DENSITY BASED TRAFFIC SIGNAL CONTROL USING ARDUINO NANO AND IR SENSOR

A PROJECT REPORT

Submitted by

BADINIGENI YOGESH	**20121032**
MANCHURI NIHASH	**20121047**
SRIKANTH VS	**20121059**

Under the guidance of

DIPIN THOMAS

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

CHENNAI – 603 103

APRIL & 2022

HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)
CHENNAI

BONAFIDE CERTIFICATE

Certified that this project report **"DENSITY BASED TRAFFIC SIGNALCONTROL USING ARDUINO NANO AND IR SENSOR "** is the bonafied work of **BADIGINENI YOGESH (20121032) MANCHURI NIHASH(20121047) SRIKANTH VS (20121059),** who carried out the project work under my supervision during the academic year **2021-2022.**

SIGNATURE
HEAD OF THE DEPARTMENT
Dr. A.L.Vallikannu

Professor and Head of the Department
Department of Electronics and
Communication Engineering
Hindustan Institute of
Technology and Science
Padur, Chennai-603103

SIGNATURE
SUPERVISOR
Ms.Dipin Thomas

Professors of
Department of Electronics and
Communication Engineering
Hindustan Institute of
Technology and Science
Padur, Chennai-603103

INTERNAL EXAMINER

Name: _____
_____

Designation:_____
Designation:_____

Name:_____
Project Viva - voce conducted on _____

EXTERNAL EXAMINER

Name:

Institution

ACKNOWLEDGEMENT

It's our extreme pleasure to thank our Chancellor **Dr. (Mrs.) Elizabeth Verghese,** Vice Chancellor **Dr. S.N.Sridhara**, and the Pro Vice Chancellor **Dr. R. W. Alexander Jesudasan** Hindustan Institute of Technology and Science for providing conducive environment which helped us to pursue our project in a diligent and an efficient manner.

We wish to express our sincere gratitude to Dean (Engineering & Technology) **Dr. Angelina Geetha**, Hindustan Institute of Technology and Science for his valuable directions, suggestions and support.

We are thankful to **Dr. A.L.Vallikannu,** Head of the Department, Electronics and Communication Engineering for having evinced keen interest in our project and for his continued support.

We are indebted to our Project Guide **DIPIN THOMAS,** Assistant Professor, Electronics and Communication Engineering for his valuable guidance and technical support in the accomplishment of our project.

We also thank our Project Coordinator **Dr.K.Sakthidasan @ Sankaran**, Professor Electronics and Communication Engineering for his support and coordination throughout the accomplishment of the project.

Our sincere thanks to all the teaching and non-teaching staff and family members who have been constantly supporting us throughout the accomplishment of this project.

ABSTRACT

In the present day world, with growing technologies and adverse development in the metropolitan cities, traffic administration has become one of the most important fields to be dealt with. The main role of a traffic administration is to constantly improve the traffic control system and effectively regulate the same .

With the number of vehicle users constantly increasing, the facility provided by the current system is limited and inefficient with respect to the energy and time consumed. A survey shows that an average person spends about four to six months of his/her entire life just waiting for the green light to be turned ON at a signal .

It is also been identified that this inadequate facility and irrational distribution of signal control is leading to such traffic issues.These inefficient traffic control system is also contributing to various traffic violation wherein the people don't possess the patience to wait for that interval of the signal which does not have much vehicle density than the other existing densities. Avoiding conditions of extreme traffic jams is highly important in the current situation.

Hence in this proposed system of traffic control, we focus on the traffic density rather than just giving control to the signals on a fixed time basis.This proposed in based on vehicle detection by IR sensors, analysation and computation of the scenarios by the Arduino UNO and the same gives the control depending on the control time in the code to the LED's . On a whole, this system senses the presence of the vehicle in that given lane and suitably gives control to the signals.

1. INTRODUCTION

1.1 INTRODUCTION

Traffic administration has the goal to constantly improve traffic system and regulation. As the number of vehicle users constantly increases and resources provided by current infrastructures are limited, intelligent control of traffic will become a point of focus in the future. Avoiding traffic jams is beneficial to both environment and economy. In our research we focus and optimization of traffic light controller in a city using IR sensor and developed using Arduino. An intelligent transportation system (ITS) estimates the traffic parameters and optimizes traffic signal to reduce vehicle delays and stop. Fixed control on traffic is basically not control according to the density, but in a manner of programming which is already fixed in the system. This paper proposes an intelligent system using Arduino for implementing it in the city

1.2 OVERVIEW

In the present modern days, traffic is the most significant problem in the metro cities.

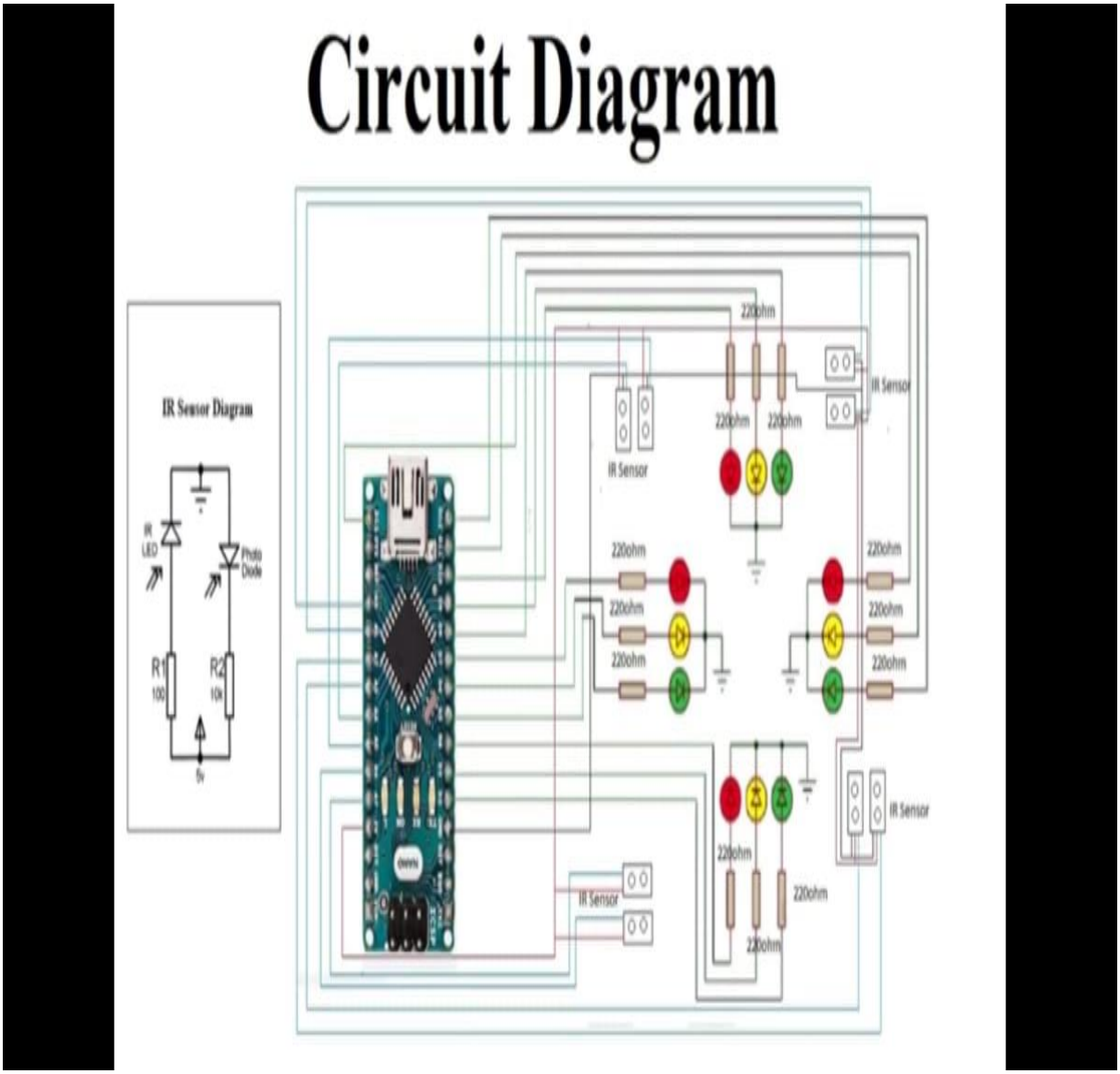
* Traffic is the most time constraint problem ,to avoid this problem we have to find some solutions.

* For this problem we bring a solution , it is called Density based traffic control system.

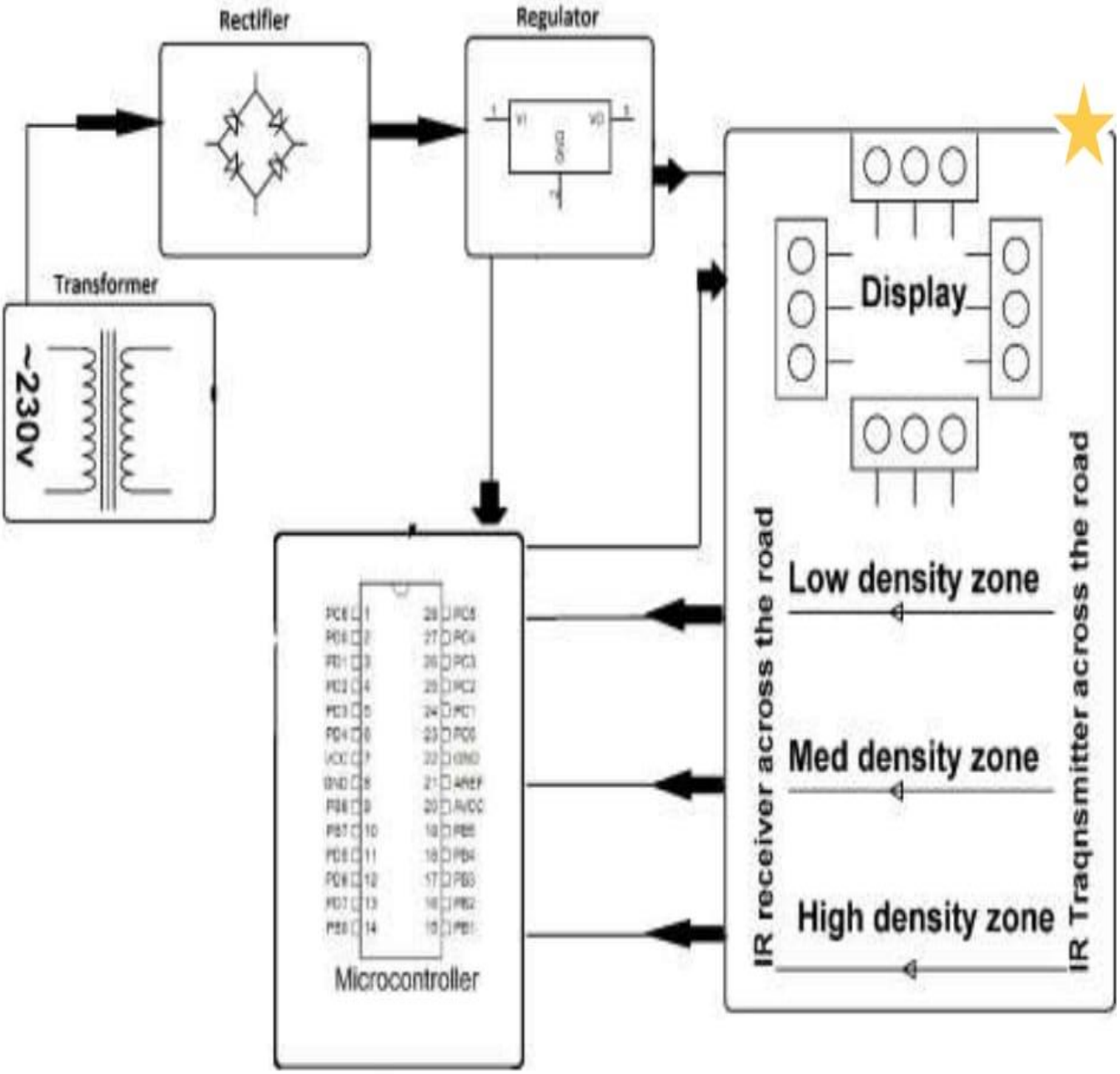
* By this density based traffic control system, we can avoid the some time-wastage from strukking in the traffic.

2.CIRCUIT AND BLOCK DIAGRAM

2.1 CIRCUIT DIAGRAM



2.2 BLOCK DIAGRAM



3. LITERATURE

3.1 LITERATURE SURVEY

There has been a great usage of surveillance systems and video monitoring for traffic control in recent years. Innovations have been made for examining the density of the traffic through image processing . But these techniques require good images whose quality is weather dependent, especially when it is raining or when there is a huge amount of fog. The image captured in the traffic signal is processed and converted into grayscale image, then its threshold is calculated based on which the contour has been drawn in order to calculate the number of vehicles present in the image . But this cannot be used in real time applications as it is very slow and the software is usually not free of cost. Automatic detecting and counting vehicles in unsupervised video on highways is a very challenging problem in computer vision with important practical applications such as to monitor activities at traffic intersections for detecting congestions, and then predict the traffic which assists in regulating traffic. Manually reviewing the large amount of data they generate is often impractical. There are various vehicle detectors such as radar, ultrasonic, and microwave detector. But these sensors are usually expensive, difficult to implement, have less capacity, and extra maintenance charges will be there. Radar sensors are affected by metal barriers near road. Passive acoustic detector array, Piezoelectric, Photoelectric, Inductive loop detector, magnetic detectors and other similar sensors are some of the commonly used sensors in the field of traffic monitoring systems. These sensors are less accurate as well as expensive.
The system which we have proposed uses an Arduino MEGA interfaced with IR sensors and load sensors . For every lane, there are three IR sensors with three corresponding load sensors placed beside and under the road respectively for detection of traffic density of that lane. According to this, there are four modes of lighting transition slots . The proposed system has a feature to clear the way for emergency service vehicles such as ambulance, fire fighting vehicles etc. An RFID tag will be mounted under every emergency service vehicle. The basic idea behind this feature is that the RFID tagged emergency service vehicle shall be detected whenever it passes on the RFID reader . A GSM module is included in the system to notify the authority if there is any malfunctioning in the system

3.2 RESEARCH OBJECTIVE

The main purpose of introducing this smart traffic system is that for every minute the vehicles at the junction will be dense and the traffic lights shall be changed to each side for some fixed time. Even though there are no vehicles at particular side, the traffic signals will glow for a given fixed time. Due to that there is time wastage & vehicles on the other side have to wait for the time to complete the process. So to reduce the wastage of time, we can implement the system that controls the traffic based on the heavy flow of vehicles at any particular side. With this system, we shall count the number of vehicles at each side at the junction and give path to the particular side which has denser traffic and keeping the other sides stoppe

3.3 PROBLEM STATEMENT

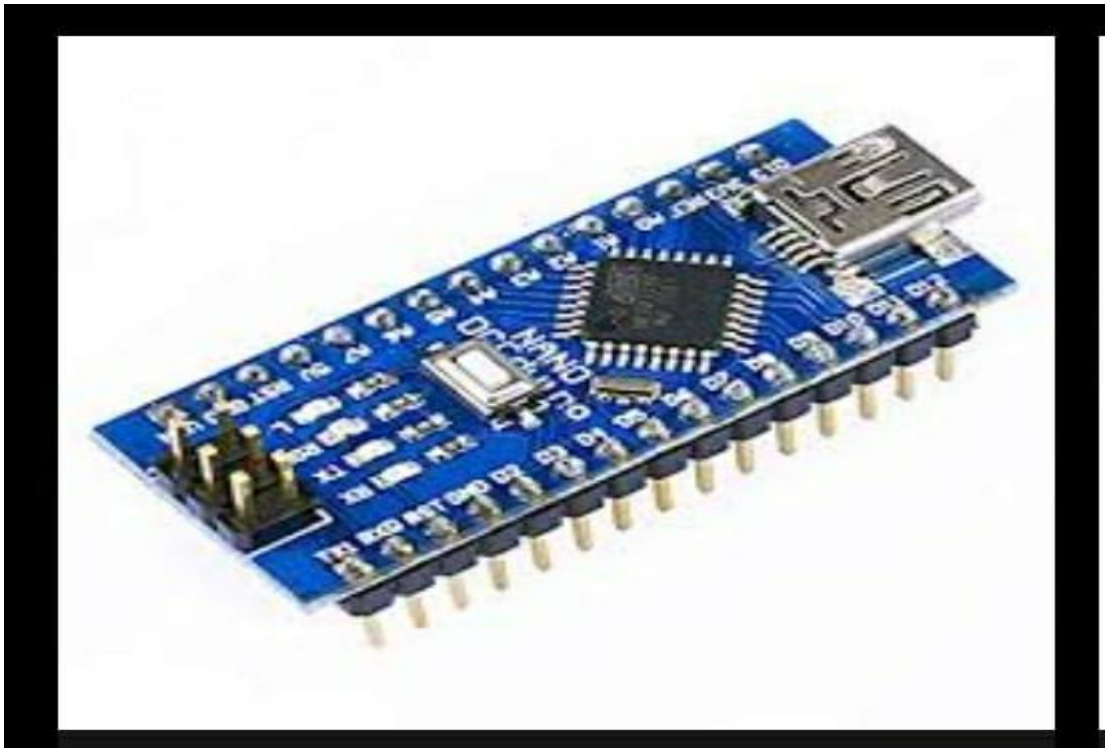
Traffic congestion is increasing on the road day- by- day. As a result of which, two main issues arises. The issues are no traffic, but still need to wait Heavy traffic jams. These problems occur due to fixed control on traffic. This research will aim to control the traffic according to the density, but in manner of programming which is already fixed in the sysTE

4. COMPONENTS REQUIRED

4.1 COMPONENTS TABLE:

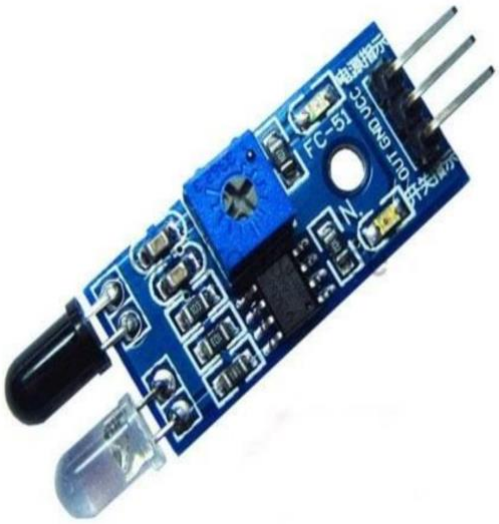
SI NO	COMPONENT	SPECIFICATION	REQUIRED
1	ARDUINO NANO	ATMEGA328	1
2	IR SENSOR	TO DETECT THE MOTION	4
3	LED'S	RED,YELLOW,GREEN	4
4	BREAD BOARD	CONNECTING CIRCUITS	1
5	JUMPER WIRES	MALE &FEMALE	REQUIRED

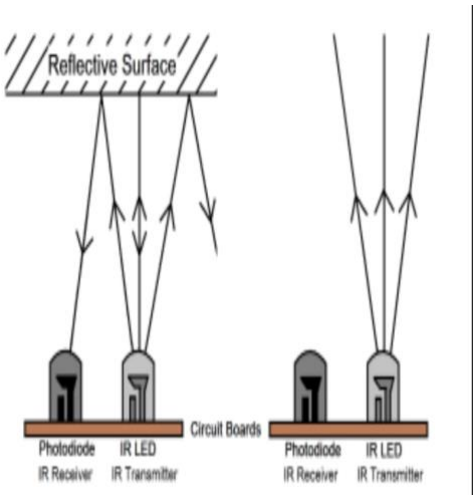
4.1.1 AURDINO NANO



Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used **to produce a clock of precise frequency using constant voltage**. There is one limitation of using Arduino Nano i.e. it doesn't come with a DC power jack, which means you can not supply an external power source through a battery. **The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008**. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor

4.1.2 IR SENSOR





IR proximity sensor is an electronic instrument which comprises of an IR light emitting diode, an IR photodiode, an op-amp (as comparator), couple of resistors (including a variable resister) and capacitors whose basic operation is to detect the presence of any kind of object or obstacle in the vicinity of the sensor within the particular range. In this particular type of IR sensor module used in the project, IC LM 393 op-amp is used as comparator. When the IR receiver does not detect any of the signals from the IR LED, the potential at the inverting input of the comparator will be higher than that corresponding to the noninverting terminal. Hence the resulting output of the comparator becomes low. On the other hand, if the IR receiver detects some signals which are sent back after encountering an obstacle/object, the potential at the inverting terminal will be low than the non-inverting terminal. Hence the output of the comparator will be high. This voltage level of the comparator is used in arriving at the conclusion of whether the object is present or not. The variable resistor connected helps in changing the sensitivity of the IR sensor module

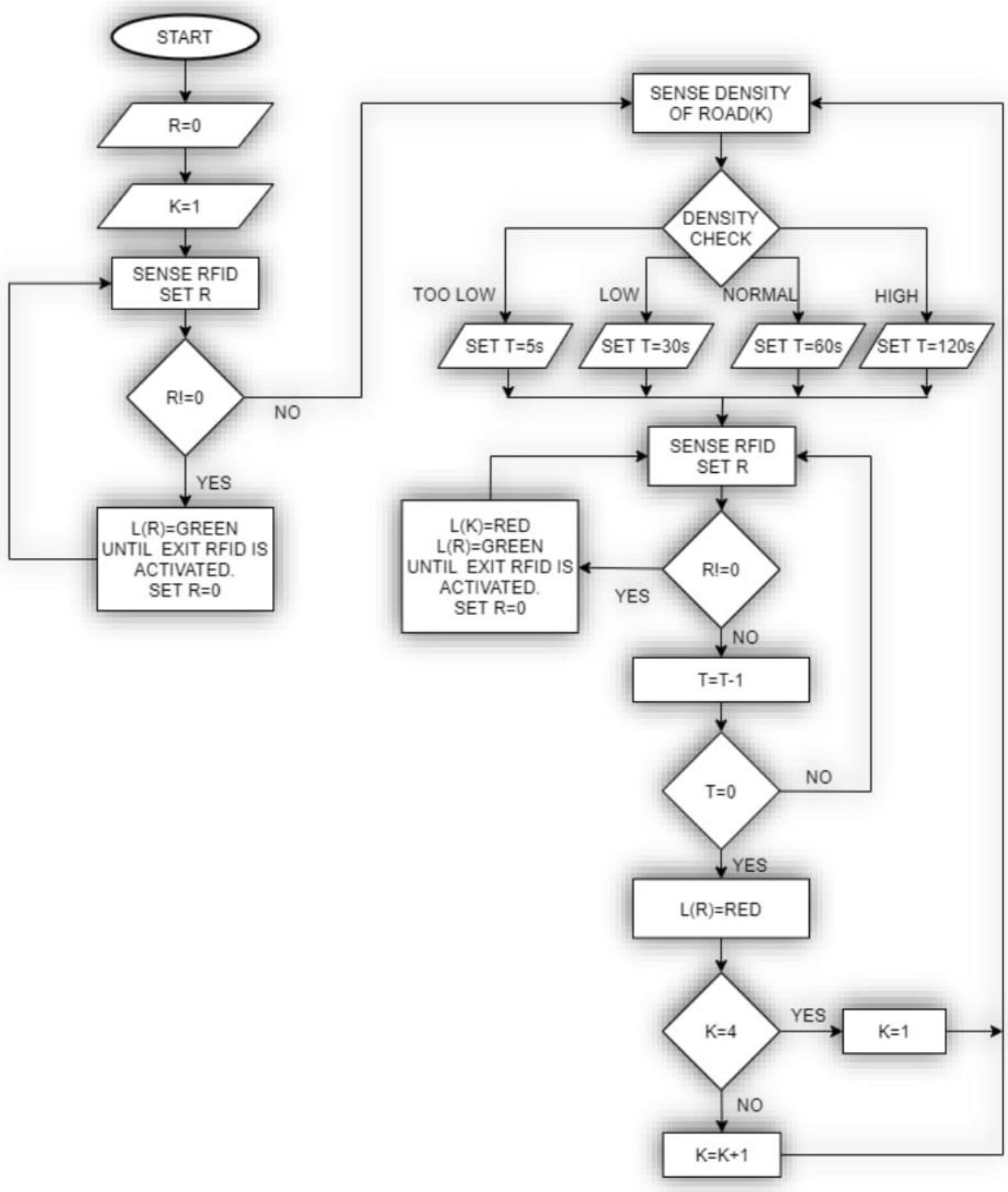
4.1.3 TRAFFIC LIGHT LED MODULE

LED is an active electronic device, comparable to a general purpose diode except for its ability to emit light with different wavelengths. When a suitable potential difference is applied across its terminals, electrons recombine with the holes within the device thereby releasing the energy in the form of photons. This phenomenon is known as electroluminescence . Following are the specific semiconductor combination employed for obtaining a LED emitting radiation of characteristic wavelength:

1. Gallium Arsenide (GaAs) – Infrared light
2. Gallium-Arsenide-Phosphorous (GaAsP) – yellow/red light
3. Gallium-Phosphorous(GaP) – green ligh

5. FLOW CHART & CODING

5.1 FLOW CHART

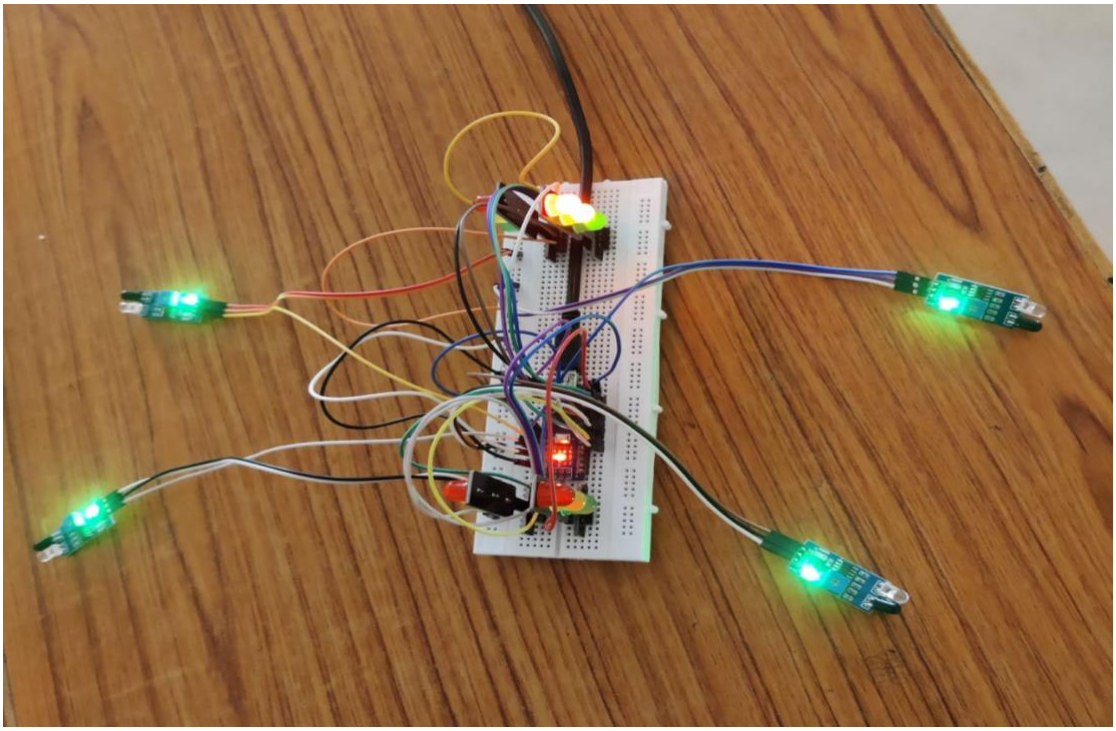


5.2 AURDINO NANO CODES:

```
//TRAFFIC CONTROL
DENSITY   2022
#define ledA1 2
# define ledA2 3
# define ledA3 4

# define ledB1 5
# define ledB2 6
# define ledB3 7

# define ledC1 8
# define ledC2 9
# define ledC3 10

# define ledD1 12
# define ledD2 11
# define ledD3 13

int a1,a2,b1,b2,c1,c2,d1,d2;

void setup()
{

Serial.begin(9600);

pinMode(ledA1, OUTPUT);
pinMode(ledA2, OUTPUT);
pinMode(ledA3, OUTPUT);

pinMode(ledB1, OUTPUT);
pinMode(ledB2, OUTPUT);
pinMode(ledB3, OUTPUT);

pinMode(ledC1, OUTPUT);
pinMode(ledC2, OUTPUT);
pinMode(ledC3, OUTPUT);
pinMode(ledD1, OUTPUT);
pinMode(ledD2, OUTPUT);
pinMode(ledD3, OUTPUT);
}
void loop() {
a1 = analogRead(A7);
a2 = analogRead(A6);
b1 = analogRead(A5);
b2 = analogRead(A4);
c1 = analogRead(A1);
c2 = analogRead(A0);
d1 = analogRead(A3);
d2 = analogRead(A2);
digitalWrite(ledA1,HIGH);
digitalWrite(ledA2,HIGH);
digitalWrite(ledA3,HIGH);
digitalWrite(ledB1,LOW);
digitalWrite(ledB2,LOW);
digitalWrite(ledB3,LOW);
digitalWrite(ledC1,LOW);
digitalWrite(ledC2,LOW);
digitalWrite(ledC3,LOW);
digitalWrite(ledD1,LOW);
digitalWrite(ledD2,LOW);
digitalWrite(ledD3,LOW);

}
else if( a2 <= 40){
digitalWrite(ledA1,LOW);
digitalWrite(ledA2,LOW);
digitalWrite(ledA3,LOW);
digitalWrite(ledB1,HIGH);
digitalWrite(ledB2,HIGH);
digitalWrite(ledB3,HIGH);
digitalWrite(ledC1,LOW);
digitalWrite(ledC2,LOW);
digitalWrite(ledC3,LOW);
digitalWrite(ledD1,LOW);
digitalWrite(ledD2,LOW);
digitalWrite(ledD3,LOW);

}
else if( b1 <= 40){
digitalWrite(ledA1,LOW);
digitalWrite(ledA2,LOW);
digitalWrite(ledA3,LOW);
digitalWrite(ledB1,LOW);
digitalWrite(ledB2,LOW);
digitalWrite(ledB3,LOW);
digitalWrite(ledC1,HIGH);
digitalWrite(ledC2,HIGH);
digitalWrite(ledC3,HIGH);
digitalWrite(ledD1,LOW);
digitalWrite(ledD2,LOW);
digitalWrite(ledD3,LOW);

}
else if( b2 <= 40){
digitalWrite(ledA1,LOW);
digitalWrite(ledA2,LOW);
digitalWrite(ledA3,LOW);
digitalWrite(ledB1,LOW);
digitalWrite(ledB2,LOW);
digitalWrite(ledB3,LOW);
digitalWrite(ledC1,LOW);
digitalWrite(ledC2,LOW);
digitalWrite(ledC3,LOW);
digitalWrite(ledD1,HIGH);
digitalWrite(ledD2,HIGH);
digitalWrite(ledD3,HIGH);

}}
```

6. FINAL OUTPUT

6.1 FINAL OUTPUT



The circuit design involves an IR sensors being placed at the left side of each of the four roads in a '+' type junction. These identify the presence of vehicle in that road of the junction. When the IR signals from them are obstructed by a vehicle, the output of the sensors go high and thereby indicate the same to the Arduino NANO (19). Based on as how many roads have vehicle density out of the four roads, the signals are turned ON. The Arduino NANO is either powered by a power bank or using a laptop which is used to upload the code as well. The coding is done in Arduino IDE platform using C/C++ language (20). The IR sensors are powered using the voltage ranges i.e. 5V and 3.3V available in the arduino board. The analog output of the IR sensors are connected to the analog pins of the arduino NANO (21). The code is written so as to set a value to the variable holding the analog value. If the analog value is well above a threshold value, then the variable is set to 1; else to 0. Here the codes for turning ON or OFF of a particular signal is written in the form of functions. Depending on whether the variable is 0 or 1, a particular set of functions are called by the code and executed. The entire execution is in the form of a loop which continuously checks for the presence of the vehicle density in any of the roads in that junction . If detected, the green signal is turned ON in that road for a period of 10000ms and then turned to red.

6.2 RESULT:

The results of the proposed model can be analysed in three different scenarios.
1. When there is vehicle density present in all the four roads of the junction, then the signal functionalises normally, similar to the existing system.
2. When there an absence of vehicle density in one or more roads but present in atleast one road, then the signal for green light skips that particular road with no vehicle density and moves forward with the ones with density present.
3. When no vehicle density is recoded in any of the roads at the junction, the yellows light is triggered in all of the signals with time delay of 800ms which gives a blinking effect in the signals

6.3 CONCLUSION:

The proposed traffic control system is the very basic step towards achieving automation in the field of traffic control system. With various advancements taking place in today's world, people are in search for automated systems which not only saves their time but also a lot of energy in different forms. The saving of fuel (petrol, diesel, natural gas), reduction in time of the operation of automobile engines, reduction in the emission of the harmful gases in the atmosphere. Thus this system helps in reducing the number of accidents that take place just because of this improper traffic control system and paving way to a better traffic control system. The proposed system aims to save the number of manhours wasted at the signals and hence making effective utilization of time. Further a lot of work and progress an be made on these lines by giving priority to emergency tag vehicles. Also, a lot of work can be done on the usage of solar energy of the operation of such systems which can also make them highly energy efficient. It is also possible to make use of gas sensors to control the timing of the timers in the traffic nodes. Using GPRS map as an additional step for progress in this area, the best route can be figured out for emergency as well as police vehicles

6.4 REFERANCE

- **Author: Shubham sahu, Dipanjan paul, S.Senthilmurugan, internantional journal of novel**
- **research and development (IJNRD) ISSN:2456-4184,Volume 3 Issue4 April, 2018.**
- **M.naveen, S.Raghavendra , D.Imran Basha,& P. Kiran kumar (2019). Density based traffic signals controlling using ARDUINO and IR sensors.International Journal oof Electronics Engineering(IJEE).ISSN: 0973-7383 volume-11. Issue-1.pp.348-351.**
- **K. Bagya Lakshmi1, M. Suresh Kumar, S. Sindhuja, R. Padmavathy, & P. Jayabharathi.**
- **(2018). Density Based Traffic Control System. Asian Journal of Science and Applied**
- **Technology ISSN: 2249-0698 Vol. 7 No. 2, 2018, pp.9-11.**