“DENSITY BASED TRAFFIC CONTROL SYSTEM”

B .TECH PROJECT REPORT

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(An Autonomous Institute Of Government Of Maharahstra And Affiliacted To Kaviyatri Bahinabai Chaudhari North Maharashtra University, Jalgaon) In Partial Of Requirement For The Degree Of BACHELOR OF TECHNOLOGY

in

Electronics And Telecommunication Engineering

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CERTIFICATE

This is to certify that the project dissertation entitled, **“DENSITY BASED TRAFFIC CONTROL**

TRFFIC SYSTEM”, which is being submitted herewith for theaward of B.TECH. is the result of the work completed by **Sanket Devray, Anup Wankhede, Bharat Virutkar, Hritik Jadhav** under my supervision and guidance within the four walls of the institute and the same has not been submitted elsewhere for the award of any degree.

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Head of Department

Principal Examiner

DECLARATION

I hereby declare that the Seminar entitled, **“DENSITY BASED TRAFFIC CONTROL TRAFFIC SYSTEM”** was carried out and written by me under the guidance of Mr.M. S. Sadavarte Sir, Assistant Professor at Government College of Engineering, Jalgaon. This work has not been previously formed the basis for the award of anydegree or diploma or certificate nor has been submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

The project is aimed at designing a Density Based traffic signal control system where the timing of signal will change automatically on sensing the traffic density at any junction. Traffic congestion is a severe problem in most cities across the world and therefore it is time to shift more manual mode or fixed timer mode to an automated system with decision making capabilities. Present day traffic signaling system is fixed time based which may render inefficient if one lane is operational than the others. To optimize this problem we have made a framework for an intelligent traffic control system. Sometimes higher traffic density at one side of the junction demands longer green time as compared to standard allotted time.We therefore propose here a mechanism in which the time period of green light and red light is assigned on the basis of the density of the traffic present at that time.

This is achieved by using PIR(proximity Infrared sensors).Once the density is calculated, the glowing time of green light is assigned by the help of the microcontroller (Arduino). The sensors which are present on sides of the road will detect the presence of the vehicles and sends the information to the microcontroller where it will decide how long a flank will be open or when to change over the signal lights. In subsequent sections, we have elaborated the procedure of this framework.

CHAPTER 1
INTRODUCTION

The very occurring urbanization from rural localities in the gaze for a better life has led to a massive growth in the urban population and caused a great boost to the infrastructure industry. One of the overstretched infrastructures is the roads, a condition that came in existence with the increase in traffic [1]. With the high speed life that is being practiced today, traffic congestion is becoming an urgent issue to discuss and avoid.

Traffic congestion leads to a decrease in the individual productivity and in that way of the society, as most of the productive working hours are wasted in traffic lines. The higher number of street vehicles, the limited road infrastructure and the absurd dissemination of the signaling system leads to the frequent chaotic congestion in today's roads. Indirectly, traffic flow congestion leads to pollution as well, as the engine of the vehicles remain in majority of the case and a large amount of natural resource such as petrol and fuel is consumed without any useful outcome.

Project motivation and purpose

The goal of this project is to develop a system that can accurately detect level of traffic .Traffic congestion is a severe problem in most cities across the world and therefore it is time to shift more manual mode or fixed timer mode to an automated system with decision making capabilities. To optimize this problem we have made a framework for an intelligent traffic control system.

Functions and Features

1. The system contains IR transmitters and IR receivers which are mounted on the either sides of roads.

2. This IR system gets activated when any vehicle passes on road between IR transmitter and IR receiver.

3. The microcontroller controls the IR system and gets activated when vehicles are passing in between the sensors.

4. Once the density is calculated, the glowing time of green light is assigned by the help of the microcontroller (Arduino).

Main Objectives Of the Project

- Propose a mathematical model and architecture design for the smart traffic lightsystem.
- Run computer visual simulation of the system for different scenarios.
- Implementation and test the system.

CHAPTER 2

Literature Survey

The increasing speed of life, has increase the traffic congestion which is an issuein our day to day activities. It's the major cause now which can bring down the production of each person and thereby, the society as lots of work hours are being wasted waiting at the traffic signal. The increase in the volume of cars, the inadequate infrastructure and the irrational distribution of the signaling system are the main factor of this chaotic congestion

.

The environment is also indirectly affected by this issue uprising as the pollution level increases as the engines remain. In most of cases, a big number of natural resources in forms of petrol and diesel is used without any positive outcome.

The highly increase in the population of our towns and cities, the busy nature of the roads and need to increase one's time, there comes a need for more dynamic, system design and efficient traffic manageable designs which seeks to overcome unnecessary congestion and lawlessness causes from undue delays.There is a needto comprehend the function of the traffic signals so that there is improvement in the driving habits by controlling the speed in order to decrease the number of traffic accidents.

The more the number of drivers know the traffic operation the less frustrated they are going to be while waiting for the change in the state. The main aim will be to develop and implement the smart traffic light signal to overcome the waiting timeof each lane of the cars and also to increase the total number of cars that can crossan intersection given the mathematical function to count the waiting time. Under the conventional method, the traffic lights are set on the fixed timer delays for a different lane. The following lights are cycled while changing from one signal to the other signal creating the unwanted and congestion

.

This method is currently used in Fiji and should be upgraded as it leads to many issues. This technique is very old and will not be able to cope with the current population density. We are proposed an optimized design and implementation of an intelligent traffic light system using an ultrasonic sensor. This sensor is used todetect the distance of the vehicles and allows the traffic to flow if traffic lane busy.

CHAPTER 3

Methodology

The proposed solution is to build a smart traffic light prototype that optimizes traffic congestion using sensors. A thorough extensive study was done in order to understand the interaction between hardware and software system components. Aaccurate data is collected from current functional traditional trafficlight systems. Figure 1 shown below presents the system architecture.

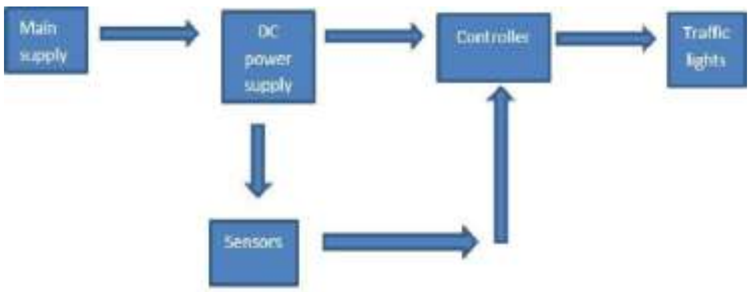


Fig. 1. Hardware implementation.

Fig. 1. Hardware implementation. The above block diagram describes a high level overview of the hardware implementation of the system. A 240V ACis the main power supply which gets converted to 5V DC by the DC power sourcethat further powers the controller and the sensor arrays.

The sensors deliver input to the controller which further performs logical operations in order to power the traffic lights. The circuit needs to be finalized and the schematic will be printed onto a PCB board on which all components will be soldered. We have used Ultrasonic sensors for traffic and vehicle detection.

The time taken by the ultrasonic sensor are pulse to leave the sensor, it bumps off the surface, and return to its location which is the sensor. As the distance taken is the full length of the time travel but we only need half of its time,so we divide the time by two.

Mansour H. Assaf, Sunil R. Das, Satyendra N. Biswas E-ISSN: 2224-2678 21 Volume 19, 2020 air due to reasons such as temperature and humidity.

In order to get the accurate distance calculated, we need to consider the ambient temperature and humidity. Distance that sound travels = Speed of sound in Medium * Time that sounds travel. For instance, only half a distance travelled by the sound wave is taken between object and the sensor. Distance between sensor and object = 0.5 * Distance that sound travels. The formula for the speed of sound in air with temperature and humidity accounted foris: For the ultrasonic sensor the time is taken for only half a signals, as we only need half. Hence, the time taken is time / 2. Distance = Speed * Time / 2. Speed of sound at sea level is = 343 m/s or 34300 cm/s. Thus, Distance = 171.5 * Time.

There will be four ultrasonic sensors interfaced with the Arduino board. These sensors will be read by Arduino and then, it will calculate the distance between the sensor and the vehicle. The total time it takes for the ultrasonic wave to propagate, hit the object, and then return signal back to the sensor. Therefore, we divide time by two [2]. s = (t * 0.034) / 2.0

Matlab and Simulink software will be used for the software implementation of this project. The FPGA software will be used for designing once the hardware implementation is complete.

The proposed system receive info from sensors in realtime. The system processes info, generates and interprets results. The conventional method of traffic flow control is implemented with the fixed timers, which generates the operation cycle for a fixed time interval. Traffic flows are so inefficient and leadsto traffic congestion and frustrations build up for many drivers, leading to accidents. For instance, if a timer is set for a green light is 30 sec and yellow lightis 5 sec, then to make one cycle for a signal will take 1.75 minutes to complete, leading to inefficiency of traffic vehicle flow. Figure 3 shows the conventional method of traffic control.

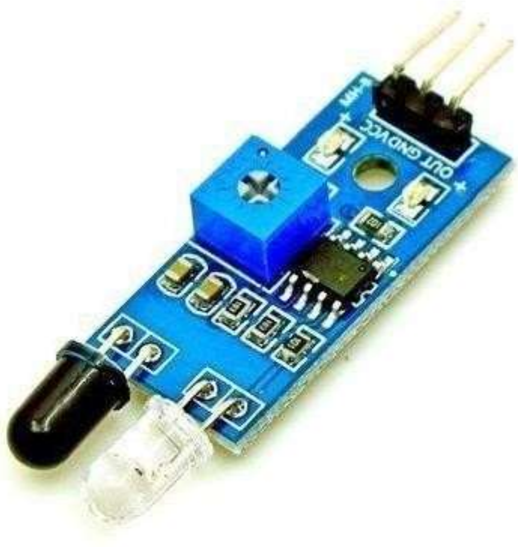
Table 1 shown below the traffic light state changes according to received inputs from the sensors. Table describes two lanes traffic behavior, going north and east. Input data from sensors are generated by sensing car traffic flow on the particular lane. Received sensor data input is used to update system states in an automatic manner to avoid traffic congestion.

CHAPTER 4
SPECIFICATION OF SYSTEM

IR sensor

Infrared transmitter - a device that emits infrared rays. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed parallel to each other. The signal is given to IR transmitter whenever the signal is high, the IR sensor is conducting it passes the IR rays tothe receiver. The IR receiver is connected with comparator. The comparator is connected with operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal of the circuit The Non inverting input terminal is connected to IR receiver. When there is an interruption in the IR rays between the IR transmitter and receiver, the IR receiver becomes not conducting. So the comparator non inverting input terminal voltage is higher than inverting input.

The comparator is at the output range of +5V. This voltage is given to microcontroller. When IR transmitter passes the rays to receiver, the IR receiver becomes conducting due to non inverting input voltage is lowerthan inverting input. Now the comparator output is GND. So the output is given to microcontroller. This circuit is mainly used to for detection of vehicles on road.



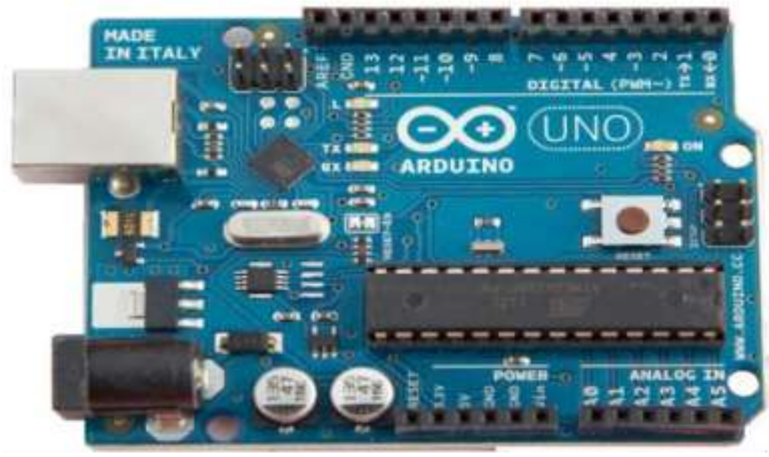
Arduino Uno:

The Arduino Uno is a microcontroller board based on the ATmega328. Arduino is an opensource, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, 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.

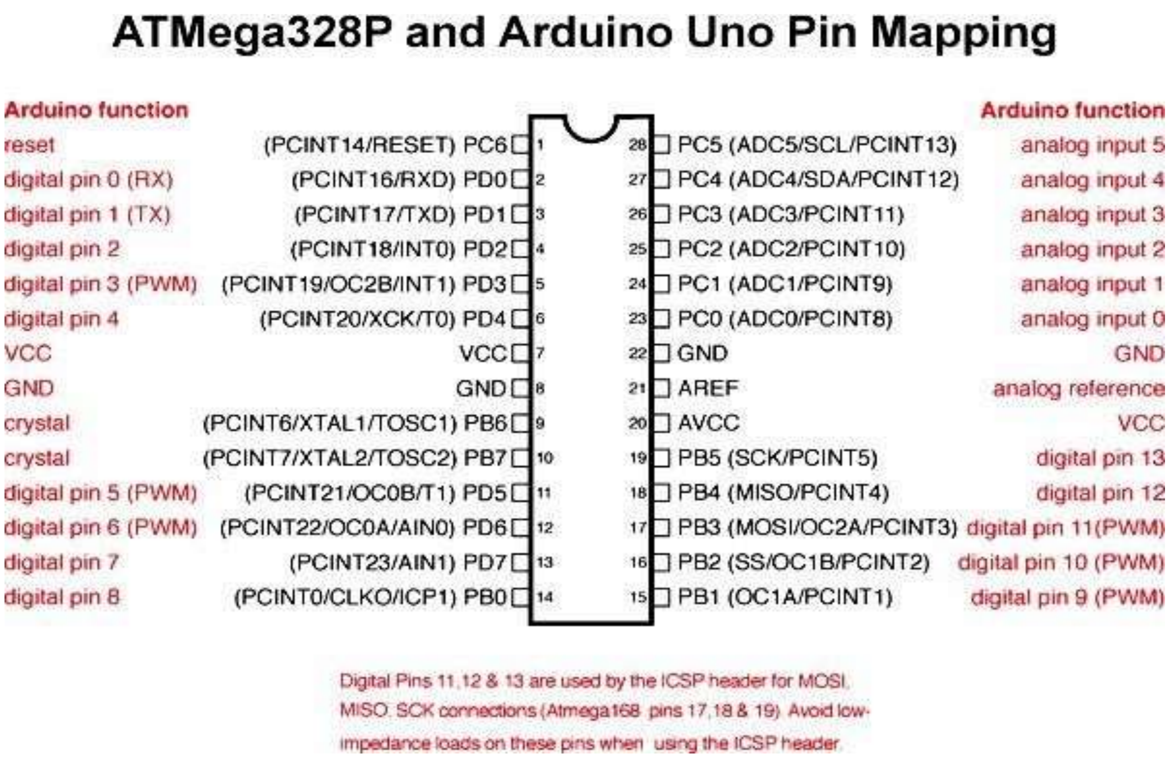
Features of the Arduino UNO:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by boot loader

- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz



ARDUINO PIN DIAGRAM



ARDUINO UNO Pin Configuration:

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and itis used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of05V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master In Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

Arduino Technical Specifications:

MICROCONTROLLER	ATmega328P
OPERATING VOLTAGE	5V
INPUT VOLTAGE (RECOMMENDED)	7-12V

INPUT VOLTAGE (LIMIT)	6-20V
DIGITAL I/O PINS	14 (of which 6 provide PWM output)
PWM DIGITAL I/O PINS	6
ANALOG INPUT PINS	6
DC CURRENT PER I/O PIN	20 mA
DC CURRENT FOR 3.3V PIN	50 mA

ADAPTER

12V power supplies (or 12VDC power supplies) are one of the most common power supplies in use today. 12V power supplies can be of twotypes: 12V regulated power supplies, and 12V unregulated powersupplies.12V regulated power supplies come in three styles: Switchingregulated AC to DC, Linear regulated AC to DC, and Switching regulated DC to DC.

We have used linear regulated AC to DC 12V power supply.

CHAPTER 5

System Design

This paper proposes a system that intelligently adjusts traffic light system response basedon the emergency vehicle priority and vehicular density for each of the lanes atthe traffic lightjunction in a real-time application. Motivated by the fact that the traffic light system's electrical energy**.**

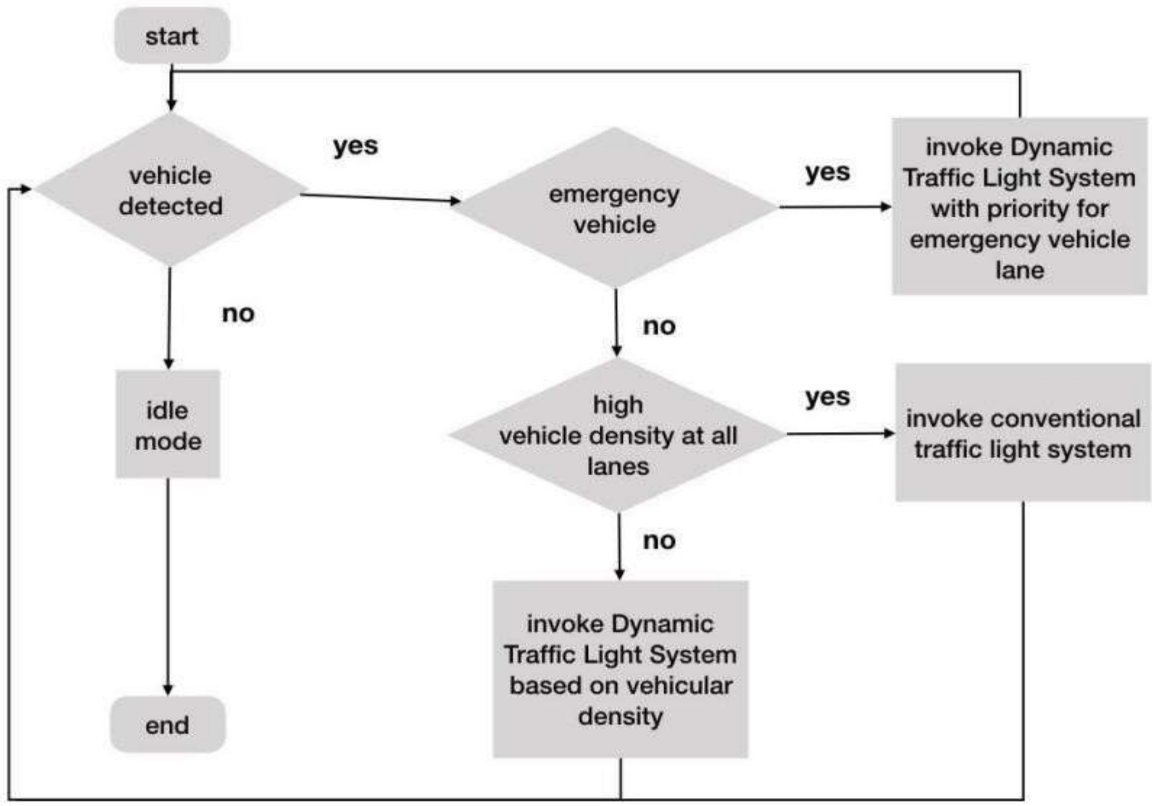


Figure 1. Flow chart of Dynamic Traffic Light Control System based on three different proposed approaches based on real-time traffic conditions and emergency vehicle priority

weights can be wastedmostly during the idle traffic and non-congested traffic, we propose an intelligent system as illustrated in Figure 1. The system is set to be on idle mode if no vehicle is detected at the lanes. As soon as a vehicle isdetected, the system will be in an active mode and invoke three different proposed approaches based on real time traffic conditions and

Emergency vehicle priority weights, i.e., invoke dynamic traffic light system with priority for emergency vehicle lane, invoke dynamic trafficlight system based on vehicular density and invoke the conventional trafficlight system. Instantly when an EV is detected at any of the lanes; the highest priority will be given to that particular lane.

The traffic light system users will be alarmed, and the green light will be turned on until the EV is safely passed through the intersection. The vehicular density for each ofthe lanes is considered in the later approaches. If all the lanes are occupied with high vehicular density, then the conventional traffic light cycles will be invoked. Otherwise, the traffic light cycles depend on the vehicular density andoccupied lanes. In this approach, each of the active lanes' cycle lengthis based on the traffic density. i.e., longer green time forthe lane with higher traffic density. For instance, if traffic is detected at one or two lanes, the lanes with detected vehicles will be activated and alternately served based on the traffic density. In contrast, the lane without any vehicle is ignored from the sequence.

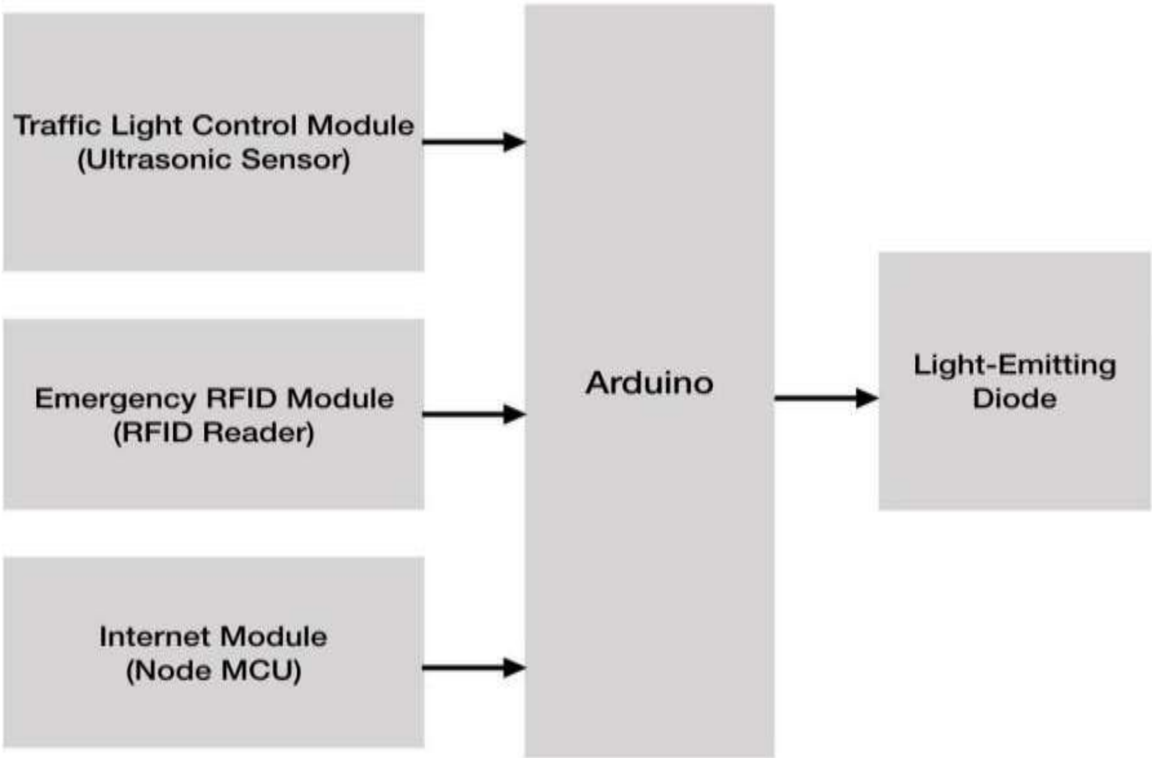


Figure 2. Block Diagram of the proposed Real-time Dynamic Traffic lightControl System with EV Priority.

Figure 2 illustrates the block diagram of the proposed dynamic traffic light control system with EV priority that consists of three modules, i.e., the traffic light control module, the emergency RFID module and the internet module. The traffic light detects vehicular density using ultrasonic sensors and assigns a dynamic set of cycle length based on the lane density condition. The emergency RFID module with a preset weighting factor information must be installed on the individual EVs to handle different types of EVs approaching the intersection. The internet module allows the traffic light to be controlled by an authorized person. Arduino Uno is used as a microcontroller to manage and control the proposed approaches.

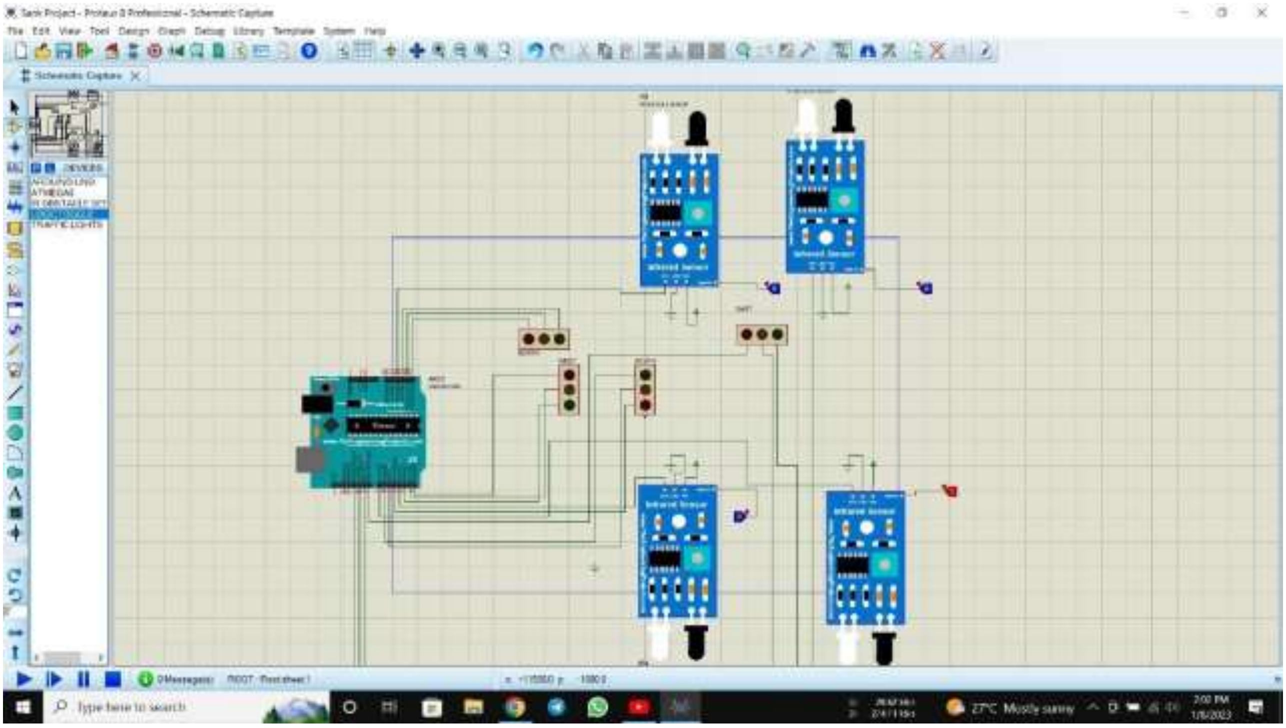


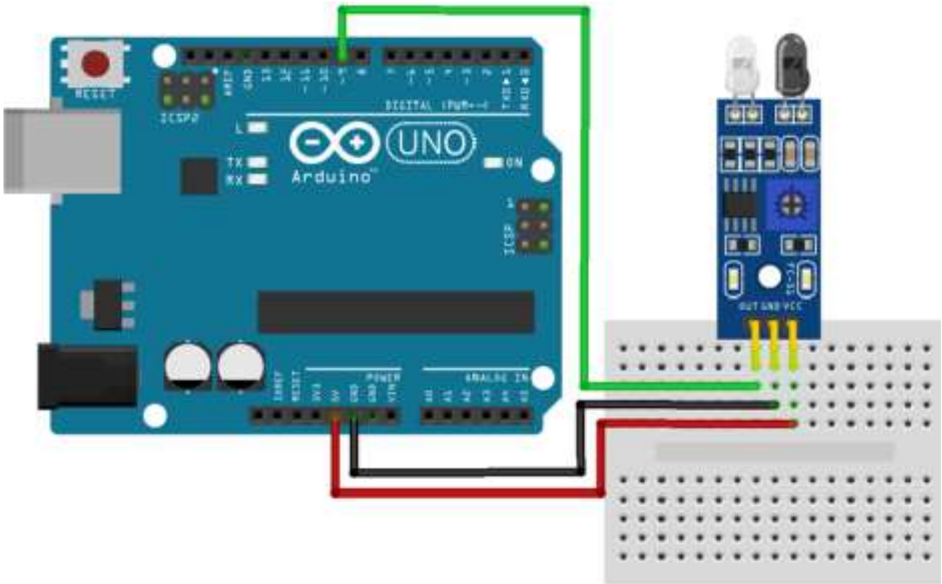
FIGURE.3- Schematic diagram of Traffic Light Control Module

FIGURE 3 illustrates the traffic light control module's schematic diagram, which consists of ultrasonic sensors. Each of the ultrasound sensors consists of two main components, the sender and the receiver. The HC-SR04 Ultrasonic Module has four pins, Ground, VCC, Trig and Echo. Ground and VCC pins of the module need to be connected to the ground and the 5 volts pins on the Arduino Board, respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.

The schematic diagram of the emergency RFID module shows in Fig.

5. The emergency RFID consists of two main components, a transponder is installed to the EV to be identified, and a transceiver is embedded in the traffic light control system. The transponder is a passive device and contains a microchip that stores and processes information of the EV and an antenna to receive and transmit a signal.In this research, we consider multiple types of EVs with different weights of priorities. We preset the weights of priorities and store thisinformation in the individual transponder. Hence the transceiver can interpret which EV has a higher priority; thus, the system can decide which lane should be granted to pass through the intersection

ARDUINO CONNECTION WITH IR SENSOR.



CHAPTER 6

System Implementation

The proposed smart traffic light system hardware implementation and various components are shown in figure 4. The main part of the project is the including the Arduino mega 2560 controller that reads signals from the HC-SR04 ultrasonic sensors and calculate the distance between vehicles and the traffic lights in order to optimize traffic flow and control traffic congestion.

Proteus with Arduino software's was used to implement the software circuit design. The circuit was constructed in Proteus and its code was written in Arduino. The hex file was uploaded onto the microcontrollerin Proteus.

Figure 5 shows the circuitry of a 4 way traffic light control system where every lane with be given fixed equal time for the traffic light to remain green. After the time is complete for a particular light at green,traffic light will change to yellow for a short period before it changes to red. Now all traffic lights will remain red and that represents that it is time for pedestrian crossing.

Figure 6 shown below depicts a 4-way sensor based traffic light controlsystem. The system is made up of 4 infrared sensors. Each of the four sensors is connected to a particular traffic light. Each of the traffic lights represents a pre-defined the road and it is denoted by a given direction.

Two logic states 0 and 1 are used in computer simulation to represent traffic density. The sensor state 0 logic represents no traffic follow and therefore pedestrian crossing is ON. However, the sensor state 1 represents a traffic situation where therefore pedestrian crossing is OFF and traffic light from red to green while the rest of the lights remain red. Figure 7 and 8 show various scenarios and the transition of traffic light from red to yellow and then to green. When the logic state for the each side roads changes from 0 to 1, the east side roads traffic light changed to green allowing traffic to flow only from the east direction.

In a situation where there is higher traffic density elsewhere, the sensorwill switch logic from 0 to 1 and the traffic light will change from red to green after a predetermined time delay. Time delay is introduced to avoid car collision. A well-planned traffic system is needed to avoid road accidents and give chances to emergency vehicles to pass through without any problems. The major challenge is to estimate traffic densityat rush and not rush hours, therefore we conducted roads surveys at different times in various weather conditions in order to measureoptimal system parameters. In the next section we present concluding remarks.

CODE:

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(A0, A1, A2, A3, A4, A5);
const int irSensorPin1 = 2; // IR sensor input pin for lane 1
const int irSensorPin2 = 3; // IR sensor input pin for lane 2
const int irSensorPin3 = 4; // IR sensor input pin for lane 3
const int irSensorPin4 = 5; // IR sensor input pin for lane 4
const int redLED1 = 6; // Red LED pin for traffic signal in lane 1
const int greenLED1 = 7; // Green LED pin for traffic signal in lane 1
const int redLED2 = 8; // Red LED pin for traffic signal in lane 2
const int greenLED2 = 9; // Green LED pin for traffic signal in lane 2
const int redLED3 = 10; // Red LED pin for traffic signal in lane 3
const int greenLED3 = 11; // Green LED pin for traffic signal in lane 3
const int redLED4 = 12; // Red LED pin for traffic signal in lane 4
const int greenLED4 = 13; // Green LED pin for traffic signal in lane 4

int trafficDensity1; // variable to store traffic density for lane 1
int trafficDensity2; // variable to store traffic density for lane 2
int trafficDensity3; // variable to store traffic density for lane 3
int trafficDensity4; // variable to store traffic density for lane 4
  void setup() {
  pinMode(irSensorPin1, INPUT);
  pinMode(irSensorPin2, INPUT);
  pinMode(irSensorPin3, INPUT);
  pinMode(irSensorPin4, INPUT);
  pinMode(redLED1, OUTPUT);
  pinMode(greenLED1, OUTPUT);
  pinMode(redLED2, OUTPUT);
  pinMode(greenLED2, OUTPUT);
  pinMode(redLED3, OUTPUT);
```

```
  pinMode(greenLED3, OUTPUT);
  pinMode(redLED4, OUTPUT);
  pinMode(greenLED4, OUTPUT);
  // Set up the LCD's number of columns and rows:
  lcd.begin(16, 2);

  // Print a message to the LCD.

  Serial.begin(9600);

}

void loop() {
  // Measure traffic density using IR sensors for both lanes
  trafficDensity1 = digitalRead(irSensorPin1);
  trafficDensity2 = digitalRead(irSensorPin2);
  trafficDensity3 = digitalRead(irSensorPin3);
  trafficDensity4 = digitalRead(irSensorPin4);
  // Set the traffic signal timing based on the traffic density in both lanes
  if(trafficDensity1==0&&trafficDensity2==1&&trafficDensity3==1&&trafficDensity4==1){

// CLEAR LANE 1
    digitalWrite(redLED1, LOW);
    digitalWrite(greenLED1, HIGH);
    digitalWrite(redLED2, HIGH);
    digitalWrite(greenLED2, LOW);
    digitalWrite(redLED3, HIGH);
    digitalWrite(greenLED3, LOW);
    digitalWrite(redLED4, HIGH);
    digitalWrite(greenLED4, LOW);
    lcd.print("CLEARING LANE 1");
```

```
   delay(5000);
   lcd.clear();
  }
 elseif(trafficDensity1==1&&trafficDensity2==0&&trafficDensity3==1&&trafficDensity4==1) {
// CLEAR LANE 2
    digitalWrite(redLED1, HIGH);
   digitalWrite(greenLED1, LOW);
   digitalWrite(redLED2, LOW);
   digitalWrite(greenLED2, HIGH);
   digitalWrite(redLED3, HIGH);
   digitalWrite(greenLED3, LOW);
   digitalWrite(redLED4, HIGH);
   digitalWrite(greenLED4, LOW);
   lcd.print("CLEARING LANE 2");

   delay(5000);
   lcd.clear();
  }
  // CLEAR LANE 3
   digitalWrite(redLED1, HIGH);
   digitalWrite(greenLED1, LOW);
   digitalWrite(redLED2, HIGH);
   digitalWrite(greenLED2, LOW);
   digitalWrite(redLED3, LOW);
   digitalWrite(greenLED3, HIGH);
   digitalWrite(redLED4, HIGH);
   digitalWrite(greenLED4, LOW);
   lcd.print("CLEARING LANE 3");

   delay(5000);
```

```
    lcd.clear();
  }
elseif(trafficDensity1==1&&trafficDensity2==1&&trafficDensity3==1&&trafficDensity4==0){
  // CLEAR LANE 4
     digitalWrite(redLED1, HIGH);
    digitalWrite(greenLED1, LOW);
    digitalWrite(redLED2, HIGH);
    digitalWrite(greenLED2, LOW);
    digitalWrite(redLED3, HIGH);
    digitalWrite(greenLED3, LOW);
    digitalWrite(redLED4, LOW);
    digitalWrite(greenLED4, HIGH);
    lcd.print("CLEARINGLANE4");

   delay(5000);
    lcd.clear();
  }
    else{
    // CLEAR ALL THE LANES
    lcd.print("CLEARING ALL LANE");

    // CLEAR LANE 1
    digitalWrite(redLED1, LOW);
    digitalWrite(greenLED1, HIGH);
    digitalWrite(redLED2, HIGH);
    digitalWrite(greenLED2, LOW);
    digitalWrite(redLED3, HIGH);
    digitalWrite(greenLED3, LOW);
    digitalWrite(redLED4, HIGH);
    digitalWrite(greenLED4, LOW);
    delay(5000);
```

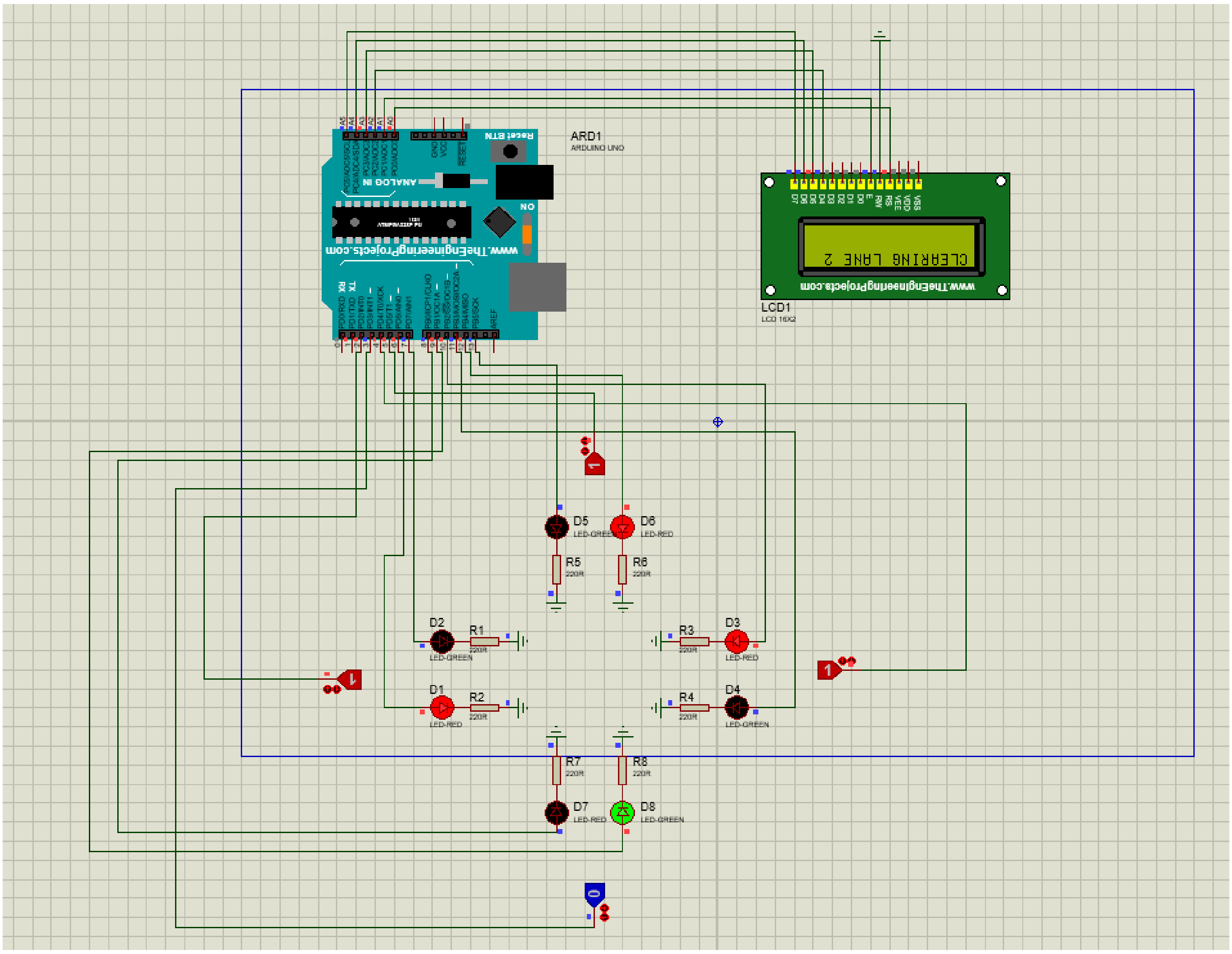
```
    // CLEAR LANE 2
     digitalWrite(redLED1, HIGH);
    digitalWrite(greenLED1, LOW);
    digitalWrite(redLED2, LOW);
    digitalWrite(greenLED2, HIGH);
    digitalWrite(redLED3, HIGH);
    digitalWrite(greenLED3, LOW);
    digitalWrite(redLED4, HIGH);
    digitalWrite(greenLED4, LOW);
    delay(5000);

// CLEAR LANE 3
    digitalWrite(redLED1, HIGH);
    digitalWrite(greenLED1, LOW);
    digitalWrite(redLED2, HIGH);
    digitalWrite(greenLED2, LOW);
    digitalWrite(redLED3, LOW);
    digitalWrite(greenLED3, HIGH);
    digitalWrite(redLED4, HIGH);
    digitalWrite(greenLED4, LOW);
    delay(5000);

    // CLEAR LANE 4
     digitalWrite(redLED1, HIGH);
    digitalWrite(greenLED1, LOW);
    digitalWrite(redLED2, HIGH);
    digitalWrite(greenLED2, LOW);
    digitalWrite(redLED3, HIGH);
    digitalWrite(greenLED3, LOW);
    digitalWrite(redLED4, LOW);
```

```
 digitalWrite(greenLED4, HIGH);
 delay(5000);
 lcd.clear();
}
}
```

SIMULATION:



CHAPTER 7

Conclusion

This paper discusses the design, implementation and validation of an intelligent traffic light system based on input data gathered fromsensors. Computer simulation and actual prototype were used to validate the proposed design and to show its effectiveness. Obtained results show that the proposed system is promising and that it is effective in controlling road traffic flow and easing traffic congestion . We plan to extend this work further by applying other techniques and adding intelligence to the system controller to better optimize performance.

CHAPTER 8

REFERENCE

[1] M. H. W. M. H. A. Albagul, “Design and Development of Sensor Based Traffic Light System,” American Journal of Applied Sciences , vol. 3, 2006.

[2] S. D. N. N. S. M. Ashwini Basavaraju, “VEHICLE DENSITY SENSOR SYSTEM TO MANAGE TRAFFIC,” International Journal of Research in Engineering and Technology , vol. 3, no. 3,2014.

[3] A.K.B.B.M.I.A. A. A. R. Faruk Bin Poyen, “Density based traffic control,” International Journal of Advanced Engineering, Management and Science, vol. 2, no. 8, 2016.

[4] T. M. Koji Hayama, “A FAR INFRARED VEHICLE SENSOR FOR A TRAFFIC SIGNAL CONTROL,” ITS Development Department, Sumitomo Electric Industries, Ltd., Osaka, Japan. [5] R.

Burnett, “MaxBotix,” 27 November 2017. [Online]. Available: https://www.maxbotix.com/articles/ultrasonic-orinfrared-sensors.htm. [Accessed 4 April 2019].

[6]“Last Minute Engineers,” [Online]. Available:https://lastminuteengineers.com/arduino-sr04-ultrasonic- sensortutorial/. [Accessed 2 April 2019]. [7] D.Nedelkovski,

“How to Mechatronics,” 2004.[Online]. Available: https://howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/. [Accessed 3 April 2019].

[8] I. G. O. Y. N. Udoakah, “DESIGN AND IMPLEMENTATION OF A DENSITY-BASED TRAFFIC LIGHT CONTROL WITH SURVEILLANCE SYSTEM,” Nigerian Journal of Technology (NIJOTECH) , vol. 36, no. 4, 2017.