close. This is shown in Figure 9. The card's ID number and access approval is displayed in arduino IDE serial monitor. This is shown in Figure 10

CONCLUSION :

In this project, we have implemented a digital security system contains door lock system using passive RFID. A centralized system is being deployed for controlling and transaction operations. The door locking system functions in real time as when the user put the tag in contact with the reader, the door open and the check-in information is stored in the database along with basic information of the user. We utilize RFID technology to provide solution for secure access of a space while keeping record of the user.

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