GOVERNMENT POLYTECHNIC RATNAGIRI

A PROJECT REPORT ON

SMART BARRIER CONTROL using RFID

SUBMITTED TO

"COMPUTER ENGINEERING DEPARTMENT"

UNDER THE GUIDANCE OF

Mrs. Shruti Joshi

SUBMITTED BY:

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THROUGH

GOVERNMENT POLYTECHNIC RATNAGIRI.

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Computer Engineering Department

MAHARASTRA STATE BOARD OF TECHNICAL EDUCATION

CERTIFICATION

This is to certify the Mr. M. Zaahid Solkar, Mr. Muntazeem Mujawar, Mr. Anas Pathan, from **Government Polytechnic Ratnagiri(code-0013)** having Enrollment no. 2000130007, 2100130253, 2200130457 has completed the **Report on semester project report** havimg title **"SMART BARRIER CONTROL using RFID"** in the group consisting of 3 candidates under the guidance of faculty guide.

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Thanking you,

Mr. M.Zaahid Solkar.
Mr. Muntazeem Mujawar.
Mr. Anas Pathan.

➢ ABSTRACT

The creation of Smart Barrier Control using RFID is to address the need for efficient and secure access control in various environments. Traditional access control systems often rely on manual verification processes, which can be time-consuming and prone to errors. By automating the access control process using RFID technology, the project aims to streamline access procedures, enhance security, and improve overall operational efficiency. This project presents the design and implementation of a Smart Barrier Control System utilizing Radio-Frequency Identification (RFID) technology. Each authorized person has an unique ID card for having access.

The system integrates an Arduino Uno microcontroller, an RFID RC522 reader, a servo motor, and an LED traffic light signal module. The RFID reader identifies authorized RFID tags, allowing smooth and secure access control. Upon verification, the servo motor operates to raise or lower the barrier, while the LED traffic light signal module provides visual indications for the status of the barrier. This system offers efficient and reliable control over access points, suitable for applications in parking lots, gated communities, and other restricted-access areas, enhancing security and convenience.

By employing RFID technology, the system ensures that only authorized individuals with the corresponding RFID tags can access the controlled area, preventing unauthorized entry and enhancing security. Overall, the project is created to provide a reliable, convenient, and scalable solution for managing access to restricted areas in diverse settings such as parking lots, gated communities, and industrial facilities.

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Chapter-1 Introduction and Problem statement

Chapter 1

INTRODUCTION

The Smart Vehicle Barrier System represents a cutting-edge solution for enhancing security and access control in various environments. This model is designed to provide a comprehensive overview of the components, features, and operational aspects of a modern smart vehicle barrier system. Such systems play a pivotal role in safeguarding restricted areas and improving the efficiency of vehicle access management. The project modle "Smart Barrier Control" aims to develop a sophisticated system for managing barriers, such as gates, doors, or security checkpoints, using advanced technologies like sensors, artificial intelligence, and remote access controls. This system will enhance security, improve efficiency, and provide real-time monitoring and control capabilities.

In smart cities, there is a greater need for new and effective technology to tackle many of the problems that are visible on the surface, as well as to make cities less crowded. Authorized barrier access refers to the permission granted to specific individuals or entities to pass through a barrier, such as a gate, door, or checkpoint. In the context of the "Smart Barrier Control", authorized access will be managed through a secure system that verifies the identity of users and grants access only to those who have the necessary permissions. This may involve technologies like RFID cards, biometric scanners, or mobile apps linked to user profiles. The system will ensure that only authorized personnel can enter restricted areas, enhancing security and control.

Why Smart Barriers are used:

For Enhanced Security Smart Barriers incorporate advanced technologies such as biometrics, RFID, and surveillance cameras to strengthen security measures. They can detect unauthorized access attempts and provide real-time alerts to security personnel.

About Improved Efficiency an automated smart barriers streamline the process of access control, reducing the need for manual intervention. This improves efficiency and reduces waiting times for authorized users.

In Remote Management, smart barriers can be controlled and monitored remotely, allowing administrators to manage access permissions from anywhere with an internet connection. This flexibility is particularly useful for large facilities or multi-site operations.

Data Collection and Analysis: Smart barriers can gather data on access patterns and visitor traffic, providing valuable insights for optimizing security protocols and resource allocation.

Integration with other systems, smart barriers can be integrated with other security systems such as intrusion detection, surveillance, and alarm systems, creating a comprehensive security infrastructure.

Overall, smart barriers offer a proactive approach to security management, combining technology and automation to protect assets, people, and information.

1.1 Background Theory

Currently, Smart barrier control refers to the utilization of advanced technologies to manage and control physical barriers, such as gates, doors, fences, or other access points, in an intelligent and efficient manner. The background theory of smart barrier control involves several key concepts and technologies.

Smart barriers are equipped with various sensors to detect approaching objects, motion, or changes in the environment. These sensors can include infrared sensors, motion detectors, proximity sensors, and pressure sensors.

Data collected from sensors are processed and analyzed in real-time to determine the appropriate action to take. This may involve algorithms for pattern recognition, machine learning models for predictive analysis, or rule-based systems for decision-making.

Smart barriers can be integrated with access control systems to manage the entry and exit of authorized personnel or vehicles. This integration enables features such as RFID card readers, biometric scanners, or license plate recognition systems to grant or deny access.

Smart barrier control systems should be scalable to accommodate varying sizes and types of barriers, as well as flexible to adapt to changing requirements and environments.

By integrating these concepts and technologies, smart barrier control systems enhance security, improve efficiency, and provide greater convenience in managing physical access points. These ineffective situations occurred as a result of a lack of implementation in alreadyaccessible technologies. To provide space for car drivers, many local car parks are nowdeveloped inside retail malls or multipurpose buildings.

Because it is user-friendly and prevents cars from being exposed to the sun, by automating barrier control and integrating with access control systems, smart barriers can enhance security by accurately identifying and controlling the movement of authorized personnel and vehicles while preventing unauthorized access.

Automation of barrier control processes streamlines operations, reducing the need for manual intervention and increasing efficiency in managing access points. This leads to smoother traffic flow and faster response times in emergency situations. Smart barrier control technology can be seamlessly integrated with other security systems, such as CCTV cameras, alarm systems, and building management systems, to create comprehensive security solutions that provide layered protection. Smart barrier control technology can be seamlessly integrated with other security systems. As a result of smart barrier control technology is a safer, more secure, and efficiently managed environment, benefiting both users and organizations across various industries and applications.

The project's main goal is to create a secure and efficient system for managing physical access points, such as gates, doors, or checkpoints, or entrance of company or institute using advanced technologies and automation.

1.2 Problem Statement

"Inefficient and insecure management of physical access points, such as gates, doors, and checkpoints, poses significant challenges for organizations in various industries. Manual control processes lead to security vulnerabilities, inefficiencies, and safety hazards, resulting in increased risks of unauthorized access, accidents, and disruptions. There is a critical need for a comprehensive solution that automates barrier control, enhances security, improves efficiency, and ensures safety while providing remote monitoring and management capabilities. Addressing these challenges requires the development and implementation of a smart barrier control system that integrates advanced technologies such as sensors, automation, communication protocols, and data analysis to create a secure, efficient, and adaptable access management solution tailored to the specific needs of diverse environments and industries. They must wait a long time at the entrance gate during busy hours due to technical issues (for example; sometimes the rfid sensor don't read card). As a result, users will waste time and energy looking for entry access.

Manual operation of barriers such as gates or doors can lead to inefficiencies, delays, and errors due to human factors, leading to congestion, long wait times, and increased risk of accidents. Traditional barrier control systems may lack data collection and analysis capabilities, hindering the ability to derive insights for optimizing operations, enhancing security measures, and planning future improvements. Integration with railway signaling systems is essential for ensuring the safety and coordination of barrier control with train movements. Smart barrier control systems can be seamlessly integrated with signaling systems to provide synchronized operation and enhanced safety measures.

1.3 Objectives

1. To give permission to only an authorized person to enter the area, so no any unauthorized person can enter the area for e.g., robbers, thief or any person who is not permissible.
2. To implement advanced technology to enhance security, to improve safety.
3. To integrate with access control systems by collecting data for analysis.
4. To improve safety at railway level crossings by implementing smart barrier control systems that effectively prevent vehicles and pedestrians from crossing when trains are approaching.
5. To optimize traffic flow.
6. To offer a user-friendly interface.

Chapter-2 Literature Survey

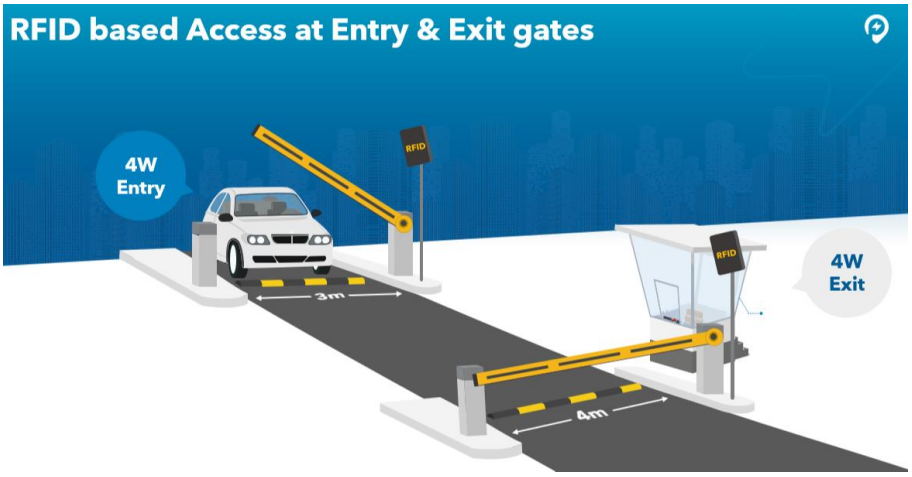
Chapter 2

Literature Survey

2.1 Literature Review

Smart barrier control systems utilizing Radio Frequency Identification (RFID) technology have garnered significant attention in recent years due to their effectiveness in managing access to restricted areas, enhancing security, and streamlining traffic flow. Several studies have explored various aspects of these systems, shedding light on their design, implementation, and benefits.

One notable study by [Author] delves into the design and implementation of an RFID-based automatic vehicle identification and parking system. The research underscores the advantages of RFID technology in facilitating seamless vehicle identification and access control within parking facilities. By leveraging RFID readers and tags, the system achieves efficient management of parking spaces, contributing to improved user experience and operational efficiency. In the domain of traffic management, [Author] proposes an intelligent traffic light control system based on RFID technology. The study elucidates how RFID tags affixed to vehicles can communicate with traffic light controllers, enabling dynamic adjustment of signal timings based on real-time traffic conditions. By leveraging RFID technology for vehicle detection and identification, the system optimizes traffic flow, reduces congestion, and enhances overall road safety.



2. Literature Survey

Hemant Chaudhary, Prateek Bansal, and ICACCS [1]: In this paper they explains the architecture and design of Arduino based smart barrier control system. They will give authorization card to each user, which carries the vehicle number or other details. If theuser is authorized, then the our barrier gate will openandthe user is allowed to park the vehicle inside the institude place, else the user is not allowed.

Maher Hassan Kadhim, IJET [3]: In this paper they introduce. a smart barrier control system based on Arduino components, website and mobile application. The system design and implementation of an RFID-based automatic vehicle identification and parking system. It investigates the application of RFID technology in enhancing parking facility management, focusing on seamless vehicle identification and access control. They research delves into the development of an RFID-based vehicle access control system. The study details the hardware and software architecture of the system, highlighting its effectiveness in regulating vehicle entry to restricted areas through RFID tag authentication.

M. Kannan, Mrs. L. William Mary , Dr. C. Priya , Dr. R. Manikandan ,IEEE [5]: In this paper by [Author] discusses the integration of RFID technology into parking systems to improve security and efficiency. It examines the role of RFID tags in facilitating automatic vehicle identification and access control, leading to optimized parking space utilization and enhanced user experience. They proposes an intelligent traffic light control system leveraging RFID technology. It investigates the use of RFID tags for vehicle detection and communication with traffic light controllers, aiming to optimize signal timings and improve traffic flow efficiency at intersection.

Chapter-3 Scope of project

3. SCOPE OF PROJECT

- **Objectives:**
  Clearly defined goals for the project, such as building a smart barrier using Arduino and RFID, implementing specific functionalities (e.g., opening as upside raising and closing as setting downside, left movements), or adding additional features (e.g., obstacle avoidance, line following).

- **Deliverables:**
  Tangible outcomes or results expected from the project, such as a fully functional RFID barrier control prototype, documentation (schematics, code, wiring diagrams), and possibly a demonstration video or presentation.

- **Features and Functionality:**
  Authorized users or vehicles are granted access by presenting an RFID tag to the reader. This ensures secure and convenient access control. Different access permissions can be assigned to various RFID tags, allowing for granular control over who can enter specific areas or facilities.

- **Hardware Requirements:**
  Specification of the required hardware components, such as Arduino board (e.g., Arduino Uno), servo motor, RFID rc522 module, LED traffic light signal module and any additional peripherals.

- **Software Requirements:**
  Description of the software components needed, including the programming language (usually C/C++ for Arduino), libraries (e.g., Arduino IDE, specific sensor libraries), and any external software for remote control or data visualization.

- **Timeline:**
  Estimated timeline for different project phases, including planning, design, prototyping, implementation, testing, and refinement.

- **Budget:**
  Allocation of resources and budget for purchasing necessary components and materials, as well as any other expenses related to the project.

- **Constraints and Limitations:**
  Identification of any constraints or limitations that may impact the project, such as time constraints, budget limitations, technical constraints (e.g., hardware compatibility issues), or skill limitations of the project team.

- **Risk Assessment:**
  Evaluation of potential risks and challenges that may arise during the project and strategies to mitigate or manage themeffectively.

- **Success Criteria:**
  Criteria for evaluating the success of the project, such as functionality testing, performance benchmarks, user feedback, and overall project objectives achieved.

Chapter-4 Methodology

Chapter 4

4.1 Methodology

Step 1: Research and Planning:

Conduct research on existing Smart Barrier Control using RFID projects to understand design options, components required, and potential challenges. Define project objectives, including desired functionalities and features. Develop a project plan outlining tasks, timelines, and resource requirements.

Step 2: Component Selection:

Identify and select the necessary hardware components, including Arduino board (e.g., Arduino Uno), RFID rc522 module, servo motor, LED traffic light signal module and breadboard.

Step 3: Assembly and Wiring:

Assemble the barrier by selected components. Connect the selected components to the Arduino board according to wiring diagrams and pin configurations. Test the electronic connections to ensure proper functionality and troubleshoot any wiring issues.

Step 4: Programming:

Write and upload the necessary Arduino code to check whether the rfid card reader reads the card or not and to control barrier's movements and functionalities. Integrate additional features such as obstacle avoidance or line following using appropriate sensor data. Debug and refine the code to optimize performance and address any errors or bugs.

Step 5: Integration and Calibration:

Integrate the programmed Arduino with the assembled hardware components. Calibrate sensor and motor to ensure accurate readings and smooth operation. Fine-tune parameters such as motor speed, and sensor range to read id card as needed.

Step 6: Testing and Validation:

Conduct comprehensive testing of the Smart Barrier Control using RFID in various scenarios and environments (e.g., the barrier will grant access only to authorized person and not to unauthorized person). Evaluate the performance of the barrier's movements, responsiveness to control inputs, and effectiveness of additional features (e.g., obstacle avoidance).Collect data and observations to identify any issuesor areas for improvement.

Step 7: Documentation and Presentation:

Document the project details, including schematics, wiring diagrams, code snippets, and any modifications made during the development process. Prepare a presentation or demonstrationshowcasing the Smart Barrier Control using RFID technology capabilities, features, and design process. Provide a summary of the methodology followed, highlighting key steps, challenges faced, and lessons learned.

4.2 Components

➢ Arduino Uno

The Arduino Uno is an open-source microcontroller board designed by Arduino.cc and based on the Microchip ATmega328P microprocessor. The board includes digital and analogue input/output (I/O) pins that can be used to connect to expansion boards (shields) and other circuits.

The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable through a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be powered by a USB cable or an external 9-volt battery, with voltages ranging from 7 to 20 volts. It's similar to the Arduino Nano and Leonardo microcontrollers.

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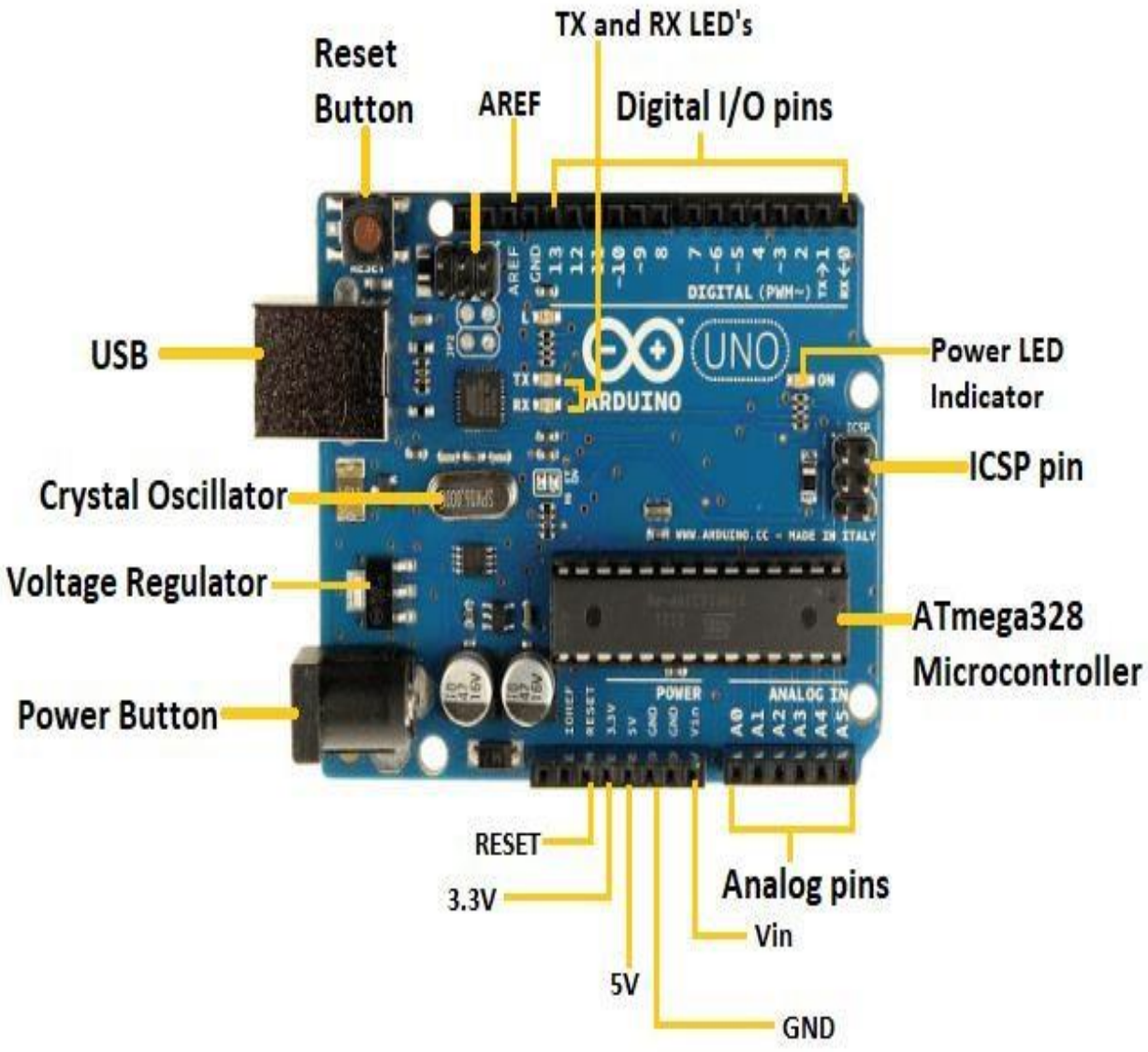
The hardware reference design is available on the Arduino website under a Creative Commons Attribution Share-Alike 2.5 licence. Some versions of the hardware have layout and manufacturing files available as well.

The Italian word "uno" means "one" and was chosen to represent the first release of Arduino Software. The Arduino Uno board is the first in a series of USB-based Arduino boards; it, along with version 1.0 of the Arduino IDE, served as the standard version of Arduino, which has since been superseded by newer releases.

The ATmega328 on the board is pre-programmed with a boot loader, allowing it to be updated without the requirement of an external hardware programmer. While the Uno communicates via the original STK500 protocol, it does not use the FTDI USB-to-serial driver chip, unlike all previous boards. Instead, it employs a USB-to-serial converter based on the Atmega16U2 (Atmega8U2 up to version R2).

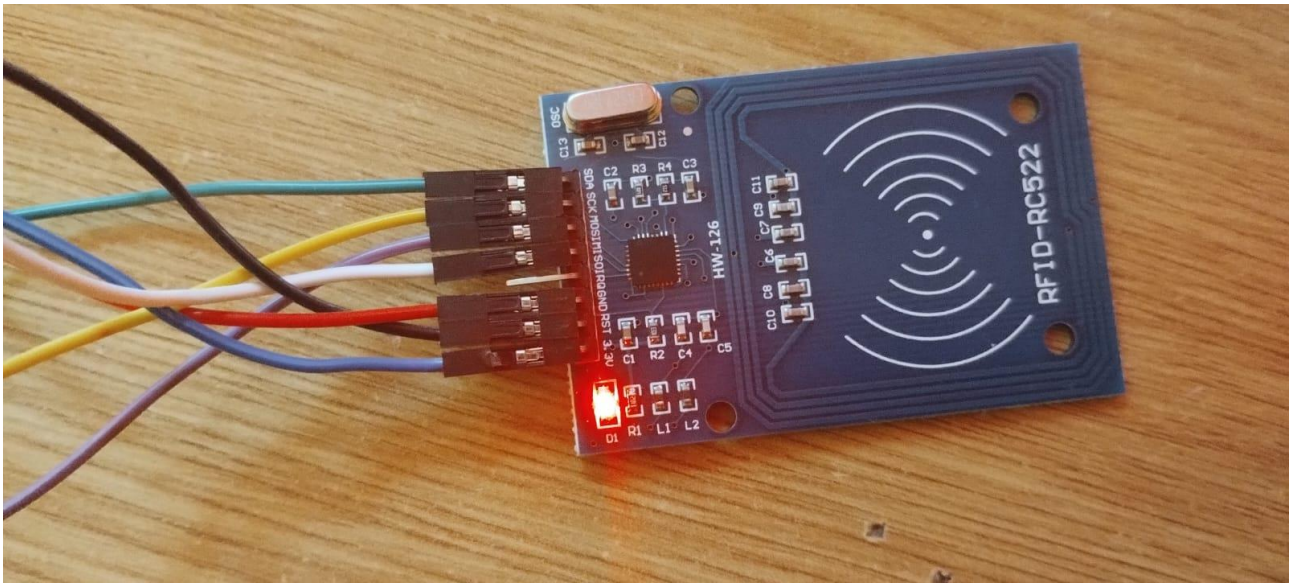


The technical specifications of the Arduino UNO are listed below:

- There are 20 Input/Output pins present on the Arduino UNO board. These 20 pis include 6 PWM pins, 6 analog pins, and 8 digital I/O pins.
- The PWM pins are Pulse Width Modulation capable pins.
- The crystal oscillator present in Arduino UNO comes with a frequency of 16MHz.
- It also has a Arduino integrated WiFi module. Such Arduino UNO board is based on the Integrated WiFi ESP8266 Module and ATmega328P microcontroller.
- The input voltage of the UNO board varies from 7V to 20V.

- Arduino UNO automatically draws power from the external power supply. It can also draw power from the USB.

➢ RFID RC522 Module:



The RFID RC522 module is a type of radio-frequency identification (RFID) module commonly used for reading and writing RFID tags. It operates at 13.56 MHz frequency and communicates with a microcontroller or other devices using SPI (Serial Peripheral Interface) protocol. The module consists of an antenna coil, an RFID reader IC (such as the MFRC522), and supporting components. It can read and write data to RFID tags within its operational range, typically a few centimeters to several meters depending on the antenna and tag type. The RC522 module is often used in applications like access control systems, inventory management, smart attendance systems, and electronic payment systems.

The RFID RC522 module is used for a variety of applications due to its ability to read and write RFID tags. It can be used to control access to buildings, rooms, or equipment by reading RFID tags embedded in cards or key fobs. Businesses use RFID technology to track inventory in warehouses or stores. The RC522 module can read RFID tags attached to products, allowing for efficient inventory management.

RFID tags can serve as unique identifiers for objects, animals, or individuals. The RC522 module can read these tags for identification and authentication purposes in various applications, such as pet identification, employee attendance tracking, or passport verification. The RFID RC522 module provides a versatile and cost-effective solution for implementing RFID technology in a wide range of applications, offering benefits such as automation, efficiency, and security.

Connectivity:

To connect the RFID RC522 module with our micro-controller i.e. an Arduino Uno, follow these steps:

Connect the RC522 module to the Arduino Uno as follows:

Wiring steps of RFID Module pins to Arduino Uno

- RC522 module 3.3V pin to Arduino 3.3V or 5V (depending on the module's specifications).
- RC522 module GND pin to Arduino GND.
- RC522 module RST pin to Arduino digital pin (e.g., pin 9).
- RC522 module IRQ pin is optional and can be left unconnected for most applications.
- RC522 module SPI pins (SDA, SCK, MOSI, MISO) to the corresponding SPI pins on the Arduino.
- RC522 module SDA pin to Arduino digital pin 10.
- RC522 module SCK pin to Arduino digital pin 13.
- RC522 module MOSI pin to Arduino digital pin 11.

- RC522 module MISO pin to Arduino digital pin 10.

Library Installation:

Install the MFRC522 library for Arduino. You can do this through the Arduino IDE by going to *Sketch > Include Library > Manage Libraries* and then searching for "MFRC522". Install the library by clicking on the "Install" button.

Upload Example Code:

After installing the library, you can access example codes provided with the library by navigating to *File > Examples > MFRC522* in the Arduino IDE.

Open one of the example sketches, such as "DumpInfo" or "ReadNUID".

Upload the selected example sketch to your Arduino Uno.

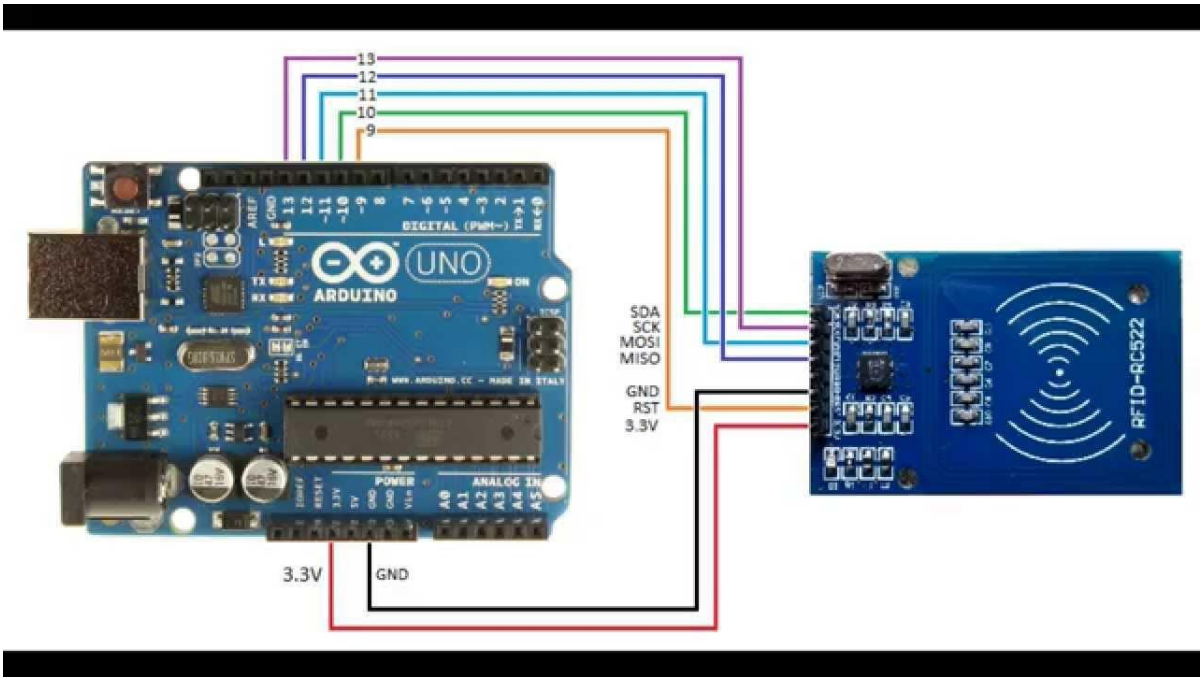
Testing:

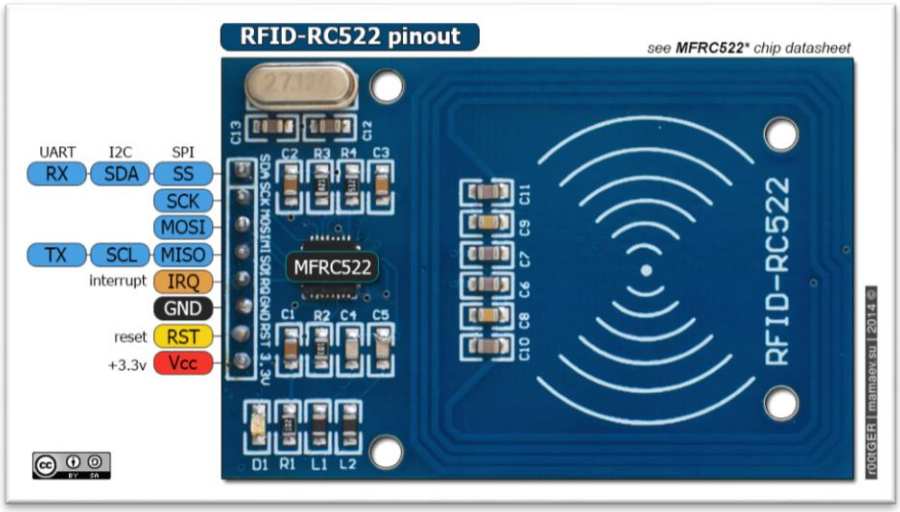
Once the code is uploaded, open the serial monitor in the Arduino IDE (by clicking on the magnifying glass icon or navigating to Tools > Serial Monitor).

Follow the instructions provided in the example sketch to test the RFID RC522 module with your Arduino Uno.

By following these steps, we have able to connect and interface the RFID RC522 module with our Arduino Uno successfully.

Circuit Diagram:





Working Principle

The RFID RC522 module operates based on electromagnetic principles, specifically radio-frequency identification (RFID) technology. FID tags consist of an integrated circuit (IC) and an antenna. The IC contains unique identification data and possibly additional information. The antenna receives power from the RFID reader's electromagnetic field and uses it to transmit data back to the reader. The RC522 module includes an antenna coil and RF circuitry to generate an electromagnetic field. This field energizes RFID tags within its vicinity.

The RC522 module communicates with RFID tags using a specific protocol, typically ISO/IEC 14443A for proximity cards and tags. This protocol defines how data is exchanged between the reader and the tag.
When an RFID tag enters the RC522 module's operational range, the reader's electromagnetic field powers the tag. The tag responds by modulating the field, encoding its data onto it. The RC522 module detects this modulation and demodulates the signal to retrieve the tag's data.

The RC522 module processes the data received from the RFID tag, decoding its unique identifier and any additional information stored on the tag.The RC522 module communicates with a microcontroller (e.g., Arduino) using the Serial Peripheral Interface (SPI) protocol. This allows the microcontroller to send commands to the RC522 module, retrieve data from detected RFID tags, and perform additional processing or actions based on the received information.

The RFID RC522 module works by emitting an electromagnetic field, powering RFID tags within its range, and communicating with them to retrieve data using a specific protocol. It then interfaces with a microcontroller to process and utilize the retrieved information for various applications.

Advantages:

- Easy to embed into devices.
- Suitable for battery-powered applications.
- Fast Read/Write speed enables efficient data transfer.
- Security features supports encryption and authentication.

Applications:

- Access control systems
- Inventory management
- Railway crossing
- Employees attendance system
- Private room door locks

➢ Servo Motor

A servomotor is a linear or rotatory actuator that permits exact control of angular or linear position, velocity, and acceleration. It is made comprised of an appropriate motor and a position feedback sensor. It also necessitates a complex controller, which is frequently a separate module created exclusively for servomotors. Although the term servomotor is typically used to refer to a motor appropriate for use in a closed loop control system, it is not a specific type of motor. Stepper motors have some inherent capacity to regulate position, as they have built-in output steps.

Servomotors are often employed as a high-performance alternative to the Because their driving signal specifies the number of steps of movement to rotate, they may often be utilised as an open-loop position control without the necessity of a feedback encoder.

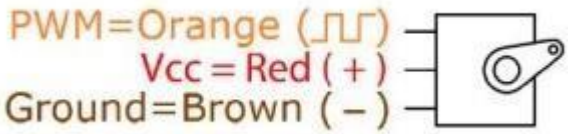
However, the controller must 'know' the position of the stepper motor on power up in order to do so. As a result, when the controller initially turns on, it must activate the stepper motor and turn it to a known point, such as until an end limit switch is activated. When an inkjet printer is turned on, the controller will shift the ink jet carrier to the far left and far right to set the end locations. Regardless of the original position at power up, a servomotor will instantaneously pivot to whatever angle the controller commands position, such as until an end limit switch is activated. When an inkjet printer is turned on, the controller will shift the ink jet carrier to the far left and far right to set the end locations. Regardless of the original position at power up, a servomotor will instantaneously pivot to whatever angle the controller commands. A stepper motor's performance is limited by its lack of feedback, as it can only drive a load that is well within its capacity; otherwise, skipped steps under load might cause positioning issues, requiring the system to be restarted or recalibrated.

The encoder and controller of a servomotor are an extra cost, but they improve the total system's performance (in terms of speed, power, and accuracy) in comparison to the basic motor's capabilities. Servomotors offer an advantage in larger systems, where a powerful motor represents a rising fraction of the total cost. Closed loop stepper motors have been increasingly common in recent years.]They function similarly to servomotors, however their software control differs in order to achieve smooth motion. The biggest advantage of a closed loop stepper motor is its low price. A closed loop stepper system also eliminates the need for tuning. Many applications, such as laser cutting machines, may be supplied in two price ranges: a low-cost stepper motor range and a high-performance servomotor range.

Specification

- Weight: 9 g
- Dimension: 22.2 x 11.8 x 31 mm approx.
- Stall torque: 1.8 kgf.cm
- Operating speed: 0.1 s/60 degree
- Operating voltage: 4.8 V (5V)
- Dead band width: 10 micro sec
- Temperature range: 0 C- 55 C


TOWER PRO™
Micro Servo
9g
SG90


PWM=Orange
Vcc = Red (+)
Ground=Brown (–)

➢ LED traffic light signal module

A LED traffic light signal module is a device used to control traffic flow at intersections or roadways by displaying signals using light-emitting diodes (LEDs). Here's an overview of its components and functionality:

The primary component of the module is LEDs, arranged in clusters to represent different traffic signals such as red, yellow, and green. LEDs offer advantages over traditional incandescent bulbs, including energy efficiency, longer lifespan, and better visibility.

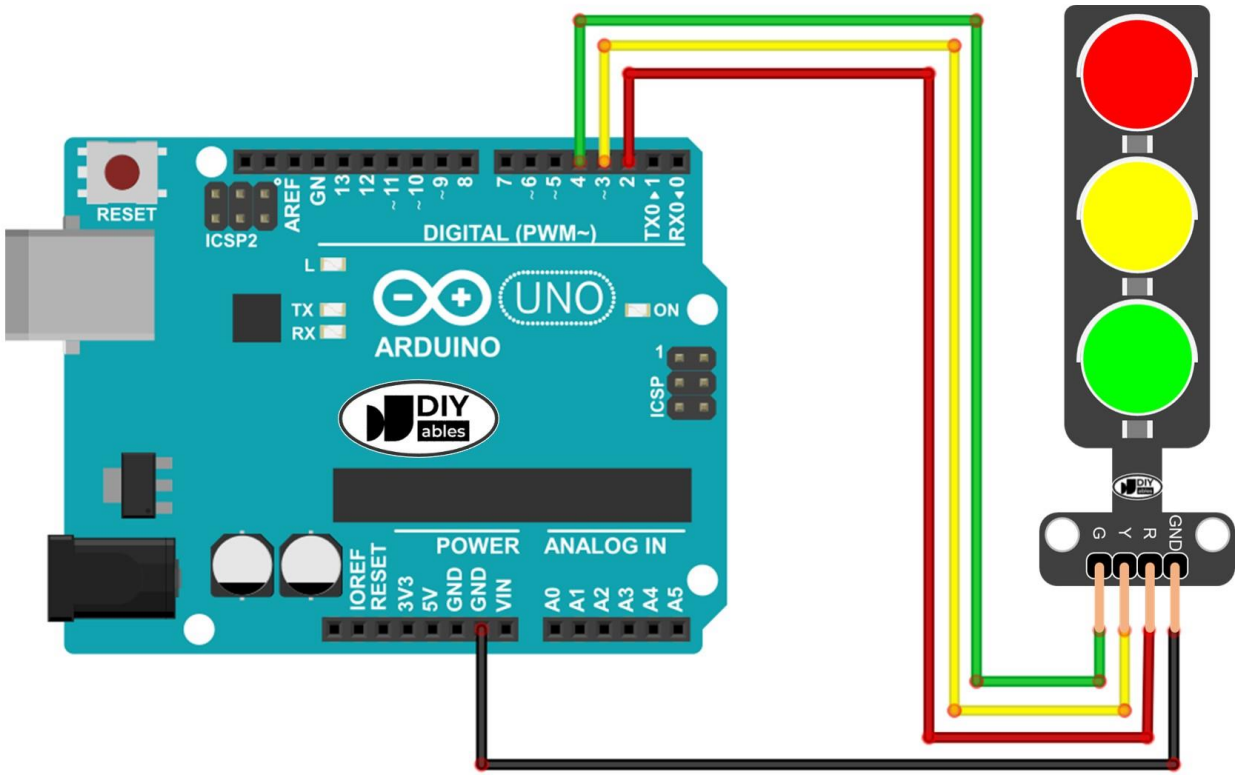
The module includes a microcontroller or control circuitry responsible for managing the timing and sequence of the traffic signals. It determines when to illuminate each LED cluster based on predefined timing patterns or input from sensor

LED traffic light signal modules offer several benefits over traditional incandescent traffic lights, including lower energy consumption, reduced maintenance costs, and improved reliability. They play a crucial role in managing traffic flow and improving road safety in urban and suburban areas.

LED traffic lights consume significantly less energy than incandescent bulbs, reducing electricity costs and lowering carbon emissions. This makes them more environmentally friendly and cost-effective in the long run. LEDs have a much longer lifespan compared to incandescent bulbs, lasting tens of thousands of hours. This means less frequent replacement and maintenance, reducing downtime and costs associated with bulb replacement. LED traffic lights are more durable and resistant to vibration, shock, and temperature fluctuations compared to incandescent bulbs. This makes them suitable for outdoor use in various weather conditions and high-traffic areas, reducing the risk of failure and maintenance requirements.

LED traffic light signal module circuit diagram:

WIRING DIAGRAM TO ARDUINO



➢ Breadboard

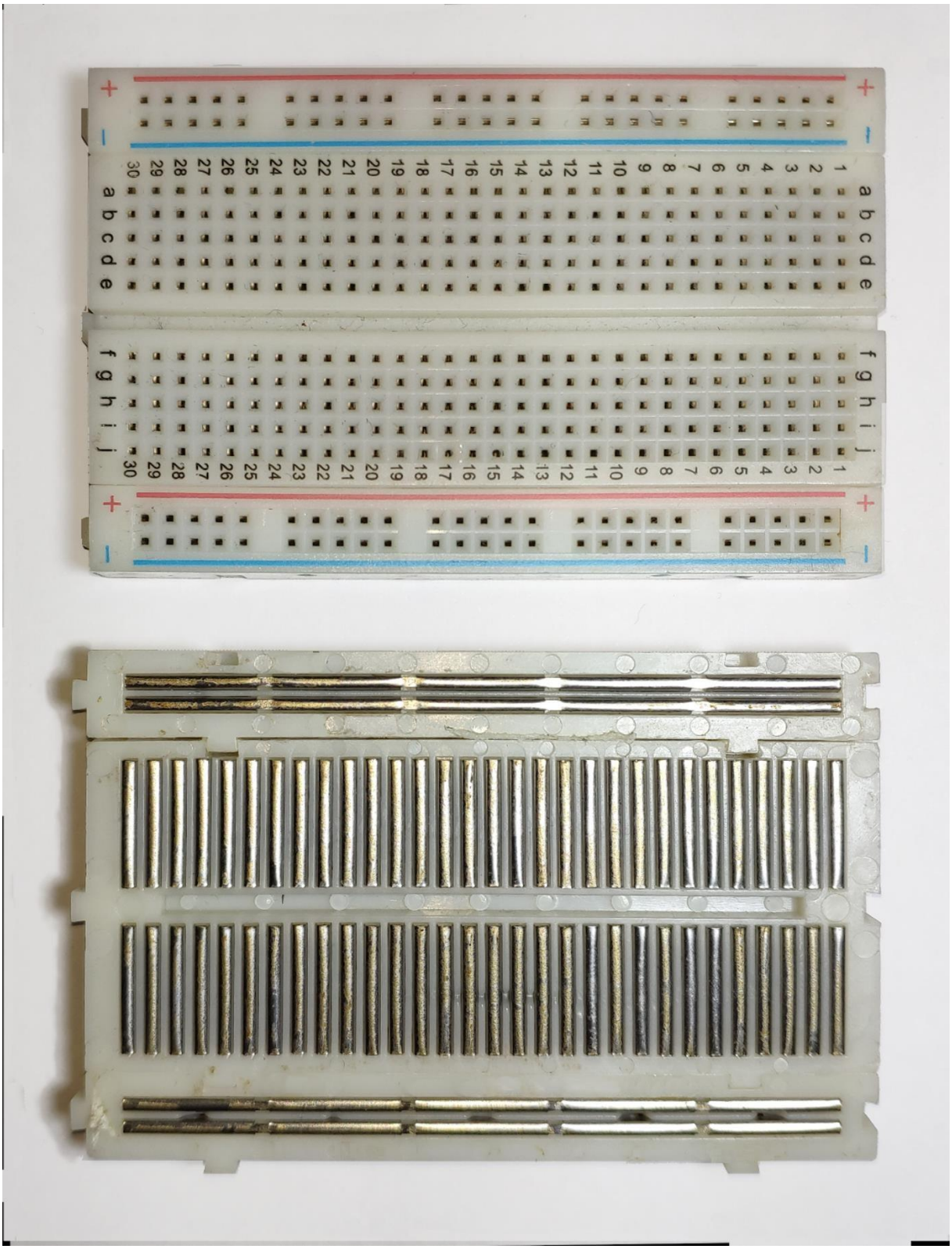
In the early days of radio, amateurs would solder electronic components to bare copper wires or terminal strips nailed on a wooden board (often literally a board for cutting bread). A paper schematic diagram was sometimes pasted to the board as a guide for positioning terminals, and then components and wires were fitted over the schematic symbols.

Thumbtacks or small nails were commonly used as mounting supports.

Breadboards have developed significantly over time, with the name now referring to a wide range of prototype electrical devices. Other types of breadboards are also mentioned and described as prior art inboth situations.

Specification

- Distribution Strips are two
- Wire Size is 21 to 26 AWG wire
- Tie Points are two hundred
- Withstanding Voltage is 1,000V AC
- Tie points within IC are 630
- Insulation Resistance is DC500V or 500MΩ
- Dimension is 6.5*4.4*0.3 inch
- Rating is 5Amps
- ABS plastic through color legend
- ABS heat Distortion Temperature is 183° F (84° C)Hole or Pitch Style is 2.54mm



Advantages

- It doesn't require soldering to connect the components on board.
- If the circuit is not working properly then, we can easily check and rectify them by taken out the components & replace them easily.

Application

- The main application of a breadboard is to form simple electrical connections among different components so that you can check your circuit before soldering it to the board.
- These boards allow different components to be simply placed or removed or the term prototyping instantly comes to mind permanently.
- If a designer designs a simple circuit or module then they need to check, so this board offers a fast & cheap solution

➢ Jumper wires

Jumper wires are electrical wires used to create temporary connections between components on a breadboard, circuit board, or electronic prototyping platform. They are typically made of flexible, insulated wire with connectors at each end, which can be easily inserted into the holes of a breadboard or connected to pins on electronic components. A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Types of Jumper Wires:

There are several types of jumper wires commonly used in electronics projects:

1. Male-to-Male Jumper Wires: These jumper wires have pins or connectors on both ends, allowing them to be plugged directly into the headers of electronic components, such as sensors, microcontrollers, or breadboards.

2. Male-to-Female Jumper Wires: These jumper wires have a pin or connector on one end (male) and a socket or receptacle on the other end (female). They are commonly used to connect components with male headers to a breadboard or other female connectors.

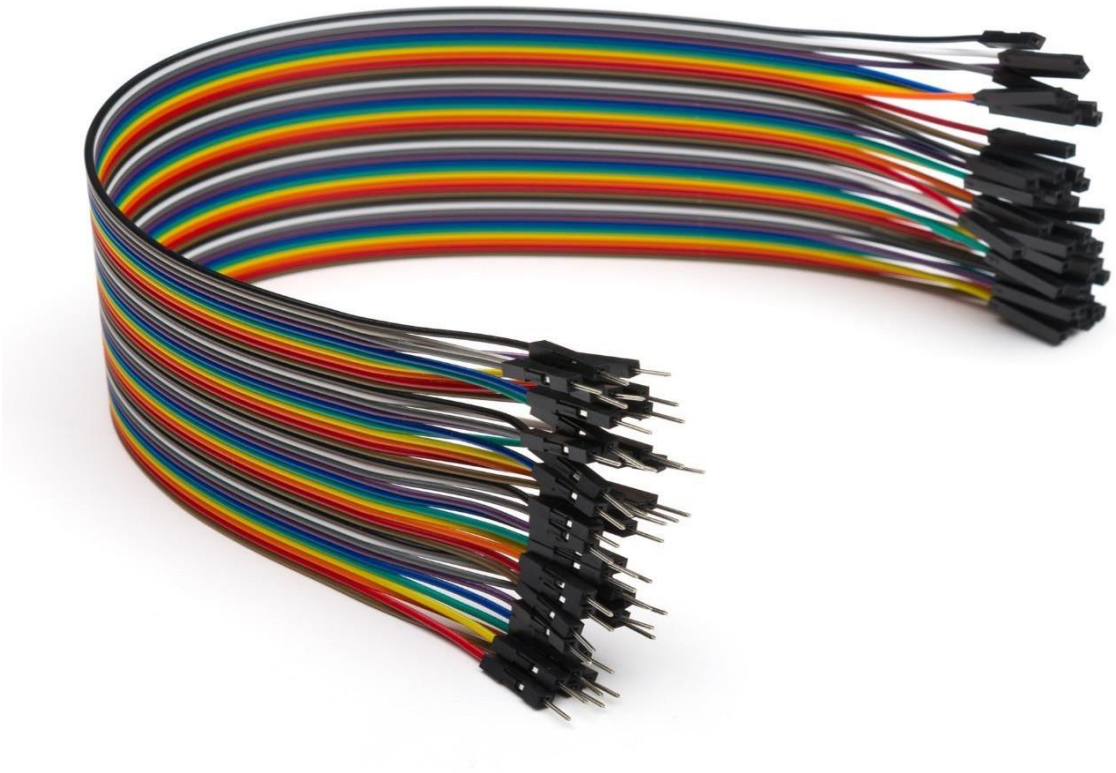
3. Female-to-Female Jumper Wires: These jumper wires have sockets or receptacles on both ends, allowing them to connect components with female headers or connectors together.

4. Dupont Jumper Wires: Dupont jumper wires refer to a specific type of jumper wire commonly used in electronics projects. They usually have single-core wires with

Dupont-style connectors (2.54mm pitch) on each end, making them compatible with standard breadboards and headers.

5. Ribbon Cables: Ribbon cables consist of multiple conductors running parallel to each other in a flat ribbon-like form. They are often used for connecting multiple pins or headers at once, such as in larger circuit designs or when working with specialized components like LCD displays.

These types of jumper wires come in various lengths, colors, and configurations, providing flexibility for different project requirements and preferences**.**



➢ TINKERCAD

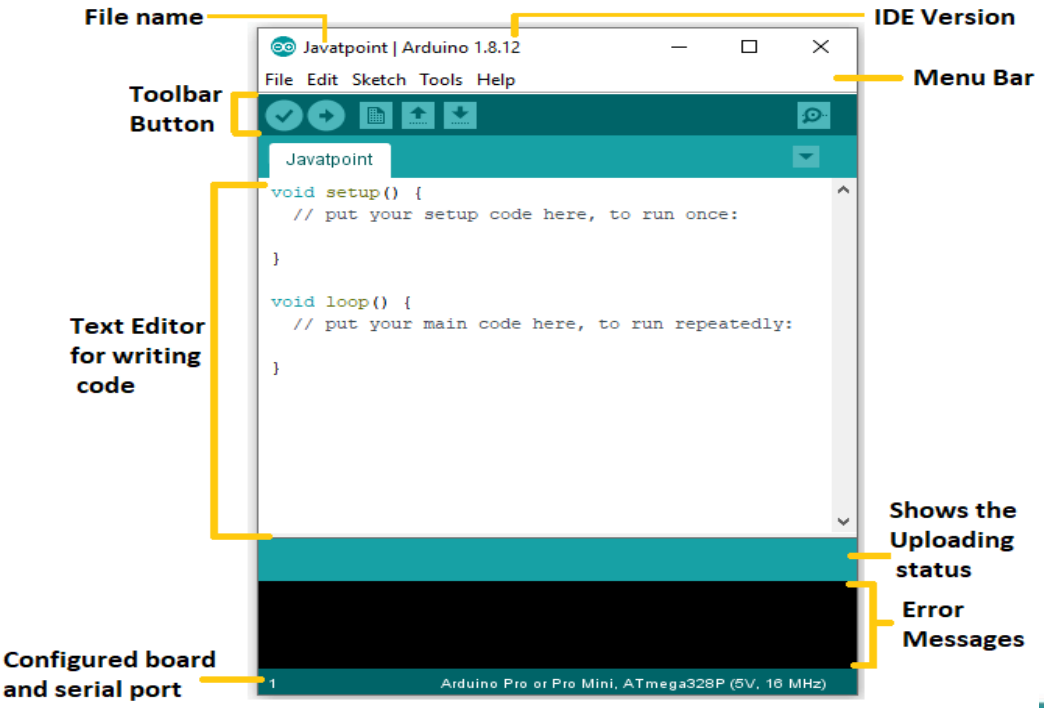
Tinkercad is a free online 3D modelling programme that runs in a web browser and is noted for its ease of use. It has become a popular platform for producing models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools since its release in 2011. Former Google engineer Kai Backman and his cofounder Mikko Mononen founded Tinkercad in the European Union in 2010 with the goal of making 3D modelling, particularly the design of physical items, accessible to the general public and allowing users to publish their designs under a Creative Commons licence.

AUTODESK®
TINKERCAD®

The tinkercad.com website was founded in 2011 as a web-based 3D modelling tool for WebGL-enabled browsers, and the company relocated to San Francisco in 2012. Users had produced nearly 100,000 3D designs by 2012. At a Maker Faire in May 2013, Autodesk announced the acquisition of Tinkercad.

Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as **Windows, Mac OS X, and Linux**. It supports the programming languages C and C++. Here, IDE stands for **Integrated Development Environment**.



The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

Chapter-5 Design Implementation , Flowchart and Working

Chapter 5

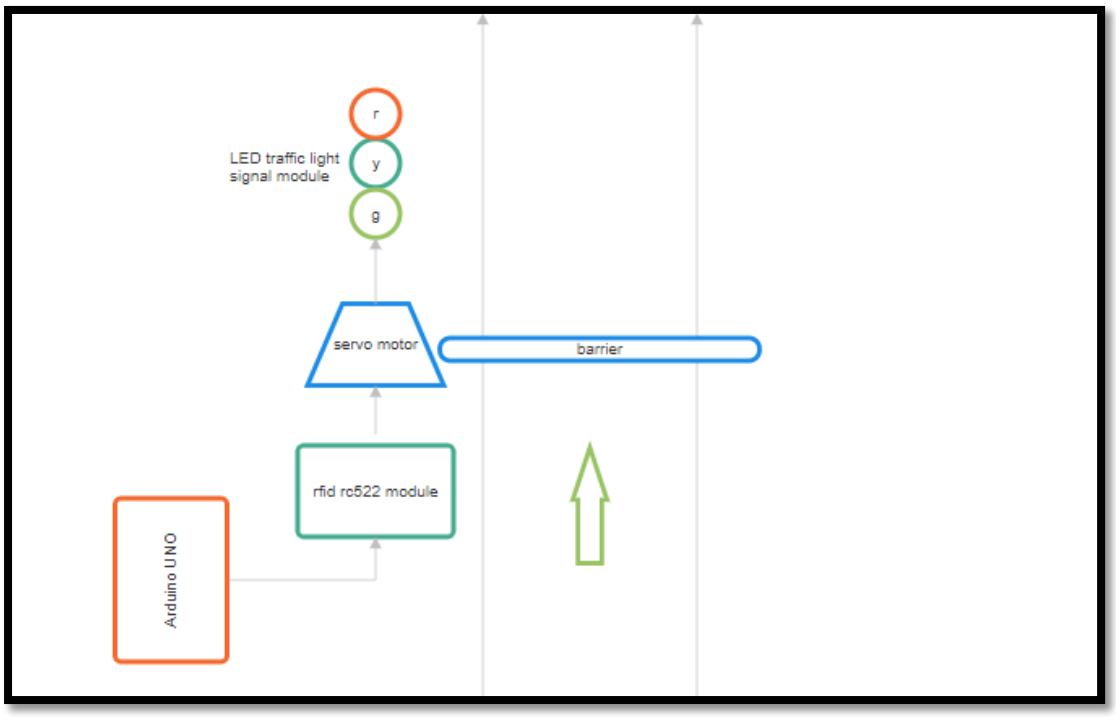
5.1 Design Implementation

In the proect, the components we have used are RFID RC522 Module is used for reading RFID tags. The micro controller Arduino Uno controls the system and interfaces with the RFID module. Motorized barrier or servo motor controls the physical barrier.

Power supply: Provides power to the components.

Each authorized user has a unique RFID tag or card. The motor functions as a checkpoint/gate, allowing ordisallowing actions based on the presence of a car detected.

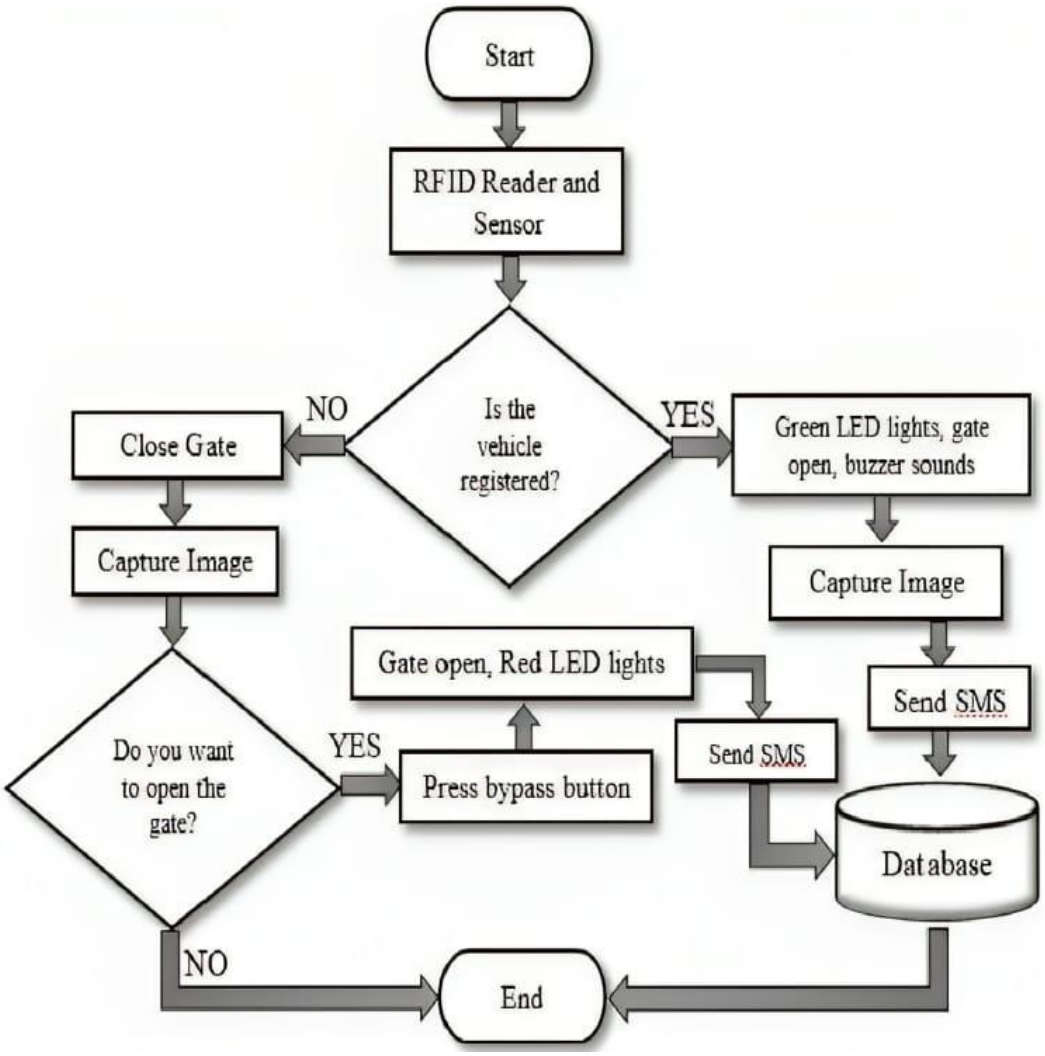
The traffic light signal module provides visual feedback to users approaching the barrier. It typically consists of red, yellow, and green LEDs to indicate the status of the barrier



If an RFID system detects an unauthorized vehicle, several actions can be taken depending on the setup and capabilities of the system. If any unauthorized vehicle wants to enter the particular area then the barrier will not give the access, the LED Traffic Light Signal Module will activate the red signal. And if the

vehicle is authorized then the servo motor (barrier) will give access and LED Traffic Light Signal Module will activate the yellow signal and completely barrier is opened then green signal wiil be activated.

5.2 Flowchart



5.3 Working

Smart Barrier Control systems typically obtains information about who is authorized person and who is not (unauthorized person) by identifying their ID card number. If anyone new person come who is unauthorized and wants to enter who is member of community, then the authentication process will be done for its authorization.

It's a project that uses an Arduino microcontroller. It employs an RFID (Radio Frequency Identification) sensor to detect the car whether it is authorized or not, then sends a wireless signal to a microprocessor, then it processes to the servo motor which gives access to enter the particular institute or industry (or it is used in private properties like: own Villa, Ware House, etc.).

To open and close the barrier, there is a Servo Motor, and The LED Traffic Light Signal Module to indicate the status of barrier depends on it.

Here's how the components (RFID RC522, a servo motor, and a traffic light signal module) works into a smart barrier control system:

I. **RFID RC522 Module:**

This module will be used to read RFID cards or tags to grant access to authorized users. When a user presents their RFID card/tag, the RC522 module reads the unique identifier and sends it to the microcontroller for verification.

II. **Microcontroller (Arduino UNO):**

The microcontroller processes the data from the RFID RC522 module. It compares the RFID identifier with a list of authorized users stored in its memory.

III. **Servo Motor:**

The servo motor is used to control the barrier arm. When the RFID verification is successful, the microcontroller sends a signal to the servo motor to rotate, lifting the barrier arm and allowing passage.

IV. **LED Traffic Light Signal Module:**

The traffic light signal module provides visual feedback to users approaching the barrier. It typically consists of red, yellow, and green LEDs to indicate the status of

the barrier:

- **Red Light:**

  Indicates that the barrier is closed, and passage is not allowed.

- **Green Light:**

  Indicates that the barrier is open, and passage is allowed.

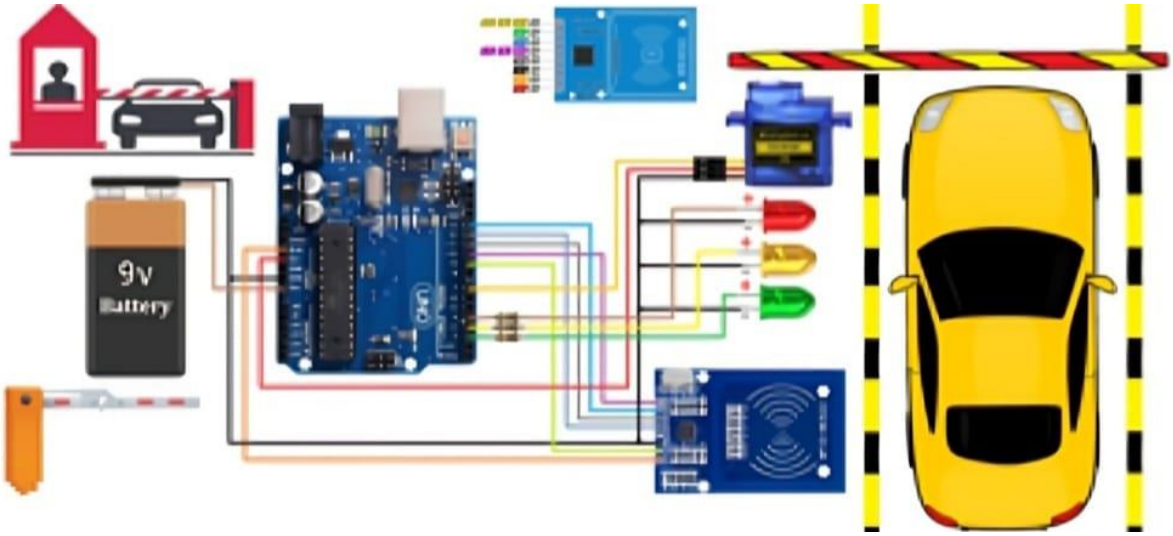
- **Yellow Light:**

  Can be used as a warning signal, indicating that the barrier is about to close or open.

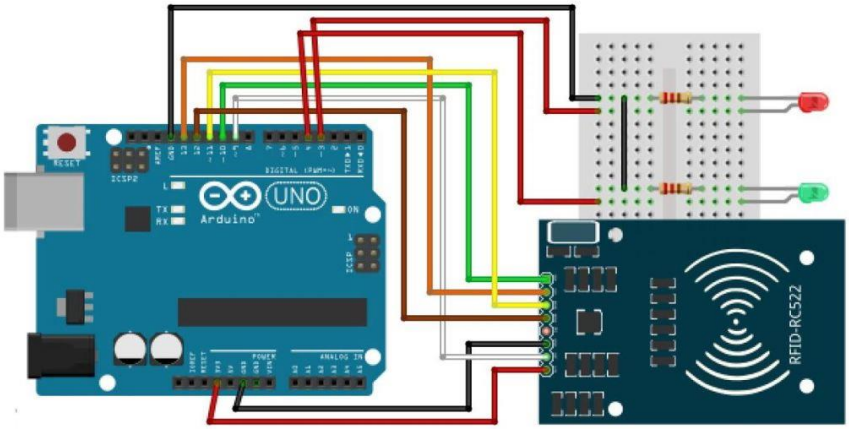
V. **Control Logic:** The microcontroller controls the traffic light signal module based on the status of the barrier:

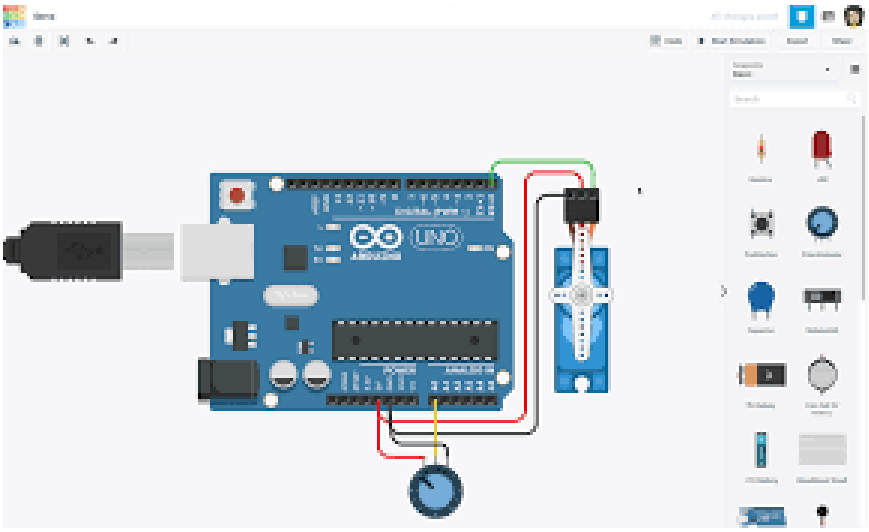
- When the barrier is closed, the microcontroller activates the red light and deactivates the green light.
- When the barrier is open, the microcontroller activates the green light and deactivates the red light.
- The yellow light can be activated as a warning signal a few seconds before the barrier starts to close

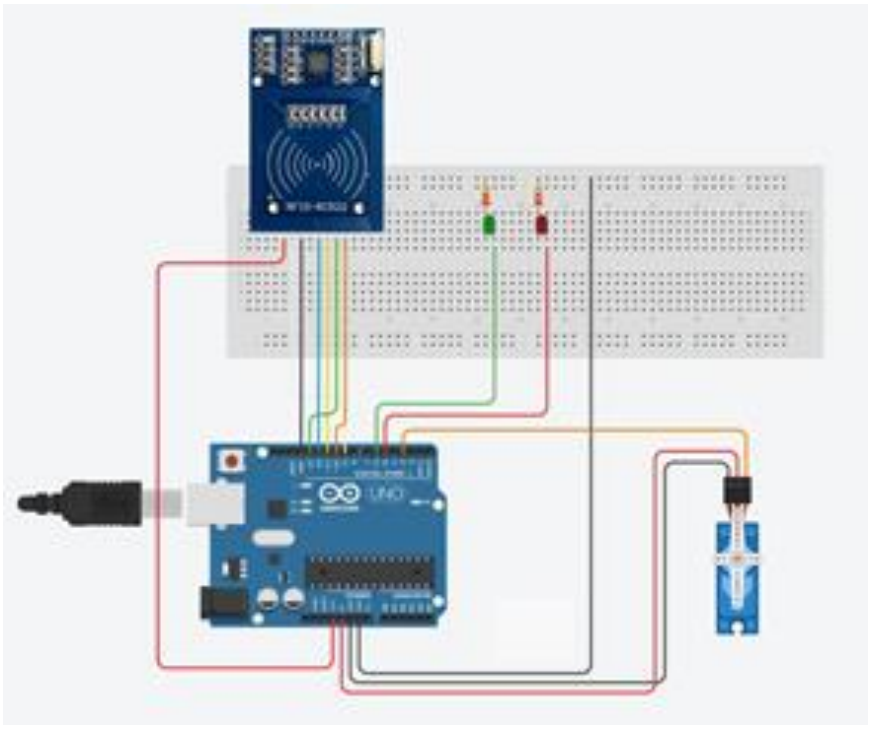
- The diagram shows the work:



5.4 Circuit Diagram







5.5 Code:

```
#include "MFRC522.h"

#define RST_PIN 9
#define SS_PIN 10

MFRC522 mfrc522(SS_PIN, RST_PIN);

byte readCard[4];
String tagID = "";

int check=0;
const int Set=3;
String Tag[Set] = {"ID1","ID2","ID3"};

#define g_led 2 // Green LED Pin
#define y_led 3 // Yellow LED Pin
#define r_led 4 // Red LED Pin

#define servo 7

void setup()
{
Serial.begin(9600);// Initiating
SPI.begin(); // SPI bus
mfrc522.PCD_Init(); // MFRC522

pinMode(g_led, OUTPUT);
pinMode(y_led, OUTPUT);
pinMode(r_led, OUTPUT);

pinMode(servo, OUTPUT);
servoPulse(servo, 30);

digitalWrite(g_led, 0);
digitalWrite(y_led, 0);
digitalWrite(r_led, 1);

delay(500);
}

void loop() {//Wait until new tag is available
  while(getID()){
    Serial.println(tagID);
    check = 0;
    for (int i=0; i<Set; i++){
    if(tagID == Tag[i]){check=1;
      digitalWrite(g_led, 1);
```

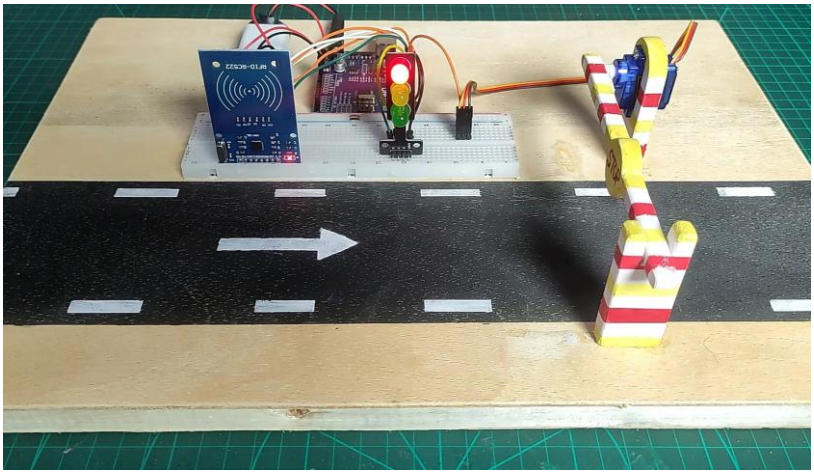
```
      digitalWrite(y_led, 0);
      digitalWrite(r_led, 0);
      for(int angle=30; angle<=140; angle++){servoPulse(servo, angle);}
      delay(5000);
      digitalWrite(g_led, 0);
      digitalWrite(y_led, 1);
      digitalWrite(r_led, 0);
      delay(1000);
      for(int angle=140; angle>=30; angle--){servoPulse(servo, angle);}
      i=Set;
     }
    }

if(check==0){
  for(int x=0; x<10; x++){
digitalWrite(g_led, 0);
digitalWrite(y_led, 0);
digitalWrite(r_led, 0);
delay(500);
digitalWrite(y_led, 1);
delay(500);
  }
}

digitalWrite(g_led, 0);
digitalWrite(y_led, 0);
digitalWrite(r_led, 1);
}
delay(10);
}

//Read new tag if available
boolean getID(){// Getting ready for Reading PICCs
  if ( ! mfrc522.PICC_IsNewCardPresent()) { //If a new PICC placed to RFID reader continue
  return false;
  }
  if ( ! mfrc522.PICC_ReadCardSerial()) { //Since a PICC placed get Serial and continue
  return false;
  }
  tagID = "";
  for ( uint8_t i = 0; i < 4; i++) { // The MIFARE PICCs that we use have 4 byte UID
  //readCard[i] = mfrc522.uid.uidByte[i];
  tagID.concat(String(mfrc522.uid.uidByte[i], HEX)); // Adds the 4 bytes in a single String variable
  }
  tagID.toUpperCase();
  mfrc522.PICC_HaltA(); // Stop reading
  return true;
}

void servoPulse (int pin, int angle){
int pwm = (angle*11) + 500;      // Convert angle to microseconds
 digitalWrite(pin, HIGH);
```

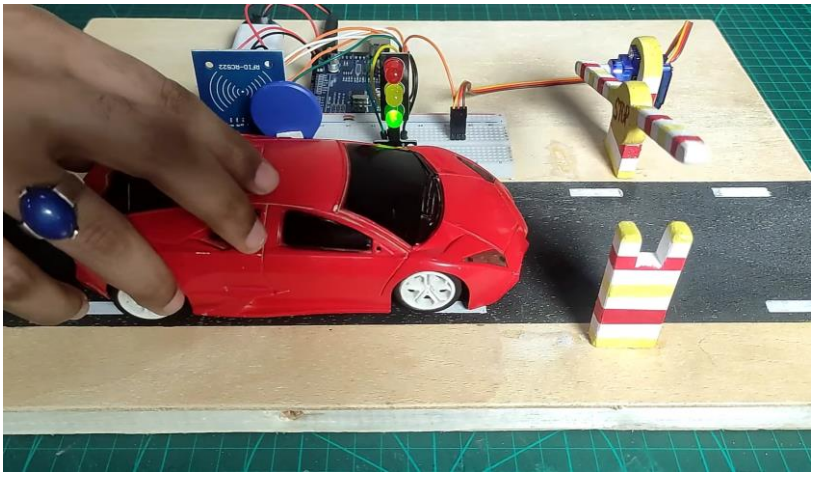
```
 delayMicroseconds(pwm);
 digitalWrite(pin, LOW);
 delay(30);                // Refresh cycle of servo
}
```

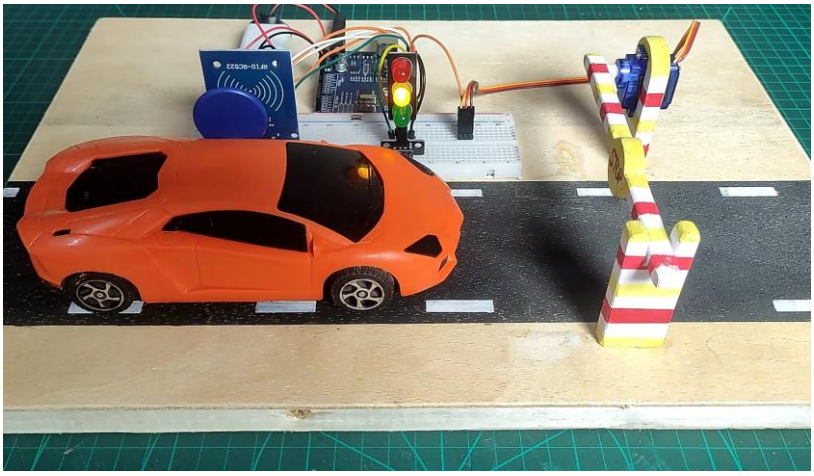
Chapter-6 Result andApplications.

Chapter 6

6.1 Project Output:







6.2 Application:

- This proposed system can be used at various places such as Institute, Private area, Ware House, Celebrity spot, Door locks, etc.
- Controlling entry and exit to parking lots or parking garages for authorized vehicles.
- On any Event Management, controlling access to events, conferences, concerts, or exhibitions to ensure only ticketed attendees enter.
- These barriers are also used in traffic control management, to release traffic it will give access to 4 to 5 vehicles step by step.
- Managing access to gated communities, apartment complexes, or individual homes.

Chapter-7 Conclusion and Future Enhancement

Chapter 7

7.1 Conclusion:

In conclusion, our smart barrier control system project effectively integrates Arduino, RFID reader, servo motor, and LED traffic light module to create a robust solution for access control and security management. By leveraging RFID technology, the system ensures seamless authentication, allowing authorized personnel or vehicles to pass through while restricting unauthorized access.

The servo motor facilitates the smooth operation of the barrier, responding swiftly to valid RFID readings. Additionally, the LED traffic light module provides clear visual signals, enhancing safety and communication within the controlled area.

Overall, our project demonstrates the potential of integrating these technologies to optimize access control processes and improve security measures in various environments. Highlight the efficiency of the system in managing access control, ensuring smooth traffic flow, and enhancing security measures. To emphasize how the system improves user experience by providing seamless access control and clear visual indications through the LED traffic lights.

7.2 Future Enhancement:

The project can be developed further to make the system more comfortable to both the driver and the barrier management. The potential enhancements or additions that could further optimize the system's performance, such as integrating wireless connectivity for remote monitoring and control or incorporating machine learning for predictive analysis. Allowing administrators to manage the barrier system from a centralized location. Additionally, integrating machine learning algorithms could enhance the system's capabilities by enabling it to adapt to changing traffic patterns or security threats.

Furthermore it, exploring the possibility of incorporating sensors for vehicle detection and environmental monitoring could provide additional data for optimizing barrier operation and enhancing overall system efficiency.

Chapter-8

References

8.1 Reference

- https://docs.arduino.cc/tutorials/4-relays-shield/4-relay-shield-basics/
- https://www.javatpoint.com/arduino-ultrasonic-distance-sensor
- https://circuitdigest.com/article/servo-motor-working-and-basics
- Muhammad Ansar, Smart Barrier Control System at Massey University, Palmerston North New Zealand, 2017.
- Agarwal, P., Sharma, S., Gupta, L., & Manideep, B. (2017). Smart ElectronicGarbage Management System- Based IOT. International Journal of Soft Computing and Engineering (IJSCE), 7(1), 93– 96.
- Wang, B.Y. (2009) Summary of IOT Technology Research. Journal of Electronic Measurement and Instrument, 12, 1- 7.
- Ali, Z. H., Ali, H. A., & Badawy, M. M. (2015). Internet of Things (IoT): Definitions, Challenges and Recent Research Directions. International Journal of Computer Applications, 128(1), 37–47.
- Chowdary, U. V., Rohith, K., Sandeep, P., & Ramu, M. (2015). Home AutomationSystem Using IR Sensors. International Journal of Electrical and Electronic Engineering (IJEEE), 4(6), 11–16.

8.2 Manufacturing and Compatibility processes:

Sr. No	Book Name	Author
1	Arduino+ Android Projectfor the Evil Genius	Simon Monk
2	30 Arduino Project for theEvil Genius	Simon Monk