Density Based Traffic System With Override Switch

Submited By

17103A0038 Tanay Gawde

18103A0067 Samadarshak Metkari

18103A0045 Sarvadnya Patil

1802A0030 Pratik More

UNDER THE GUIDANCE OF

MINI PROJECT GUIDE: PROF. SHEETAL MAPARE

DEPARTMENT OF ELECTRONICS ENGINEERING

VIDYALANKAR INSTITUTE OF TECHNOLOGY

WADALA (E), MUMBAI-400 037.

YEAR 2021-22

CERTIFICATE OF APPROVAL
For
Mini Project 2-B

This is to certify that

17103A0038 Tanay Gawde
18103A0067 Samdarshak Metkari
18103A0045 Sarvadnya Patil
18102A0030 Pratik More

Have successfully carried out Mini Project work entitled

Density Based Traffic System With Override Switch

in Department of Electronics
As laid down by University of Mumbai during the academic year 2021-22

Under the Guidance of

Mini Project Guide: **Prof. Sheetal Mapare**

Signature of Guide

Abstract

With the increase in human population in cities and therefore number of vehicles, traffic control signals have been playing significant role in managing traffic flow in cities. It provides safety and convenience to both drivers and pedestrians.

However, traditional traffic control signals fails in time management, as it allocates equal time slots to each road it is managing. This creates unnecessary waiting for drivers, which could not be endurable in every case, as being in time, is important to everyone.

A density based traffic control signal prototype with emergency override based on Bluetooth technology is proposed in this project. The proposed project allocates different time slots to each road according to vehicle density; thereby providing time management. The project incorporates priority based traffic signal management for high density lanes and emergency vehicles. An additional safer alternative for pedestrians crossing the road is provided; wherein based on priority the traffic signal goes red while pedestrians request to cross the road.

Thus the project implements a prototype for automatic and safer traffic signal management system based on emergency; which can be further used on a larger scale in real time for better and safer roads using RFIDs.

INDEX

1.Introduction

Transportation has been instrumental in the global economic growth since the earliest civilizations known to man and efficient traffic management has a major impact on the country's economy. 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. The major cause leading to traffic congestion is the high number of vehicle which was caused by the population and the development of economy. Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, these results in some congestion .As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage impacts in check. The goal of Intelligent Traffic Management system is to achieve improvements in mobility, safety and productivity of transport system through integrated applications of advanced monitoring, communication, display and control process technologies both in the vehicle as well as on the road. The advent of ICT during Industrial Revolution led to faster, or productive management of resources worldwide .

However, the Industrial Revolution also resulted in huge improvements in road construction and cheaper vehicles. Over the past few years, the exponential increase in urban population and vehicle ownership has led to a substantial increase in traffic congestion. Hence, there arose a need to integrate ICT with transport infrastructure and vehicle to form a background for ITS which were expected to deal with traffic congestion problems throughout the world very efficiently.

ITS mainly make use of Artificial Intelligence AI for the purpose of automation minimal human intervention. Vehicle detection technologies are ITS based and are used for vehicle actuated signal control. Actuated control implies the dependence of signal

cycle length, phase split and even phase sequence on the vehicle actuations registered at detectors and sensors. It is a type of traffic responsive signal control in which signal receives inputs that reflect current traffic conditions and use this data to automatically create an optimal timing plan for the crossing. These signals receive data from vehicle detectors placed at the crossing and modify the default timing plan accordingly. As per information available from ministry of road transport and highways, India, over 130,000 deaths annually, the country has overtaken China and has the worst road traffic accident rate worldwide. Experts say that it might be higher considering the case of under reporting.

It is rated that 13 people die every hour in road accidents and majority of the victims fall under the active age group 25-32. Losing the earning number of families would be disastrous for their families. India loses about $30 billion to road accident. Most of the time, accidents are blamed upon drivers, calling it aggressive or over speeding. But if the equipment meant for road safety is working perfectly then accidents should not occur even in the case of wrong driver behavior because such equipment should have been designed only after considering all affecting factors .

In considering the traffic signals, which are placed at road junctions to regulate the flow of traffic, cannot be simply at any intersection. Each intersection has its own unique characteristics. The traffic engineer designs the signal only after studying all of the characteristics and analyzing the various possible scenarios. The problem arises when the earlier assumed scenarios do not match with real time scenarios. Hence, it is a method to solve the problem of invisibility of traffic signal caused by huge vehicles blocking the view, prevent traffic congestion at toll gate and highways. The system comprising of an Arduino which is installed at major traffic junctions and is programmed to connect to each automobile passing by with the help of IR sensors. In case of emergency vehicles like Ambulance or fire brigade, a Bluetooth/Wi-fi module is connected so that it can send signals to signal posts and display status on the LCD and allow it to get pass through the signals stopping all other vehicles. If a pedestrian is in emergency and want to cross the road, then a switch is installed so that by pressing of it, the signals become red and he can cross the road easily.

The traffic lights ensure that vehicles from every direction get a chance to proceed through intersection in an orderly fashion. Normally, the traffic lights are programmed for

particular time intervals. But, in day-to-day life, it has been observed that traffic on one side on a two way road is predominantly more when compared to the other. In such situation, programming equals interval of time for both types of traffics, attributes to congestion during hours of heavy traffic, making traffic delays.

Theoretical views of different applications implemented through this project work are as follows:

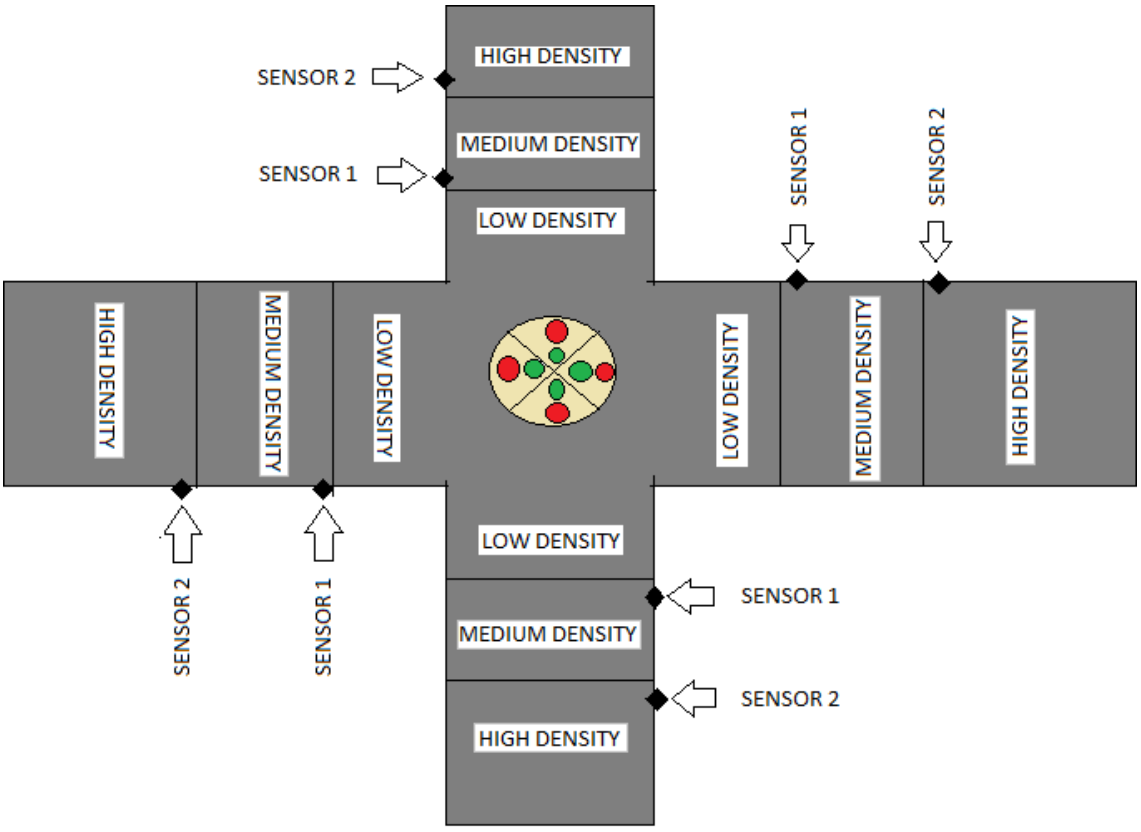


Fig. Overview diagram of Density Based Traffic Control Signal with Emergency Override

Fig. 1.1 Overview of Density Based Traffic Signal with Emergency Override

The advantages of this project are road congestion is reduced, road which is heavily dense is given high priority and released first thus saving time of larger number of passengers, helps in violating traffic rules, reduced man power and further allow any kind of emergency vehicle to pass through the signals by turning the green light on of that lane and allow pedestrians to cross the road in case of any emergency by pressing the switch, as shown in fig. 1.1 .

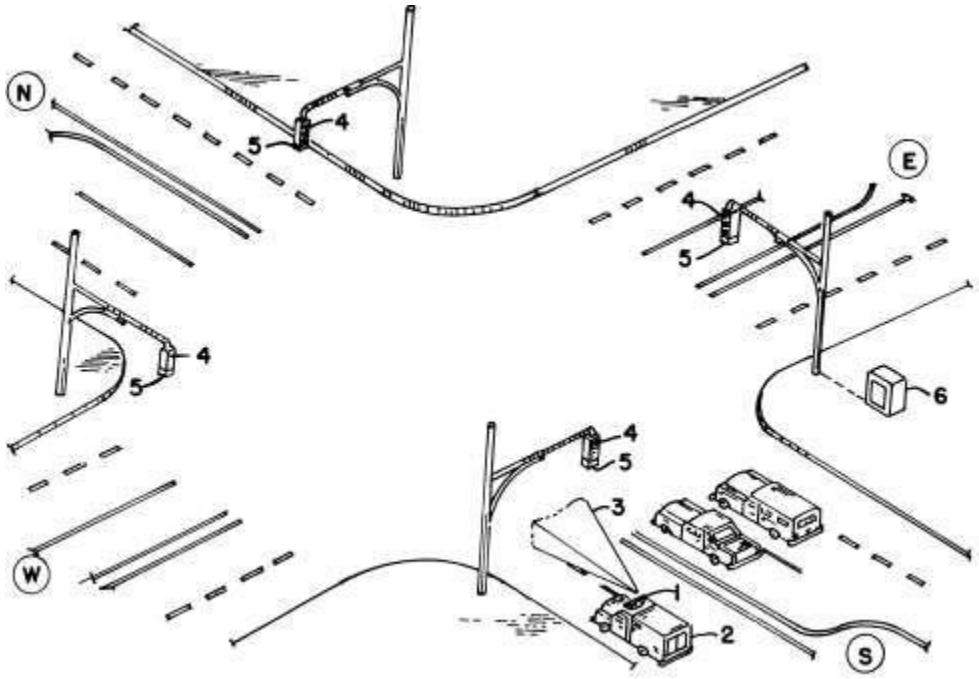


Fig. 1.2 Flow of traffic at a cross junction

2.Literature Review

The traffic pattern on Indian roads is highly heterogeneous in nature. There are around 30 billion vehicles in India growing at the rate of 15-17% annually. The probability of accidents is also increasing. Average number of roads accidents per thousand is around 23 which is highest in the world. Buses and trucks are responsible for 43% of accidents.

K.M. Yousef et al in his paper has developed an adaptive traffic control system based on a traffic infrastructure using wireless sensor network to control the flow of traffic. They also developed an intelligent traffic controller to control the operation of the traffic infrastructure supported by WSN. It senses the traffic and dynamically changes the traffic lights through wireless transmission. It only adds convenience to already existing traffic light system and not safety.

W. Wen in his paper has proposed a framework for a dynamic and automatic traffic light control system. They paste RFID tags on cars and us RFID reafers to make note of that number of cars, average speed, traffic flow etc. and store in a database by passing the information wireless. This database is later used to control the traffic signal lights, which helps in reduction of traffic congestion.

P. Sinhmar has proposed in his paper a solution to reduce the number of traffic jams with the help of IR transmission and microcontroller. The IR transmistter and receiver is to count the number of vehicles passing and decision to change the traffic delay is made by microcontroller based on the collected information. Such a system is useful in getting accurate statistics and helps in designing better traffic signal lights.

A number of intelligent transport system technologies were developed to allow safe and easy transportation. They vary from basic management system such as CCTV systems, triangular method, GPS based traffic system, Bluetooth detection and sensing technologies.

2.1. CCTV and Speed Cameras

M. Kilger has suggested in his paper that CCTV and speed cameras can track thespeeding vehicles in a periphery of 1Km but they will not be able to prevent immediate

accidents and they do not take immediate actions. The number plate recognition system tracks the vehicle of rash driver but by the time the vehicle is recognized and cops arrive at the spot there is a possibility that the person speeding up might have already encountered an accident.

The images used in this work are grey scale, 320*240 pixels and sampled five times per second. The resolution and sample rate are selected to provide sufficient detail in images to identify individual vehicles and to capture sequential images rapidly enough so that individual vehicles can be tracked between images without pattern recognition techniques.

2.2. Triangular Method or Floating Car Data

S. Brietenberger has proposed in his paper that in developed countries, a high proportion of cars contain one or more mobile phones. These phones periodically transmit their present location information to the mobile network even when no voice connection is established. In mid-2000's attempts were made to use mobile phones as anonymous traffic probes.

Floating car data are positions of vehicles traversing city throughout the day. The most common type of FCD comes from taxis and delivery vehicles which are on main arterial roads and highways throughout most of the day. The second approach has many positive and negative attributes that must be dealt with to provide accurate travel time interference. First, FCD is the most inexpensive data to attain, since many vehicles automatically gather this data on their vehicles for logistics purpose. Second, positions are accurate, since GPS is used and it has high accuracy. There are many disadvantages as well. First, FCD is usually sampled in frequency, on the order of 2-3 minutes. The reason for this is that taxi or delivery companies do not need such as time granularity of their vehicle position. Therefore preprocessing needs to take place in order to snap the sets of points onto the proper streets with possibility what multiple paths for given road network. Keeping all this in mind, constructing more and more accurate travel time predictions can be fruitful with various issues to tackle.

With the increase in congestion there is more number of cars, more mobiles and more problems. Triangular method is complicated especially in areas where same mobiles

phone tower server two or more parallel routes. By 2010, popularity of triangular method was declining.

2.3. Vehicle Re-Identification

It started in 1954 and was standardized in 1981 by National Highway Traffic Safety Administration. Ramchandran R.P. has proposed in his paper that identifications performed using a nearest neighbor classifier and a linear fusion stratergy. The fusion of multiple detector signals is shown to improve vehicle-identification accuracy slightly and provides system redundancy.

In their investigation into the feasibility of using multi detector fusion for traffic surveillance, a feature based on color information from video camera is used to augment the inductive feature obtained from inductive loop detectors. Inductive signatures are unique deviations in the inductance of a loop detector caused by the passing of a vehicle. Inductive loop detectors are prevalent in cities all over the world. Their investigation using color from video is performed for following reasons.

Video cameras and video detection are becoming more popular. Color Information is not correlated with inductive signature information. Color can be extracted to derive. Color can be verified visually and color is used with signature information to increase identification accuracy. Since their investigation is performed using video footage, this is not optimized for vehicle for vehicle identification and no calibrated loops, better results can be expected in the future with the use of improved video imaging and loop detection.

2.4. GPS Based Methods

An increasing number of vehicles are equipped with in-vehicle GPS systems that have 2-way communication with traffic data provider. Position readings from these vehicles are used to compute vehicle speeds.

X. D. Zhang has proposed in his paper that a GPS is a space-based radio positioning system that combines computer techniques to provide 24- hour three-dimensional position, velocity and time information to suitably equipped users anywhere on or off the Earth. The car GPS navigation system finds the way easily and quickly. While driving on an unfamiliar road or being caught by heavy traffic, the most convenient

and fastest way yo get to destination is to use a GPS system. Through the satellites, car GPS navigation systems are able to show other possible routes to the destination.

2.5. Emergency Vehicle Notification System

J. Claswson [13] has proposed in his paper that in-vehicle e-call is an emergency call generated manually by the vehicle occupants or automatically via activation of in-vehicle sensors after the accidents. When activated, the in-vehicle e-call device establishes an emergency call carrying both voice and data directly to the nearest emergency point or the nearest public safety answering point. The data contains information about the incident, including time, precise location, direction of vehicle travelling and vehicle identification which helps in aid reaching the person within minutes of accident.

2.6. Inductive Loop Detection

Inductive loops can be placed in a roadbed to detect vehicles as they pass through the loop's magnetic field. The simplest detectors simply count the number of vehicles during a unit of time typically 60 seconds in the United States, that pass over the loop, while more sophisticated sensors estimate the speed, class of vehicles and distance between them. Loops can be placed in a single lane or across multiple lanes and they work with very slow or stopped vehicles as well as vehicles moving at high speed.

The inductive loop system behaves as a tuned electrical circuit in which the loop wire and lead-in cables are the inductive elements. When a vehicle passes over the loop or is stopped within the loop, the vehicle induces eddy currents in the wire loops, which decrease their inductance. The decreased inductance actuates the electronics unit output relay or solid state optically isolated output, which sends a pulse to the traffic signal controller signifying the passage or presence of a vehicle.

2.7. Bluetooth Detection

Bluetooth is an accurate and inexpensive way to measure travel time and make origin and destination analysis. Bluetooth is a wireless standard used to communicate between electronic devices like mobile phones, smart phones, headsets, navigation systems and computers etc. Bluetooth road sensors are able to detect Bluetooth MAC addresses from Bluetooth devices in passing vehicles. If these sensors are interconnected

they are able to calculate travel time and provide for origin and destination matrices. Compared to other traffic measurement technologies, Bluetooth has differences:

Accurate measurement points with absolute confirmation to provide to second travel times. In non-intrusive, which can lead to lower cost installations for both permanent and temporary sites?

It is limited to how many Bluetooth devices are broadcasting in a vehicle so counting and other applications are limited. Systems are generally quick to set up with little to no calibration needed.

Since Bluetooth device becomes more prevalent on board vehicles and with more portable electronics broadcasting, the amount of data collected over time becomes more accurate and valuable for travel time and estimation purposes.

2.8. Sensing Technologies

Technological advances in telecommunication and information technology, coupled with ultramodern state of art microchip, RFID Radio frequency identification and inexpensive intelligent beacon sensing technologies, have enhanced the technical capabilities that will facilitate motorist safety benefits for intelligent transportation systems globally. Sensing systems for ITS are vehicle and infrastructure based network systems, i.e. intelligent vehicle technologies.

Infrastructure sensors are indestructible such as in-road reflectors devices that are installed or embedded in the road or surround the road e.g., on buildings, posts and signs as required and may be manually disseminated during preventive road construction maintenance or by sensor injection machinery for rapid deployment. Vehicle sensing systems include deployment of infrastructure to vehicle and vehicle to infrastructure electronic beacons for identification communications and may also empty video automatic number plate recognition or vehicle magnetic signature detection technologies at desired intervals to increase sustained monitoring of vehicles operating in critical zones.

3.Design and Specification

3.1. Problem Statement

Due to the ever increasing population of motor vehicles in modern developed industrialized and urban areas, traffic congestion is recognized as one of the major problems. Travelling to different places within the city is becoming more difficult, there is a loss in productivity from workers, trade opportunities are lost, delivery gets delayed and thereby the cost goes on increasing which ultimately leads to frustration and imbalanced life.

Urban traffic control is one of the most challenging problems of the day. Roads and highways are unlikely to, expand much due to cost and dwindling land supply, so intelligent systems such as advanced traffic signal control is critical for operating current roadway systems at maximum capacity. In a street network with poorly timed traffic signals, fuel consumed by vehicles stopping and idling accounts for approximately 40% of network wide vehicular fuel consumption. Most of the junctions have reached a bottleneck stage. The case is evident from commuting experiences and the statistical surveys revealing the face that there are at least 34.77 lakh vehicles, 71% are two wheelers, 16% cars and 3% autos in a city like Bangalore alone. Road traffic control strategies like pre-timed, progression schemes, actuated, semi actuated control, traffic response, adaptive control strategies have inherent limitations even today. What is needed is an inexpensive model with less human intervention to control traffic. A perfect proportion of civilization and decentralization of control process is required.

3.2. Existing Method

Traffic pattern on Indian roads is highly heterogeneous in nature. There are around 30 million vehicles in India which are growing at the rate of 15-17% annually. The 23 metros contribute towards 35% of the total motor vehicles in the country. In terms of numbers on road two-wheelers dominate the scene with about 65% of the share in total number of vehicles whereas in terms of percent share of trips, buses cover maximum passenger kms of about 36% of total. Vehicular ownership is very low in this country with only 26 vehicles per thousand of population as against 533, 546, 623, 615 and 197 motor vehicles per 1000 of population in France, Germany, Malaysia and Singapore

respectively.

In India, work trips are the most important component of traffic demand during peak hours of the day. Transport demand is likely to increase by about 2.5 times from 1991 to 2010 in large metros and other medium sized cities by 3-3.5 times. Indian traffic and transport system has a number of drawbacks which causes problems of delays, unsafely, pollution and inadequate parking. Average number of road accidents per thousand of vehicles is around 23, which is one of the highest in the world. NMT are involved in about 6065% of the road accidents and share of pedestrians is also very high standing at about 40% .

3.2.1 Area Traffic Control System

ATCS is an indigenous solution for Indian Road Traffic, which optimizes traffic signal, covering a set of roads for an area in a city. It is an intelligent traffic signal control system that use data from vehicle detectors and optimize traffic signal settings in an area to reduce vehicle delays and stops. The control system operates in real time with the capacity to calculate optimal cycle time and feeds input to traffic controllers with a different set of stage timings. The timing plans of traffic controller change automatically to reduce stoppage time, which in turn reduces overall journey time. The road traffic controllers can be connected to ATCS server through managed leased line network. Thus traffic monitoring over an area can be made possible from a central location. The system facilitates storing of traffic data for individual junctions over a period of days, including traffic pattern during peak hours, which enables traffic engineers to view and analyzing the same .

The original technology on ATCS was developed by centre for Development of Advanced Computing, Thiruvananthpuram, WML is manufacturing the same and have supplied more than 200 controllers in cities such as Pune, Jaipur and Ahmedabad. The system supplied so far is working satisfactorily at different environmental conditions and hence filed proven. Traffic Signal Controllers are the electronic equipment kept at the junction to control duration of traffic signals. The controllers are designed using microprocessor based control circuits and can be operated in any one of the following modes e. g. Fixed time mode, Demand actuated mode, Forced flash mode etc. .

The function of the vehicle detector is to identify the presence or passage of vehicles and provide input for traffic actuated signal control systems. Different types of

vehicle detectors are currently available, but among them, the most popular and economical one is the conventional inductive loop vehicle detectors. The sensor loop is embedded on the pavement consisting of one or more turns of wire. Metallic parts of the vehicle resting or passing over the sensor loop get unbalanced the tuned circuit detector local oscillator resulting in detection. The size, shape and configuration of the loop vary considerably depending upon the specific application. The loop sensors, vehicle detectors together with control electronics sense the traffic load at the junction.

The communication network is the intermediate part which helps to communicate between the central control station and remote end junction controller. After analyzing the overall traffic flow in the corridor or in a city, the central control station updates the time plan to each and every junction controller through this UDP Internet Protocol based network communication link. The CCS consists of ATCS server, Operator Consoles, external storage device and projection etc. All traffic signal controllers are connected to CCS over managed leased line network at 64 Kbps. The status of individual junction controller, their loaded timing plan and stage utilization timings can be viewed at a glance from this central location.

3.2.2. Urban Traffic Control System

The WML's UTCS is a microprocessor based Road Traffic Control System with fixed time and Demand Actuated Control. The UTCS can be used as an independent system at isolated intersections or as part of synchronized chain of controllers for coordinated control of traffic. The UTCS supports both cabled and cable less CLF synchronization. It uses highly accurate crystal oscillator for the drift free operation of its real time clock for rime synchronization. Alternatively, the time synchronization can be achieved through GPS or broadcast from a central computer over PSTN line. The UTCS supports group level programming and has facilities to monitor Green-Green conflict and lamp burnout at software and hardware level. Controller has LCD Display with LED back lighting which gives very good visibility at outdoors.

The junction specific plans can be entered either through a built-in PC/AT keyboard or through the serial interface. Remote monitoring and control of UTCS controller is possible through dial up telephone network from a central computer. This facility supports plan entry from the remote computer.

3.3 Proposed Smart Traffic Junction

Fig 3.1 shows the block diagram of proposed system which comprises of Arduino, IR sensor, LCD display, LEDs, and a Bluetooth module. The proposed system controls three parameters namely, on pedestrian crossing, emergency vehicle clearance and traffic rules violation. For on road pedestrian crossing, the traffic signaling system will be working as usual based on the time delay logic but with an extra time slot provided for pedestrian crossing. The pedestrian signal control will be turned ON based switch which is pressed by pedestrian in case of emergency. All the above said operations will be carried out continuously.

If any emergency vehicle arrives at any side of the road it is detected using Bluetooth transmitter and receiver. A Bluetooth transmitter is placed in the emergency vehicle and receiver is placed in the signal pole at each side. The Bluetooth transmitter transmits the signal up to an extent. When the receiver receives the signal within this limit, the driver press the switch of the physical device like smartphone or module by which we get display of the message as "EMERGENCY" in the LCD display for 5 sec in the specified direction to alert the people and then the signal on that side will be switched to green and others to red.

If the density at a traffic junction becomes high, it will be detected by IR sensors which give instruction to Arduino which is programmed in such a manner that the more is the traffic density, more will be time given to that lane to clear traffic.

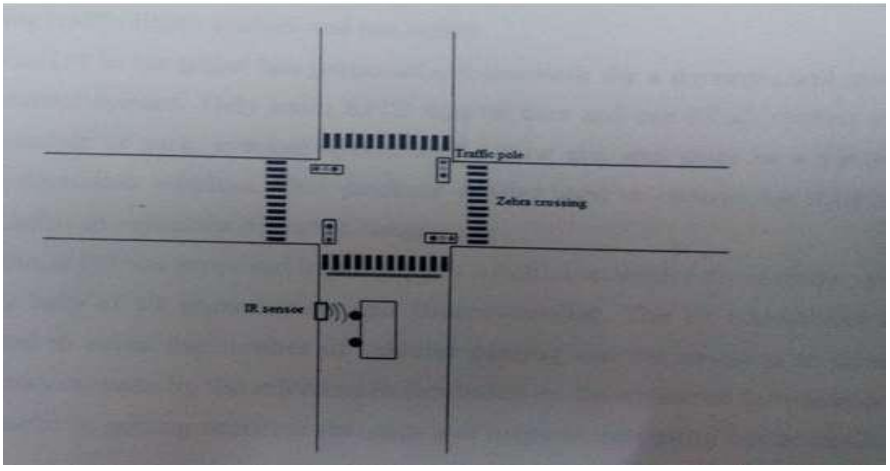


Fig. 3. 1. Traffic Density Measurement

4.Hardware Description

4.1 Traffic junction part

In the traffic junction part, A Bluetooth transmitter transmits the signal towards the vehicle. There are 12 LEDs, as shown in figure 4.1, used to display traffic signal at the 4 road junction . 3 LEDs are placed for each road. IR transmitters and receivers are used to detect the traffic density at the road and to release that particular road which has more density. Other than that, we have a Bluetooth module to connect the physical device like smart phone to arduino which will receive the signals and behaves according to the program. A switch is also used for each lane so that the pedestrian in each lane, in case of emergency, can turn it on to cross the road and it will get turn off after a short delay.

4.1.1. Block Diagram

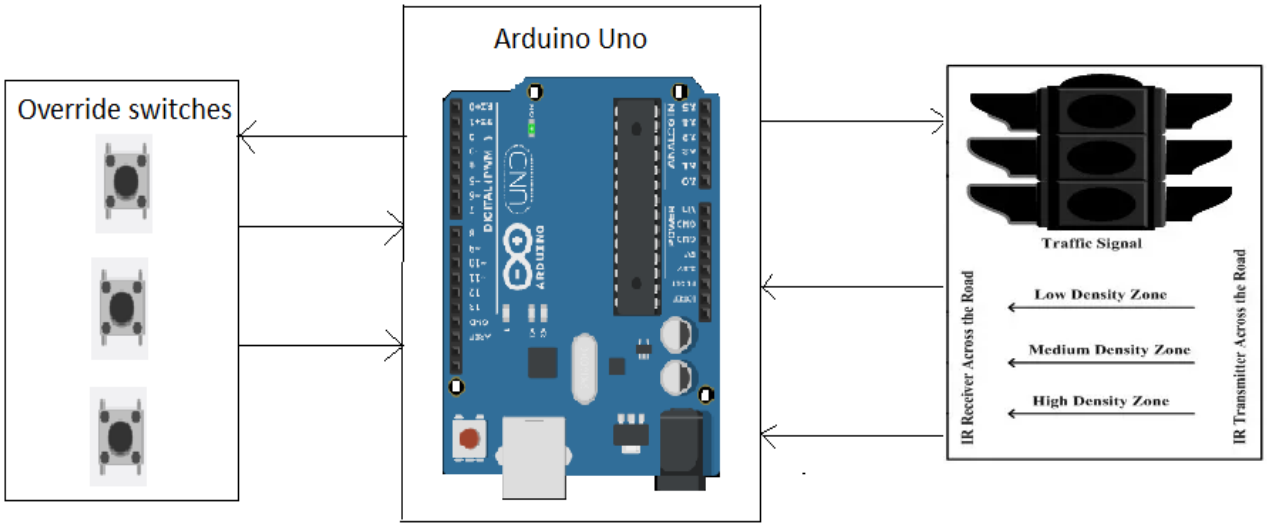


Fig 4.1 Block Diagram of density based traffic control system with emergency override

4.1.2 Circuit Diagram

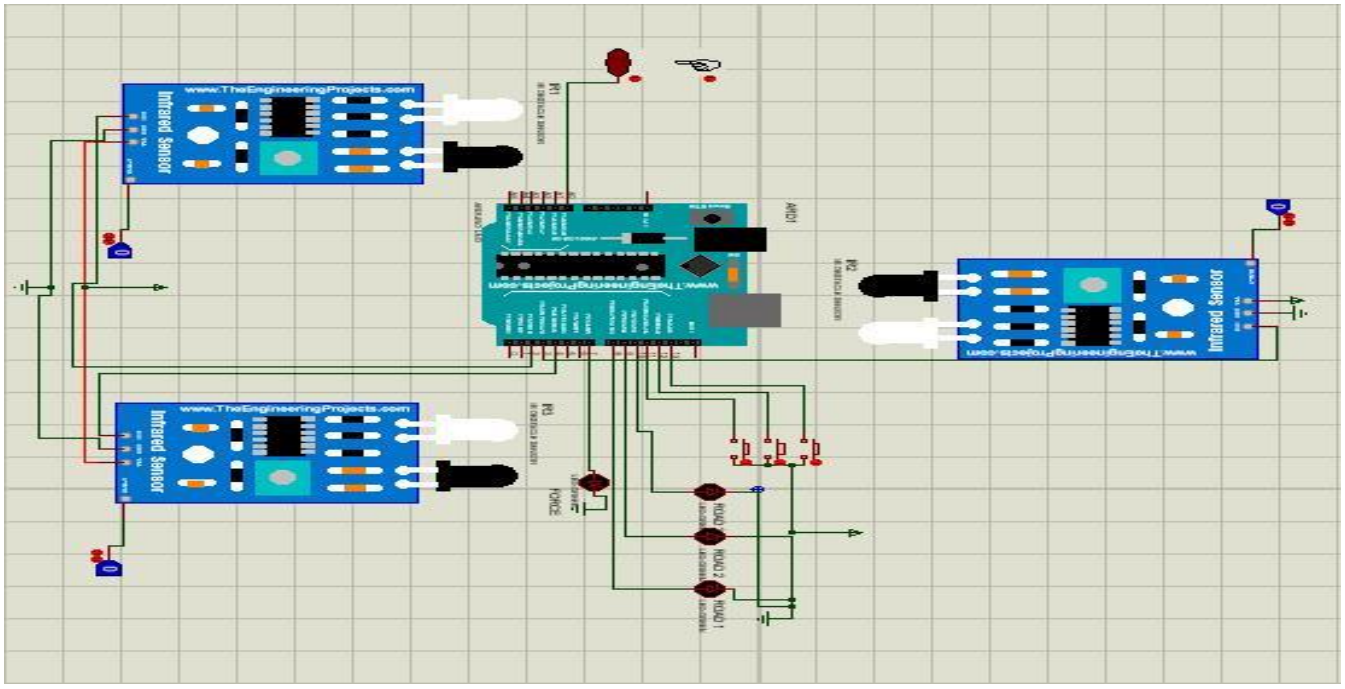
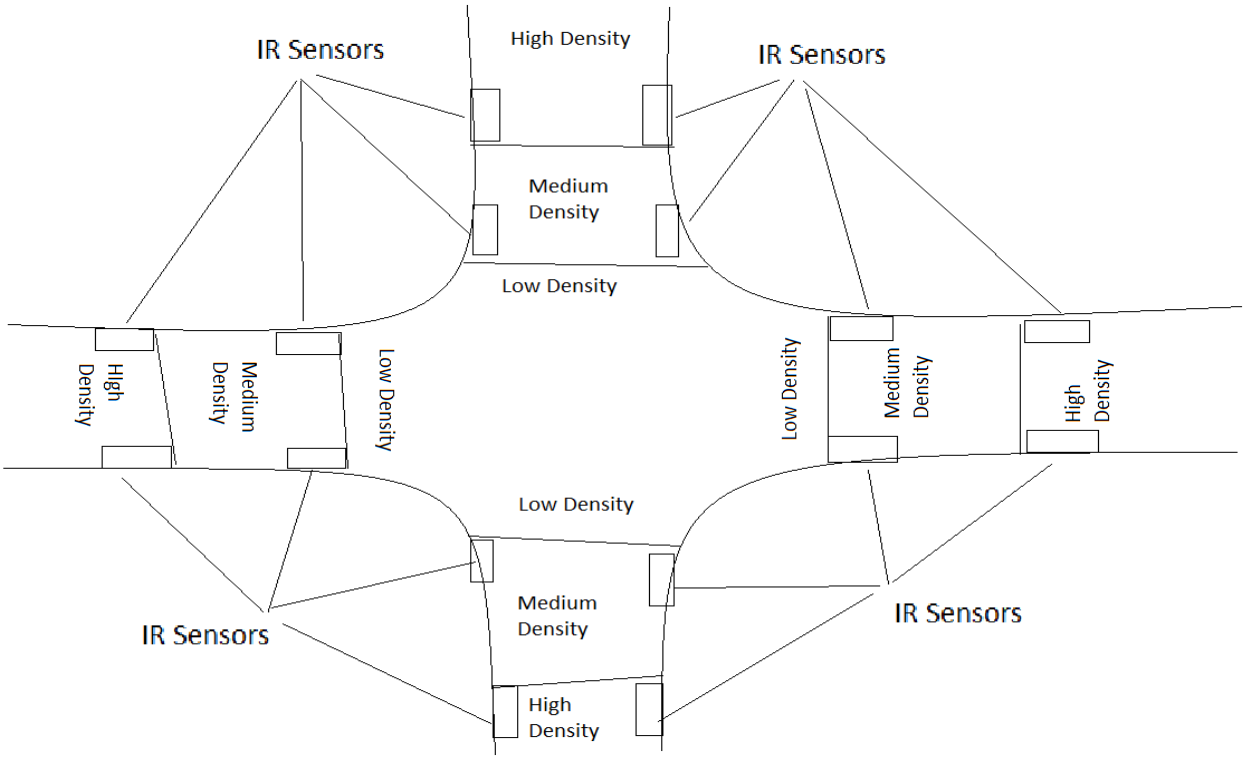


Fig.4.2 Circuit Diagram

4.1.3 Road Diagram



4.2.1 Hardware features

- Typical - 80dBm sensitivity.
- Up to +4dBm RF transmit power.
- Low Power 1.8V Operation, 3.3 to 5 V I/O. PIO control.
- UART interface with programmable baud rate.
- With integrated antenna.
- With edge connector.

4.2.2 Software features

- Slave default Baud rate: 9600, Data bits:8, Stop bit:1,Parity:No parity.
- PIO9 and PIO8 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.
- Auto- connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto- pairing PINCODE:"1234" as default.
- Auto- reconnect in 30 min when disconnected as a result of beyond the range of connection.

4.3. IR Sensors

IR sensors are used to sense the traffic density of every road in the junction and release the heavily dense road first. IR sensors work by using a specific light sensor to detect light wavelength in the IR spectrum. When an object is close to the sensor, the light from LED bounces off the object and into the light sensor. This results in a large jump in intensity, which is detected using a threshold value .

Operating Voltage: 5V

MODE SELECTION - Configurable HIGH / LOW Output State (Using AH and AL pins)

Adjustable Range using preset (potentiometer on board)

Since the sensor module works on INFRARED, for obstacles with reflective surfaces (white colored), the maximum range will be higher and for non-reflective surfaces (black colored), the maximum range will be lower. This can in turn be used for detecting white/black lines (in line follower ROBOTs) or bright/dark objects (in object identification ROBOTs)

Useful for various Robotic Applications, Room Visitor Counter Systems, etc

Fig. 4.4 IR Sensor

4.4 Arduino UNO

The Arduino UNO is a microcontroller board based on the AT UNO (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC to DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila

.

Fig. 4.5 Arduino UNO

Specifications

Microcontroller	AT UNO
Operating Voltage	5V
Input Voltage (recommended)	7-12V

Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash	256 KB of which 8 KB used by bootloader
SRAM Memory	8 KB
Clock Speed	16 MHz

POWER:

The power pins are as follows:

• VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access itthrough this pin.

•5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

•3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

• GND. Ground pins.

INPUT/OUTPUT

Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

• Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX). Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .

• External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

• PWM: 0 to 13. Provide 8-bit PWM output with the analogWrite() function.

• SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Duemilanove and Diecimila.

• LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

• I2C: 20 (SDA) and 21 (SCL). Support I2C (TWI) communication using the Wire library

(documentation on the Wiring website). Note that these pins are not in the same location as the I2C pins on the Duemilanove.

The UNO has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function

There are a couple of other pins on the board:

• AREF. Reference voltage for the analog inputs. Used with analogReference().

• Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

4.6 Switch

These small, two-pin, SPST momentary pushbuttons are intended for mounting to PCBs, but they can also be plugged into standard 0.1" breadboards as shown in the picture to the right. We use them as reset buttons and user pushbuttons in several of our products, including the 3pi robot and most of our Orangutan robot controllers. Note that this button should not be used with voltages above 12 V, and it should not be used to switch currents greater than 50 mA.

- Activation force: 6 oz
- Maximum rating: DC 12 V / 50 mA
- On resistance: ≤ 50 mΩ
- Off resistance: > 100 MΩ
- Life: > 100,000 cycles

Fig 4. 8. Switch

4. 7. Light Emitting Diode

A Light-emitting Diode is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting. Early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness.

When a light-emitting diode is forward biased switched on, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electro luminescence the colour of the light corresponding to energy of the photon is determined by the energy gap of the semiconductor. An LED is often small in area less than 1 mm * 1 mm and integrated optional components may be used to shape its radiation pattern. LEDs present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching and greater durability and reliability.

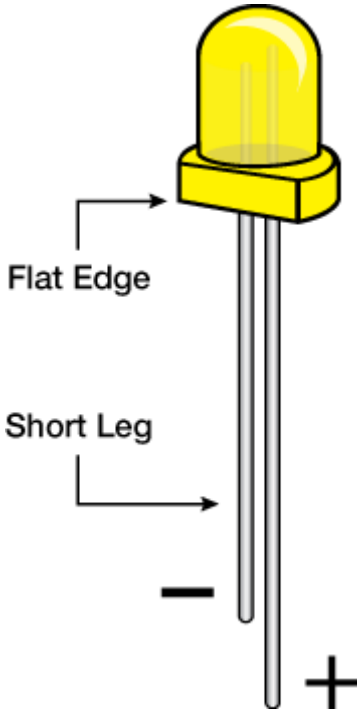


Fig. 4.9 Light Emitting Diode

LEDs are used in application as diverse as replacements for aviation lighting, automotive lighting particularly brake lamps, turn signals and indicators as well as in traffic signals. Infrared LEDs are also used in the units of many commercial products including T.V. , DVD player and other domestic appliances.

Features

- Popular T-1 3/4 colorless 5mm package
- High luminous power
- Typical chromaticity coordinates x=0.30, y=0.29 according to CIE1931.
- Bulk, available taped on reel.
- ESD-withstand voltage: up to 4KV .
- The product itself will remain within RoHS compliant version.

Descriptions

- The series is designed for application required high luminous intensity.
- The phosphor filled in the reflector converts the blue emission of InGaN chip to ideal white.

5.Software Implementation

5.1. Software Requirements

Arduino IDE

The Arduino IDE is a cross-platform application that is written in Java programming language. This is originated from processing open source IDE. This processing IDE used for to code interactive programs with 2D, 3D or PDF output, this is compatible with GNU linux, MAC OS X, and Windows.

It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

A program written with the IDE for Arduino is called a *sketch*. Sketches are saved on the development computer as text files with the file extension *.ino*. Arduino Software (IDE) pre-1.0 saved sketches with the extension *.pde*.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Embedded C

The embedded C language is used for program coding. Use of C in embedded system is driven by following advantages: It is small and reasonably simpler to learn, understand , program and debug. C Compilers are available for almost all embedded devices in use today and there is a large pool of experienced C programmers.

Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/microcontroller or any system. This makes it convenient for a user to develop programs that can run on most of the systems. As C combines functionally of assembly language or high-level assembly language. It is fairly efficient. It supports access to I/O and provides ease of management.

Embedded C has to use with limited resources RAM, ROM, I/Os as an embedded processor. Thus, program code must fit into the available program memory. If code exceeds the limit, the system is likely to crash. Assembly language seems to be an obvious choice for programming embedded devices. However, use of assembly language is restricted to developing efficient codes in terms of size and speed. Also, assembly codes lead to higher software development costs and code probability is not there. Developing small codes are not much of a problem, but large programs/projects become increasingly difficult to manage in assembly language. Finding good assembly programmers has also become difficult to manage in assembly language. Hence high level languages are preferred for embedded systems programming. Embedded C requires compilers to create files to be downloaded to the microcontrollers/ microprocessors where it needs to run. Embedded compilers give access to all resources which is not provided in compilers for desktop computer applications .

6.Flow Diagram

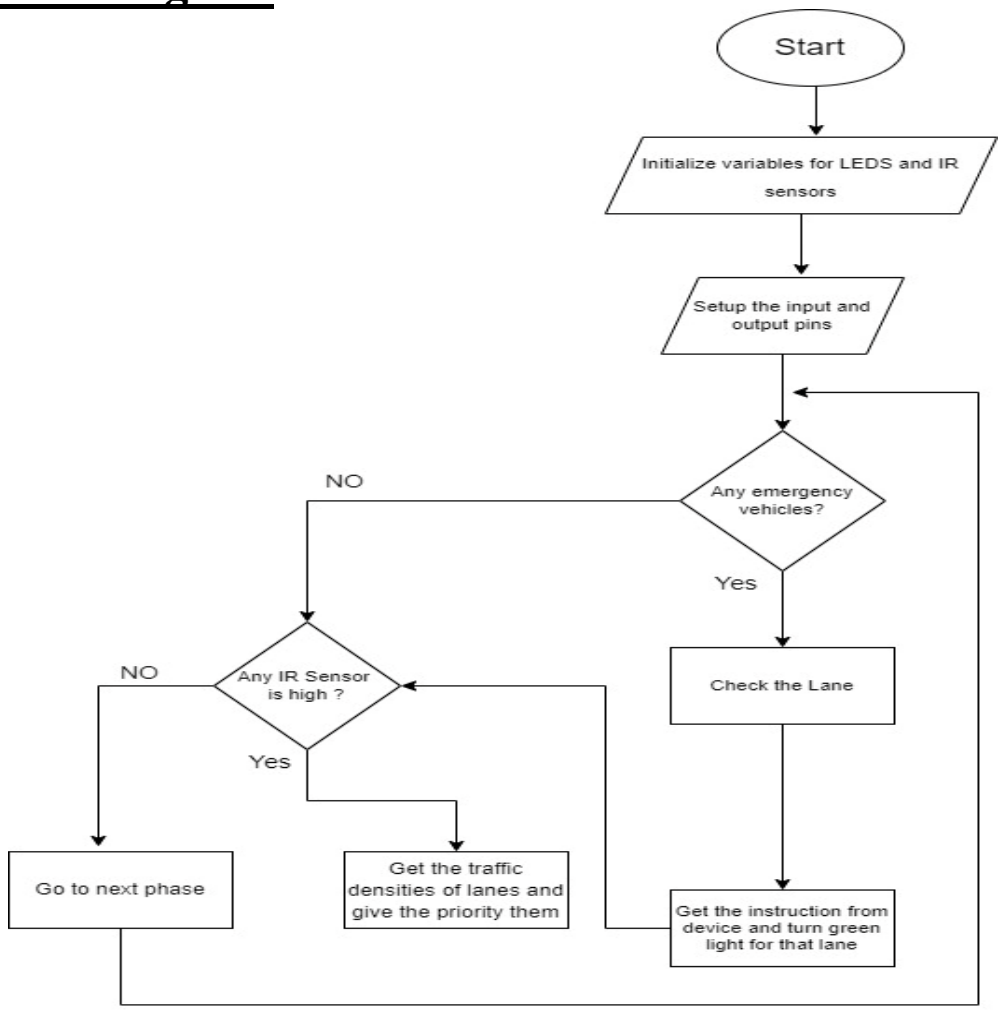


Fig. 5.1 Flow Diagram of Density Based Traffic Junction with Emergency Override

7.Implementation and Results

The traffic lights will be displayed at the junction and works in normal timings or in regular intervals when density of each is lane is low.

When the density increases, the IR sensors will work and hence, they will give input to Arduino so that an appropriate time delay should be given to that lane to clear the traffic as in priority.

When an emergency vehicle comes, it will connect to Arduino with the help of a mobile device and a Bluetooth module (HC-05). As it connects, signal is given to Arduino, on which lane the emergency vehicle is coming and then the Arduino will stop its all activities and give priority to Emergency vehicle to get pass through by giving the green signal of that lane to a much longer time. This is given in fig. 6.3.

In case of a pedestrian, when he/she will turn on the switch, the signal will becomes green for walking purpose.

Here L1, L2, L3, L4 are signals a LANE1, LANE2, LANE3, LANE4.

R, Y and G are the color of signals at that lane i.e. Red, Yellow and Green, where Red is to stop, Yellow is to wait and Green is to go.

Serial Number	L1	L2	L3	L4	Expected Result	Obtained Result
1	G	R	R	R	GRRR	GRRR
2	Y	Y	R	R	YYRR	YYRR
3	R	G	R	R	RGRR	RGRR
4	R	Y	Y	R	RYYR	RYYR
5	R	R	G	R	RRGR	RRGR
6	R	R	Y	Y	RRYY	RRYY
7	R	R	R	G	RRRG	RRRG
8	Y	R	R	Y	YRRY	YRRY

8.Application and Advantages

8.1. Applications

- For traffic signal monitoring and controlling.
- If a number of signals are synchronized, it is possible to build a smart city.
- Automated driving vehicles can communicate with the signals wirelessly, so indicators may become redundant.
- It can also be used at highways for having less wastage of time.
- In case of emergency, a pedestrian can cross the road by just turn a switch on.
- Emergency vehicles like ambulance or fire brigade truck can pass through the signals without any kind of wastage of time.

8.2 Advantages

- Avoids wastage of time due to the traffic
- Fully automatic
- Low power consumption
- It provides the easy access in the traffic light.
- Low cost to design the circuit, maintenance of the circuit is good
- Easy convenience to handle
- Fuel saving
- Help for disabled people to cross the road easily
- Reduced accident

9.Conclusion and Future Scope

9.1 Conclusion

Density Based Signal Management in Traffic System with emergency override shows how the Traffic Light Signal control, including with the implement of Emergency vehicle get passed through signals. The acquired data from IR Sensors reschedule the traffic light timing according to the traffic condition for low or high density road traffic. If the density of the road traffic is high then Maximum density of traffic will allow maximum default timing for traffic lights.

Minimum density of traffic will allow traffic with minimum timing for traffic lights. If the traffic rate on both side is Equal or gap within traffic then according to arrival time traffic light signal set to minimized. Emergency Override can be done by Bluetooth device which keeps green signal on till the vehicle get passed up through signals. A pedestrian can cross the road by turning the switch on in the case of emergency.

9.2 Future Scope

Emergency services are provided for ambulance by giving a signal to Arduino by Bluetooth. Two or more junctions can be designed to use a single Bluetooth instead of independent one for each junction. We can use other technologies like Wifi or LTE for sending a signal from ambulance to the microcontroller chipset. In future implementation, different priorites can be given to vehicles as follows Ambulance, fire brigade.

Number of passing vehicle in fixed time slot on the road decide density range of traffic and on the basis of vehicle count, chipset Arduino will decide the traffic light delays for next recording interval, The recorded data can be downloaded to computer through communication between sensors, microcontroller and computer. Administrator sitting on computer can command system microcontroller to download recorded data, update lights, erase memory etc. Thus administrator on a central station computer can access traffic conditions on any approachable traffic lights and nearby reduce traffic congestion to an extent. This can be done through RADIO as shown in fig. 8. 1. Data

transfer between the microcontroller and computer can also be done through telephone network, data call activated SIM. This technique allows the operator to gather the recorded data from a far end to his home computer without going there.

In case of pedestrians, in future, if density of pedestrians increases on footpath at a cross junction, it can be sensed by sensors and further the lights can be managed according to that.

10.References

10.2.1 W. Pattara, Estimating road traffic congestion using vehicle velocity, International conference on its telecommunication, 2006, pp 1001-1004.

10.2.2 K. M. Yousef, J. N Al-Karaki and A. M. Sharnawi, Intelligent traffic light flow control system using wireless sensor network, JISE, May 2010, pp 753-768.

10.2.3 P. Sinhmar, Intelligent traffic light and density control using IR sensors and microcontroller, IJATER, Vol 2, Issue 2, Mar 2012, pp 30-35.

10.2.4 Amrita Rain and Govind Singh Patel, Multiple Traffic control using wireless sensor and density measuring camera, sensors & transducers, IFSAm Vol 94, Issue 7, July 2008, pp 126-132.

10.2.5 Morarescu, Highway traffic model- based estimation, IEEE, American control conference (ACC), 2011, pp 2012-2017.

10.2.6 S. Breitenberger, Traffic information potential and necessary penetration rates, Traffic emerging and control, Dec 2004, pp 390-395.

10.2.7 Sanjay S. Dorle, Pratima L. Patel, Design Approach for Dynamic Traffic Control System Based on Radio Propagation Model in VANET, International Journal of Computer Science and Network, Vol 2, Issue 1, 2013.

10.2.8 Shruti K R & Vinohi.K. , Priority Based Traffic Lights Controller Using Wireless Sensor Network

10.2.9 Zhang, Yuye, and Weisheng Yan., Research of Traffic Signal Light Intelligent Control System Based on Microcontroller, First International Workshop on Education Technology and Computer Science,2009, pp 301–303.