

Four Roads Traffic Controller

March 2022

*Created by
Team 4*



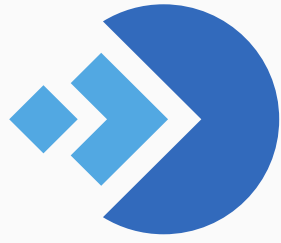


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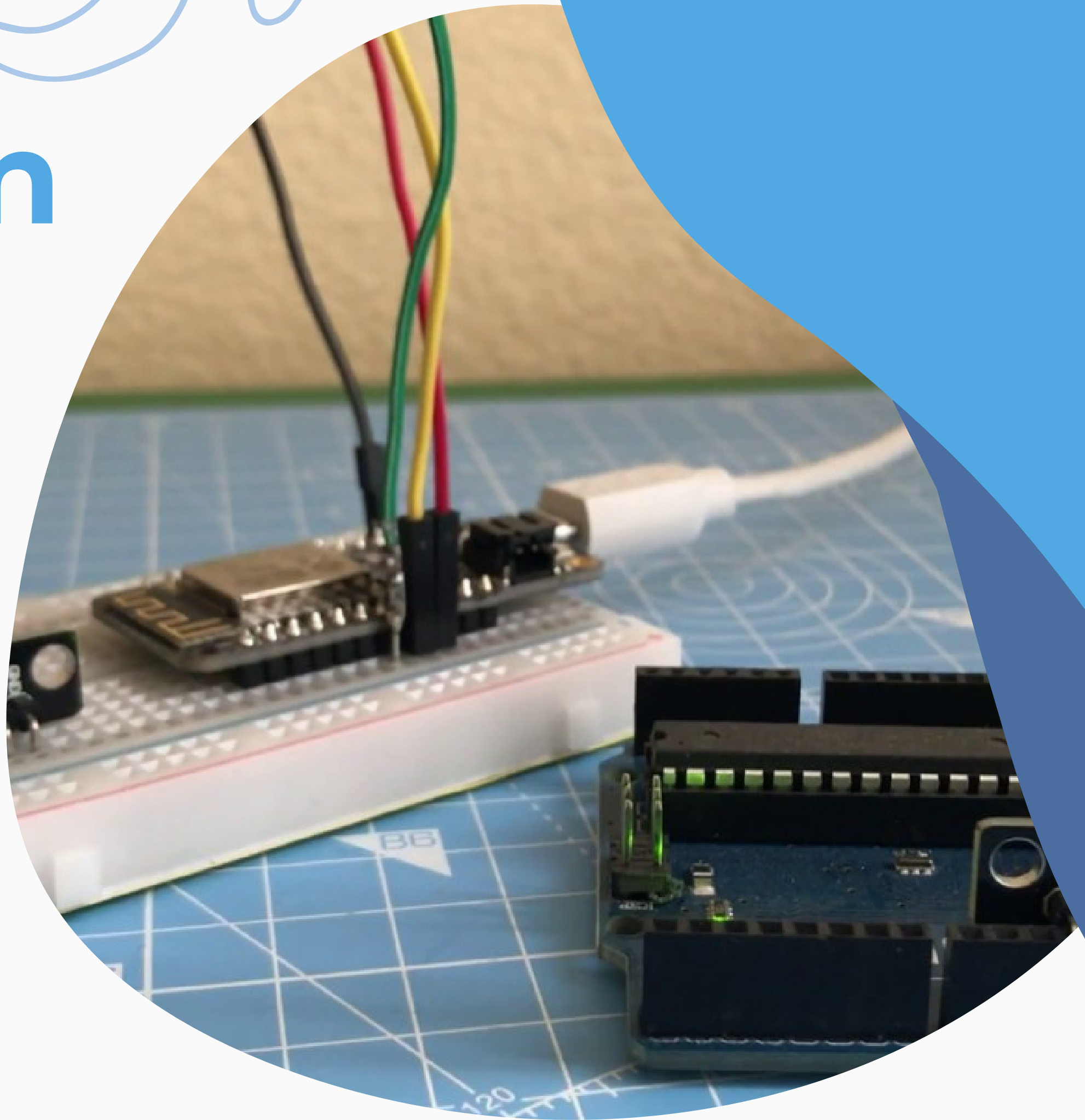
- Introduction & Hypothesis
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Demonstrated Materials Are All Generic

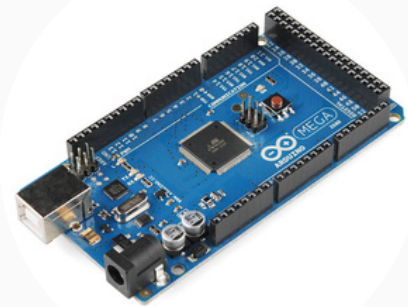
Introduction

This traffic light controller will be used to control the flow of traffic. These can be applied at high traffic areas to avoid traffic blocks or accidents.

The main part of this project is the Arduino which will control the LEDs and their timings to guide the vehicles



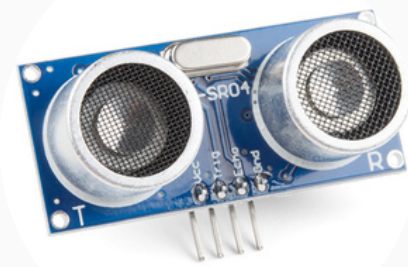
Tools & Components



**Arduion Mega
2560**



**Generic Resistors (x12)
220 Ohm**



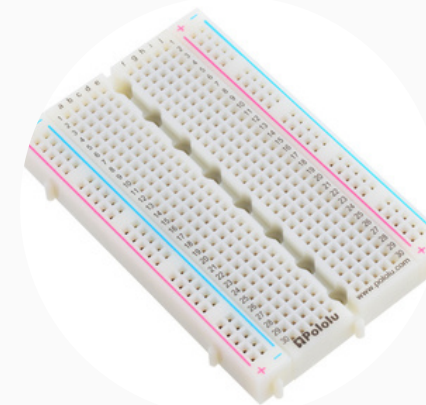
**Ultrasonic Sensor
HC-SR04 (x4)**



Jumber Wires (xN)



**Generic LEDs (x4)
Red-Green-Yellow**



Breadboards (x4)

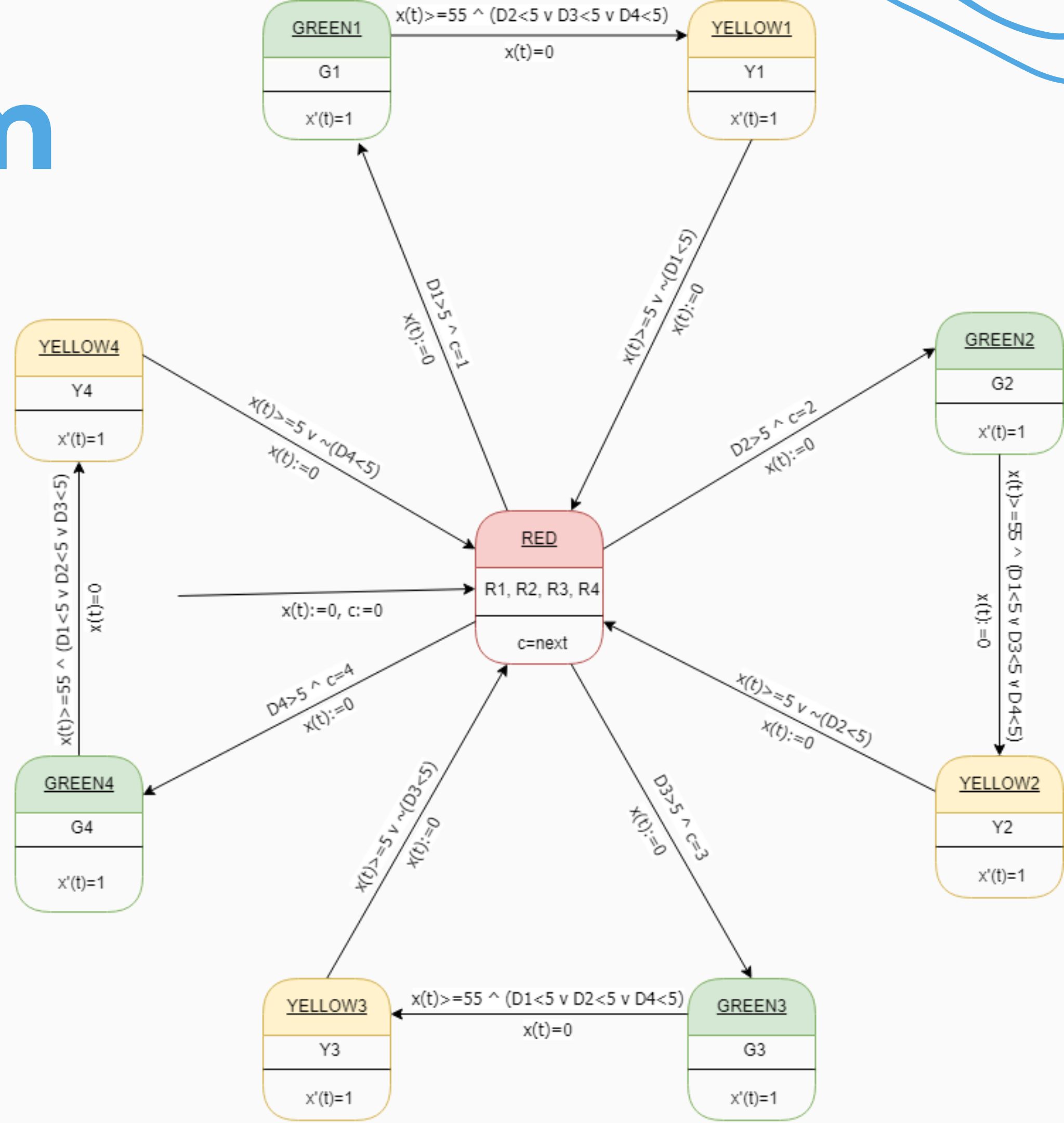
State Diagram

Continuous variable: $x(t) : \mathbb{R}$ (timer)
 $c : \{1, 2, 3, 4\}$ (the signal NO)

Input: $D1, D2, D3, D4 : \mathbb{R}$ (distances)

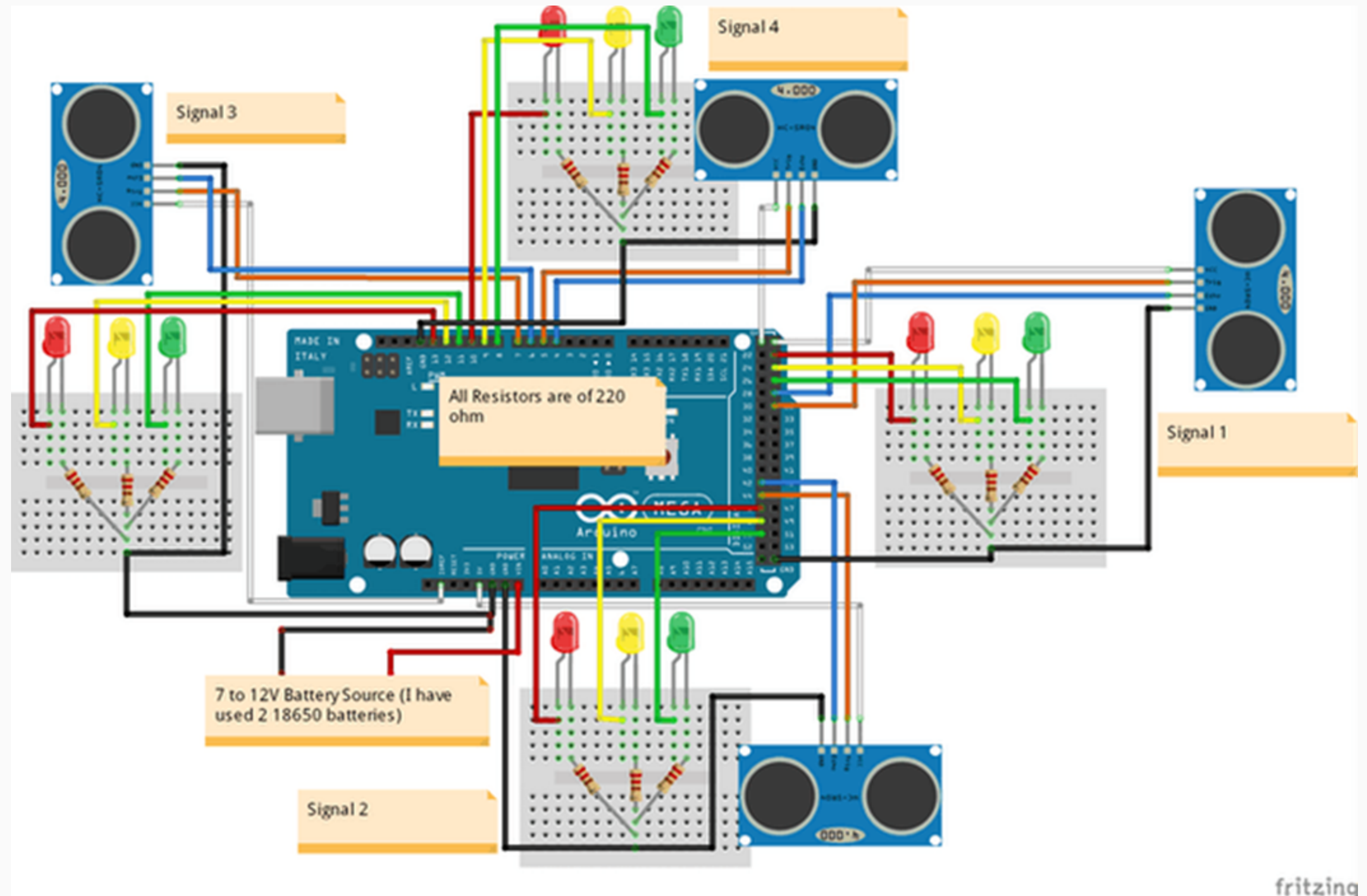
Output : $R1, Y1, G1,$
 $R2, Y2, G2,$
 $R3, Y3, G3,$
 $R4, Y4, G4 : \text{pure}$ (lights)

Implemented On
<https://app.diagrams.io>



Circuit Diagram

Implemented On:
[Tinkercad.com](https://www.tinkercad.com)



Source Code

C++ Code For Implementing
The Previous State Diagram &
Circuit Diagram On The
Arduino Kit

Github Project Repo:
<https://github.com/Mohamed-Shalaan/4Traffic-Controller>

```
1  #include<TimerOne.h>
2
3  // Each color index in the array
4  const int RED = 0;
5  const int YELLOW = 1;
6  const int GREEN = 2;
7
8  // The ultrasonic sensors directions
9  const int UP = 0;
10 const int RIGHT = 1;
11 const int DOWN = 2;
12 const int LEFT = 3;
13
14
15 // The timer period is set at 100 milli seconds.
16 const int TIME_PERIOD_MILLIS = 100;
17
18 // Distance under which it will look for vehicles.
19 const int FARTHEST_DISTANCE = 5;
20 const int SIGNALS_PINS[4][3] = {{6, 5, 4}, {17, 18, 19}, {14, 15, 16}, {11, 12, 13}};
21
22 // The time that the light takes in milliseconds.
23 const int GREEN_DELAY= 5000;
24 const int YELLOW_DELAY= 2000;
25
26 // Trigger and echo for each ultrasonic sensor.
27 volatile int TRIGGER_PINS[4] = { 8, 2, 0, 10};
28 volatile int ECHO_PINS[4] = { 7, 3, 1, 9};
29
30 // Variables for storing the distance covered
31 volatile int SignalsDistance [4];
32
33 void setup (){
34     Serial.begin (115200);
35     //Begin using the timer. This function must be called first.
36     Timer1.initialize (TIME_PERIOD_MILLIS * 1000);
37
38     //Run a function each time the timer period finishes.
39     Timer1.attachInterrupt (softInterr);
40
```

```

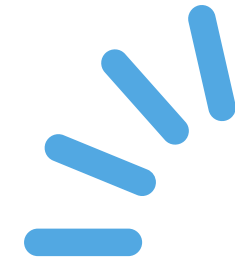
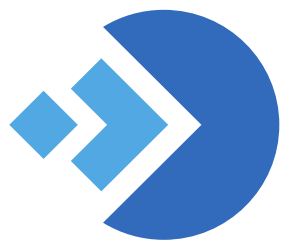
41 // Declaring LED pins as output
42 for (int dir = 0; dir < 4; dir++){
43     for (int color = 0; color < 3; color++){
44         pinMode (SIGNALS_PINS[dir][color], OUTPUT);
45     }
46 }
47
48 // Declaring ultrasonic sensor pins as input/output
49 for (int i = 0; i < 4; i++) {
50     pinMode (TRIGGER_PINS[i], OUTPUT);
51     pinMode (TRIGGER_PINS[i], INPUT);
52 }
53 }
54
55 // This is interrupt function and it will run each time the time
56 void softInterr () {
57     // Reading from first ultrasonic sensor (Up)
58     SignalsDistance[UP] = readDistanceFrom(UP);
59
60     // Reading from second ultrasonic sensor (Right)
61     SignalsDistance[RIGHT] = readDistanceFrom(RIGHT);
62
63     // Reading from third ultrasonic sensor (Down)
64     SignalsDistance[DOWN] = readDistanceFrom(DOWN);
65
66     // Reading from fourth ultrasonic sensor (Left)
67     SignalsDistance[LEFT] = readDistanceFrom(LEFT);
68
69     // Print distance values on serial monitor for debugging
70     print ();
71 }
72
73 void loop () {
74     // If there are vehicles at any signal
75     for (int dir = 0; dir < 4; dir++) {
76         if (SignalsDistance[dir] < FARTHEST_DISTANCE) {
77             signalsFunction(dir);
78         }
79     }
80 }
81

```

```

85 // Make RED LED LOW and make Green HIGH for 5 seconds
86 digitalWrite (SIGNALS_PINS[direction][RED], LOW);
87 digitalWrite (SIGNALS_PINS[direction][GREEN], HIGH);
88 delay (GREEN_DELAY);
89 // if there are vehicels at other signals
90 bool anotherRoadHasTraffic = false;
91 for (int dir = 0; dir < 4; dir++) {
92     if (dir != direction && SignalsDistance[dir] < FARTHEST_DISTANCE)
93         anotherRoadHasTraffic=true;
94     break;}}
95
96 if (anotherRoadHasTraffic){
97     // Make Green LED LOW and make yellow LED HIGH for 2 seconds
98     digitalWrite (SIGNALS_PINS[direction][GREEN], LOW);
99     digitalWrite (SIGNALS_PINS[direction][YELLOW], HIGH);
100     delay (YELLOW_DELAY); }
101
102 int readDistanceFrom (int direction) {
103     digitalWrite (TRIGGER_PINS[direction], LOW);
104     delayMicroseconds (2);
105     digitalWrite (TRIGGER_PINS[direction], HIGH);
106     delayMicroseconds (10);
107     digitalWrite (TRIGGER_PINS[direction], LOW);
108     int t = pulseIn (ECHO_PINS[direction], HIGH);
109     return t * 0.034/2;}
110
111 // Function to make all LED's LOW except RED one's.
112 void resetAll () {
113     for (int dir = 0; dir < 4; dir++){
114         digitalWrite (SIGNALS_PINS[dir][RED], HIGH);
115         digitalWrite (SIGNALS_PINS[dir][YELLOW], LOW);
116         digitalWrite (SIGNALS_PINS[dir][GREEN], LOW);}}
117
118 void print () {
119     Serial.print ("\tUP: ");
120     Serial.println (SignalsDistance[UP]);
121     Serial.print ("Left: ");
122     Serial.print (SignalsDistance[LEFT]);
123     Serial.print ("\tRight: ");
124     Serial.println (SignalsDistance[RIGHT]);
125     Serial.print ("Down: ");
126     Serial.println (SignalsDistance[DOWN]);}

```

Our Team



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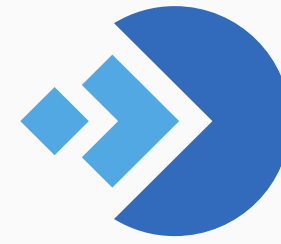
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Thank You

For Your Time