PIMPRI CHINCHWAD EDUCATION TRUST's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

Savitribai Phule Pune University

A project report on

SMART TRAFFIC MANAGEMENT SYSTEM USING INTERNET OF THINGS (IoT)

Academic year 2020-2021

By-

Nikita Vijay Khairnar

Roll no – SECOB214

Guided by -

Prof. Anagha Chaudhari

Pimpri Chinchwad College of Engineering

Nigadi , Pune

Department of Computer Engineering

CERTIFICATE

This is to certify that **Miss Nikita Vijay Khairnar** from SE Computer Department has successfully completed the project report on topic **SMART TRAFFIC MANAGEMENT SYSTEM USING INTERNET OF THINGS (IoT)** in the academic year 2020-2021.

Date : November 20 , 2020

Place : Nigadi , Pune

Signature

(Prof. Anagha Chaudhari)

Abstract

Name of student : **Nikita Vijay Khairnar**

Roll no. : **SECOB214**

Department : **Computer Engineering**

Project title: **Smart traffic management system using internet of things (IOT)**

Project supervisor: **Prof. Anagha Chaudhari**

Month and year of Project submission: **November 20 , 2020**

Traffic lights have become an integer part of human's day-to-day life. With this motivation in the mind, this project aims at designing and implementing, a running model of traffic light controller which is controlled according to the density of vehicle on road. We will use AT Mega microcontroller and IR sensor for performing all the computation and control related task

Keywords: IoT, Sensors, Microcontroller.

Acknowledgements

I would like to express my gratitude and appreciation to all those who gave me opportunity to make this project and its report . A special thanks to the project coordinator Prof.Anagha chaudhari , Department of Computer Engineering , Pimpri Chinchwad college of Engineering , Nigadi , Pune who helped me throughout the project and also helped me while making the report too .

I would also like to thank the staff of the Computer Engineering department who allowed me to use all the necessary materials from laboratory to complete the project .

I would also like to thank and appreciate the guidance given by other supervisors especially for guiding me about the presentation which helped me to improve my presentation skills .

Yours sincierly ,

Nikita Vijay Khairnar

Contents

List of Figures

Abbreviations

- **IoT :** Internet of Things
- **IR :** Infra Red
- **LED :** Light Emitting Diode
- **Wi-Fi :** Wireless Fidelity
- **WSN :** Wireless Sensor Network
- **NFC :** Near Field Communication
- **ITS :** Intelligent Transportation System

Chapter 1

INTRODUCTION

1.1 About the project :

This project smart traffic management system which uses sensor data, communication and automated algorithms is to be developed to keep traffic flowing more smoothly. The aim of the project is to control the duration of green or red light for a specific traffic light at an intersection. In this project the duration for which a green or red traffic signals glows depends on the number of cars present. When traffic is heavy in one direction, the green lights should stay on longer; less traffic should mean the red lights should be on for longer time interval.

As amount of traffic is increasing day by day it has become important to develop a traffic control system which will help to reduce the traffic . The traffic indirectly also increases air pollution because generally people don't switch off their car while they are at the signal . This also causes increase in fuel consumption . So by considering the importance of traffic management I decided to make a project to help manage the traffic

Chapter 2

LITERATURE SURVEY

2.1 About IoT

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. These devices, often called ”connected” or ”smart” devices, can sometimes talk to other related devices, a process called machine-to-machine(M2M) communication, and act on the information they get from one another. Humans can interact with the gadgets to set them up, give them instructions or access the data, but the devices do most of the work on their own without human intervention. Their existence has been made possible by all the tiny mobile components that are available these days, as well as the always-online nature of our home and business networks. Connected devices also generate massive amounts of Internet traffic, including loads of data that can be used to make the devices useful, but can also be mined for other purposes. All this new data, and the Internet-accessible nature of the devices, raises both privacy and security concerns. But this technology allows for a level of real-time information that we have never had before. We camonitor our homes and families remotely to keep them safe. Businesses can improve processes to increase productivity and reduce material waste and unforeseen downtime. Sensors in city infrastructure can help reduce road congestion and warn us when infrastructure is in danger of crumbling .Gadgets out in the open can monitor for changing environmental conditions and warn us of impending disasters.

2.2 Advantages and Disadvantages of IoT

2.2.1 Advantages

Communication: IoT encourages the communication between devices, also famously known as Machine-to-Machine (M2M) communication. Because of this, the physical devices are able to stay connected and hence the total transparency is available with lesser inefficiencies and greater quality.

Automation and Control: Due to physical objects getting connected and controlled digitally and centrally with wireless infrastructure, there is a large amount of automation and control in the workings. Without human intervention, the machines are able to communicate with each other leading to faster and timely output. Information: It is obvious that having more information helps making better decisions. Whether it is mundane decisions as needing to know what to buy at the grocery store or if your company has enough widgets and supplies, knowledge is power and more knowledge is better.

Monitor: The second most obvious advantage of IoT is monitoring. Knowing the exact quantity of supplies or the air quality in your home, can further provide more information that could not have previously been collected easily. For instance, knowing that you are low on milk or printer ink could save you another trip to the store in the near future. Furthermore, monitoring the expiration of products can and will improve safety.

Time: As hinted in the previous examples, the amount of time saved because of IoT could be quite large. And in today's modern life, we all could use more time.

Money: The biggest advantage of IoT is saving money. If the price of the tagging and monitoring equipment is less than the amount of money saved, then the Internet of Things will be very widely adopted. IoT fundamentally proves to be very helpful to people in their daily routines by making the appliances communicate to each other in an effective manner thereby saving and conserving energy and cost.

Allowing the data to be communicated and shared between devices and then translating it into our required way, it makes our systems efficient.

Efficient and Saves Time: The machine-to-machine interaction provides better efficiency, hence; accurate results can be obtained fast. This results in saving valuable time. Instead of repeating the same tasks every day, it enables people to do other creative jobs.

Better Quality of Life: All the applications of this technology culminate in increased comfort, convenience, and better management, thereby improving the quality of life

2.2.2 Disadvantages

Compatibility: Currently, there is no international standard of compatibility for the tagging and monitoring equipment. I believe this disadvantage is the most easy to overcome. The manufacturing companies of these equipment just need to agree to a standard, such as Bluetooth, USB, etc. This is nothing new or innovative needed.

Complexity: As with all complex systems, there are more opportunities of failure. With the Internet of Things, failures could sky rocket. For instance, let's say that both you and your spouse each get a message saying that your milk has expired, and both of you stop at a store on your way home, and you both purchase milk. As a result, you and your spouse have purchased twice the amount that you both need. Or maybe a bug in the software ends up automatically ordering a new ink cartridge for your printer each and every hour for a few days, or at least after each power failure, when you only need a single replacement

Privacy/Security: With all of this IoT data being transmitted, the risk of losing privacy increases. For instance, how well encrypted will the data be kept and transmitted with?

Do you want your neighbors or employers to know what medications that you are taking or your financial situation? Safety: As all the household appliances, industrial machinery, public sector services like water supply and transport, and many other devices all are connected to the Internet, a lot of information is available on it. This information is prone to attack by hackers. It would be very disastrous if private and confidential information is accessed by unauthorized intruders

Lesser Employment of Manpower: The unskilled workers and helpers may end up losing their jobs in the effect of automation of daily activities. This can lead to unemployment issues in the society. This is a problem with the advent of any technology and can be overcome with education. With daily activities getting automated, naturally, there will be fewer requirements of human resources, primarily, workers and less educated staff. This may create Unemployment issue in the society

2.3 IoT in Traffic Management

Traffic management is one of the biggest infrastructure hurdles faced by developing countries today. Developed countries and smart cities are already using IoT and to their advantage to minimize issues related to traffic. The culture of the car has been cultivated speedily among people in all types of nations. 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.

Chapter 3

REQUIREMENTS

3.1 Hardware Components

1. Microcontroller (Arduino Mega 2560):

- The Arduino Mega 2560 is a microcontroller board based on the Atmega 2560.
- It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.
- It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
- The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

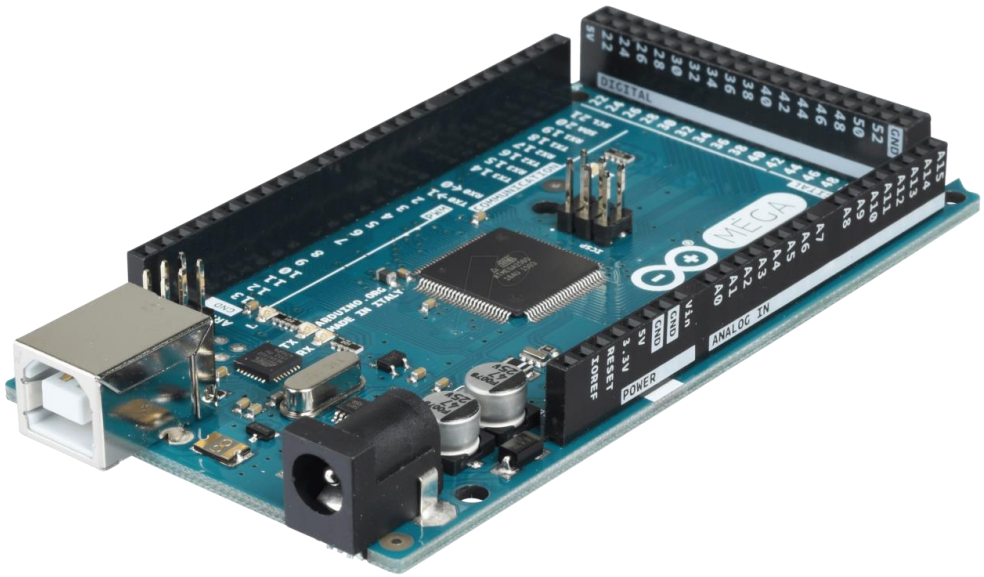


Figure 3.1: Arduino Mega 2560.

2. Microcontroller (Arduino Uno):

- The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328Pmicrocontroller and developed by Arduino.cc.
- Advanced RISC Architecture
- 6 PWM channels
- Programmable serial USART
- Operating voltage 4.5V – 5.5V
- On-chip Analog Comparator
- 8-channel ADC with 10-bit accuracy

Figure 3.2: Arduino Uno.

3. LEDs:

LEDs are used for the purpose of signaling according to the traffic condition.

Figure 3.3: LED for traffic lights .

4. IR Sensor:

IR Sensor is used to count the vehicles on the road.

Figure 3.4: IR Sensor .

5. Jumper Wires:

It is used to connect the components to each other.

Figure 3.5: Jumper Wires .

3.2 Software Requirement

1. Arduino IDE:

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, MacOS, Linux) that is written in the programming language Java. 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.

2. Proteus Design Suite:

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

Chapter 4

PRINCIPLE

4.1 Existing System

The exiting traffic system is generally controlled by the traffic police. The main drawback of this system controlled by the traffic police is that the system is not smart enough to deal with the traffic jam or in case of more traffic . Also , even if traffic lights are used the time interval for which the vehicles will be showed green or red signal is fixed. Therefore, it may not be able to solve the problem of traffic congestion. Also the traffic police get exposed to the pollutants released by the vehicles which affect their health . So by considering their health and the competence of the project in handling the traffic more effectively the proposed syatem is much better than existing system .

4.1.1 Disadvantages of Existing System

i) Traffic congestion

ii) No means to detect traffic congestion

iii) Number of accidents are more

iv) It cannot be remotely controlled 1

v) It requires more manpower

vi) It is less economical

4.2Proposed System

In the proposed system the duration of green or red light for a specific traffic light at an intersection is managed . In this project the duration for which a green or red traffic signals glows depends on the number of cars present i.e. density of cars in a lane . When traffic is heavy in one direction, the green lights should stay on longer; less traffic should mean the red lights should be on for longer time interval. .

4.2.1 Advantages of Proposed System

I. Reduce day to day congestion by improving traffic flow
II. Reduce pollution by limiting traffic jams
III. Better than time based traffic control
IV. Save considerable amt of time
V. Avoid traffic jams which causes public incovenience
VI. No need of traffic inspector at the junctions

4.3 Method

4.3.1 fabrication of project

1. First begin with setting up the traffic lights in the system.
2. Take the marker, scale and a cardboard then we marked four points with a spacing of 5 cm distance each.
3. Then count10 strips and mark a point at 11^{th} strip.
4. Then cut out the marked region using a cutter.
5. Next cut the cardboard at the points marked but cut only the top surface so that they can be bent.
6. Make 4 such cuts then turn it upside down and mark the 4 sections with numbers.
7. Noe make 2 sets of holes in each section to fix the red and the green LEDs.
8. Then fix the LEDs in the holes such that the anode of the LED faces your left and cathode towards your right.
9. Next take an 8core cable which has 8 different wires and separate the wires at both the ends. Then strips the ends using a wire stripper.
10. Then take 8 single pin connectors and cut them into 2 halves. Strip the cut ends of these single pin connectors and join then with the wires of 8 core connectors at both the ends.
11. After connecting them insulate the joints.

4.3.2 Placement of electronic component

1. First take the bread board wire and connect the cathode pins of the LEDs together.

2. Connect the cathode pins to a common ground using a wire, a female pin connector and a resistor.

3.Now take the 8core cable fixed with 8 pin connectors and connect its ends to the anode pins of all the LEDs.

4.Bend the setup to form a square and then put a tape around it to hold it in place.

5.Now take another piece of cardboard and put the Aluminium pipe and mark it. Cut out the marked portion and place the Aluminium pipe in it.

6.now pass the free end of the 8core cable through the Aluminium pipe. Also fox the pipe to the LED setup.

4.3.3 Final connection

1. We need Bread board, Arduino Uno, Male to male single pin connectors, IR sensors with cables connected.
2. Noe take 2 male single pin connectors and connect one side of wire to BCC and ground of Arduino board and the other side of the wire should be connected to Vcc and ground pin of the bread board.
3. Then connect 1 more male to male single pin connector from ground terminal of Arduino board to the bread board.
4. Take one IR sensor, connect Vcc and ground to the positive and negative of the bread board.
5. Then connect all IR sensors.
6. Now connect the anode terminals of all the green LEDs to pin no 0,1,2,3 of the Arduino board.
7. Similarly connect the red colored LED anode terminals to pin no 4,5,6,7 of Arduino board.
8. Then connect the all 4 digital IR sensors output pin to the pin no 8,9,10,11 of the Arduino board.
9. Finally connect one side of resistor to all 8 LEDs cathode wires and the other end should be connected to the 2nd ground of the bread board.
10. Now finally by using the programming logic and traffic density the traffic lights can be controlled.

4.3.4 A View of Signals at Lanes

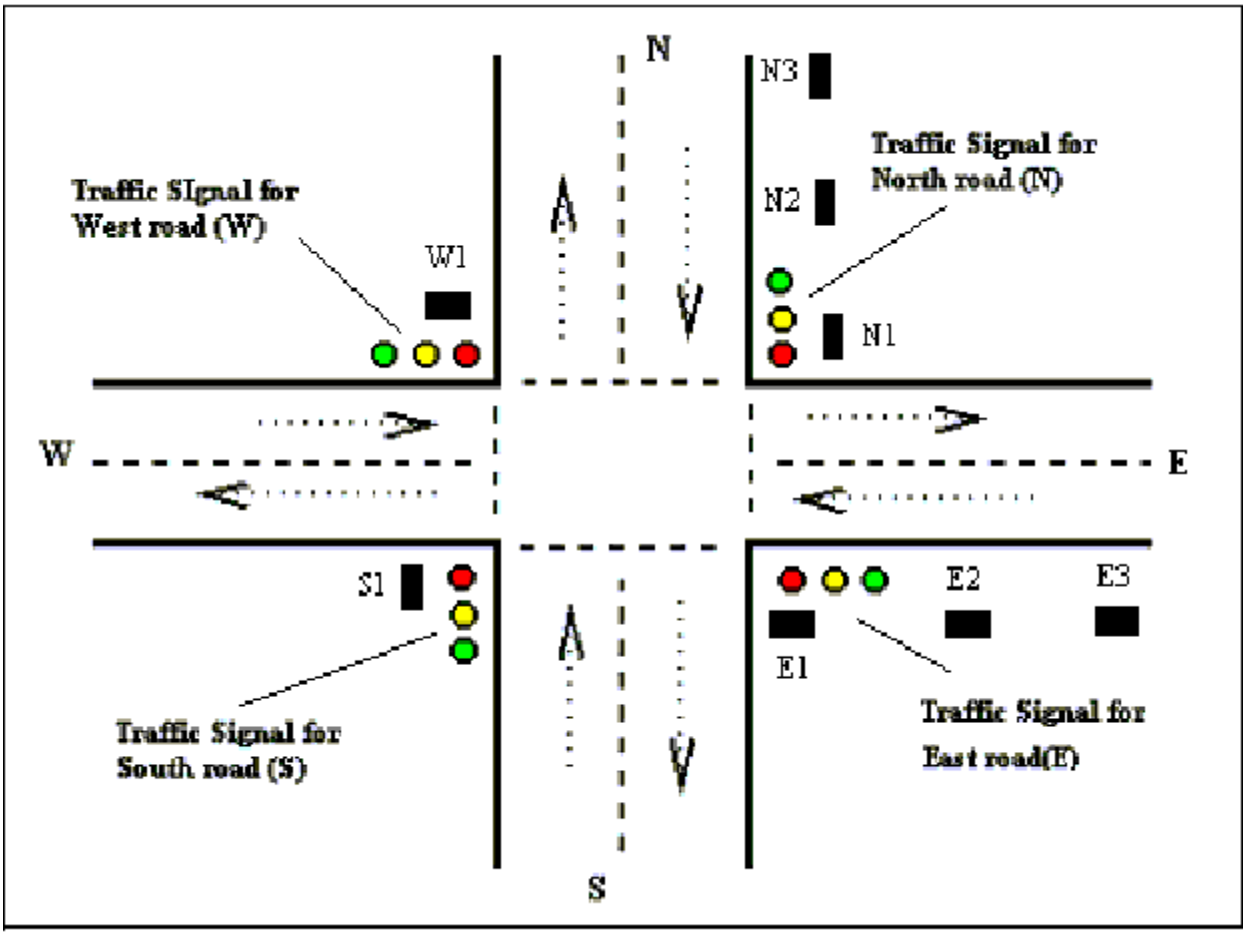
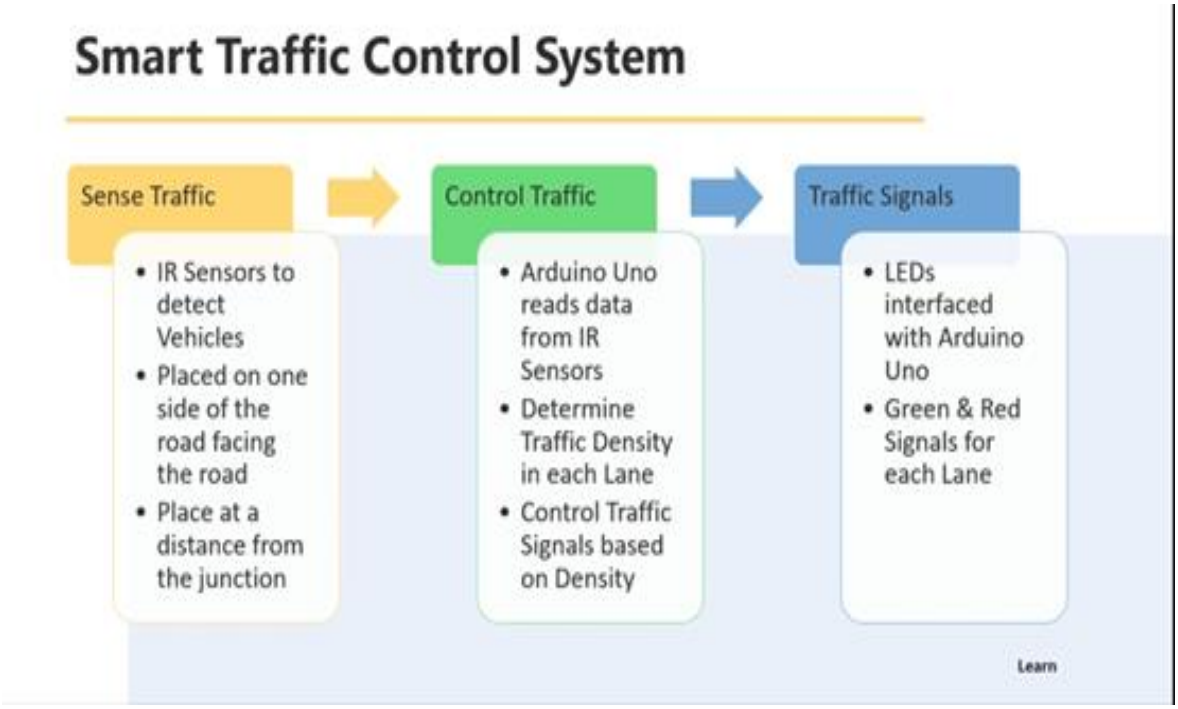


Figure 4.1: Traffic lanes

4.4 Diagrams

4.4.1 Logic Diagram



4.5 Algorithms

4.5.2 Traffic Control Algorithm

Step 1: Start

Step 2: initialize all sensors to zero and define the amount of extra time for which the green signal will be on as well as the pin no for each sensor

Step 3: Sensors will read the no. of vehicles on each lane using digitalRead() function .

Step 4: if (Vehicle Count < Threshold) Then status = Normal traffic. Turn on the green signal for all the lanes one after another in a sequential manner . When signal is green for one lane , the others will remain red.

Step 5: else status = congestion.

Step 6: COMPARE the no of vehicles on each lane , Select the highest of the four ,turn on green signal for that lane having more cars for defined time delay . When time ends, turn on the red signal.

4.5.2 Traffic Control Code

```
int sensor1 = 0;
int sensor2 = 0;
int sensor3 = 0;
int sensor4 = 0;

#define sensor1pin 8
#define sensor2pin 9
#define sensor3pin 11
#define sensor4pin 10
int time_delay = 5000;

void setup() {
// put your setup code here, to run once:
DDRD = B11111111;
PORTD = B00000000;

}

void loop() {

// put your main code here, to run repeatedly:
sensor1 = digitalRead(sensor1pin);
sensor2 = digitalRead(sensor2pin);
sensor3 = digitalRead(sensor3pin);
sensor4 = digitalRead(sensor4pin);

signal_logic();

 }
```

```
void signal_logic(){
if (sensor1 == 1){
PORTD = B11100001;
delay(time_delay);
}
if (sensor2 == 1){
PORTD = B11010010;
delay(time_delay);
}
if (sensor3 == 1){
PORTD = B10110100;
delay(time_delay);
}
if (sensor4 == 1){
PORTD = B01111000;
delay(time_delay);
}
else{
PORTD = B11100001;
delay(time_delay);
PORTD = B11010010;
delay(time_delay);
PORTD = B10110100;
delay(time_delay);
PORTD = B01111000;
delay(time_delay);
```

Chapter 5

RESULTS AND ANALYSIS

5.1 Results and Analysis

The proposed system helps in better time based monitoring and thus has certain advantages over the existing system like minimizing number of accidents, reducing fuel cost and is remotely controllable etc.

The proposed system is designed in such a way that it will be able to control the traffic congestion as well as track the number of vehicles. The administrator of the system can access local server in order to maintain the system.

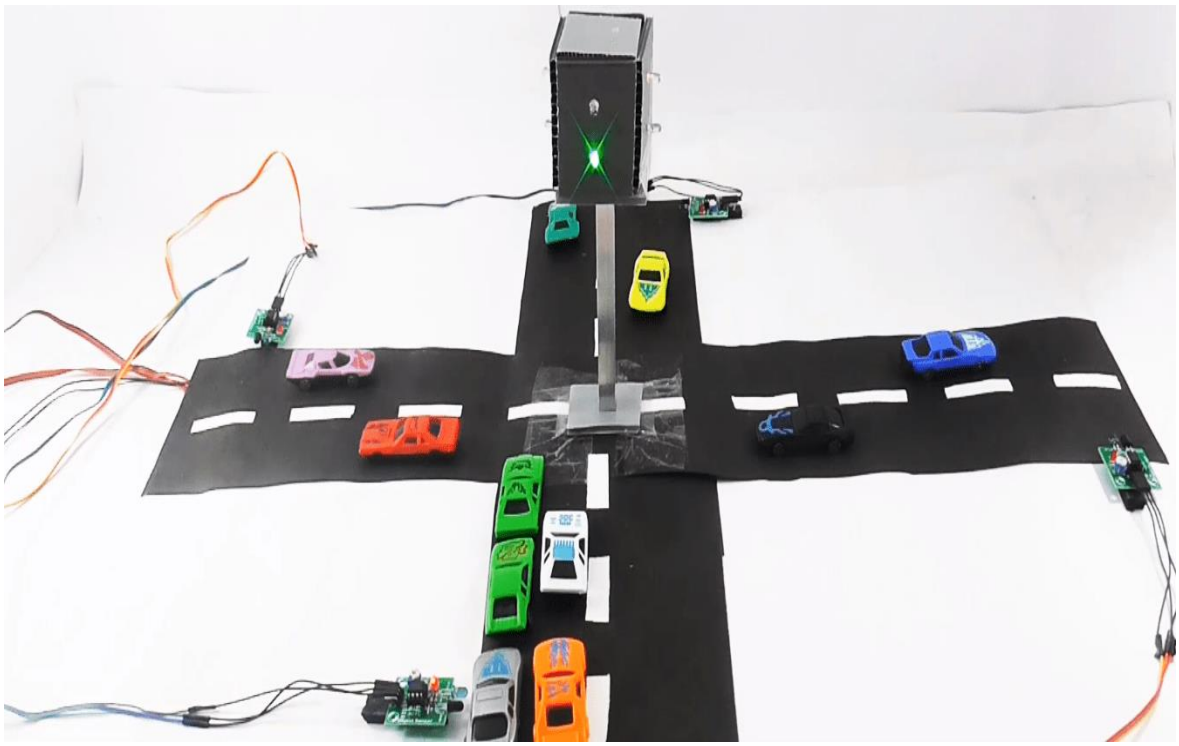


Figure 5.1: Model of the Project

5.2 LIMITATION

- IR sensors sometimes may absorb normal light also.
- IR sensors work only for fewer distances.
- Should arrange in accurate manner otherwise they may not detect in the traffic density.

5.3 APPLICATION

- Avoids wastage of time due to the traffic
- Fully automatic
- Low power consumption
- It provides the easy access in the traffic light
- Low cost to design the circuit,maintenance of the circuit is good
- Easy convenience to handle.

Chapter 6

MISCELLANEOUS

6.1 Future Scope

- The system can be replaced by image processing system which will give efficient results.
- In the future advancements of this TMS(Traffic Monitoring System),a model ambulance can able to communicate with all base station to get an easy free lane to rush up reaching the hospital on time for needy people.So much scenarios automatically is cleared with its arrival schedule.
- For future directions, different priority levels for multiple incidents and scenarios can be considered.
- Along with that an emergency signal for an emergency vehicle (such as an Ambulance) can also be included in order to serve them better.

Conclusion

- Smart Traffic Management System has been developed by using multiple features of hardware components in IoT .
- Traffic optimization is achieved using IoT platform for efficient utilizing allocating varying time to all traffic signal according to available vehicles count in road path.
- Smart Traffic Management System is implemented to deal efficiently with problem of congestion and perform re-routing at intersections on a road.
- By using this system configuration we can reduce the possibilities of traffic jams.
- The number of passing vehicles on the road decides the density range of traffic and on the basis of vehicle count microcontroller decides the traffic light delays.
- Traffic load and emergency vehicles are continuously measured by sensors connected to a microcontroller-based system which also performs all intersection control functions.