PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ACADEMIC YEAR 2023-2024

A Preliminary Project Report

on

AUTOMATIC RAILWAY GATE CONTROL SYSTEM USING ARDUINO UNO

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Under the Guidance of:- **H.O.D :-**

Mr. R.C.Iyer. **Mr V.K.Taksande**

CERTIFICATE

This is to certify that the project entitled " **Automatic railway gate control system using Arduino uno**" has been carried out by the team under my guidance in partial fulfilment of the degree Bachelor of Engineering in Electronics & Telecommunication Engineering of RTM Nagpur University, during the Academic year 2023-2024 (semester-V).

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Date:

ACKNOWLEDGEMENT

This has occasioned us to express a sense of great pleasure to express thankfulness and deep gratitude to teachers and parents for their moral support. We hereby pay respect to **Dr. R.C. Iyer** a project guide for his constructive suggestions, technical support and improvement in the project report. He also provided us an opportunity to complete our project under his guidance.

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INTRODUCTION :-

Ultrasonic Module HC-SR04 Interfacing with 8051

Introduction

Ultrasonic HC-SR04 Module

Ultrasonic Module HC-SR04 works on the principle of SONAR and RADAR system.

- The HC-SR04 module has an ultrasonic transmitter, receiver, and control circuit on a single board.
- The module has only 4 pins, Vcc, Gnd, Trig, and Echo.
- When a pulse of 10µsec or more is given to the Trig pin, 8 pulses of 40 kHz are generated. After this, the Echo pin is made high by the control circuit in the module.
- The echo pin remains high till it gets the echo signal of the transmitted pulses back.
- The time for which the echo pin remains high, i.e. the width of the Echo pin gives the time taken for generated ultrasonic sound to travel towards the object and return.
- Using this time and the speed of sound in air, we can find the distance of the object using a simple formula for distance using speed and time.

For more information about ultrasonic module HC-SR04 and how to use it, refer to the topic Ultrasonic Module HC-SR04 in the sensors and modules section.

Introduction to Arduino Uno with atmega328P

The Arduino Uno is a popular microcontroller board based on the ATmega328P microcontroller. It's widely used for prototyping and DIY electronics projects. Here's a brief introduction:

- ✞ Microcontroller: The heart of the Arduino Uno is the ATmega328P microcontroller, which is an 8-bit AVR microcontroller by Atmel (now owned by Microchip Technology). It runs at 16MHz

and has 32KB of Flash memory for storing your program, 2KB of SRAM, and 1KB of EEPROM for data storage.

- Digital and Analog I/O: The Arduino Uno has 14 digital input/output pins (6 of which can be used as PWM outputs) and 6 analog input pins. These pins can be used to interface with various sensors, displays, and other electronic components.
- Voltage Regulator: The board includes a voltage regulator that allows it to be powered with an external DC power supply (7-12V) or through USB. It provides a stable 5V supply for the microcontroller and other components.
- USB Interface: Arduino Uno features a USB interface for programming and serial communication with your computer. You can upload your code via USB and also send/receive data for debugging.
- Compatibility: The Arduino Uno is compatible with the Arduino IDE, a user-friendly software development environment that simplifies code writing and uploading.
- Open-Source: Arduino is an open-source platform, which means that the hardware design and software are freely available for modification and distribution.
- Shields: Arduino Uno is often used with "shields," which are add-on boards that extend its capabilities. These shields can include things like WiFi, Ethernet, motor control, and more.
- Arduino Uno is a great choice for beginners due to its simplicity and extensive community support. It's an excellent platform for learning about electronics and programming while building various projects.

The Key features of Arduino Uno :

- 4 KB on-chip ROM (Program memory).
- IC: Microchip ATmega328P (8-bit AVR core)
- Clock Speed: 16 MHz on Uno board, though IC is capable of 20 MHz maximum at 5 Volts.
- Flash Memory: 32 KB, of which 0.5 KB used by the bootloader.
- SRAM: 2 KB.
- EEPROM: 1 KB.
- USART peripherals: 1 (Arduino software d

Application Arduino Uno with atmega328P :

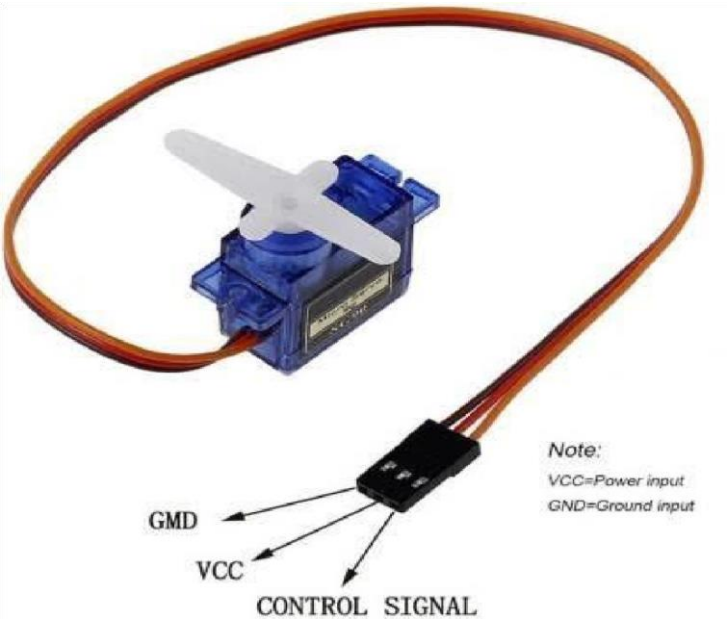
Arduino Uno with atmega328P application

The Arduino Uno, featuring the ATmega328P microcontroller, is a versatile platform for various applications, from simple DIY projects to more complex ones. Here are some common applications:

- LED Blinking: A classic starter project where you can learn to control the onboard LED and external LEDs using digital pins.
- Sensor Monitoring: Interface with sensors like temperature, humidity, light, or motion sensors to gather data for various applications like home automation or environmental monitoring.
- Robotics: Build robots and control their movement and sensors using the Uno. It's often used in educational robotics.
- Home Automation: Control lights, appliances, or heating systems in your home using relays or other components.
- Data Logging: Collect data from various sensors and log it to an SD card or transmit it to a computer for analysis.
- Internet of Things (IoT): Connect your Uno to the internet using shields or modules like ESP8266 or ESP32 to create IoT devices.
- Display Projects: Use OLED, LCD, or LED displays to show information, create digital clocks, or even small games.
- Sound Projects: Create music players, sound synthesizers, or alarms using piezo buzzers or external sound modules.
- Security Systems: Develop security systems with motion sensors, cameras, and alarms to protect your home or belongings.
- Remote Control: Build remote-controlled vehicles, drones, or devices using RF or Bluetooth modules.
- Educational Projects: Arduino Uno is a popular choice for educational purposes, teaching electronics and programming.
- Custom Prototyping: Design custom circuits and prototypes for specific applications, from medical devices to industrial control systems.

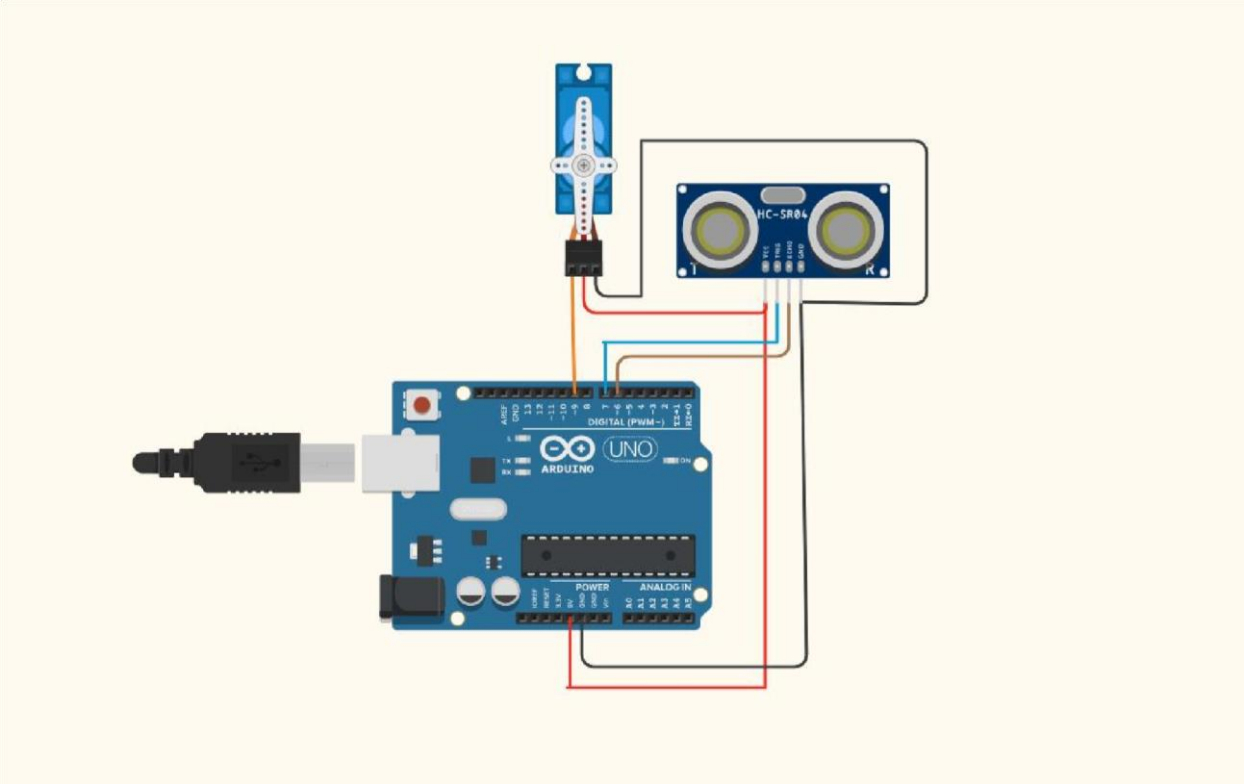
Micro Servo Motor Information:

- Size: Micro servo motors are often categorized by their size, such as 9g, 12g, or 20g, referring to their weight.
- Operating Voltage: They typically operate within a voltage range of 4.8V to 6V, but this can vary depending on the specific model.
- Torque: The torque output of a micro servo motor can vary but is generally in the range of 0.5 kg-cm to 2.5 kg-cm.



- Speed: The speed at which a micro servo motor can move is usually between 0.1 to 0.2 seconds per 60 degrees of rotation.
- Rotation Range: Micro servos often have a rotation range of around 90 to 180 degrees, but this can also vary.
- Control Signal: They are controlled using a PWM (Pulse Width Modulation) signal, typically with a frequency of 50 Hz and a pulse width between 1 ms to 2 ms.
- Gear Type: Micro servos employ various gear types, including plastic and metal gears, which affect their durability and precision.
- Compatibility: They are commonly used with standard servo connectors, which include three wires for power, ground, and signal.
- Weight and Dimensions: These can vary based on the specific model, but they are generally compact and lightweight.
- Applications: Micro servo motors are used in a wide range of applications, including RC (RadioControlled) vehicles, robotics, drones, camera gimbals, and small mechanical projects requiring precise control.

INTERFACING DIAGRAM :-



COMPONENTS LIST

1. Arduino Uno with atmega328P
2. Ultrasonic sensor HC-SR04
3. Plastic geared Micro servo
4. Single strand wire instead of jumper wires
5. Mini Breadboard
6. Lithium ion battery with case
7. Few drops of superglue
8. Arduino programming cable
9. Arduino IDE

Steps Of Programming :-

1. Connect Uno board with programming cable and connect USB side to computer.
2. Open Arduino IDE and Copy paste the above code.
3. Before clicking on upload check if proper board is selected.
4. You can click on tools then Board option later select Arduino Uno.
5. Now cross check for port number and you can select this from tools and port.
6. Once you are done with this you can hit on that upload button.
7. Once you have finished uploading successfully disconnect USB cable.
8. Now you can power Arduino Uno using external battery.
9. As I' am using 3.7v battery I did not use any resistor, if you are using higher volt battery you may need resistor as per the voltage values.

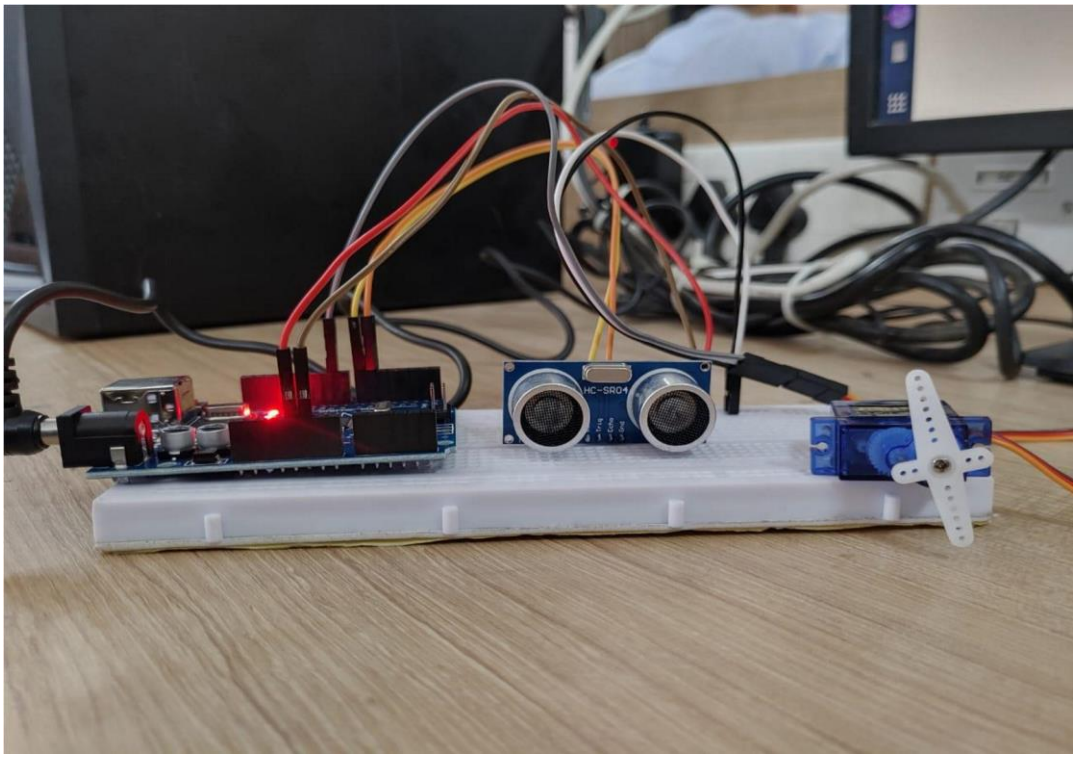
PROGRAM :-

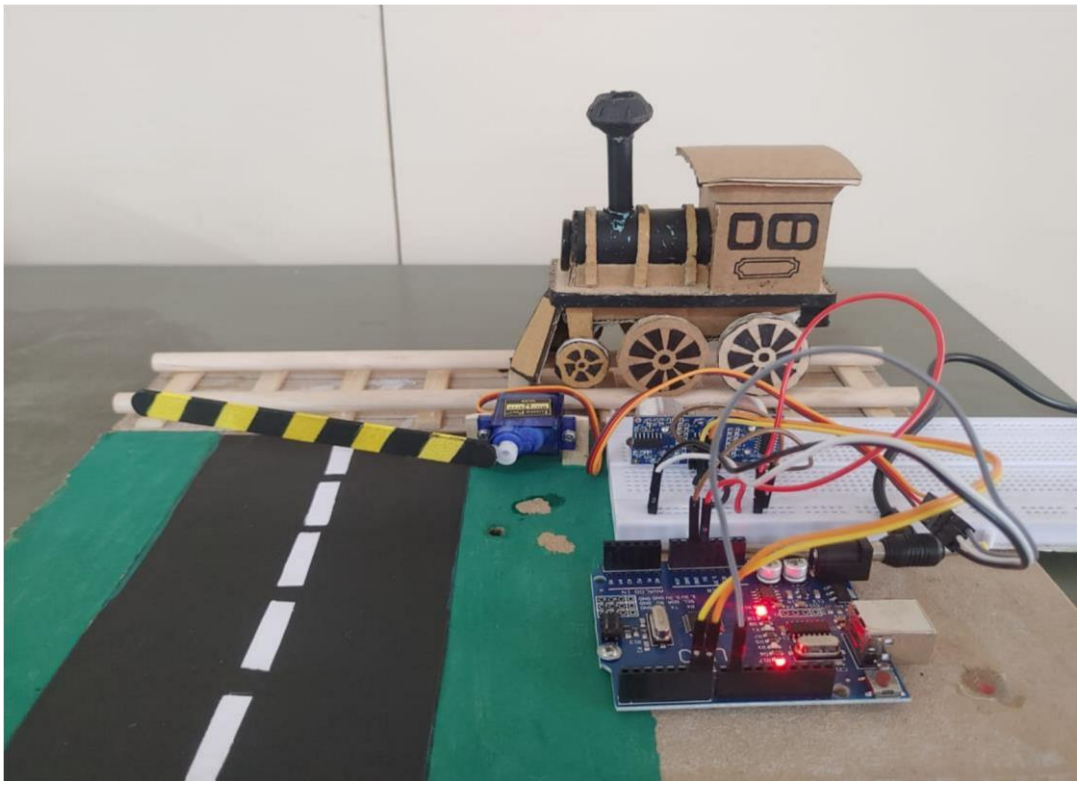
```
#include <Servo.h>

Int servoPin=9 ;

Servo servo ;

Int angle =0 ; // servo position in degrees

#define echoPin 6

#define triggerPin 7

Void setup()

{ pinMode(triggerPin, OUTPUT) ; // Sets the trigPin as an
OUTPUT pinMode(echoPin , INPUT) ; // Sets the echoin as an
INPUT

 Serial.begin(9600) ; // Serial Communication is starting with 9600 of baudrate speed

Servo.attach (servoPin) ;
```

```
}

Void loop()

{

Long highPulseDuration ;

 Int calculatedDistanceCm ;

//Set the trigPin to low, before setting it to high for the pulse
digitalWrite(triggerPin. LOW) ; delayMicroseconds(5);

// Create the 10 seconds pulse on the trig pin
digitalWrite(triggerPin, HIGH);
delayMicroseconds(10) ;

//Set the pin to low to end the pulse
digitalWrite (triggerPin, LOW);

//Read the duration at the high pulse on the echo pin highPulseDuration= pulseIn (echoPin,
HIGH);

// Calculating the distance  calculatedDistanceCm=
highPulseDuration*0.034/2 ;

 // Speed of sound wave divided by 2 (go and back)

// Displays the distance on the Serial Monitor

Serial.print("Calculated Distance: " ) ;

Serial.print (calculatedDistanceCm);

Serial.println(" cm ") ;

If(calculatedistanceCm<10)

{

Servo.write(90) ;
Delay(15) ;
```

```
}

If(calculatedistanceCm>10)

{

Servo.write(0) ;

Delay(15) ;

}

Delay (1000) ;

}
```

PROJECT IMAGES :-





WORKING PRINCIPLE :-

- The plastic geared micro servo as shown in the visual above, it has plastic gears and the servo horns carry a holder/barrier made from Popsicle stick.
- Coming to the connections we are using D9 pin on Arduino Uno board which is PWM pin elaborated as pulse width modulations meaning the signals for micro servo goes in the form of pulses from D9 pin.
- As we have connected D9 pin with signal input pin of micro servo we will be using the other 2 pins called as Gnd and Positive to + and – pin of Breadboard power rails.
- These completes servo connections now we will see the basic functions and connections of ultrasonic sensor.
- The HC-SR04 or generally called by the name ultrasonic sensor or ultrasonic distance sensor has 4 pins.
- These pins are called as Vcc, Trig, Echo and Gnd here as usual we will be connecting Vcc and Gnd pins with + and – rails of breadboard where as Trig and Echo are connected to D5 and D3 pins of Arduino Board.
- The actual image of HC-SR04 sensor is as shown in image below from the visual we can see 2 circle shaped structures.
- These circles are nothing but transmitter and receiver parts, here when it is supplied with power, one end transmits ultrasonic signals and this travels up to a accurate distance of 15cms in the travel path if it detects any obstacles the signals hit the object and travel back to the receiver end.
- There are numerous applications of this small module and one of the application is in our project!
- So coming to our project we are using vehicles as a obstacle, when this sensor picks up signals from obstacle it sends signals to micro servo to lift for a specific time(as given in the code) and come to default state.
- If you observe carefully you can see letters T and R at the corners of sensors these are Transmitter and receiver part.