Density Based 4 Way Automatic Traffic Signal Control System



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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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This is to certify that this project entitled "**Density Based 4 Way Automatic Traffic Signal Control System**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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ABSTRACT

Traffic congestion is a severe problem in many major cities across the world and it has become a nightmare for the commuters in these cities. Traffic can be controlled in several main junctions by incorporating either automatic traffic light control or traffic police. But conventional traffic light system is based on fixed time concept allotted to each side of the junction which cannot be varied as per varying traffic density. At some times, priority of traffic light needs to be changed based on a greater number of vehicles waiting in same road, VIPs vehicles and Ambulance vehicles etc. We propose to design and develop a density-based traffic signal system. The signal changes automatically on sensing the traffic density at the junction. The prototype model was developed using IR sensors and Arduino. We use Arduino to write programming according to our requirements due to its simplicity and economy and IR sensors is used to measure the traffic density in a particular road. IR sensors are arranged on each road in accurate manner to detect traffic density properly; these sensors always sense the traffic on that particular road. All these sensors are interfaced to the Arduino. Based on these sensors, controller detects the traffic and controls the traffic system. The controls of traffic light depend on number of vehicles available in the road.

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LIST OF ABBREVIATIONS

DC	Direct Current
AC	Alternating Current.
IR	Infrared Receiver
IC	Integrated Circuit
LED	Light Emitting Diode
PCB	Printed Circuit Board
LCD	Liquid Crystal Display

CHAPTER I
INTRODUCTION

1.1 Introduction

In modern life we have to face with many problems one of which is traffic congestion becoming more serious day after day. It is said that the high volume of vehicles, the inadequate infrastructure and the irrational distribution of the development are main reasons for increasing traffic jam [1]. The major cause leading to traffic congestion is the high number of vehicles which was caused by the population and the development of economy. Due to the massive growth in urbanization and traffic congestion, automatic based traffic light controller is needed to reduce the traffic delay and travel time especially in developing countries. Traffic congestion is now considered to be one of the biggest problems in the urban environments.

Traffic problems will be also much more widely increasing as an expected result of the growing number of transportation means and current low-quality infrastructure of the roads [2] . In addition, many studies and statistics were generated in developing countries that proved that most of the road accidents are because of the very narrow roads and because of the destructive increase in the transportation means. This idea of controlling the traffic light efficiently in real time has attracted many researchers to work in this field [3] with the goal of creating automatic tool that can estimate the traffic congestion and based on this Variable, the traffic signal can be varied.

Congestion in urban areas has given rise to the gradual increase in automobiles and vehicles due to the migration of people into urban settlements bringing about different pros and cons. One of such disadvantages is the increase in both human and vehicular movement which additionally leads to high traffic on major roads in a city and therefore prompts activity clog in urban zones. Traffic congestion occurs when the use of road network increases and it is characterized by bad roads in communities and increase in community population. Traffic jam occurs at a point when vehicles completely stop for a period of time. Extreme Congestion occurs mostly during workdays and rush hours (morning and evening). One of the principal reasons why congestion exists on the roads is

due to the increase in the number of vehicles. That is, when the number of vehicles outnumber the capacity of the available infrastructure such as good roads, traffic light and road regulators.[4]

As population of urban settlers increases, the need to acquire personal vehicle for transport increases, and traffic congestion increases as the number of vehicles increases combined with an absence of proper infrastructure. The national government and councils neglect to follow up on the approaching danger of increased congestion until it eventually occurs. The roads of the city do not expand in size alongside an inexorably vehicle dependent populace. An example is a single street with one lane on each side before will probably not get developed in ten years after the population has expanded. The authorities frequently neglect to take this into consideration.[5]

The rapid increase in the number of vehicles without a rapid increase in road networks is the main cause of congestion which is a major concern in the society. While it may be difficult to totally tackle congestion, there are a few different ways to control its future rate of increment like: quick response to traffic- blocking incidence and accidents, removing mischances from major roads quickly by utilizing the service of roving vehicles run by Government Traffic Management Centers (GTMC); This is an incredible strategy for diminishing blockage delays, building of more roads in developing regions and improving on urban region road network, and car-sharing service which would reduce the need to own personal vehicles thereby reducing the number of cars on the road.[6]

1.2 Background Study

Density, speed, and flow are the three critical parameters for road traffic analysis. High-performance road traffic management and control require real-time estimation of space mean speed and density as input for large spatial and temporal coverage of the roadway network. In Adaptive Traffic Control System which receive information from vehicle such as position and speed and then it utilize to optimize the traffic signal. The system specifies the use of onboard sensors in vehicle and standard wireless communication protocol Specified for vehicular applications. They implement various traffic Signal control Algorithms. Intelligent traffic system for VANET suggest that creation for smart city framework for VANET consisting of Intelligent Traffic Lights which transmit warning

messages and traffic statistic. In That System Various Routing Protocol Has Been Discussed and compared.

Traffic control system which is usually stationed at strategic location like road intersections to control the flow of traffic is dated as far back 1868. The history and evolution of traffic control system can be found in [2]. Traffic control signal shows the right of way to users at a particular time by displaying lights of standard color (red, yellow, and green). The red light is a clear caution to “stop” prohibiting any vehicle from moving further while the green light simply means “go”. This is set to permit vehicular movement in the denoted direction. The yellow light warns the driver that the signal is about to change to red, it definitely does not mean full- throttle ahead but rather slow down and prepare to stop but most road users fail to adhere to this.

This is one of the issues this study seeks to curb. Chinyere et al. (2011) proposed an intelligent system for controlling traffic which was designed by combining Structured Systems Analysis/Design Methodology (SSADM) and the Fuzzy-Logic- based Design Methodology. Two electromagnetic sensors were placed on the road with the second sensor placed behind the first sensor. While one sensor counts the number of cars that go past the traffic light, the other counts the number of cars coming from a distance and the difference between the two is evaluated. There is one state for each phase of the traffic light and the state machine controls the sequence of state of the fuzzy traffic controller and a state is skipped if there are no vehicles [3].

In the authors proposed a system which uses a Raspberry pi as its microcontroller to provide the signal timing based on the traffic density i.e., the signal timing changes automatically on sensing the traffic density at the junction. The cameras were placed on top of the signals for a clearer view. The image captured in the signal was first processed then converted into grayscale image. Its threshold was calculated based on the contour which has been drawn in order to calculate the number of vehicles present in the image. After the calculation on the number of vehicles was done, the outcome helped to know which side the density is high based on which signals will be allotted for a particular side. An adaptive traffic light control was proposed in [5] using a wireless sensor network which is classified into three categories namely; the wireless sensor network, the localized

traffic flow model policy and the higher-level coordination of the traffic lights agents. Wireless sensors were stationed on the lanes going in and out of the intersection.

The function of the sensors is to identify and detect car number, speed and some other variables; before sending the information to the nearest Intersection Control Agent who will decide on the flow model of the junction depending on the data from the sensor. Ganiyu et al. (2014) designed a system using Programmable Integrated Circuit (PIC) 16F84A micro controller, power section, crystal oscillator and light emitting diode (LED). To control traffic effectively, the PIC was implemented via an integrated circuit (IC) programmer using a microbic program which is written in Basic language. The sensing unit used is a pressure switch which detects the weight of vehicle that steps on it and sends a signal to the micro controller. [7] improved on this work by including surveillance system. Many researches have thought of various models to manage traffic congestion and these models can be grouped under three categories- namely network, application and acquisition. The acquisition layer is made of sensors like infrared (IR), RFID among others while application category includes information collection and analysis. Network category is made of cellular mobile network, Bluetooth, Wi-Fi etc. [8]

1.3 Definition of Traffic Signal Control

Traffic signal controllers are electronic devices located at intersections that control the sequence of the lights. Traffic flow information is picked up by the detectors from the roadway and transmitted to the computer system for processing. The detectors are normally embedded in or suspended above the roadway.

1.4 Traffic Light

Traffic lights, traffic signals or stoplights, also known as robots in South Africa, are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control flows of traffic. The world's first traffic light was a manually operated gas-lit signal installed in London in December 1868. It exploded less than a month after it was implemented, injuring its policeman operator. Earnest Sirrine from Chicago patented the first automated traffic control system in 1910. It used the words "STOP" and "PROCEED", although neither word was illuminated.

1.5 Types of Traffic Light

Traffic lights are internationally standardized by the Vienna Convention on Road Signs and Signals. Traffic lights alternate the right of way accorded to users with a sequence of illuminating lamps or LEDs of three standard colors:

- **Red light** Prohibits any traffic from proceeding. A flashing red indication requires traffic to stop and then proceed when safe (equivalent to a stop sign).
- **Amber light** (also known as 'orange light' or 'yellow light') Warns that the signal is about to change to red, with some jurisdictions requiring drivers to stop if it is safe to do so, and others allowing drivers to go through the intersection if safe to do so. In some European countries (such as the UK), red and amber is displayed together, indicating that the signal is about to change to green. A flashing amber indication is a warning signal. In the United Kingdom and Ireland, a flashing amber light is used only at pelican crossings, in place of the combined red–amber signal, and indicates that drivers may pass if no pedestrians are on the crossing. The length of time that a traffic light remains green or red is known as a **phase**.
- **Green light** Allows traffic to proceed in the direction denoted, if it is safe to do so and there is room on the other side of the intersection.

1.6 Objectives

The objectives of this project:

- To design and construct a **Density Based 4 Way Automatic Traffic Signal Control System.**
- To put the whole prototype under several tests by creating different scenarios to validate our work.
- To take notes from our real-time tests so that those can be used for future improvements.

1.7 Project Organization

In this report, Chapter one covers introduction, background, objectives. Chapter two represents theory, description of the micro controller, SMPS, IR sensor, capacitor, resistor and other components. Chapter three describes and working principle of the project. In chapter four we have discussed result and discussion. In chapter five we discuss about future modification, conclusion.

CHAPTER II
THEORY OF THE PROJECT

2.1 Introduction

This Project has worked on two things, Hardware and Software. The main controller is Arduino Nano which is mainly control this project. This Arduino nano is program by Arduino IDE Software. That's why Arduino Nano control this project smoothly.

Software

- Arduino IDE
- Proteus 8.9

Hardware

- Arduino Nano
- SMPS
- IR Sensor
- Voltage Regulator
- Capacitor
- Resistor
- BC547

2.1.1 Arduino Nano

Arduino is open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling Lights, motors, and other actuators.

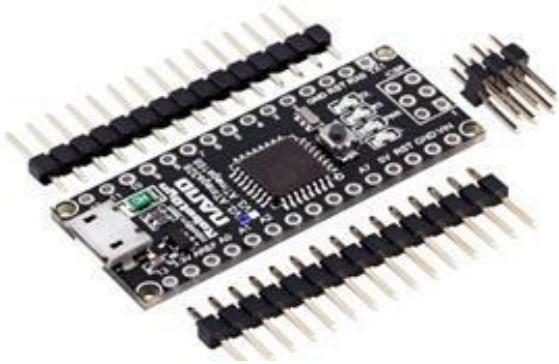


Figure 2.1: Arduino Nano

The micro-controller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, Maxims'). Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a small, complete, and breadboard friendly component. It has everything that Decimal/ Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano can automatically sense and switch to the higher potential source of power.

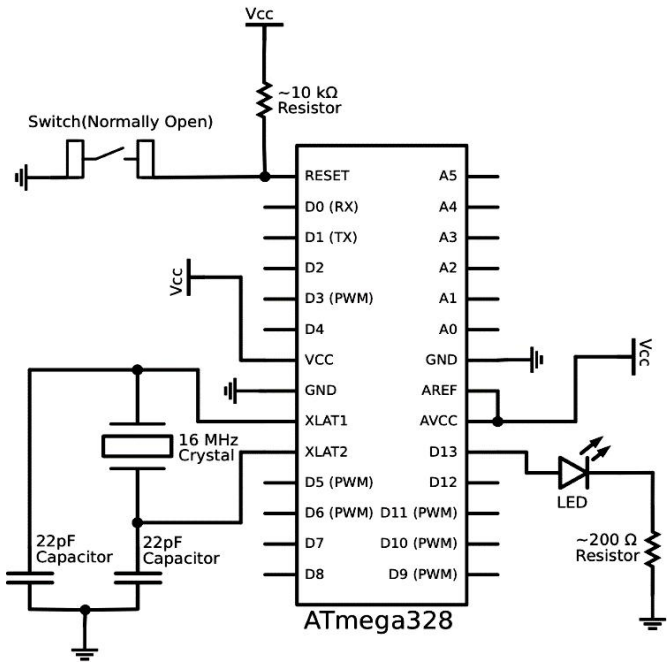


Figure 2.2: Arduino Nano schematic diagram

Arduino Nano's got the breadboard-ability of the Boarding and the Minibus with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, and GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It has two layers. That make it easier to hack and more affordable. One of the best features of Arduino Nano is, it's easy to use, compact and also small.

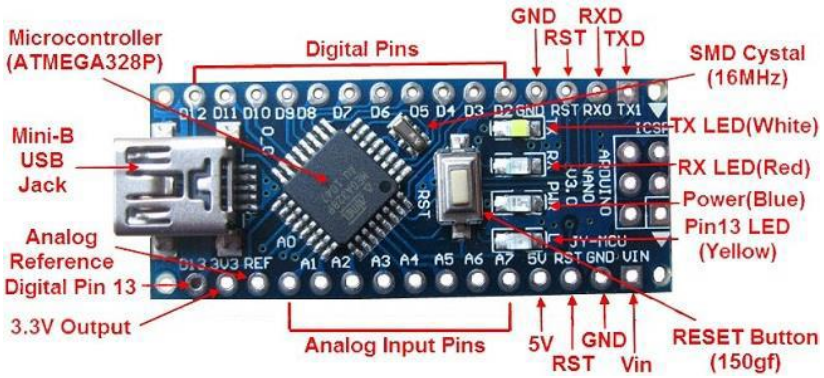


Figure 2.3: How Arduino Nano looks like

Specifications:

- Micro controller: Atmel ATmega328
- Operating Voltage (logic level): 5 V
- Input Voltage (recommended): 7-12 V
- Input Voltage (limits): 6-20 V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- Flash Memory: 32 KB (of which 2KB used by boot loader)
- SRAM : 2 KB
- EEPROM: 1 KB

Features:

- Automatic reset during program download
- Power OK blue LED

- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Standard 0.1 spacing DIP (breadboard friendly)
- Manual reset switch

The high-performance Microchip Pico Power 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes.

Micro controller IC ATmega328p

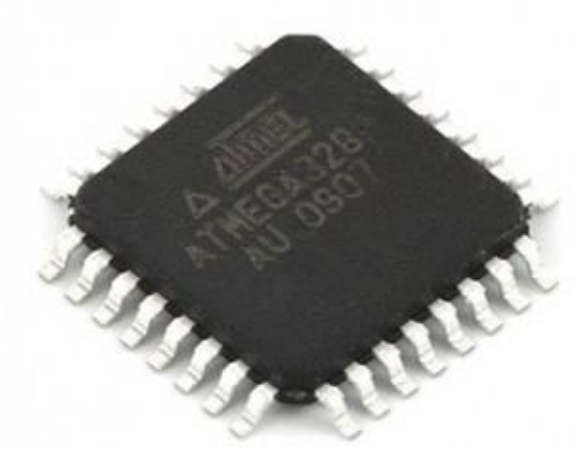


Figure 2.4: Micro controller IC AT Mega 328p

The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves through puts approaching 1 MIPS per MHz, balancing power consumption and processing speed.

2.1.2 Switch Mood Power Supply

A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source to DC loads, such as a personal computer, while converting voltage and current characteristics.



Figure 2.5: SMPS Power Supply

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor.

This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight. Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching

currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

2.1.3 IR Sensor

An infrared sensor is an electronics device that emits certain features around it and / or detects infrared radiation. Infrared sensors are capable of measuring the heat emitted by an object and detecting motion. In this project we will control the fan and light automatically through the closed loop system so the IR sensor for the system is definitely needed as a response. Here the fan will turn on and the light will turn on when the IR sensor detects an object and the fan and light will switch off automatically when an object leaves the house.

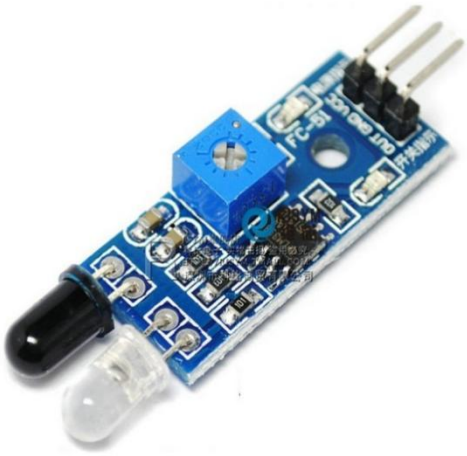


Figure 2.6: IR Sensor

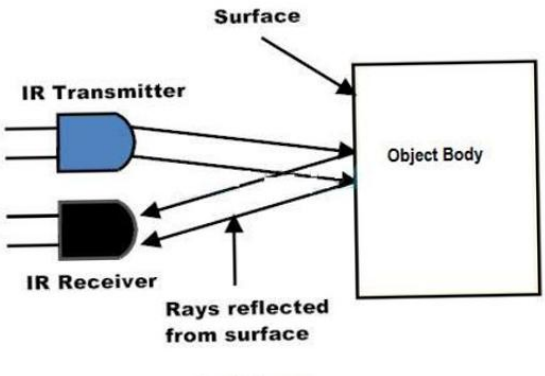


Figure 2.7: IR sensor reflection System

Principles of operation:

Sensor works with sense. When an object intersects the sensor light then the sensor detects something. Some infrared ray is deflected from the object and scene the length of this distance. In this sensor we can make a fixed length light and detect our exact object. If some object comes in front of this sensor, then the sensor detects it and sends a signal in LED.

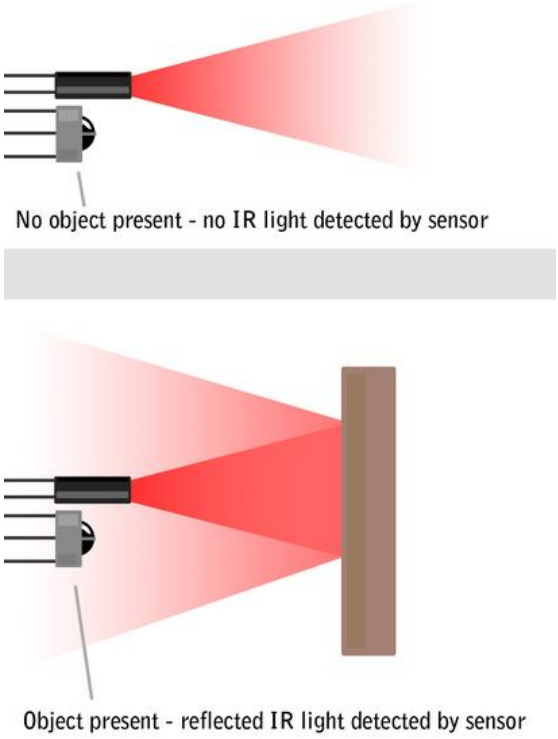


Figure 2.8: IR sensor Detection System.

2.1.4 5V Regulator IC

There may be variations in voltage sources in the circuit, resulting in no stable output voltage. The power controller keeps the output voltage of the IC unchanged. The 7805 IC, a member of the 78xx series of equitable stable power controllers used to maintain such flexibility, is an integrated circuit of power control (IC) circuit. The xx to 78xx indicates the display voltage. The voltage regulator IC supply +5-volt regulated power supply to the heater.

Voltage Regulator IC Specification

- Incoming voltage limit 7V
- Current rating IC = 1A
- Output voltage range V Max=5.2V, V Min=4.8V

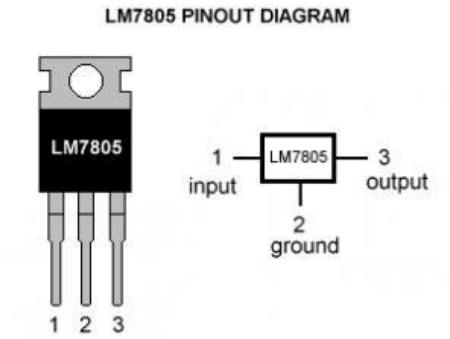


Figure 2.9: 5V Regulator IC

2.1.5 The Smoothing Capacitor

If there is a power difference between all the conductors (for example, when a capacitor is connected to the entire battery), the electric field increases through the dielectric, which leads to the accumulation of a positive device (+Q) on the plate. negative device (- Q) on another plate to assemble. If the battery is long enough to be connected to the capacitor, no current can flow to the capacitor. However, if a fast or variable strain is applied through the capacitor, the displacement of the current will flow.



Figure 2.10: Capacitor

The dielectric current between the plates exceeds the minimum amount of current and has the potential of an electric field called rotational stress. Conductors and tracks include inductance and unnecessary resistance. Capacitors are widely used in electronic circuits to

block direct current, while allowing current transfer. In analog filter filters, they smooth out the energy flow. In sound circuits, they tuned the radios to specific frequencies. In power transmission systems, they stabilize voltage and energy flow. The bridge is filled with a large DC wave smarter (0.637 Vmax) which can move a little bit, and the input to the output waveform is twice the input frequency. We can improve the DC output current output and at the same time reduce the AC change in the source by using more capable smooth filtering to the source shape. The soft or hull load capacitors are connected to the full output circuit of the bridge, which raises the DC output even higher, because it acts as a capable capacitor, as will be shown below.

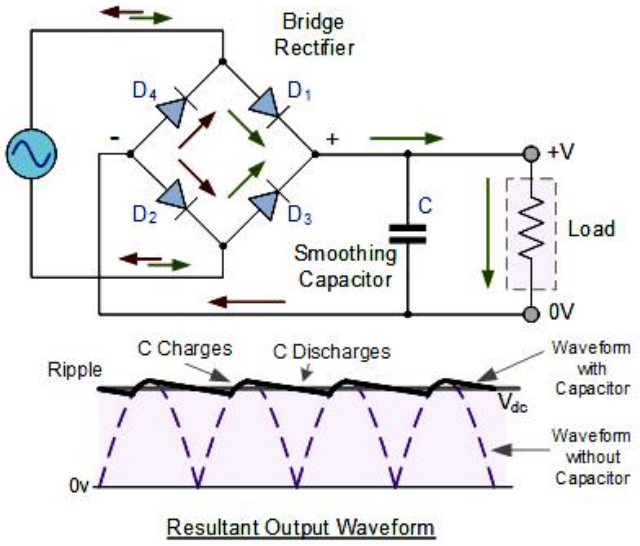


Figure 2.11: The Smoothing Capacitor with Full Bridge Rectifier

The value of the capacitor is very low and the capacitor has a small effect on the waveform. However, if the smooth capacitor is large enough (to use a parallel capacitor) and the current capacity is not large, the output voltage will be as smooth as pure DC.

2.1.6 Resistor

The electrical resistance is the element of the two idle terminals which uses electrical resistance as part of the circuit. The electronic circuits that resist to reduce running use, adjust the signal levels, the different parts of the voltage, the active elements, and the transmission lines, among other uses. High-power controls, which can dissipate large amounts of energy such as heat, can be used as part of automotive controls, power distribution systems, or test load generators. Fixed resistance with resistance slightly

changed in temperature, time or operating voltage. Flexible savings can be used to adjust the basic parameters (such as volume control or light dimmer), or as sensors for temperature, light, humidity, energy, or chemical activity.

(a) resistor, (b) rheostat (variable resistor), and (c) potentiometer



IEC resistor symbol

Specifications:

- Resistance: 220 Ohms
- Power (Watt): 0.25W, 1/4W
- Temperature Coefficient: 350ppm/Celsius
- Tolerance: +/- 5%
- Case: Axial

2.1.7 Transistor BC547

Specifications:

- Bipolar Transistor, NPN, 45v, to-92
- Transistor Polarity: NPN
- Collector Emitter Voltage V(br) ceo: 45V
- Transition Frequency Type ft: 300MHz
- Power Dissipation Pd: 625mW
- DC Collector Current: 100mA
- DC Current Gain hFE: 150
- Straight-lead housing

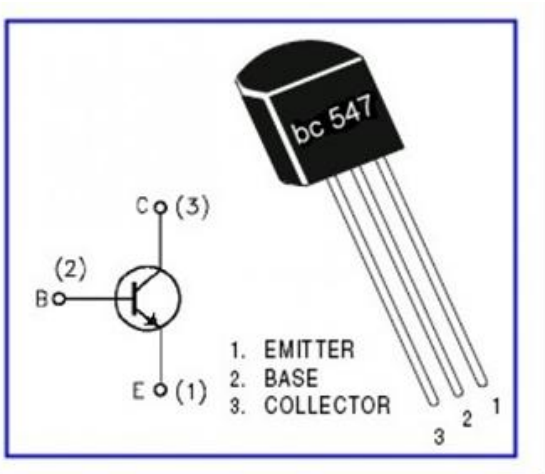


Figure 2.12: BC 547

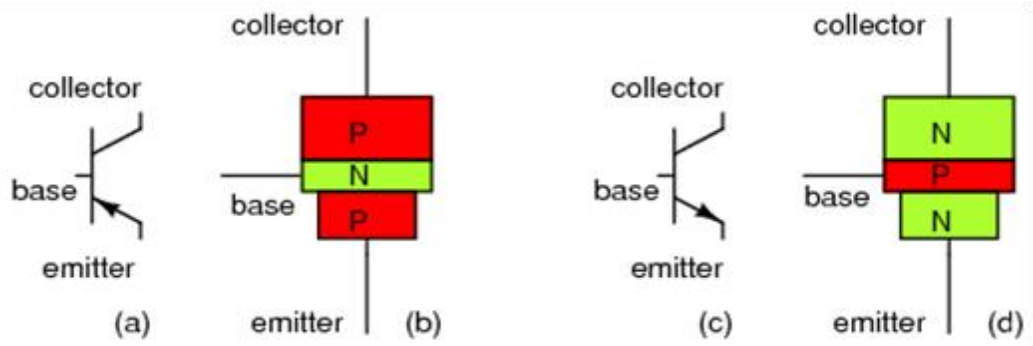


Figure 2.13: Transistor Symbols

Negotiation of pits and electrons is best left to another chapter in my opinion. Here I want to explore how these components can be used, not to analyze their intimate internal details. I do not mean to underestimate the importance of understanding semiconductor physics, but sometimes a deeper focus on solid-state physics interferes with understanding the functions of these resources at the material level. Taking this approach, I think the reader has some knowledge of semiconductors: the difference between the “P” and the “N” semiconductors, the performance of the PN (diode) combination, and the meanings of the words “Reverse discrimination” and “further discrimination” . ” If these ideas are not clear to you, it is best to refer to the preceding chapters in this book before proceeding with this one. The bipolar transistor contains a three-layer “sandwich” material for a semedonded (extrinsic) semiconductor material, either P-N-P in Fig below (b) or NNP in (d). Each layer that forms a transistor has a specific name, and each layer is

assigned to a telephone contact to connect to the circuit. Scheme symbols are shown in Fig below (a) and (d).

BJT transistor: (a) PNP scheme symbol, (b) body structure (c) NPN symbol, (d) structure.

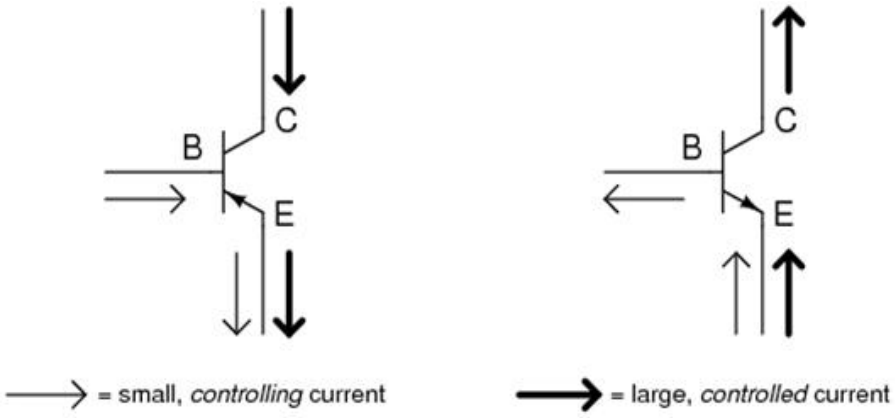


Figure 2.14: NPN & PNP Transistor Symbol

The PNP transistor and the NPN transistor is effectively the difference between the truth of what happened in polarity operation. For who maketh a way in the operating condition of time, the stock of transistor is directly in a vein, the ends of the indicators of the voltage of the opposite of each and every one. Controlled bipolar transistors act as current controllers. In other words, transistors reduce the amount of current transmitted by a small controlling current. Currently the main emitter to be shaped Stamp Collecting power from either the emitter called a sort transistor (PNP or NPN, respectively). From a small office in order to run the main current from the emitter to the base or from the base to the emitter of the transistor depending on (PNP or NPN, respectively). Semiconductor depending on the picture level, the arrow points straight forward by electronic resource flow.

In the run to the base-emitter Library Base rain that causes the emitter current flowing in the arrow Editor. Bipolar transistors are called bipolar because their main flow of electrons in a semiconductor material occurs in two kinds of N and P from the largest shaped stamp collector to emitter current (and vice versa). In other words, charging carriers categories - Electron islands Canarie - that connect the current through the transistor. In order to see it, and govern, and the current run is always linked by wire to the emitter, and electrons are constantly flowing in the direction the arrow transistor. This is the first and most important

rule the use of transistors, the waves traveling through the indicators must be run on the device to function as a coordinator. At present, small communities often called the current government because only the base current passes through a wire to the base of the transistor. On the other hand, a great man, and the more restrained than the end of the current is said to be no one to pass by them, be shaped in a collection Stamp Collecting for the sake of the current mode of the wire. The current total is the basic emitter and collector currents from Oxford Current Act. There are no current from the base of the transistor to open button closing and blocking the current collector. The current base is closed, shows the amount of current through the transistor shaped Stamp Collecting the button that allows parity. The current collection is very limited by the current base, regardless of the amount of electrical energy is available compress it.

2.1.8 Arduino Software

The Arduino Nano digital microphone control unit can be configured using the Arduino IDE software. There is no need to install any software other than Arduino. First select "Arduino Nano" from the Devices, Board menu (according to the microcontroller on our board). Communication uses the original STK500 protocol (reference, C files). We can also call the downloader and subroutine manager ICSP (Schema Series System). The ATmega16U2 software has a source code (or 8U2 on rev1 and rev2 boards). ATmega16U2 / 8U2 can be unlocked Full of DFU loaders: Rev1 boards: Connect the welding adhesive to the back of the board (next to the Italian map) and restore the 8U2. Rev2 or later boards: 8U2 / 16U2 HWB line pulling ground support, which simplifies tuning in DFU mode.

The on-board RX and TX traffic lights will be illuminated when supplied with a USB serial chip and a computer via USB connection (but not for serial communication on nails 0 and 1). The program library allows for continuous communication in each of the Nano digital anchors. ATmega328 also supports I2C (TWI) and SPI connections. The Arduino software includes a mobile library to facilitate I2C buses.

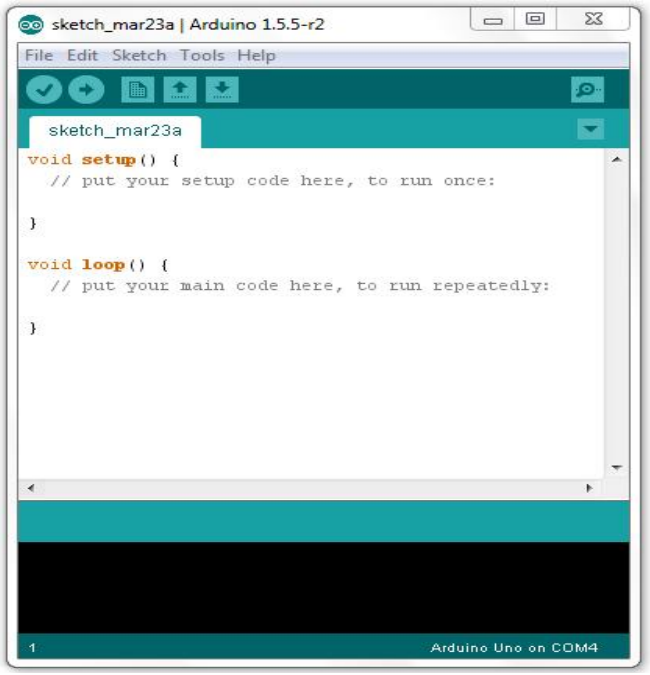


Figure 2.15: Arduino Software Interface IDE

2.1.9 Proteus Software

Proteus Design Suite is a suite of software tools used for electronic design automation. The program is primarily used by electronics design engineers and technicians to print schematic and electronic publications.

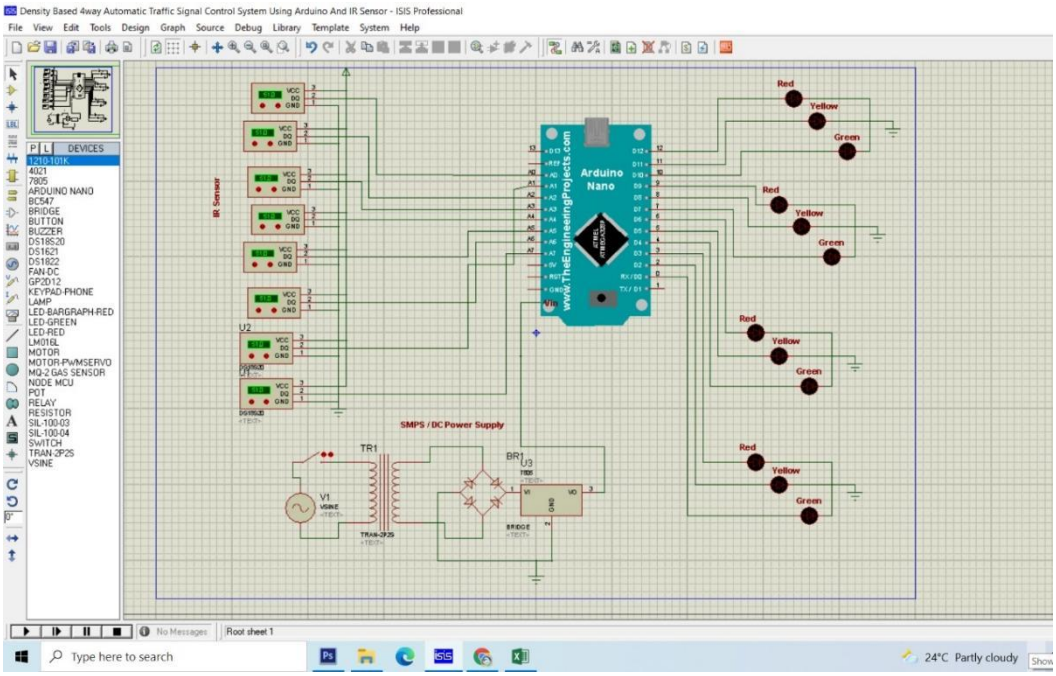


Figure 2.16: Proteus Software Interface

CHAPTER III

DESING & FEBRICATION

3.1 Introduction

This section we describe our project block diagram, circuit diagram, system working principle, 3d verification and PCB design.

3.2 Block Diagram

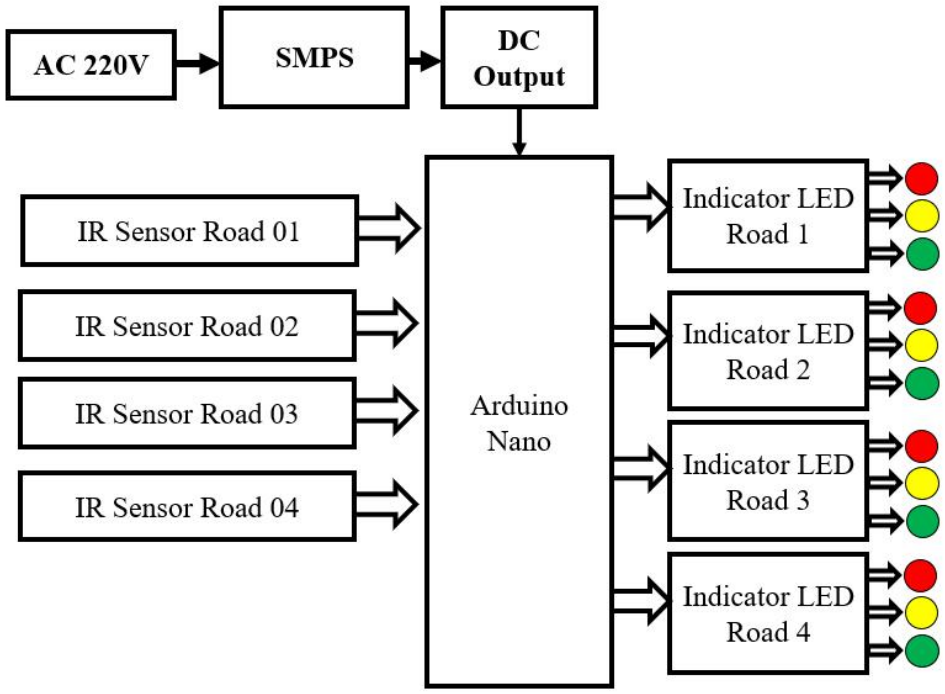


Fig: 3.1: Block diagram of project

3.3 Circuit Diagram

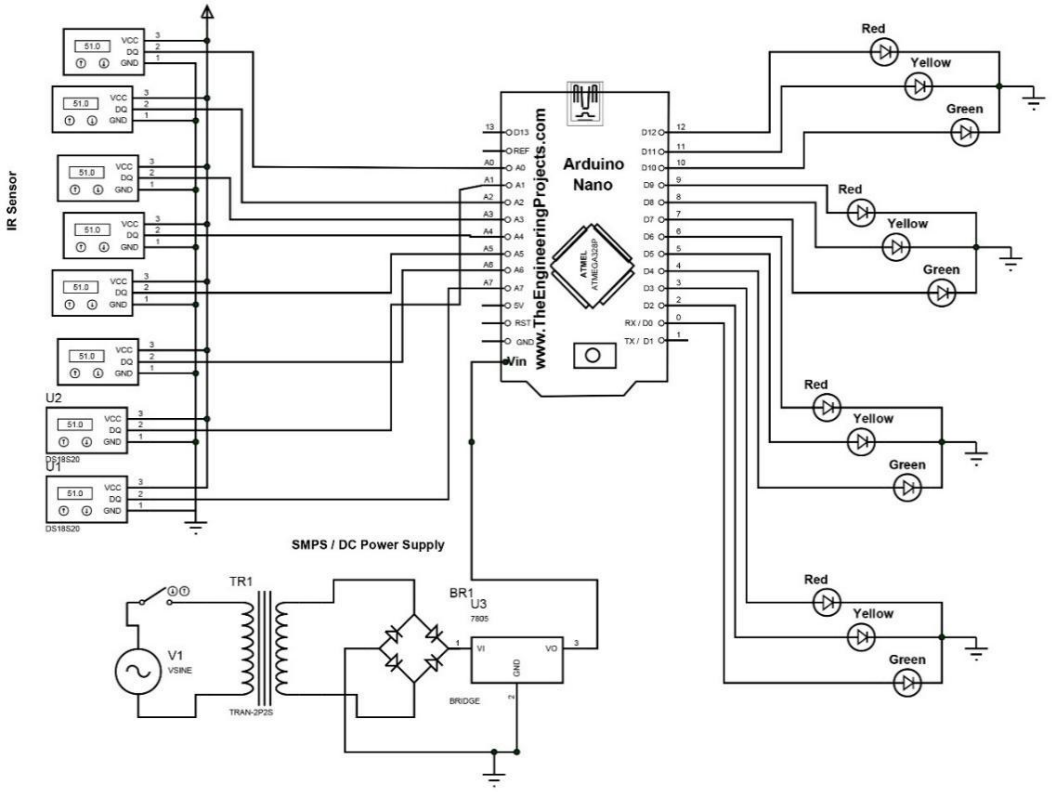


Fig: 3.2: Circuit diagram of the Project

3.4 Working Principle

Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat-treating ovens and other applications and vehicles with minimal or reduced human. Automatic system is so useful in our daily life. In this project we use a SMPS for primary power source. Here also use an Arduino Nano, IR Sensor, LED indicator, Capacitor, Resistor, Transistor and voltage regulator. The main work of this project is the signal lights of the road will be lit based on the density of the vehicle on the road. That way we will control the cars on the road. Here IR sensors is used to measure the density of the vehicle and Arduino micro-controller used to operate the whole system.

3.5 Flow Chart

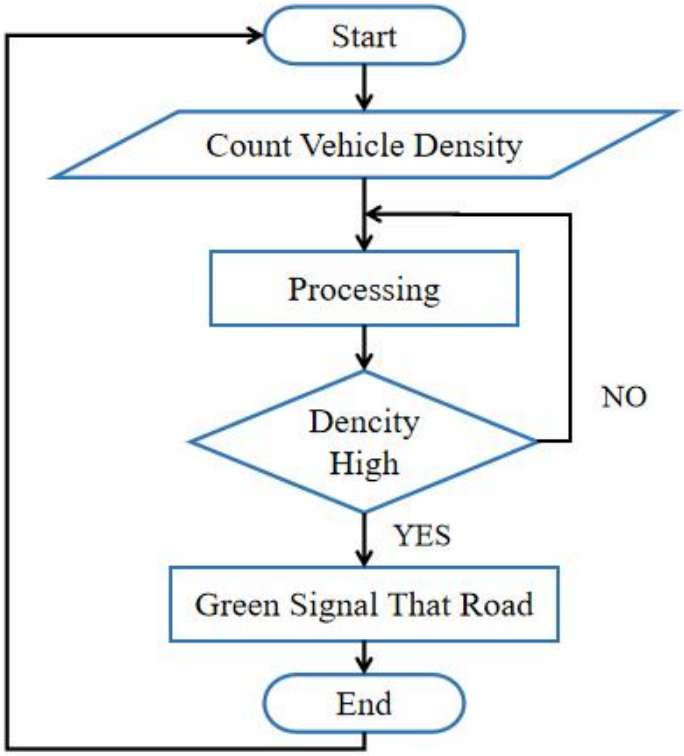


Figure 3.3: Flow Chart of Our System

3.6 Project Image

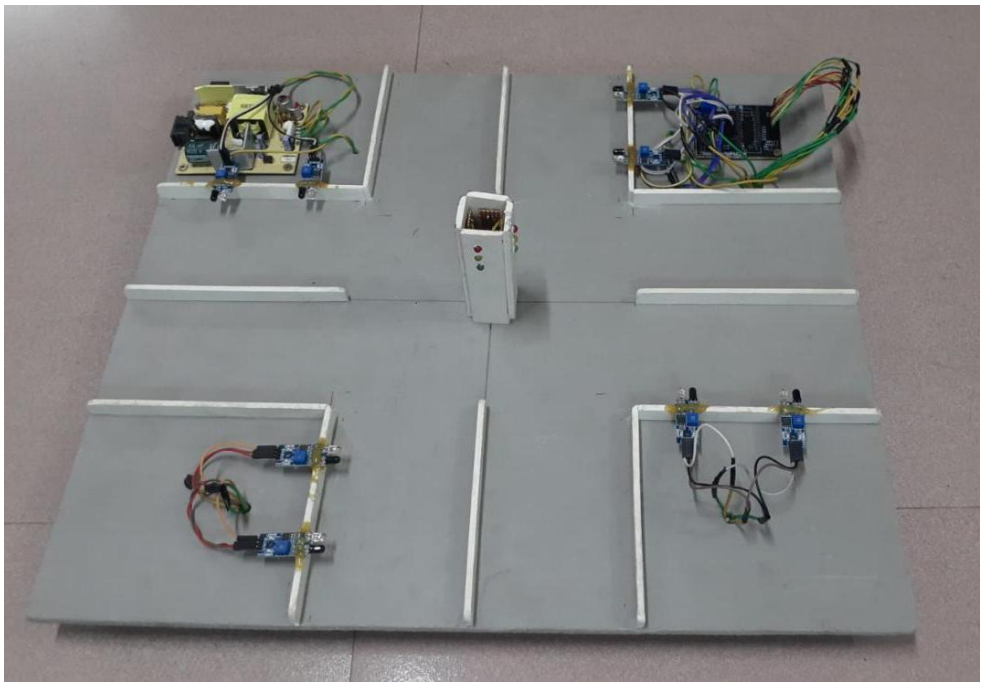


Figure 3.4: Our Final Project Image

3.7 Printed Circuit Board Design

PCB design provides information on the connection from the schematic pull module to the pure list form. This details, along with the user's design rules and various design automation. The 16 copper layers of the PCB can be manufactured with a design size limited to the product configuration.

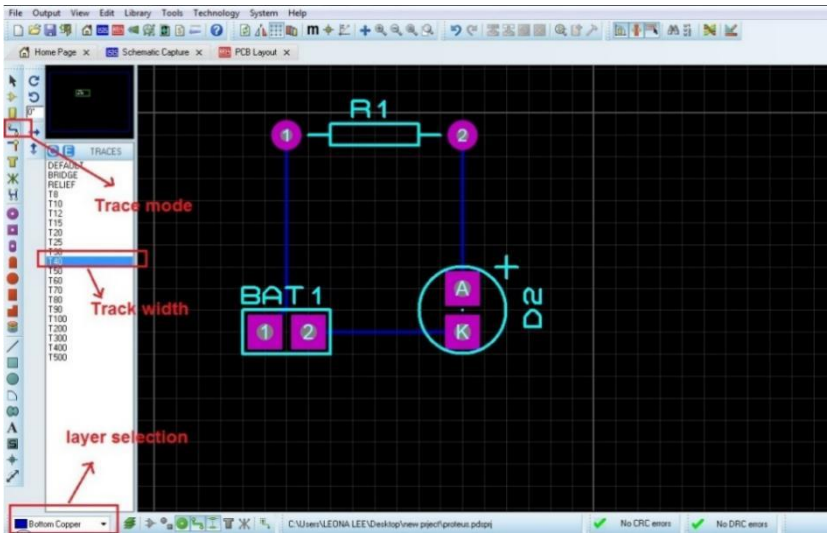


Figure 3.5: PCB Design

3.8 3D View:

The 3-dimensional framework allows you to view the board set on a 3D board, as well as a semi-transparent plane that shows the area around the board. STEP output can be used to transfer to active CAD programs, such as Autodesk for hard work or plant deployment.

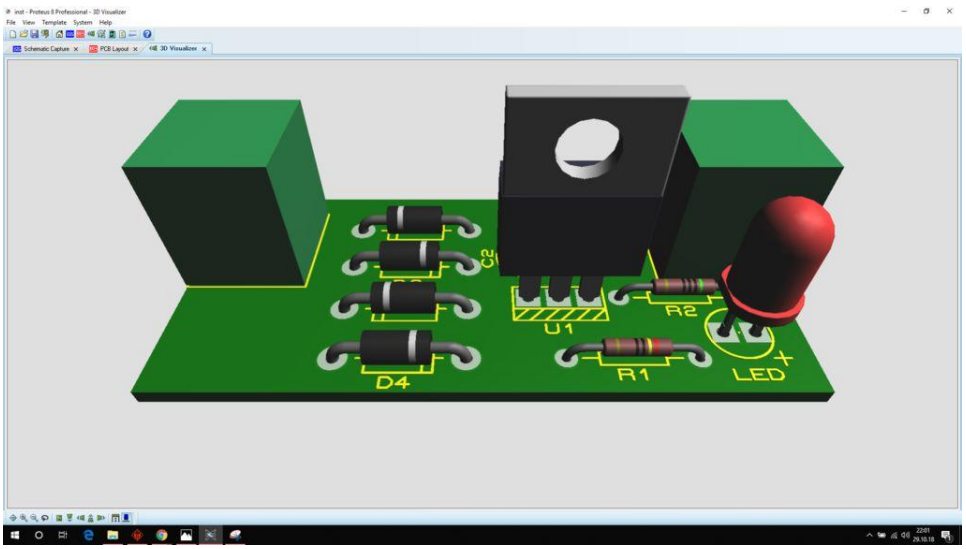


Figure 3.6: 3D Verification

Chapter IV

RESULT & DISCUSSION

4.1 Introduction

This chapter contains the results obtained and discussion about the project. We have also covered discussions about advantages, disadvantages and limitation of current version of the protection system.

4.2 Result

This chapter contains the results obtained and discussion about the full project. Our project is **Density Based 4 Way Automatic Traffic Signal Control System**. In our project making we used PVC boards for total hardware making. After finally completing this project, we ran it & we observed the output of this project. We can see that it is working well as expected. After making our project we observe it very careful. It works as we desire. Our project give output perfectly and all equipment are work perfectly.

- At first, we start our system.
- Then try to make density in road and then IR sensor detect the vehicle and control signal light depends on density of vehicle on road.

4.3 Advantages of Density Based 4 Way Traffic Light

There are certainly many advantages of our project and some of the major ones have been given below:

- 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.
- By using this Arduino Nano, we can create many more controls to the appliances.

- Easy convenience to handle.

4.4 Disadvantages of Density Based 4 Way Traffic Light

Although our project has many applications and benefits but there are some limitations of the project as well and the good thing is that these limitations are minor and doesn't affect the efficiency of the system.

- IR sensors work only for fewer distances.
- We have to arrange IR sensors in accurate manner otherwise they may not detect the traffic density.

4.5 Limitations

- Traffic signal work automatically its algorithm, Emergency situation may fell some problem.
- Its a demo project , that's why its area is small.
- Project may response slow for instrument quality, real life project will be work accurately.

4.6 Applications

Some of the application areas of the project has been pointed out below:

- The project is mainly used in the traffic signals in metropolitan cities to provide uniform distribution of traffic.
- It is work in busy 4 way road signal.

4.7 Discussion

In this paper we have studied the **Density Based 4 Way Automatic Traffic Signal Control System Using Arduino And IR Sensor**. A traffic light system has been designed and developed with proper integration of both the hardware and the software. This interface is synchronized with the whole process of the traffic system. Automatically, this project could be programmed in any way to control the traffic light model and will be useful for planning proper road system. Although we faced many problems in the beginning of making the project, we are able to complete it in a beautiful way with the efforts of everyone.

Chapter V
CONCLUSION

5.1 Conclusion

The density-based traffic control system has been designed, constructed and tested to ensure validation of its function and operations. In this research, we have succeeded in minimizing the traffic congestion created by the fixed time-based traffic light system. The system is effective and the cost of production is very low.

5.2 Future Work

We are thinking about adding many features to our project in the future to get more desirable outcomes. Some of the future scopes are given below:

- We look forward to future improvements to make our system design more efficient.
- In the future, we plan to add additional features to the system, such as surveillance camera monitoring, ultrasonic sensor for car counting and voice broadcasting system.
- In the future, we are planning to launch an IoT system that can be tracked wirelessly by traffic police for any occurrence.

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Appendix

Micro-controller Code:

```
#define ledA1 4
#define ledA2 3
#define ledA3 2

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

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

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

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() {
  readSensor();
  if (b1 == 1 && b2 == 1)
  {
    roadBopen();
  }
  else if (d1 == 1 && d2 == 1 && (b1 == 0 || b2 == 0))
  {
    roadDopen();
    if (b1 == 1 && b2 == 1)
    {
      roadBopen();
    }
  }
  else if (a1 == 1 && a2 == 1 && ((d2 == 0 || b2 == 0) || (d1 == 0 || b1 == 0)))
  {
    roadAopen();
    if (b1 == 1 && b2 == 1)
    {
      roadBopen();
    }
    else if (d1 == 1 && d2 == 1 && (b1 == 0 || b2 == 0))
    {
      roadDopen();
    }
  }
```

```
  else if (c1 == 1 && c2 == 1 && ((d2 == 0 || b2 == 0 || a2 == 0) || (d1 == 0 || b1 == 0 || a1
== 0)))
  {
    roadCopen();
    if (b1 == 1 && b2 == 1)
    {
      roadBopen();
    }
    else if (d1 == 1 && d2 == 1 && (b1 == 0 || b2 == 0))
    {
      roadDopen();
    }
  }
  ////////////////////////////////////////////////////////////////////////////////////////////////
  else if ((b1 == 1 && b2 == 0) && (c1 == 1 || d1 == 1 || b1 == 1) && (c2 == 1 && d2 ==
1 && b2 == 1))
  {
    roadBopen();
  }
  else if ((d1 == 1 && d2 == 0) && (c1 == 1 || a1 == 1) && (b1 == 0 && b2 == 0) &&
(c2 == 0 && a2 == 0))
  {
    roadDopen();
  }
  else if ((a1 == 1 && a2 == 0) && (c1 == 1 && c2 == 0) && (d1 == 0 && d2 == 0) &&
(b1 == 0 && b2 == 0))
  {
    roadAopen();
  }
  else if ((c1 == 1 && c2 == 0) && (b1 == 0 || b2 == 0) && (d1 == 0 || d2 == 0) && (a1
== 0 || a2 == 0))
  {
    roadCopen();
```

```
  }
  ////////////////////////////////////////////////////////////////////////////////////////////////////
  else if ((b1 == 1 && b2 == 0) && (c1 == 0 || c2 == 0) && (d1 == 0 || d2 == 0) && (a1
== 0 || a2 == 0))
  {
   roadBopen();
  }
  else if ((d1 == 1 && d2 == 0) && (c1 == 0 || c2 == 0) && (b1 == 0 || b2 == 0) && (a1
== 0 || a2 == 0))
  {
   roadDopen();
  }
  else if ((a1 == 1 && a2 == 0) && (c1 == 0 || c2 == 0) && (d1 == 0 || d2 == 0) && (b1
== 0 || b2 == 0))
  {
   roadAopen();
  }
  ////////////////////////////////////////////////////////////////////////////////////////////////////
  else if (a1 == 0 && b1 == 0 && c1 == 0 && d1 == 0)
  {
   roadBopen();
   if (a1 == 0 && b1 == 0 && c1 == 0 && d1 == 0)
   {
    roadDopen();
   }
   if (a1 == 0 && b1 == 0 && c1 == 0 && d1 == 0)
   {
    roadAopen();
   }
   if (a1 == 0 && b1 == 0 && c1 == 0 && d1 == 0)
   {
    roadCopen();
   }
```

```
  }
}
void readSensor()
{
  a1 = analogRead(A7);
  a2 = analogRead(A6);
  b1 = analogRead(A4);
  b2 = analogRead(A5);
  c1 = analogRead(A1);
  c2 = analogRead(A0);
  d1 = analogRead(A3);
  d2 = analogRead(A2);

if (a1 < 400) a1 = 1; else a1 = 0; if (a2 < 400) a2 = 1; else a2 = 0;
if (b1 < 400) b1 = 1; else b1 = 0; if (b2 < 400) b2 = 1; else b2 = 0;
if (c1 < 400) c1 = 1; else c1 = 0; if (c2 < 400) c2 = 1; else c2 = 0;
if (d1 < 400) d1 = 1; else d1 = 0; if (d2 < 400) d2 = 1; else d2 = 0;

Serial.print(a1);
Serial.print("\t");
Serial.print(a2);
Serial.print("\t");
Serial.print(b1);
Serial.print("\t");
Serial.print(b2);
Serial.print("\t");
Serial.print(c1);
Serial.print("\t");
Serial.print(c2);
Serial.print("\t");
Serial.print(d1);
Serial.print("\t");
Serial.print(d2);
```

```
Serial.println("\t");

}

void roadAopen()
{
  digitalWrite(ledA3, LOW);

  digitalWrite(ledA1, HIGH);
  digitalWrite(ledB3, HIGH);
  digitalWrite(ledC3, HIGH);
  digitalWrite(ledD3, HIGH);
  delay(10000);
  digitalWrite(ledA1, LOW);
  digitalWrite(ledA2, HIGH);
  delay(1000);
  digitalWrite(ledA2, LOW);
  readSensor();
}
void roadBopen()
{
  digitalWrite(ledB3, LOW);

  digitalWrite(ledA3, HIGH);
  digitalWrite(ledB1, HIGH);
  digitalWrite(ledC3, HIGH);
  digitalWrite(ledD3, HIGH);
  delay(10000);
  digitalWrite(ledB1, LOW);
  digitalWrite(ledB2, HIGH);
  delay(1000);
  digitalWrite(ledB2, LOW);
  readSensor();
```

```
}
void roadCopen()
{
  digitalWrite(ledC3, LOW);

  digitalWrite(ledA3, HIGH);
  digitalWrite(ledB3, HIGH);
  digitalWrite(ledC1, HIGH);
  digitalWrite(ledD3, HIGH);
  delay(10000);
  digitalWrite(ledC1, LOW);
  digitalWrite(ledC2, HIGH);
  delay(1000);
  digitalWrite(ledC2, LOW);
  readSensor();
}
void roadDopen()
{
  digitalWrite(ledD3, LOW);

  digitalWrite(ledA3, HIGH);
  digitalWrite(ledB3, HIGH);
  digitalWrite(ledC3, HIGH);
  digitalWrite(ledD1, HIGH);
  delay(10000);
  digitalWrite(ledD1, LOW);
  digitalWrite(ledD2, HIGH);
  delay(1000);
  digitalWrite(ledD2, LOW);
  readSensor();
```