Ashoka Institute of Technology and Management

ARTIFICIAL INTELLIGENCE PROJECT

Adaptive Traffic Signal Control System using Arduino and Sensors

TEAM MEMBERS

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AIM

The aim of the project "Adaptive Traffic Signal Control System using Arduino and Sensors" is to develop an intelligent traffic management system that dynamically adjusts the timing of traffic signals based on real-time traffic conditions. By utilizing Arduino microcontrollers and sensors, the project aims to enhance traffic flow, reduce congestion, minimize waiting times, and improve overall transportation efficiency. The system will continuously monitor traffic parameters such as vehicle volume, density, and queue lengths at various intersections, and use this data to optimize signal timings and allocate green time intelligently. The goal is to create an adaptive traffic signal control system that can respond to changing traffic patterns in real-time, leading to smoother traffic flow and better utilization of road infrastructure.

COMPONENTS USED

1. ARDUINO UNO MICROCONTROLLER
2. ULTRASONIC SENSOR (4 PINS)
3. SERVO MOTOR 9G (3 PINS)
4. JUMPER WIRE MALE TO MALE
5. JUMPER WIRE MALE TO FEMALE
6. BREADBOARD
7. CARDBOARD FOR DUMMY

BERIEF DESCRIPTION ABOUT PARTS

1. ARDUINO UNO REVISION 3

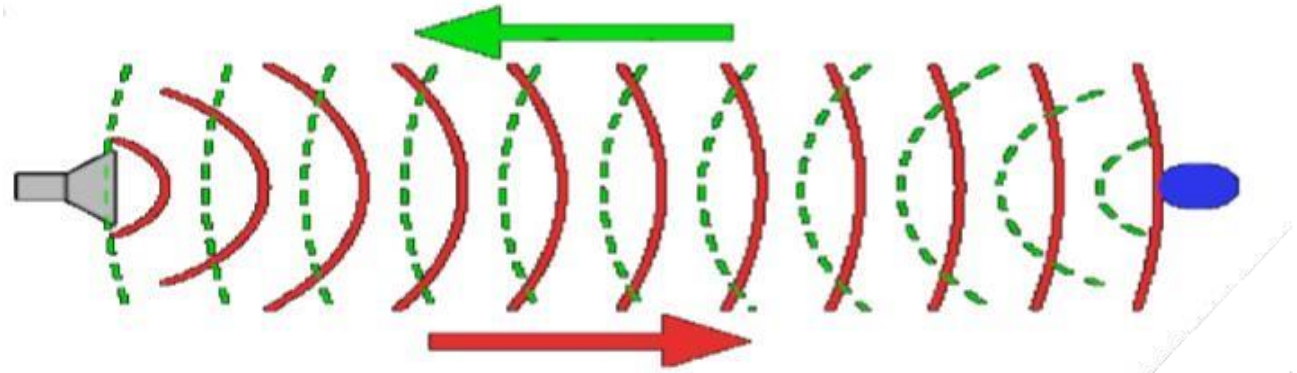
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

2. Ultrasonic Sensor (4 pins)

The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).

The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

Distance = Time x Speed of Sound / 2



The ultrasonic sensor can measure the distances in centimetres and inches. It can measure from 0 to 2.5 meters with a precision of 3 cm. It has more difficulties reading reflections from soft, curved thin or small objects like cotton, curved surface, etc.

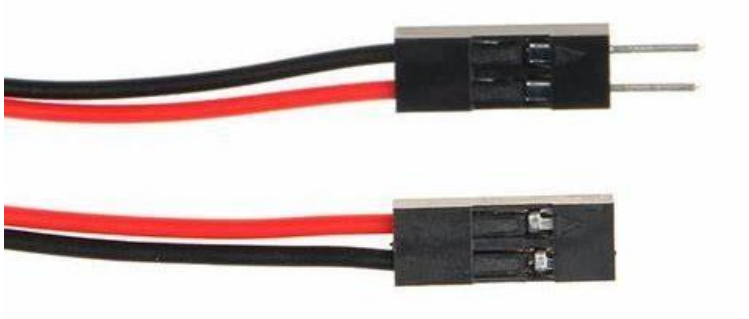
3. Servo motor 9g (3 pins)

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

4. Jumper Wire (MALE TO MALE AND MALE TO FEMALE)

Used to make connections quickly and efficiently.

Male to Male Jumper wire



Male to Female Jumper wire

5. Bread Board

Used for easy and multiple connections

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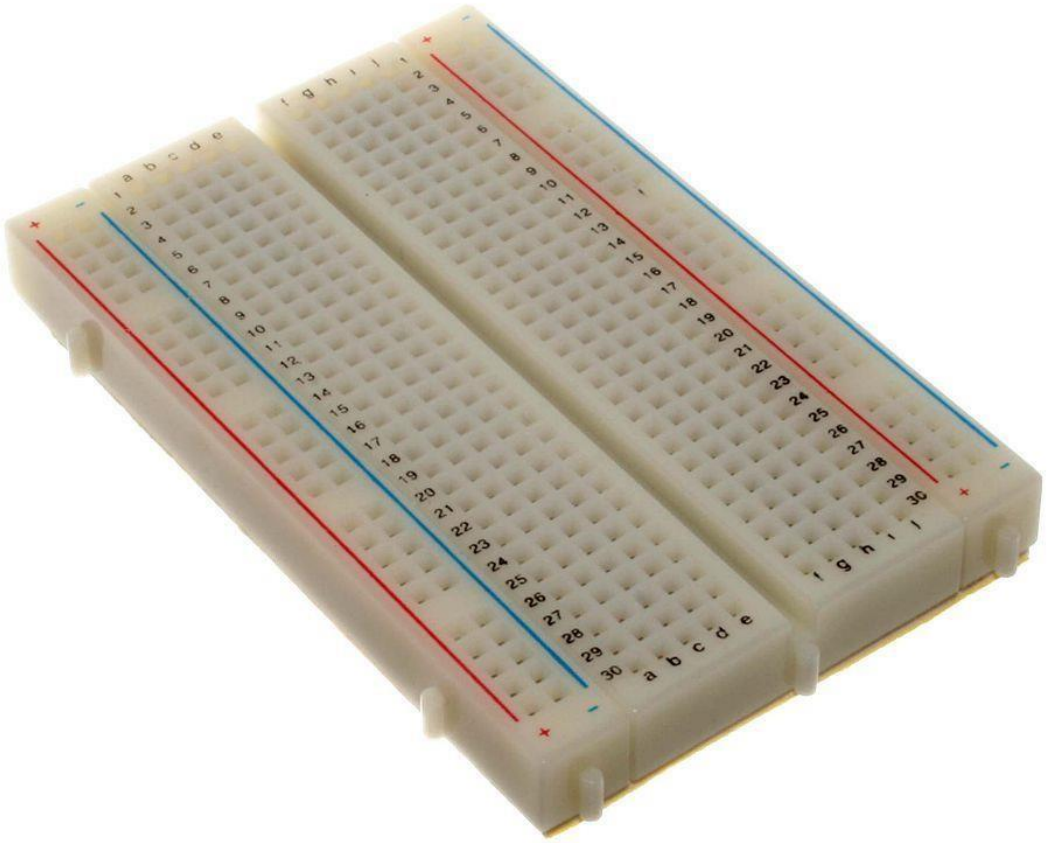
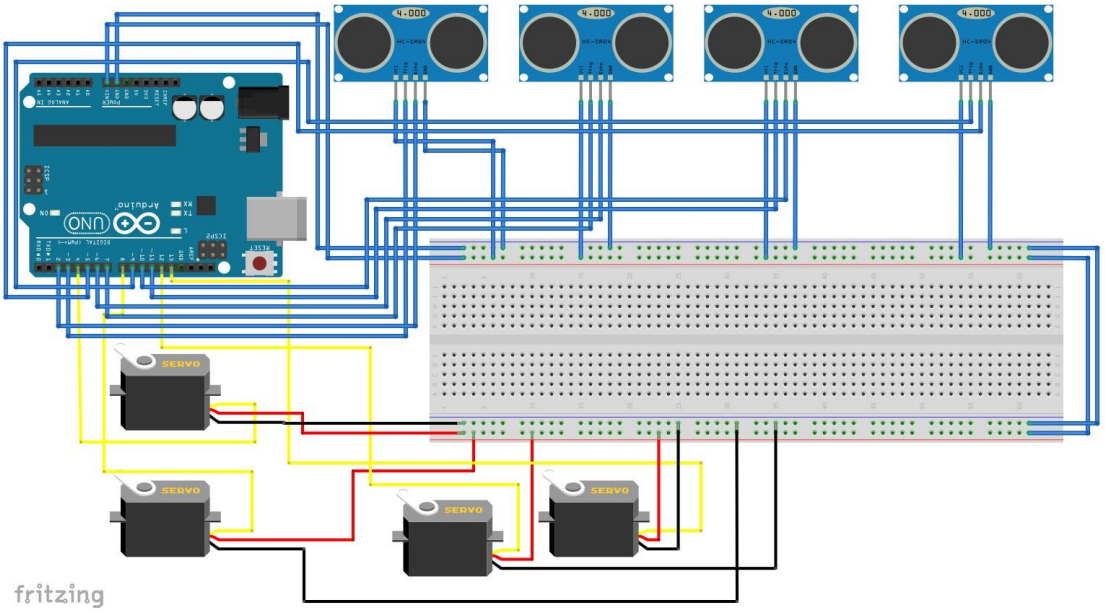
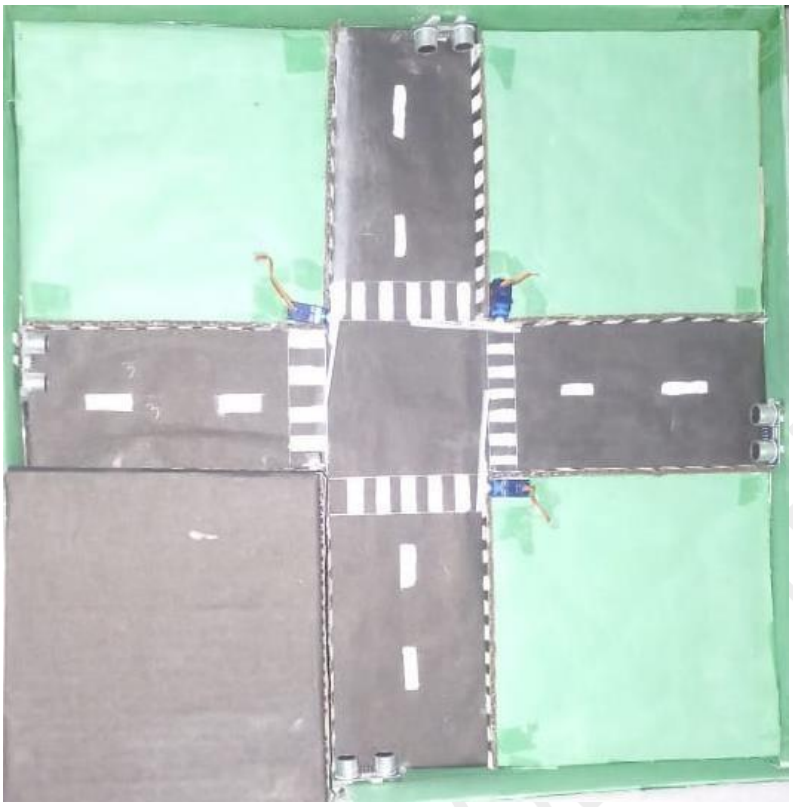
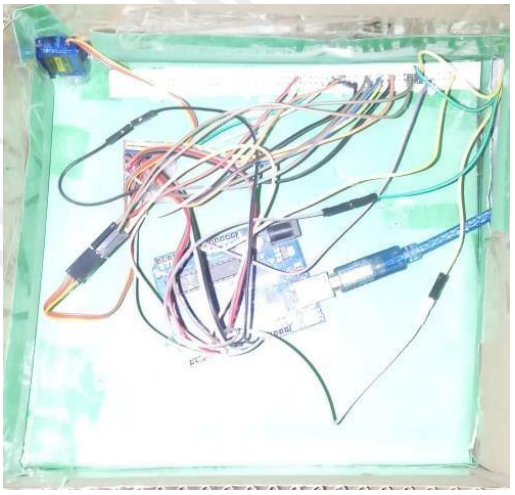


CIRCUIT DIAGRAM and Project Images







Code use in c++

```
#include  <Servo.h>
Servo ServoMotor0;
Servo ServoMotor1;
Servo ServoMotor2;
Servo ServoMotor3;
int flag = 0, distance0, distance1, distance2, distance3, time0, time1, time2, time3, duration0, duration1, duration2, duration3;
void setup() {
  Serial.begin(9600);
  pinMode(2, INPUT);//echo
  pinMode(3, OUTPUT); //trig
  ServoMotor0.attach(4);
  pinMode(6, INPUT);//echo
  pinMode(7, OUTPUT); //trig
  ServoMotor1.attach(8);
  pinMode(10, INPUT);//echo
  pinMode(11, OUTPUT); //trig
  ServoMotor2.attach(12);
  pinMode(5, INPUT);//echo
  pinMode(9, OUTPUT); //trig
  ServoMotor3.attach(13);
}
void loop() {
  if(flag>=0 && flag<=3)
  {
    digitalWrite(3, LOW);
    delayMicroseconds(2);
    digitalWrite(3, HIGH);
```

```
delayMicroseconds(10);
digitalWrite(2, LOW);
duration0=pulseIn(2, HIGH);
distance0=(duration0/2)/29.1;
Serial.println(distance0);
delay(500);
if(flag==0)
{
  ServoMotor0.write(0);
  ServoMotor1.write(90);
  ServoMotor2.write(90);
  ServoMotor3.write(90);
  flag=flag+1;
  Serial.println("Motor 0");
  Serial.println("Time Duration: ");
  if(distance0>(19-0) && distance0<=(19-5))
  {
    for(int i=0; i<15; i++)
    {
      Serial.println(i+1);
      delay(1000);
      digitalWrite(3, LOW);
      digitalWrite(3, HIGH);
      digitalWrite(3, LOW);
    }
  }
  else if(distance0>(19-5) && distance0<=(19-10))
  {
    for(int i=0; i<20; i++)
```

```
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(3, LOW);
    digitalWrite(3, HIGH);
    digitalWrite(3, LOW);
  }
}
else if(distance0>(19-10) && distance0<=(19-15)
{
  for(int i=0; i<25; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(3, LOW);
    digitalWrite(3, HIGH);
    digitalWrite(3, LOW);
  }
}
else
{
  for(int i=0; i<5; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(3, LOW);
    digitalWrite(3, HIGH);
    digitalWrite(3, LOW);
  }
```

```
  }

}
else if(flag==1)
{
  ServoMotor0.write(90);
  ServoMotor1.write(0);
  ServoMotor2.write(90);
  ServoMotor3.write(90);
  digitalWrite(8, LOW);
  delayMicroseconds(2);
  digitalWrite(8, HIGH);
  delayMicroseconds(10);
  digitalWrite(6, LOW);
  duration1=pulseIn(6, HIGH);
  distance1=(duration1/2)/29.1;
  Serial.println(distance1);
  delay(500);
  flag=flag+1;
  Serial.println("Motor 1");
  if(distance1>(19-0) && distance1<=(19-5))
  {
    for(int i=0; i<15; i++)
    {
      Serial.println(i+1);
      delay(1000);
      digitalWrite(7, LOW);
      digitalWrite(7, HIGH);
      digitalWrite(7, LOW);
```

```
  }
}
else if(distance1>(19-5) && distance1<=(19-10))
{
  for(int i=0; i<20; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(7, LOW);
    digitalWrite(7, HIGH);
    digitalWrite(7, LOW);
  }
}
else if(distance1>(19-10) && distance1<=(19-15))
{
  for(int i=0; i<25; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(7, LOW);
    digitalWrite(7, HIGH);
    digitalWrite(7, LOW);
  }
}
else
{
  for(int i=0; i<5; i++)
  {
    Serial.println(i+1);
```

```
      delay(1000);
      digitalWrite(7, LOW);
      digitalWrite(7, HIGH);
      digitalWrite(7, LOW);
    }
  }
}
else if(flag==2)
{
  ServoMotor0.write(90);
  ServoMotor1.write(90);
  ServoMotor2.write(0);
  ServoMotor3.write(90);
  digitalWrite(11, LOW);
  delayMicroseconds(2);
  digitalWrite(11, HIGH);
  delayMicroseconds(10);
  digitalWrite(10, LOW);
  duration2=pulseIn(10, HIGH);
  distance2=(duration2/2)/29.1;
  Serial.println(distance2);
  delay(500);
  flag=flag+1;
  Serial.println("Motor 2");
  if(distance2>(19-0) && distance2<=(19-5))
  {
    for(int i=0; i<15; i++)
    {
      Serial.println(i+1);
```

```
    delay(1000);
    digitalWrite(11, LOW);
    digitalWrite(11, HIGH);
    digitalWrite(11, LOW);
  }
}
else if(distance2>(19-5) && distance2<=(19-10))
{
  for(int i=0; i<20; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(11, LOW);
    digitalWrite(11, HIGH);
    digitalWrite(11, LOW);
  }
}
else if(distance2>(19-10) && distance2<=(19-15))
{
  for(int i=0; i<25; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(11, LOW);
    digitalWrite(11, HIGH);
    digitalWrite(11, LOW);
  }
}
else
```

```
  {
    for(int i=0; i<5; i++)
    {
      Serial.println(i+1);
      delay(1000);
      digitalWrite(11, LOW);
      digitalWrite(11, HIGH);
      digitalWrite(11, LOW);
    }
  }
}
else if(flag==3)
{
  ServoMotor0.write(90);
  ServoMotor1.write(90);
  ServoMotor2.write(90);
  ServoMotor3.write(0);
  digitalWrite(9, LOW);
  delayMicroseconds(2);
  digitalWrite(9, HIGH);
  delayMicroseconds(10);
  digitalWrite(5, LOW);
  duration3=pulseIn(5, HIGH);
  distance3=(duration3/2)/29.1;
  Serial.println(distance3);
  delay(500);
  flag=flag+1;
  Serial.println("Motor 3");
  if(distance3>(19-0) && distance3<=(19-5))
```

```
{
  for(int i=0; i<15; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(9, LOW);
    digitalWrite(9, HIGH);
    digitalWrite(9, LOW);
  }
}
else if(distance3>(19-5) && distance3<=(19-10))
{
  for(int i=0; i<20; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(9, LOW);
    digitalWrite(9, HIGH);
    digitalWrite(9, LOW);
  }
}
else if(distance3>(19-10) && distance3<=(19-15))
{
  for(int i=0; i<25; i++)
  {
    Serial.println(i+1);
    delay(1000);
    digitalWrite(9, LOW);
    digitalWrite(9, HIGH);
```

```
        digitalWrite(9, LOW);
       }
      }
      else
      {
       for(int i=0; i<5; i++)
       {
        Serial.println(i+1);
        delay(1000);
        digitalWrite(9, LOW);
        digitalWrite(9, HIGH);
        digitalWrite(9, LOW);
       }
      }
    }
  }
  else
  {
    flag=0;
  }
}
```

Working of Project

It is a fully automatic traffic prediction system. First of all the we will name the Road by Road 1, Road 2, Road 3 & Road 4. If the Road 1 is on then at that time the other 3 Roads (Road 2, Road 3 & Road 4) will be barricaded. Now the Ultrasonic sensor will calculate the traffic of Road 2 and according to the traffic it will allot the time to Road 2 and when Road 1 time is done then automatically it will barricade the Road 1 and Road 2 barricade will be on and then it will calculate the traffic of Road 3 and accordingly the process will go on. According to this process we can save time.