DEPARTMENT OF INFORMATION TECHNOLOGY

Smart Traffic Management System

A

Dissertation Work

Submitted as Major Project in Partial fulfillment for the award of
Bachelor of Engineering in Information Technology.

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DEPARTMENT OF INFORMATION TECHNOLGY
UNIVERSITY INSTITUTE OF TECHNOLGY
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CERTIFICATE

This is to certify that the project entitled **"Smart Traffic Management System"** being submitted by –**Mohika Agrawal, Muskan Agrawal, Shalini Malviya, Shatakshi Nimare**–students of Seventh Semester, Department of Information Technology have/has done their work as MAJOR PROJECT for Partial fulfillment of Bachelor of Engineering in Information Technology from RGPV, Bhopal (M.P.) is a record of bonafide work carried out by his/her under my/our supervision.

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DECLARATION

I/We declare that project is entitled **"Smart Traffic System Management"** is my/our own work conducted under the supervision of Prof. Ratish Agarwal, Department of Information Technology, University Institute of Technology, RGPV Bhopal (M.P.).

I/We further declare that, to the best of my/our knowledge the project does not contain the work which have been submitted for the award of the degree either in the University or in any other University/Deemed University without proper citations.

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Abstract

In this paper a new methodology is described to efficiently handle and manage traffic in a highly populated and congested area. The traffic management system's framework makes use of an essential technology required which is IoT which is done by using a software called Tinkercad. It also has other important parts such as an Arduino Uno R3, ultrasonic distance sensor, bread board mini. To further help to navigate the traffic the proposed framework uses algorithm to find the optimum path through traffic. Arduino UNO will serve the purpose in this project to handle all the switching of the LEDs and controlling their timings. Ultra sound distant sensor used to determine the traffic density.

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Introduction

1.1 Project perspective:

In traditional perspective of traffic management: In the twentieth century, the only way to improve traffic flow and reduce congestion was physical infrastructure. Adding or improving roads is a complex, expensive and disruptive effort, and offers only a partial solution.
Modern perspective of traffic management: Smart traffic systems are a revolution because they can have a dramatic effect on traffic flow and congestion at a small fraction of the cost of building a new road. More importantly, they address the root of the problem—regulating traffic patterns, improving public transport and effectively balancing private and public transportation.
Rather than just adding more capacity, while traffic volumes grow unchecked, smart traffic systems can actually reduce and contain the traffic problem. They can improve quality of life, reduce pollution, and even save lives, reducing the number of accidents by providing real-time information to drivers.

1.2 Objectives:

Traffic management is a system used to regulate city traffic. It uses sensors and traffic signals to monitor, control and respond to traffic conditions. These centrally managed sensors and traffic signals are found on the city's main roads.

Objectives of smart traffic management systems:

1. Reduce traffic congestion: by improving traffic flow.
2. Prioritize traffic according to real-time changes in traffic conditions.
3. Reduce pollution by limiting traffic jams.
4. Improve traffic incident response time by creating a more effective system to monitor and manage traffic incidents.

1.3 Scope of Work:

IoT can be used by most of the metropolitan cities around the world to make their life more comfortable and easy. IOT eliminates the need to be close to operating a component, as components can be accessed and controlled through great distances. This makes the proposed framework more autonomous and reliable. Every distinct

command can be used to command and control a particular area in IOT. There is a need of control framework for traffic control and movement in appropriate way such as congestion issues is eliminated. Subsequently by utilizing IOT framework idea this can be achieved. On the off chance that traffic lights work's contingent to the number of vehicles in a path or street, at that point the proper time control should be there for the traffic light so that the gridlock on roads should be reduced.

1.4 Organization of Project Report

The report organization is the structure of the project. It's created separately, with specialists and workers from various departments. These personnel work under the project manager.
Report organization is a process. It provides the arrangement for decisions on how to realize a project. It decides the project's process: planning how its costs, deadlines, personnel and more will be implemented and by which project management tools. The project organization is then presented to the project stakeholders.

Mentor of Project:
IoT based enabled traffic control system is prepared under the guidance of
Prof. Ratish Agrawal, Dept. of Information technology.

Project team:
Mohika Agrawal
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Literature Survey

2.1 Background Study

According to the Google report of most populated countries in the world India comes on 2nd position after china with a total population of around 1,296,834,042 approx people and counting, so with this ranking in a populated country without any doubt there is an big issue of traffic gridlock on roads.

Also according to a survey, the number of vehicles per thousand population has increased considerably from 317 to 578 during 2005-2006 to 2017-18, posing challenges to traffic management. With increasing traffic on roads, it is necessary to implement a more advanced technique of managing traffic signal timer that would efficiently deal with real-time traffic.

Traffic Signal Control system in most of Indian cities is based on Fixed Time control mode or Manual override mode. As the traffic surges, the fixed timer signal is inefficient to manage most of the time and the traffic police have to control traffic manually based on the real-time traffic condition. This has also led to increased accidents of traffic cops. Reports suggest that road congestion in peak hours among Indian cities averages 149 per cent, implying commuters take 1.5 times longer for a peak-hour commute. Traffic officials confirmed that around 25-30 traffic cops get hurt monthly particularly at the traffic signal or roundabouts during peak hours when they are on a duty to manually manage traffic movement.

Developed countries and smart cities are already using IoT and to their advantage to minimize issues related to traffic. In most cities, it is common for people to prefer riding their own vehicles no matter how good or bad the public transportation is or considering how much time and money is it going to take for them to reach their destination.

Traffic gridlock is a serious problem in metropolitan cities to combat this problem IoT perform cohesively so that the amount of traffic and light control can be easily managed by ultrasonic sensors. So the Internet of Things (IoT), also sometimes referred to as the Internet of Everything (IoE), consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware. Sensors in city infrastructure can help reduce road congestion and warn us when infrastructure is in danger of crumbling.

2.2 Research Gap

This simple tool helps to identify the gap between the current situation and the future state that you want to reach, along with the tasks that you need to complete to close this gap. As we illustrated above there is a great gap between previous system and current need of systems so we need to drop up this gap by developing new system called Traffic Management System. This system will terminate traditional calling and will be replaced to a new system.

2.3 Expected Outcome

In the given model we get solution for gridlock problem. The smart traffic system estimates the count of number of vehicles or density of vehicles depending on the output given by the ultrasonic sensors and thus by applying optimizing algorithm, the signal timing changes automatically. The signal timing of green light is more in lanes having high density traffic and the timing is kept low in lanes having low density traffic. As a result, there will be less congestion on the roads and the waiting time will be reduced.
Further to give priority to emergency vehicle and for tracking lost cars, RFID is utilized.

Proposed Work

3.1 Introduction

In this proposed model we will give solution for gridlock problem. The autonomous mode depends on output given by the ultrasonic sensor and applying optimizing algorithm. The main purpose of this project is, if there will be no traffic on the other signal, one shouldn't wait for that signal. The system will skip that signal and will move on the next one.
Arduino is the main part of this project and it will be used to read from ultrasonic sensor HC-SR04 and calculate the distance. This distance will tell us if any vehicle is near the signal or not and according to that the traffic signals will be controlled.
The main task was to avoid use of delay because we have to continuously read from the ultrasonic sensors and also at the same time, we have to control signals which requires the use of delay function. So we repetitively measure a period of time in microseconds and at the end of each period, an interrupt function will be called. In this function, we will read from the sensors and in the loop function, we will control the traffic signals.

3.2 Hardware and Software Requirements

The software that we used is tinkercad.

1. Tinkercad :-
Tinkercad is a free, online 3D modeling program that runs in a web browser, known for its simplicity and ease of use. Tinkercad uses a simplified constructive solid geometry method of constructing models. A design is made up of primitive shapes that are either "solid" or "hole". Combining solids and holes together, new shapes can be created, which in turn can be assigned the property of solid or hole. In addition to the standard library of primitive shapes, a user can create custom shape generators using a built-in JavaScript editor.

Shapes can be imported in three formats: STL and OBJ for 3D, and 2-dimensional SVG shapes for extruding into 3D shapes. Tinkercad exports models in STL or OBJ formats, ready for 3D printing. Tinkercad also includes a feature to export 3D models to Minecraft Java Edition, and also offers the ability to design structures using Lego bricks.
Tools used in tinkercad: -

Name	Quantity	Component
U3	1	Arduino Uno R3
DIST5 DIST6	2	Ultrasonic Distance Sensor (HC-SRO4)
D13 D6	2	Yellow LED
D5 D8	2	Red LED
D7 D9	2	Green LED
R1 R2 R3 R4 R5	5	0.33 kΩ Resistor
R6	1	330 Ω Resistor

2. Arduino Uno R3: -

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

3. Ultrasonic Distance Sensor: -

An ultrasonic sensor HC-SRO4 is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect from boundaries to produce distinct echo patterns.

4. LEDs:-
To turn on an LED, the Arduino needs to send a HIGH signal to one of it's pins. To turn off the LED, it needs to send a LOW signal to the pin. You can make the LED flash by changing the length of the HIGH and LOW states. The Arduino has an on-board surface mount LED that's hard wired to digital pin 13. It's the one with an "L" next to it:

5. Arduino IDE:
The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, MacOS, and Linux) that is written in the programming language C++. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.

3.3 Algorithm

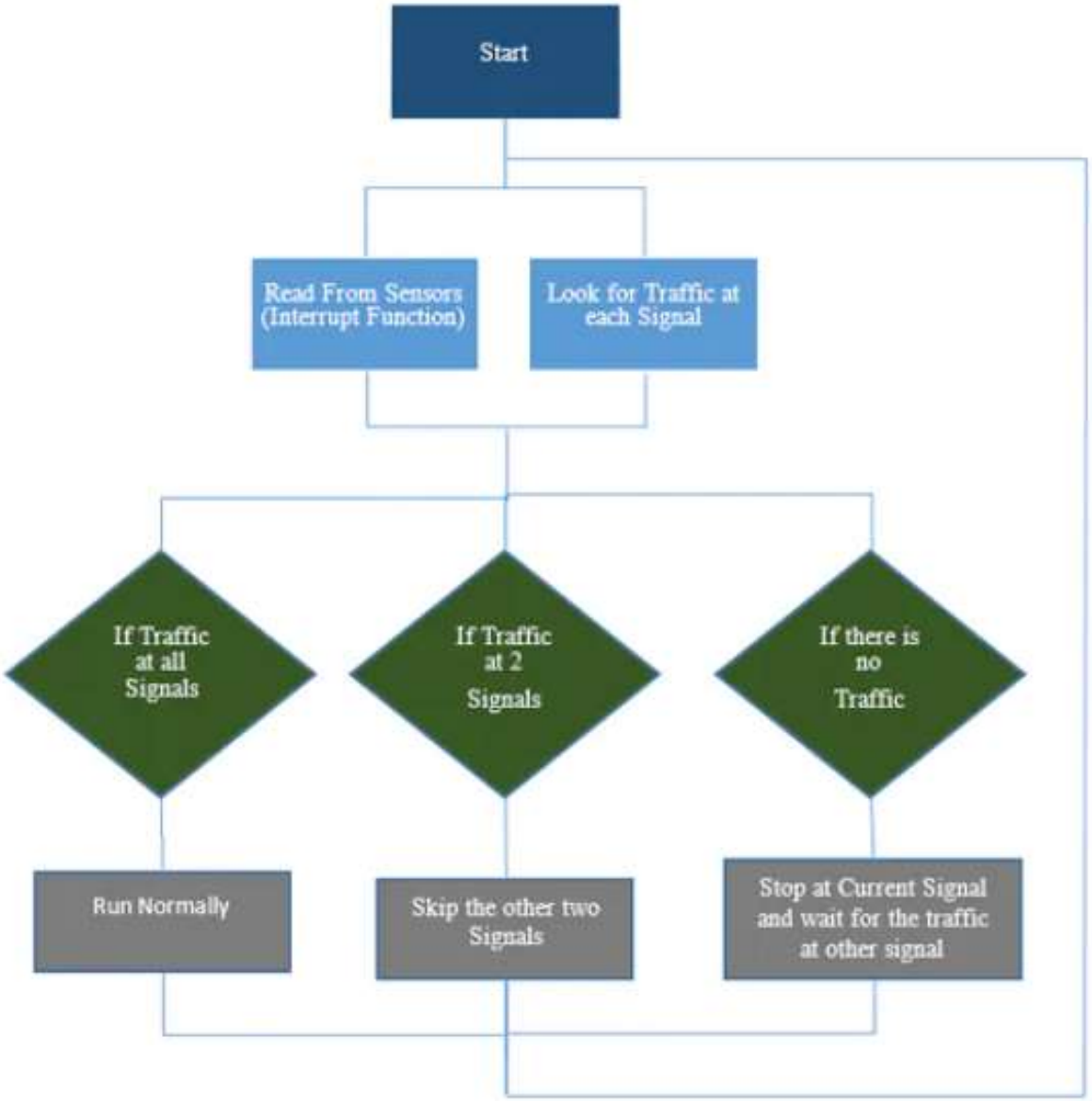
The Arduino Uno R3 is having a coding function using embedded C programming languages as efficient programming language. With the help of using the algorithm, the road which has more traffic will have a higher priority and a time delay is given to the vehicles to clear the road depending on the density of the vehicles present in that lane as judged by the ultrasonic sensors.

ALGORITHM-
The working of the project is divided into three steps
1. If there is traffic at all the signals, then the system will work normally by controlling the signals one by one.

2. If there is no traffic near a signal, then the system will skip this signal and will move on to the next one. For example, if there is no vehicle at signal 2,3 and currently the system is allowing vehicles at signal 1 to pass. Then after signal 1, the system will move on to signal 2 skipping signal 2 and 3. However in our project we have used 2 signals so if there is no traffic at signal 2 then the system will allow traffic to flow from signal 1 and then it will switch to other signal when there is traffic.

3. If there is no traffic at all the 4 signals, system will stop at the current signal and will only move on the next signal if there will be traffic at any other signal.

3.4 Flowchart



Implementation Process

4.1 Overview of Tools Incorporated

Smart traffic signal based on the microcontroller & ultrasonic sensors, in which the sensors are placed to detect density of vehicles present in that lane. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect from boundaries to produce distinct echo patterns. Microcontroller will be used to read from ultrasonic sensors and calculate the density of vehicles. Further the data on traffic density and traffic signaling control are sent wirelessly to Arduino. Arduino has a coding function embedded in C language which based on the algorithm given above helps to determine the duration of the green light of the traffic signal.

4.2 Salient Features

In this we are having ultrasonic sensor. We place that sensor around 20 or 30 meter behind the traffic light. When the number of cars in the line increases the distance between the ultrasonic sensor and the last in the line decreases that's how we identify the density of the cars in a line. we compare the distance between the other cars in the other lines and line is having less distance then we make the traffic signal in that line green.

4.3 Sample Coding of essentials modules

```
int red1=8;
int green1=6;
int yellow1=7;
int red2=3;
int green2=5;
int yellow2=4;
const int pingPin = 10; // Trigger Pin of Ultrasonic Sensor
const int echoPin = 9; // Echo Pin of Ultrasonic Sensor
const int pingPin2 = 12; // Trigger Pin of Ultrasonic Sensor
const int echoPin2 = 11; // Echo Pin of Ultrasonic Sensor

void setup() {
  // put your setup code here, to run once:
pinMode(red1,OUTPUT);
```

```
pinMode(red2,OUTPUT);
pinMode(yellow1,OUTPUT);
pinMode(yellow2,OUTPUT);
pinMode(green1,OUTPUT);
pinMode(green2,OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  int distance1,distance2;
  distance1=calculatedistance(pingPin , echoPin);
  distance2=calculatedistance(pingPin2 , echoPin2);
  if(distance1>=distance2){
     digitalWrite(red1,LOW);
digitalWrite(green2,LOW);
digitalWrite(red2,LOW);
digitalWrite(green1,LOW);
digitalWrite(yellow1,HIGH);
digitalWrite(yellow2,HIGH);
delay(200);
    while(distance1>distance2){
   distance1=calculatedistance(pingPin , echoPin);
  distance2=calculatedistance(pingPin2 , echoPin2);
digitalWrite(red1,HIGH);
digitalWrite(green2,HIGH);
digitalWrite(red2,LOW);
digitalWrite(green1,LOW);
digitalWrite(yellow1,LOW);
digitalWrite(yellow2,LOW);
    }

  }

if(distance2>distance1){
    digitalWrite(red1,LOW);
digitalWrite(green2,LOW);
digitalWrite(red2,LOW);
digitalWrite(green1,LOW);
digitalWrite(yellow1,HIGH);
digitalWrite(yellow2,HIGH);
```

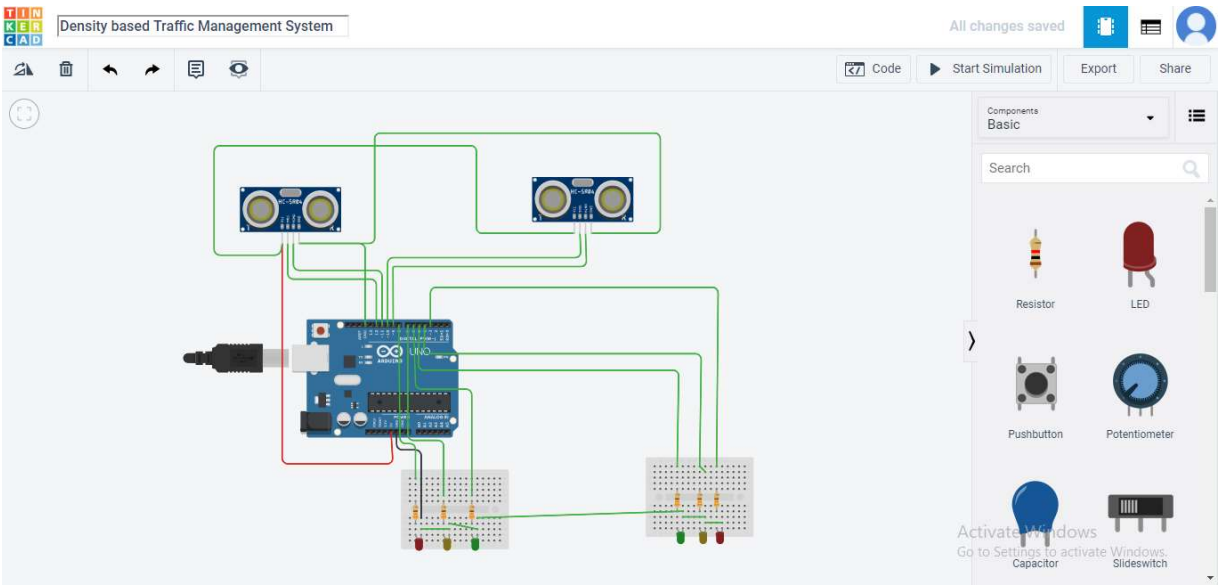
```
delay(200);
  while(distance2>distance1){
      distance1=calculatedistance(pingPin , echoPin);
  distance2=calculatedistance(pingPin2 , echoPin2);
digitalWrite(red1,LOW);
digitalWrite(green2,LOW);
digitalWrite(red2,HIGH);
digitalWrite(green1,HIGH);
digitalWrite(yellow1,LOW);
digitalWrite(yellow2,LOW);
  }
}
}

long microsecondsToCentimeters(long microseconds)
{
   return microseconds / 29 / 2;
}

int calculatedistance(int pingPin , int echoPin){
    long duration, inches, cm,meter;
  pinMode(pingPin, OUTPUT);
  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);
  digitalWrite(pingPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(pingPin, LOW);

  pinMode(echoPin, INPUT);
  duration = pulseIn(echoPin, HIGH);

  cm = microsecondsToCentimeters(duration);
  meter = cm/100;
  return meter;
}
```

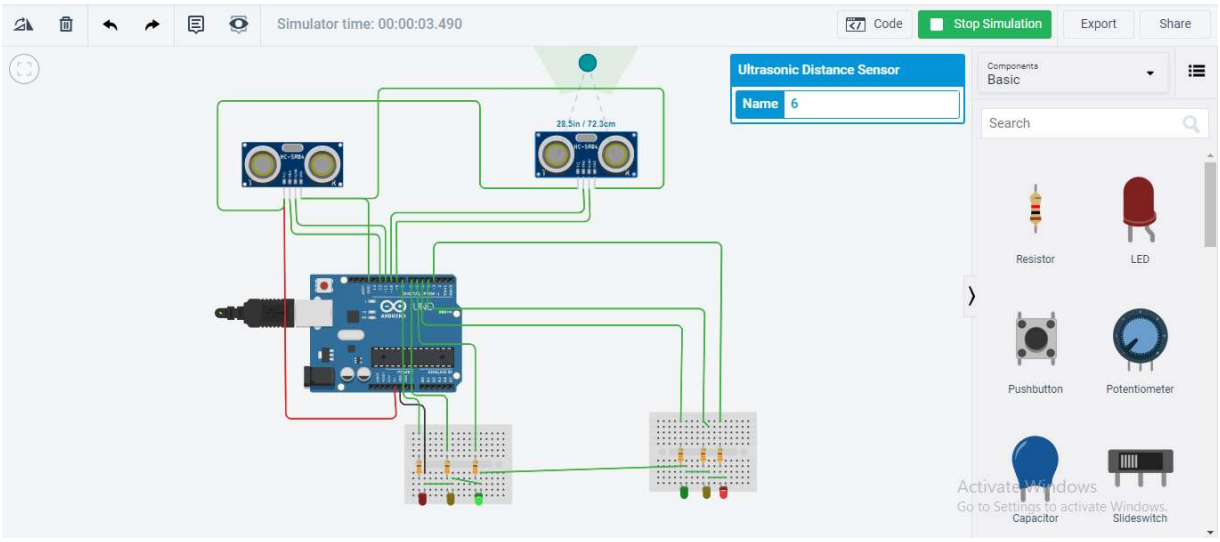
Result/Performance Analysis

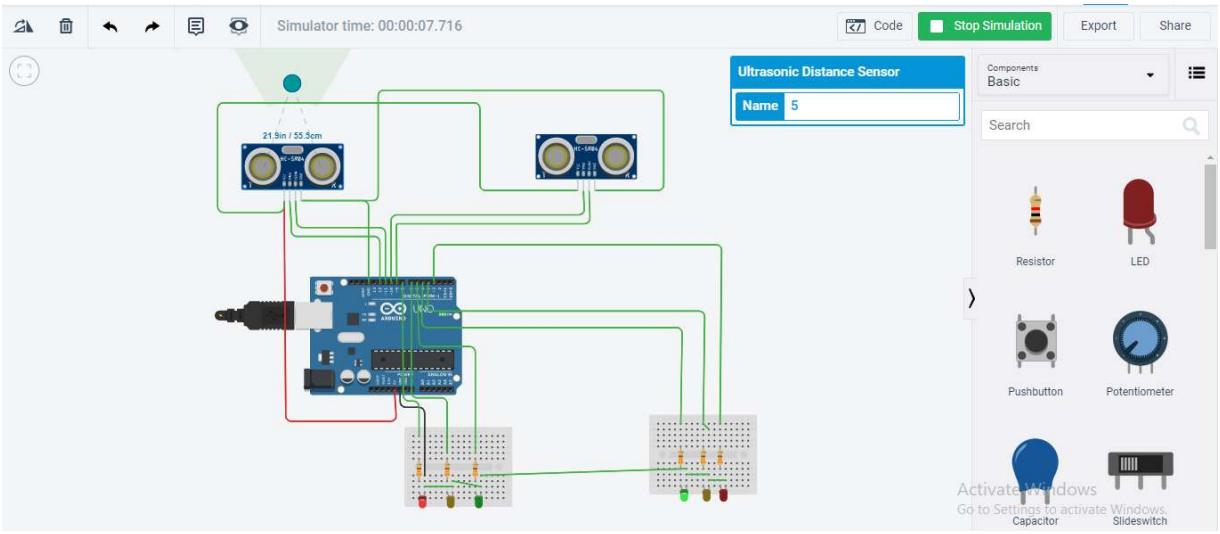
5.1 Project Evaluation

The results obtained are based on the prototype as shown in Fig.3 of a four way traffic junction. The ultrasonic sensors used in the prototype is the HC-SR04 as portrayed. These sensors can be used to determine the presence of an obstacle which in our case is vehicles. Each lane houses sensors which are positioned vertically at the divider. These sensors are connected to the Arduino using wires and the information collected by the sensors is processed by Arduino. Arduino then determines the level of traffic and allots timing to the traffic light indicators which are the red, yellow, and green LED's. The setup of the prototype housing the Arduino, the ultrasonic sensors and the traffic light indicators. With the help of ultrasonic sensors an approximate level of traffic can be found out that is equivalent to real time values of traffic. This information gathered can be used to assess and control the traffic lights in real time depending on actual densities of traffic. This will intern help in saving time and reducing the negative effects of traffic congestion.

5.2 Snapshots




Simulator time: 00:00:03.490
Code
Stop Simulation
Export
Share
Ultrasonic Distance Sensor
Name 6
Components
Basic
Search
28.5in / 72.3cm
Resistor
LED
Pushbutton
Potentiometer
Capacitor
Slideswitch
Activate Windows
Go to Settings to activate Windows.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Ultrasonic Distance Sensor
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Components
Basic
Search
21.9in / 55.5cm
Resistor
LED
Pushbutton
Potentiometer
Capacitor
Slideswitch
Activate Windows
Go to Settings to activate Windows.

Conclusion

6.1 Conclusion

The proposed framework guarantees brilliant control of movement framework and deals with the activity blockage. The outcome is as we anticipated. By this proposed framework time administration for flag lights is finished this implies discovery of ease of movement in volume at each intersection will decrease the activity gridlock issue. Freedom of activity for crisis car is effectively utilized. Subsequently, numerous valuable life would be spared. Furthermore, the framework has programmed and manual activity. All the framework control and discovery are conceivable by sensors and cameras set at the intersections. Also, at exhibit we have actualized the outline for just movement control, and vehicle leeway in the event of crisis. In future this can be stretched out to following of stolen car which can be simple and fast, when lost vehicle is distinguished an email might be dropped. In future it can also control the traffic through an optimizing algorithm in which it will work automatically by checking the density of the traffic
in all directions and will act accordingly.

6.2 Future Work

1. This project still has space for improvement and can be extended by displaying traffic data in an application that can be accessed by the public.

2. In addition the system can be made in more efficient by using a camera with higher resolution or by replacing the HC-SR04 ultrasonic sensors with industrial grade sensors that serve the same purpose.

3. Further changes can also be made to the system that permits emergency vehicles to be given the highest priority in any situation. Each important vehicle like ambulance, fire brigade, etc can be assigned a RFID number which can be read and they can be given preference over other vehicles.

References

[1] Rahul B. Pendor , P. P. Tasgaonkar " An IoT Framework for Intelligent vehicle monitoring System ", International Conference on Communication and Signal Processing, April 6-8, 2016, India.

[2] K. Kishore Kumar, S. Durai, M. Thanjai Vadivel and K. Antony Kumar “Smart Traffic System using Raspberry Pi by Applying Dynamic Color Changer Algorithm”2-3,2016.