VISVESVARAYA TECHNOLOGICAL UNIVERSITY
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A PROJECT REPORT ON

"MANAGING CONGESTION IN TRAFFIC"

Submitted in partial fulfilment of requirement of 8th semester of B.E course during the year 2019-2020

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CERTIFICATE

This is to certify that the project work entitled "**MANAGING CONGESTION IN TRAFFIC"** is a bonafied work carried out by, **SHEETAL PAWAR (3GN15EC074), GAGANDEEP SINGH (3GN14EC021), NETRA CHILSHETTY (3GN16EC040)** in partial fulfilment for the course **ELECTRONICS AND COMMUNICATION ENGINEERING** by **VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI** during the year 2019-20. The project report has been approved as it satisfies the academic requirements in respect of internship work prescribed for the Bachelor of Engineering Degree.

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EXTERNAL VIVA

Name of examiner	**signature with date**
1)……	……
2)……	……

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ABSTRACT

Traffic congestion has been one of the major issues that most metropolises are facing in spite of measures being taken to mitigate and reduce it. In the recent past, traffic congestion has emerged as one of the main challenge for engineers, planners and policy makers in urban areas. Modern social and economic structures, shaped by car-oriented urban development and rapid growth in vehicle ownership, have established congestion as an inescapable reality of urban life. The growing impact of congestion is seen in terms of deteriorating urban air quality besides other adverse effects on quality of urban living.

The main focus of this study is aimed at understanding the recurring urban congestion, its measurement and mitigation. Literature review on this problem reveals some interesting insights. One of the important outcome was that there is no single, broadly accepted definition of traffic congestion. Traffic congestion can generally be defined as excess of demand for road travel. Many professionals and organizations have defined congestion in different ways based on variety of criteria. There have been attempts to develop congestion measurement indices for heavily motorized countries. In less motorized countries, there are not many documented studies on how to measure congestion and plan for its mitigation. Identification of traffic congestion threshold is an essential requirement for defining the congestion and suggesting appropriate mitigation measures.

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Chapter 1

INTRODUCTION

Cities and traffic have developed hand-in-hand since the earliest large human settlements. The same forces that draw inhabitants to congregate in large urban areas also lead to sometimes intolerable levels of traffic congestion on urban streets and thoroughfares. Effective urban governance requires a careful balancing between the benefits of agglomeration and the dis-benefits of excessive congestion. Traffic Congestion is one of the major issues experienced in most metropolitan cities in the developing nations. Traffic Congestion involves queuing, slower speeds and increased travel time which wastes energy of the commuters and causes stress, thus reducing the overall productivity and imposing an intangible cost on the society. It also affects various other factors like environment, usage of natural resources, quality of life and safety of commuters as well as pedestrians, directly and/or indirectly. Hence, Urban Traffic Congestion possesses a challenge for all large and growing urban areas and thus many measures have been taken over years to attenuate the same. As congestion continues to increase, the conventional approach of 'building more roads' does not always work due to varying circumstances. In fact, building new roads can actually compound congestion in some cases by inducing greater demands for vehicle travel that quickly eat away the additional capacity. This is becoming more and more apparent in the form of greater congestion and delays observed in major cities. Besides this, suitable corridors in such cities for major roadwork are becoming increasingly difficult to be obtained, thus increasing the cost of construction.We will build an Arduino Traffic Light Controller and in this post, you are going to learn about how to make a density based traffic light controller using Arduino. The main purpose of this project is, if there will be no traffic on the other signal, one shouldn't wait for that signal. The system will skip that signal and will move on the next one. Arduino is the main part of this project and it will be used to read from ultrasonic sensor HC-SR04 and calculate the distance. This distance will tell us if any vehicle is near the signal or not and according to that the traffic signals will be controlled. The main task was to avoid use of delay because we have to continuously read from the ultrasonic sensors and also at the same time, we have to control signals which requires the use of delay function. So we have used the timerone library which is used to repetitively measure a period of time in microseconds and at the end of each period, an interrupt function will be called. In this function, we will read from the sensors and in the loop function, we will control the traffic signals.

Chapter 2

LITERATURE SURVEY

[1] Review of traffic management control techniques

The Iris/ARTES 10 programme of the European Space Agency (ESA) aims to develop a satellite system for air traffic services (ATS) and aeronautical operational control (AOC) complementing the existing and future aeronautical communications infrastructure. This paper presented the approach to and the results of the Iris communication capacity assessment conducted in the first phase of the programme. The approach discussed within this paper was based on a combination of the message exchanges defined in the ldquo communications operating concept and requirements for the future radio systemrdquo document (COCR) of EUROCONTROL and FAA and realistic air-traffic scenarios. The generated voice, data and air traffic was intended for two major purposes: first to identify capacity and protocol requirements for the design of the Iris communication system and secondly as input for the system performance evaluation (2008).This research presented an overview of the design and function of the Intelligent Roadway Information System (IRIS). IRIS provides Advanced Traffic Management System (ATMS) capabilities to the California Department of Transportation's (Caltrans) rural Districts 1, 2, 5, and 10. Most ATMS programs are not suited to rural areas and IRIS presents a low-cost alternative that provides significant operational capabilities to rural districts. IRIS was developed by the Minnesota Department of Transportation and Caltrans has submitted functional enhancements to be integrated into the official code. Full deployment to each rural district has been successful with a reduction in the number of traffic management software applications and servers in those districts (2014). The "Intelligent Container" is a sensor network used for the management of logistic processes, especially for perishable goods such as fruit and vegetables.The system measured relevant parameters such as temperature and humidity. The concept of "cognitive systems" provides an adequate description of the complex supervision tasks and sensor data handling. According to research, the cognitive system can make use of several algorithms in order to estimate temperature related quality losses, detect malfunctioning sensors, and to control the sensor density and measurement intervals.

[2] Traffic congestion: causes and solution

Congestion impacts the movement of people. Traffic congestion not only causes pollution, but also wastes time and energy. The major factor for traffic congestion in Hinjewadi today is the imbalance seen in its Modal Split Ratio -a very low ridership in public transport due to poor service quality and less frequency - which leads to an increase in the number of private vehicles causing congestion which furtherleads to an increase in travel time and emission of exhaust gases causing air pollution. Change in

commuters' thinking and their behavioral pattern is studied by extensive surveying.Vehicle Composition and Occupancy Factor of commuters is also analyzed to understand the traffic flow in the area. The Origin-Destination matrix was drawn and the visuals were created using VISSIM Software. Solutions for increasing congestion in the area are given by suggesting optimal infrastructural changes, enhancing the use of public/semi-public transportation, and increasing the Occupancy Factor of vehicles. The future development of the IT-sector and the impact of Pune Metro Rail are also taken into account. Hinjewadi is a suburb located in Pune (India), mainly known for its IT-Park (Rajeev Gandhi Infotech Park). The 2800 acre IT-Park in Hinjewadi houses more than 120 companies of different sizes. The Infotech Park is subdivided in three phases, with four further phases planned. According to a survey conducted by OLA Cabs in the year 2017-Shivaji Chowk, located in the IT-Park is considered amongst the seven biggest bottlenecks in India. The average speed of vehicles in Pune during peak hours is 22 kilometres per hour (kmph) while that in Hinjewadi is just 16 kmph. In some areas, the average speed drops as low as 6 kmph.

On an average, the commuters spend more than an hour to travel a distance of 2 km between Wakad Taking into account the various parameters and the extent of the project, a list of research papers is studied. Literature survey is the most important part of the project as it shows a direction to proceed and set achievable objectives. Various papers related to traffic congestion measurements and solutions were considered to get a broader outlook towards the problem. This was followed by Reconnaissance Survey which included study of the area, interaction with locals, officials and experts, study of previous investigations, etc. The Preliminary Survey included collecting data by conducting various surveys like Volumetric Study, Road-Side Interview Surveys, Occupancy Factor Survey, Origin-Destination Survey, Speed and Delay Survey, Accident Survey, etc. Based on the observations made during the field reconnaissance and analysis of data, the most obvious problems have been identified and optimum solutions were then formulated. The costs of these alternatives, their impact on the traffic flow and congestion, etc. were calculated using various software.

[3] Traffic congestion and possible solution (a case study of Asansol)

The main objective of the study is to identification the actual cause behind the congestion and provided the practical solutions for Asansol city to reduced congestion. This paper is generated on the basis of primary and secondary data. The first step selecting the indicator to highlight the congestion that is the flow diagram, and snapping the images. To carry out primary data the data has been collected through survey method-counting the vehicles movements from 9.30a.m to10.30a.m comprising a total no of 3247 vehicles, standing on the different meeting points of study area to show volume of movements. Snapping the images at peak hour and also non-peak hour to show comparison of different situation on different time. To know the actual situation and get possible suggestions about the problem no of listed questions have been asked among 60 peoples randomly which

are pedestrians, bus drivers, vehicle owners, and retailers since 4 days. The secondary data have been collected from journals available on internet, R.T.O Office, Bus Association Office about vehicles number, Bus number are running on city road for daily purpose. All the methods are carried out in systematic way first data collection, data processing, data analysis, and last presenting the data in a right way. Asansol city is the second largest city in west Bengal after capital city Kolkata, lies between the longitude 86.99E -23.68Nlatitude, between the Damodar and Ajoy River. According 2011 census the population 1156,387 with density 3,500sqkm. Asansol ranked 11th among Indian cities and 42nd in world fastest growing cities.

[4] Research on urban road traffic congestion of Hyderabad a case study

There are several causes for traffic congestion in Hyderabad city which leads to loss of time, fuel etc. Illegal parking The main cause of illegal parking is insufficient parking space available for parking of vehicles. Illegal parking is one of the main causes of traffic congestion in Hyderabad. Illegal parking's are mostly done in front of cinema halls, petrol pumps and footpaths etc. Due to this traffic flow is interrupted and slows down the speed of vehicle until the wrongly parked vehicles are removed. Accidents- Accused. Disobeying traffic rules Another reason for traffic congestion is disobeying the traffic rules most of the two wheelers taxi and auto drivers don't obey the traffic rules to minimize their journey time. They choose shortcut and take wrong turns in prohibited areas which lead to traffic congestion. Sometimes they pass through a narrow gap provided in between medians which leads to accidents.Traffic congestion also depends upon seasonal factors there is huge traffic congestion during rainy season compared to any other seasons in Hyderabad. During the rainy reason most of the underground drainage systems are failed due to excess runoff of rain water which leads to obstruction in traffic flow and sometimes attractive seasonal offers provided by shopping malls leads to insufficient parking space, then high demand for parking space is generated leads to illegal parking of vehicles on road side and footpath. Pavement failures Pavement deformation leads to traffic congestion deformation in terms of corrugations, depressions, rutting and shoving etc.

[5] Analysis of traffic congestion and remedial measures at traffic, Mor in pabna city,bangladesh

The economic development of a country mostly depends on the good transportation system. Development of new transportation system involve huge amount of money and time. Most of the cases the invested money is irreversible. The developing country like Bangladesh the best approach is to improvement of existing facilities we have. Pabna, one of the rising cities in Bangladesh. As a result the population

in Pabna increasing day by day, so as the traffic congestion. Traffic Mor is one of the major intersection in Pabna city. In overall context Traffic Mor road intersection plays an important role in existing traffic system of the city. Traffic Mor road intersection is tee type road intersection at level. Traffic flow of this intersection is mixed traffic flow and both way is two way. In this study an attempts are made to investigate the geometric elements, traffic congestion, and traffic control devices at Traffic Mor road intersection. Pabna is a town in Rajshahi Division of Bangladesh and the administrative capital of eponymous Pabna District. It is located on the north bank of Padma River. Pabna is a city having a population of 186,781 (2012, en. Wikipedia) and area of 18.64 sq km (en. bengaliwiki.com) and there are three major roads connecting with other districts.Pabna is characterized as an important trade and manufacturing center of Bangladesh. The district lies under the zone of influence of the Rajshahi City which is one of the fast developing cities in the country. The district is dotted with many industrial units for its easy transportation linkages with other parts of the country. It also plays a vital role on food security for both Rajshahi and Pabna

[6] An assesment of traffic congestion and its effect on productivity of urban Ghana

Whereas traffic congestion disrupts business activities and reduces productivity level, research has shown that it may also be a symbol of growth in an economy. As the economy grows and real income of household increases, vehicle population surges up, contributing to traffic congestion, particularly within cities. Given the critical importance of productivity on the Gross Domestic Product (GDP) growth, it is economically worthwhile, and of policy importance to recognize the deleterious effect of traffic congestion on productivity. This study attempts to assess the extent to which congestion affects worker productivity. The study focuses on the transportation system in Kumasi Metropolis, Ghana. Kumasi was chosen for the research due to its strategic location as a transit point to the north, south, central and western parts of Ghana, which makes it prone to traffic congestion. The study adopted survey strategy on five major road links in the metropolis. Primary data was collected using questionnaire instrument. Descriptive statistics was used to analyse the data with the aid of Statistical Package for Social Sciences (SPSS). The results from the analysis indicated that mobility in Kumasi Metropolis is restricted due to congestion, causing excessive travel delays, particularly, during peak hours and negatively affecting productivity. Therefore, expanding transport infrastructure as well as improvement in the traffic management and control system should be given attention to improve the transportation system in the metropolis. This would enhance worker productivity and ultimately increase GDP.

[7] Traffic congestion – causes and solutions: a study of talegaon dabhade city

Cities and traffic have developed hand-in-hand since the earliest large human settlements. The same forces that draw inhabitants to congregate in large urban areas also lead to sometimes intolerable levels of traffic congestion on urban streets and thoroughfares. Effective urban governance requires a careful balancing between the benefits of agglomeration and the disadvantages of excessive congestion. Road traffic congestion poses a challenge for all large and growing urban areas. The full report on which this summary is based aims to provide policymakers and technical staff with the strategic vision, conceptual frameworks and guidance on some of the practical tools necessary to manage congestion in such a way as to reduce its overall impact on individuals, families, communities and societies. Urban traffic congestion is a significant and growing problem in many parts of the world. Moreover, as congestion continues to increase, the conventional approach of "building more roads" doesn't always work for a variety of political, financial, and environmental reasons. In fact, building new roads can actually compound congestion, in some cases, by inducing greater demands for vehicle travel that quickly eat away the additional capacity? Against this backdrop of serious existing and growing congestion traffic control techniques and information systems are needed that can substantially increase capacity and improve traffic flow efficiency.

[8] Traffic congestion problem and solution

One of the big problems facing city municipalities is the traffic congestion. It makes life in cities uncomfortable for people. Every year governments spend huge budgets to solve this problem. Koya is suffering from this problem especially at rush traffic hours. In this paper, the traffic congestion problem is studied for the road connecting Sawz Square and Shahidan Square in Koya city. The congestion is measured by determining the level of service of the street (LOS) through calculating the traffic flow rate of the street and free flow rate; the LOS level was D. For determining peak hour traffic volume the calculation is made through the manual counting of vehicles and multiplying by passenger car equivalent (PCE) where the speed is reduced to (10 km/hr). In addition, the topography, elevations and alignments of the road are studied. This paper determined the real causes of the traffic congestion in this specific street in Koya city and proposed solutions for solving the problem. Keywords: traffic congestion, peak hour traffic, traffic jam, urbanization. Koya is one of the cities of the Kurdistan region. The main road connecting two major cities of Kurdistan, Sulaimanya and Erbil is going through this city and exactly through this street. Satellite image showing the strategic location of the city. The increase in the individuals' income pushed people to buy passenger cars. The development in road infrastructure in the city is not adequate to accompany the high number of vehicles in the city. Since the end of 80s, there is no noticeable infrastructure development in the city especially in the downtown roads. The city grew randomly without planning and new quarters were built with a little planning while city development needs a deep plan. The congestion problem is a common problem among developed and underdeveloped countries, so, it's a global problem.

[9] The cause effect and possible solution to traffic condition on nigeria road (A Case Study of Basorun-Akobo Road, Oyo State)

Due to increase in population and the attraction of human activities into urban region which in turn leads to the growth of vehicle ownership and use, there is demand for road space which has led to increase in the number of public transport operation. Consequently, the demand for road space is greater than the supply because the rate of provision of transport facilities is less than the rate of growth of vehicle ownership and use which result into traffic congestion. Traffic congestion is the impedance of vehicles imposed on each other due to speed-flow relationship in conditions where the use of transport system approaches capacity. Traffic congestion in Nigeria, taking Basorun-Akobo Road in Ibadan Oyo State as a case study has been analysed using experimental and theoretical approaches. These involve traffic counting and delay survey. In order to carry out effective research work on the case study road, the method adopted were traffic counting and traffic delay survey. The effect of traffic congestion on the study area are Waste of time, Delay movement, Accident, Inability to forecast travel time, Fuel consumption, Road rage and environmental pollution. Possible solutions to traffic congestion on the case study area is to: Dualize the Road, Provide Adequate Parking Space, Construct proper Drainage and Install Traffic Control Devices. Introduction Road became important means of transportation during the reign of Roman Empire. Roman's kingdom modernized, used road effectively compared to the existing usage of road whereby ox, man, chariot, camel, bull were used as major carrier in road transportation. But the invention of the motor vehicle meant that roads were no longer meant for pedestrians, chariot and animals. The invention called for improvement of the state of the roads, which led to increased speeds and danger to road users. This then called for a proper construction and control of traffic to increase efficiency of the roads in traffic performance.

[10] Case study on traffic management for rectification of congestion on road stretch

Traffic volume study: It is used to determine the number of movements, pedestrian on vehicular traffic flow & classification of roadway vehicles & it also helps to identify critical flow & time period. The traffic volume data should be collected during peak & non-peak hour with time interval 30 min. This study is conducted to examine the existing traffic data and to identify any improvement necessarily to accommodate existing or projected traffic volume and traffic calming device.After analyzing the date we proposed the design of traffic lights to rectify the congestion. This study is done because traffic volume is useful in design of pavement, geometric design, computing road capacity, planning one way street, regulatory measures, sidewalks cross walks, subways, pedestrian signals, intersection and deciding on signal timing and channelization. It has seen that the future traffic projection based on previous or present day traffic volume studies in necessary for an estimate of the existing facilities. It also seen that the projection of traffic can lead to policy decision with respect to the requirement of bypasses to the city and

increase the road capacity. The purpose of this study is to analysis the traffic pattern and trends for the planning of traffic operation and controls of signaling. There are different types of method is used for collecting the data like Manual count &Automatic count. In this study we used manual count. The data is collected on road Chandigarh Landran – Banur and Sirhind –kharar . Two points in considered in every road A & B, the distance between each point is 1km. On those two points the two students one stand at the start of the line and other will stand at the end of the line. If the different types of vehicle is used for collecting the data the number of students or person will increase. The number of vehicles has to be counted manually, the data collected for different types of vehicles like Bull Carts, Two Wheelers (TW), Four Wheelers (FW), Low Motor Vehicles (LMV) and High Motor Vehicles(HMV). The time interval is taken 30 min & it is a two lane road.

Chapter 3

PROBLEM IDENTIFICATION

The traffic congestion is a situation on road networks when physical uses of road by vehicles increases. It occurs when road networks are no longer capable to accommodating the volume of movements that used by them and it is characterized by slow speed, long trip timing and high vehicular queuing.

The purpose of this project is to develop a series of systems model for traffic passing through a 4-way intersection, controlled by traffic light. We will assume that arrangement of traffic lights and road lanes is fixed and that the lights switch from red to green to amber in a regular repetitive pattern. Moreover, we assume that driver behavior is constrained by the road rules (we keep this part really simple) and the desire to avoid vehicle collisions. A space cushion is certain amount of distance you keep between you and the car in front of you that allows you to easily maneuver in any condition. A typical space cushion in perfect conditions would be about 3 seconds between you and the car in front of you.

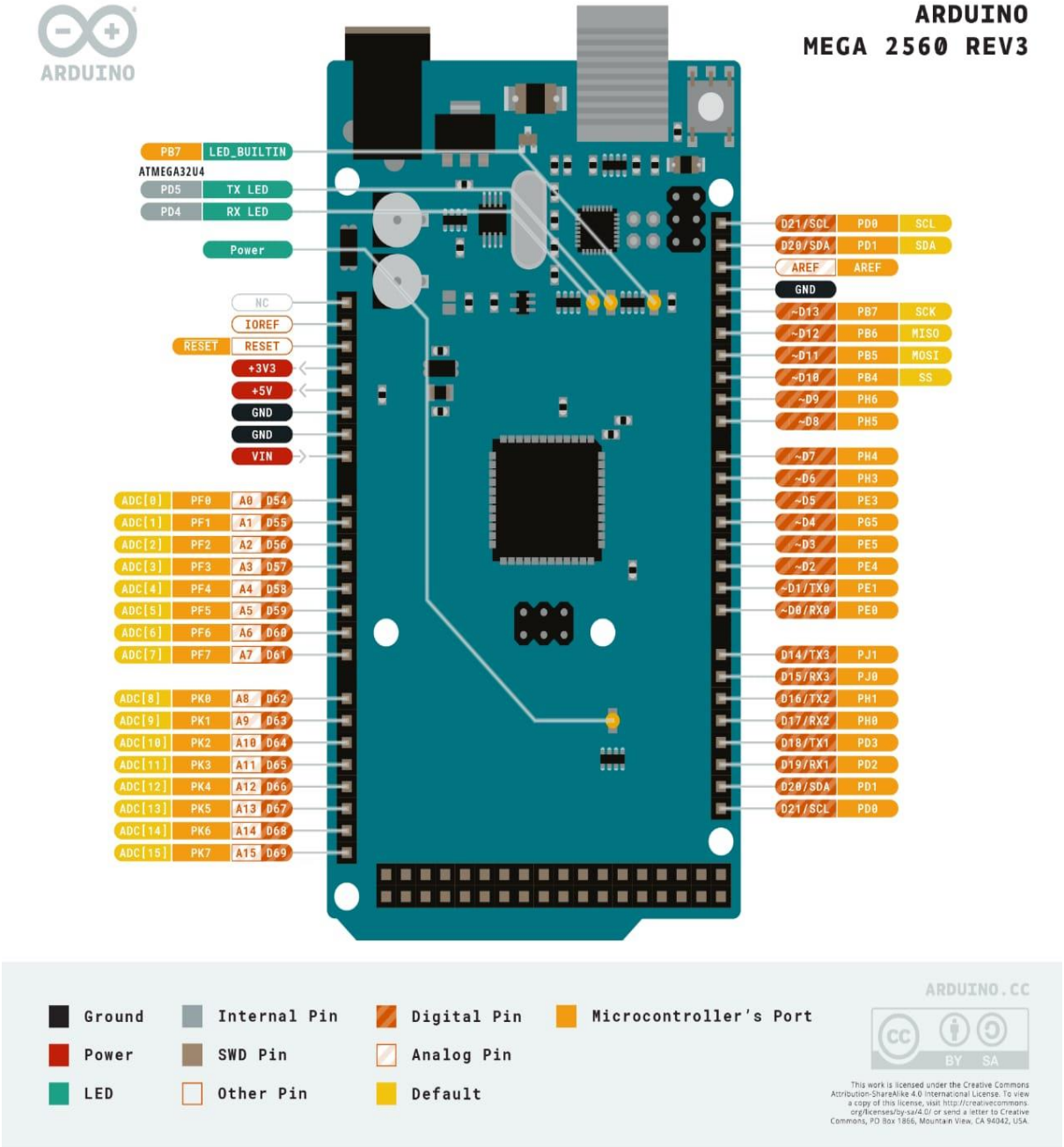
Chapter 4

DETAILS OF HARDWARE/SOFTWARE

4.1 Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector8 If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 Ma
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	13
Length	101.52 mm
Width	53.3 mm
Weight	37 g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ARDUINO
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ATMEGA32U4
PB7 LED_BUILTIN
PD5 TX LED
PD4 RX LED
Power
NC
IOREF
RESET
+3V3
+5V
GND
GND
VIN
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ADC[1] PF1 A1 D55
ADC[2] PF2 A2 D56
ADC[3] PF3 A3 D57
ADC[4] PF4 A4 D58
ADC[5] PF5 A5 D59
ADC[6] PF6 A6 D60
ADC[7] PF7 A7 D61
ADC[8] PK0 A8 D62
ADC[9] PK1 A9 D63
ADC[10] PK2 A10 D64
ADC[11] PK3 A11 D65
ADC[12] PK4 A12 D66
ADC[13] PK5 A13 D67
ADC[14] PK6 A14 D68
ADC[15] PK7 A15 D69
D21/SCL PD0 SCL
D20/SDA PD1 SDA
AREF AREF
GND
~D13 PB7 SCK
~D12 PB6 MISO
~D11 PB5 MOSI
~D10 PB4 SS
~D9 PH6
~D8 PH5
~D7 PH4
~D6 PH3
~D5 PE3
~D4 PG5
~D3 PE5
~D2 PE4
~D1/TX0 PE1
~D0/RX0 PE0
D14/TX3 PJ1
D15/RX3 PJ0
D16/TX2 PH1
D17/RX2 PH0
D18/TX1 PD3
D19/RX1 PD2
D20/SDA PD1
D21/SCL PD0
Ground
Power
LED
Internal Pin
SWD Pin
Other Pin
Digital Pin
Analog Pin
Default
Microcontroller's Port
ARDUINO.CC
BY SA
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4.2 HC-SR04 (Ultrasonic Sensor)

Fig 4.2.1

(a) Ultrasonic Sensor HC SR04 (b) HC SR04 Pin Diagram

4.2.2 Pin Configuration

Pin Number	Pin Name	Description
1	VCC	The VCC pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to

		initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

4.2.3 HC-SR04 Sensor Features

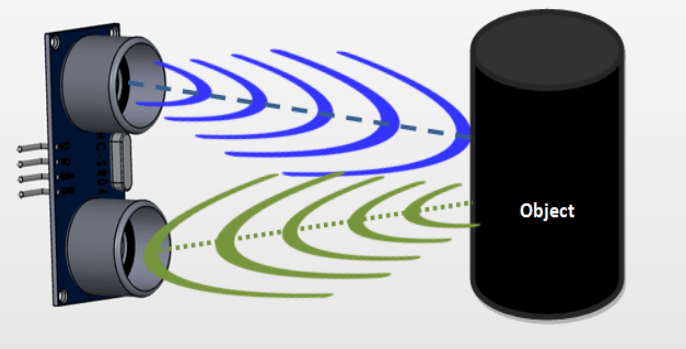
- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

HC-SR04 Ultrasonic Sensor - Working

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below



Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

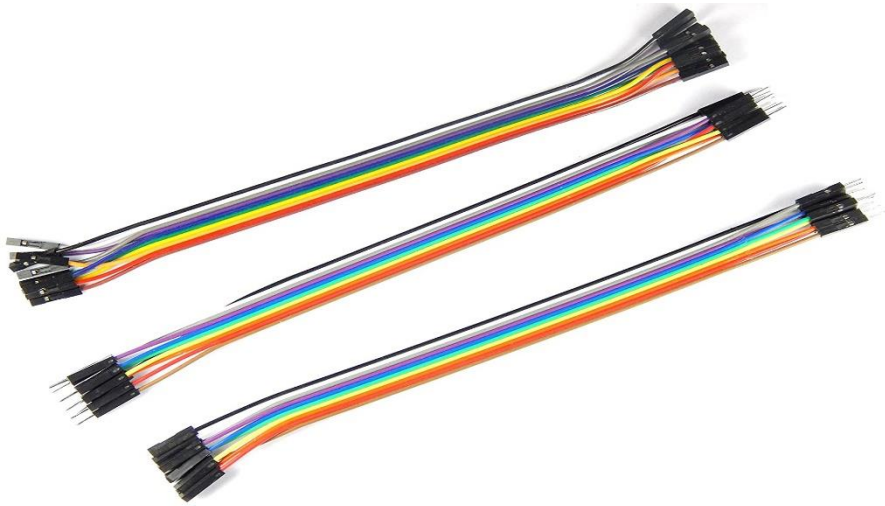
4.3 LEDS (RED, GREEN, YELLOW)

A **light-emitting diode** (**LED**) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron

holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross

the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

4.4 JUMPER WIRES

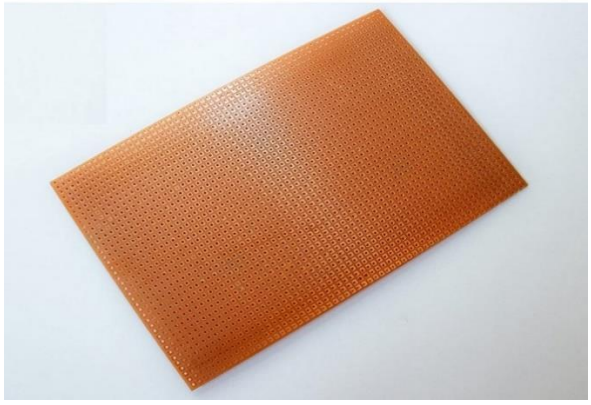


A **Jump wire** (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

4.5 RESISTOR

A **resistor** is a passive two terminal electric component that implements resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

4.6 GROUP BOARD



It is a rectangular board with many mounting holes. They are used for creating electrical connections between electronic components and single board computers or microcontrollers such as Arduino and Raspberry Pi. The connections aren't permanent and they can be removed and placed again.

4.7 LCD Modules(16x2)

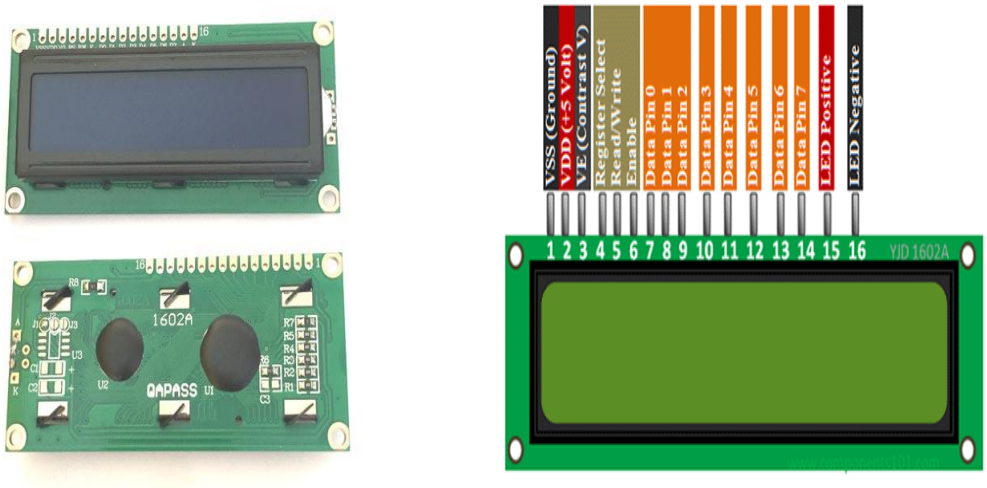


Fig 4.7.1

(a) 16x2 LCD Module **(b) 16x2 LCD Module Pin out**

4.7.2 Pin Configuration

PinNo:	Pin Name:	Description
1	VSS (Ground)	Ground pin connected to system ground
2	VDD (+5 Volt)	Powers the LCD with +5V (4.7V – 5.3V)
3	VE (Contrast V)	Decides the contrast level of display. Grounded to get maximum contrast.
4	Register Select	Connected to Microcontroller to shift between command/data register
5	Read/Write	Used to read or write data. Normally grounded to write data to LCD
6	Enable	Connected to Microcontroller Pin and toggled between 1 and 0 for data acknowledgement
7	Data Pin 0 to Data pin 7	Data pins 0 to 7 forms a 8-bit data line. They can be connected to Microcontroller to send 8-bit data. These LCD's can also operate on 4-bit mode in such

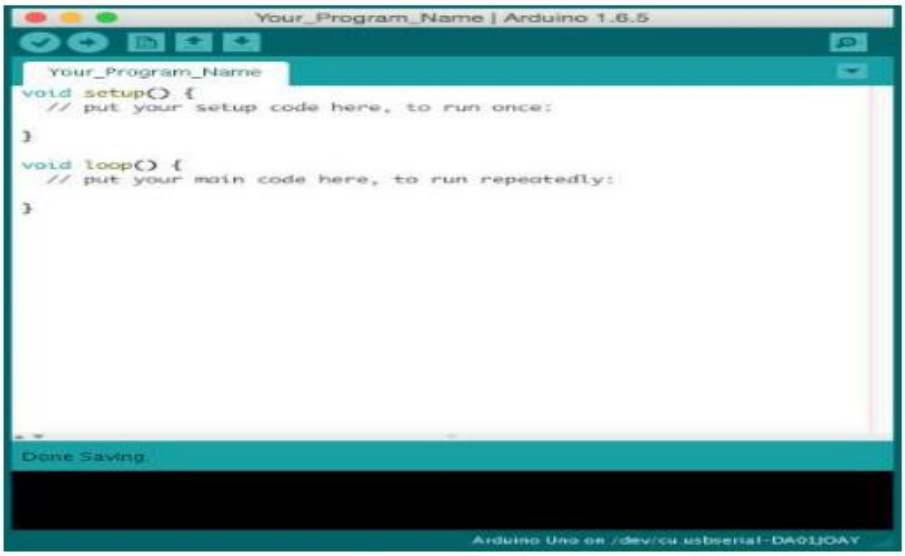
		case Data pin 4,5,6 and 7 will be left free.
8	LED Positive	Backlight LED pin positive terminal
9	LED Negative	Backlight LED pin negative terminal

4.7.3 Features of 16×2 LCD module

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is built by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

4.8 SOFTWARE REQUIRED

Software installation:



Arduino Installation:

After learning about the main parts of the Arduino UNO board, we are ready to learn how to set up the Arduino IDE. Once we learn this, we will be ready to upload our program on the Arduino board. In this section, we will learn in easy steps, how to set up the Arduino IDE on our computer and prepare the board to receive the program via USB cable.

Step 1:

First you must have your Arduino board (you can choose your favorite board) and a USB cable. In case you use Arduino UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or decimal, you will need a standard USB cable (A plug to B plug), the kind you would connect to a USB printer as shown in the following image.

Fig : USB Cable

Fig :Arduino Mega 2560

Step 2:

Download Arduino IDE Software. You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.

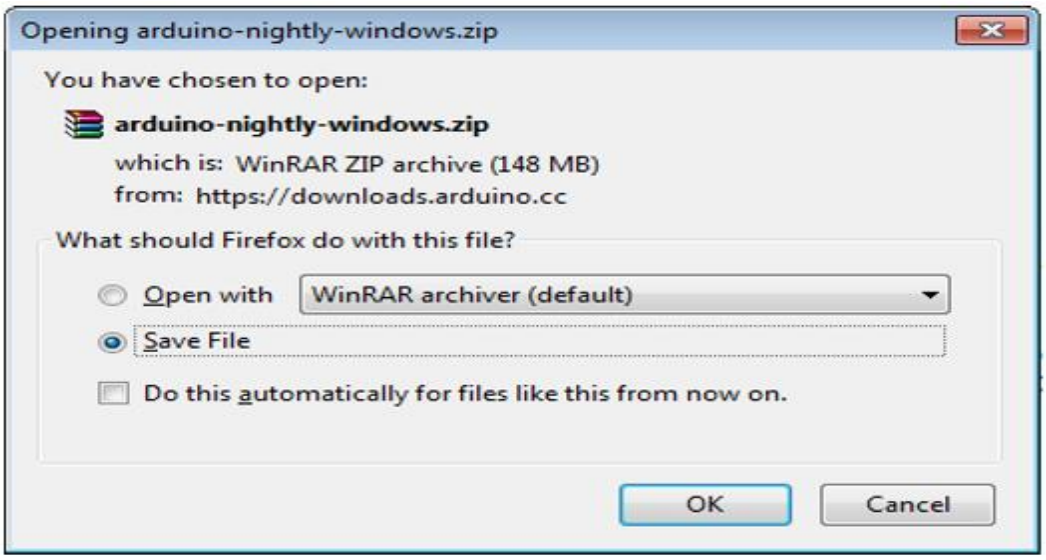


Fig 5: Arduino nightly windows

Step 3: Power up your board.

The input voltage to the 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 it through this pin.5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it. 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA. GND. Ground pins.

Step 4: Launch Arduino IDE.

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double click the icon to start the IDE.

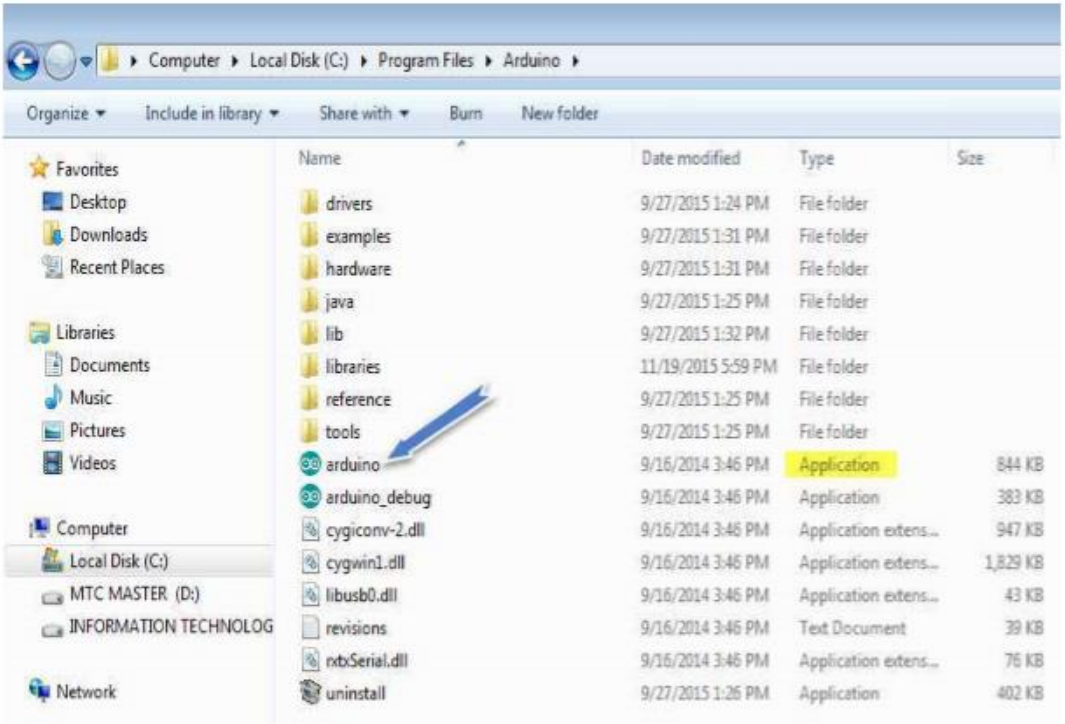


Fig 6: Downloading Arduino software

Step 5: Open your first project.

Once the software starts, you have two options:

- Create a new project.
- Open an existing project example.

To create a new project, select File --> New.

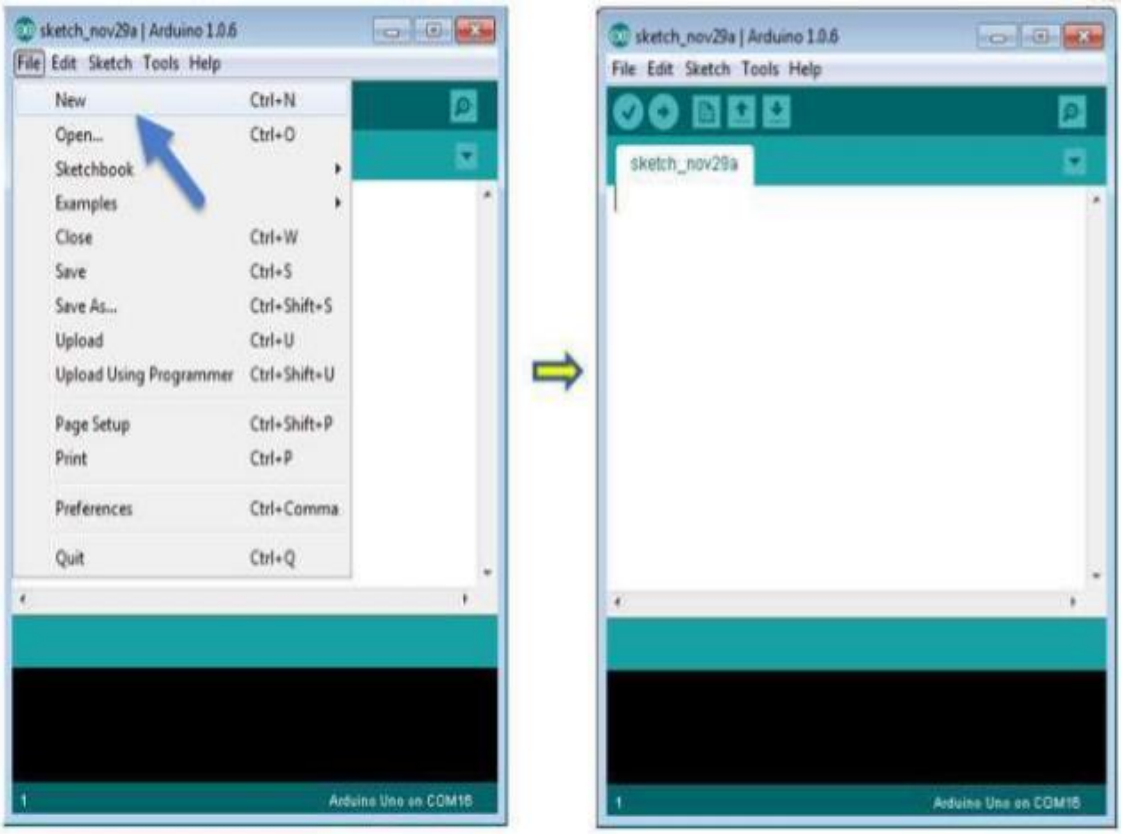


Fig 7: Create new file

To open an existing project example, select File -> Example -> Basics -> Blink.

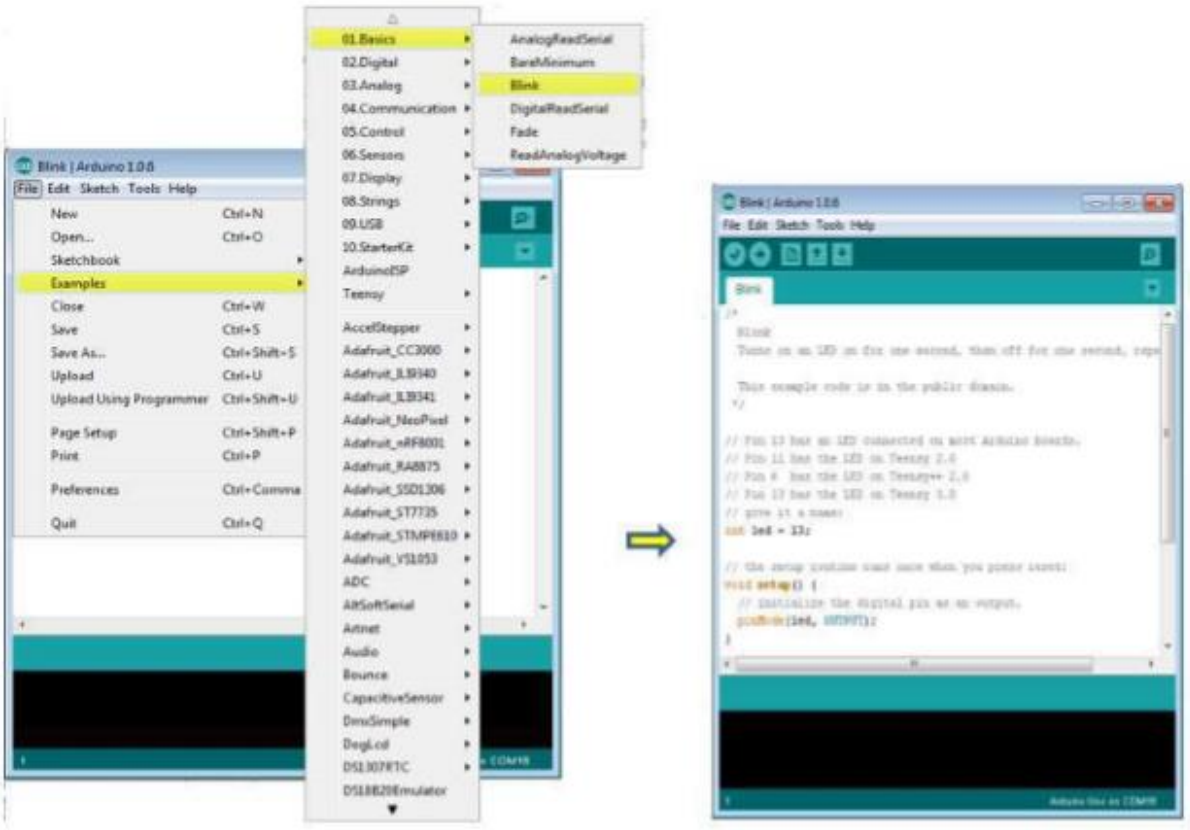


Fig 8: Initial step

Here, we are selecting just one of the examples with the name Blink. It turns the LED on and off with some time delay. You can select any other example from the list.

Step 6: Select your Arduino board.

To avoid any error while uploading your program to the board, you must select the correct

Arduino board name, which matches with the board connected to your computer.

Go to Tools -> Board and select your board.

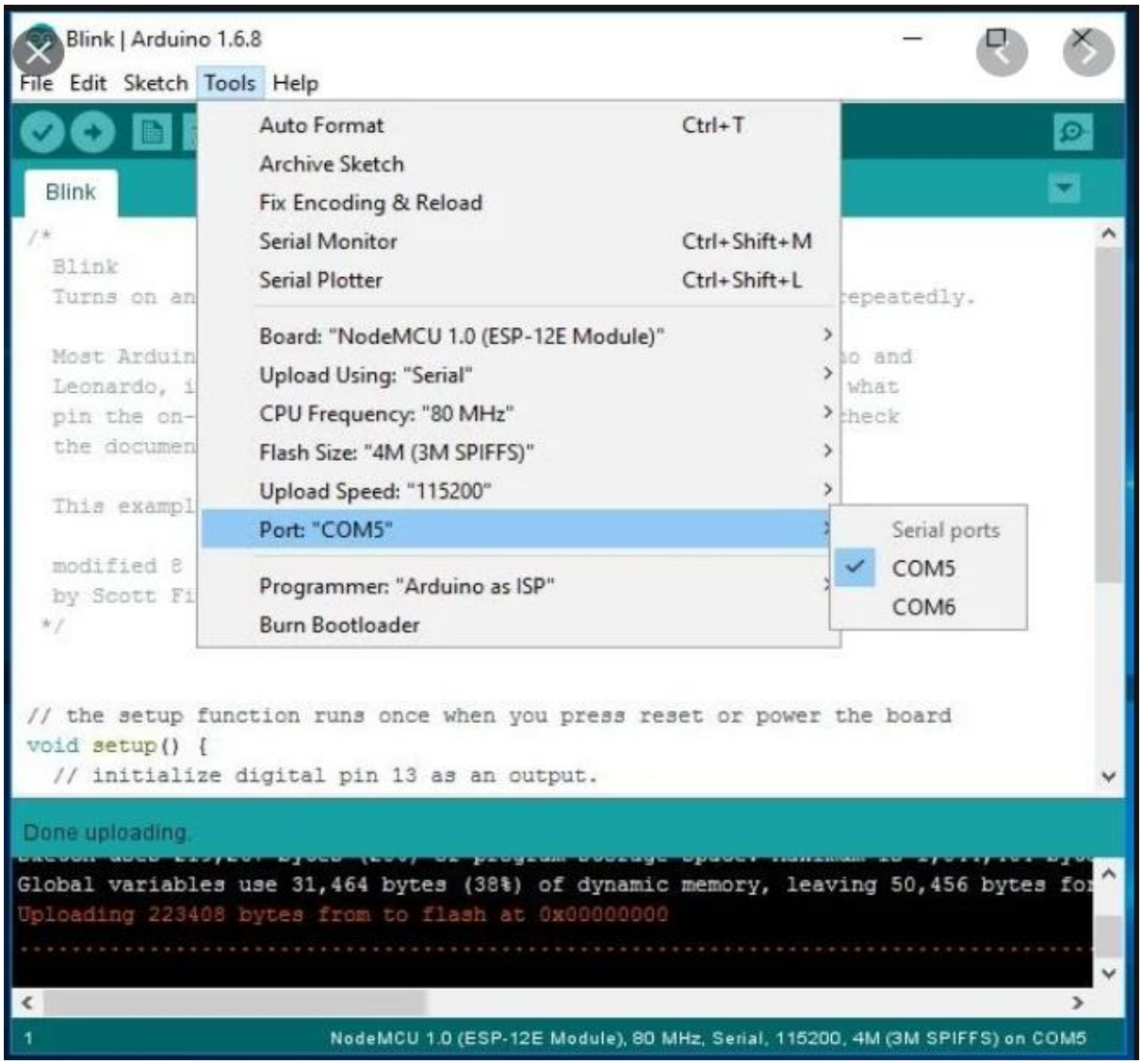


Fig 9: Selecting a board

Here, we have selected Arduino mega 2560 board according to our tutorial, but you must select the name matching the board that you are using.

Step 7: Select your serial port.

Select the serial device of the Arduino board. Go to Tools -> Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

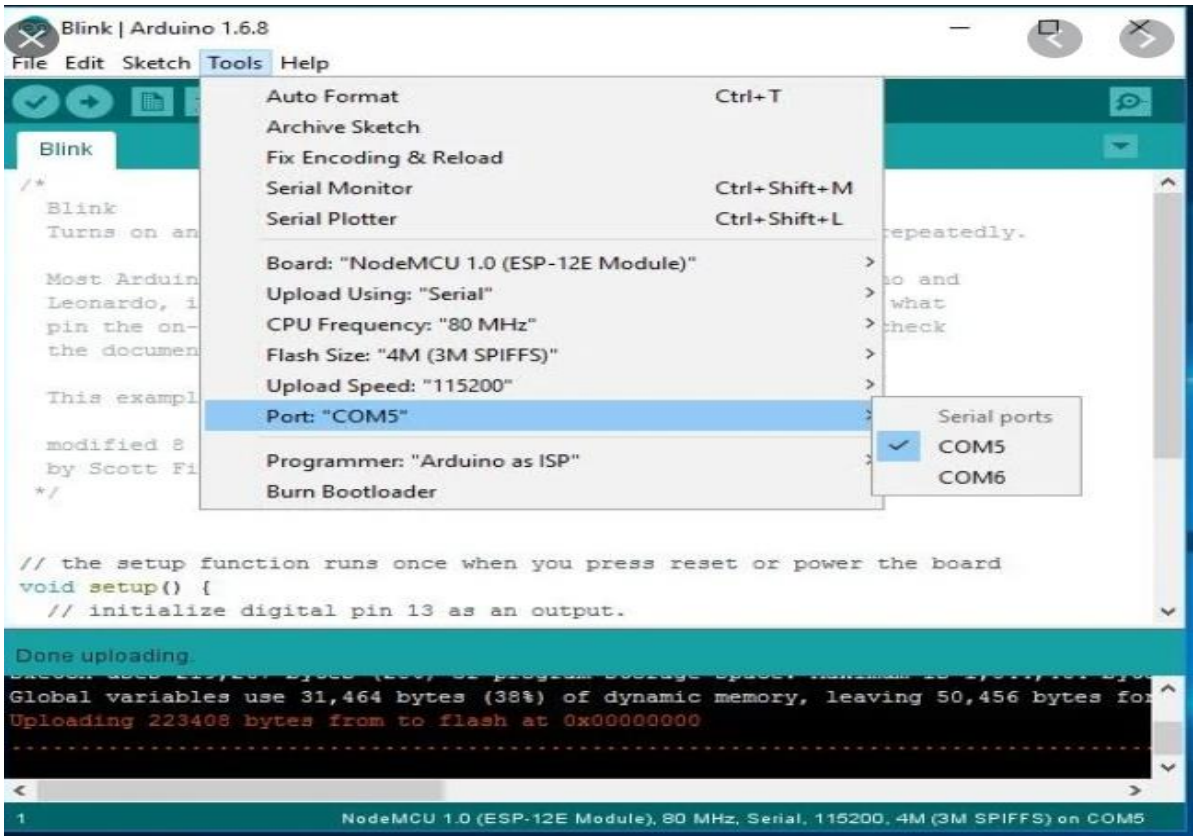


Fig 10: Selecting COM port

Step 8: Upload the program to your board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.

Chapter 5

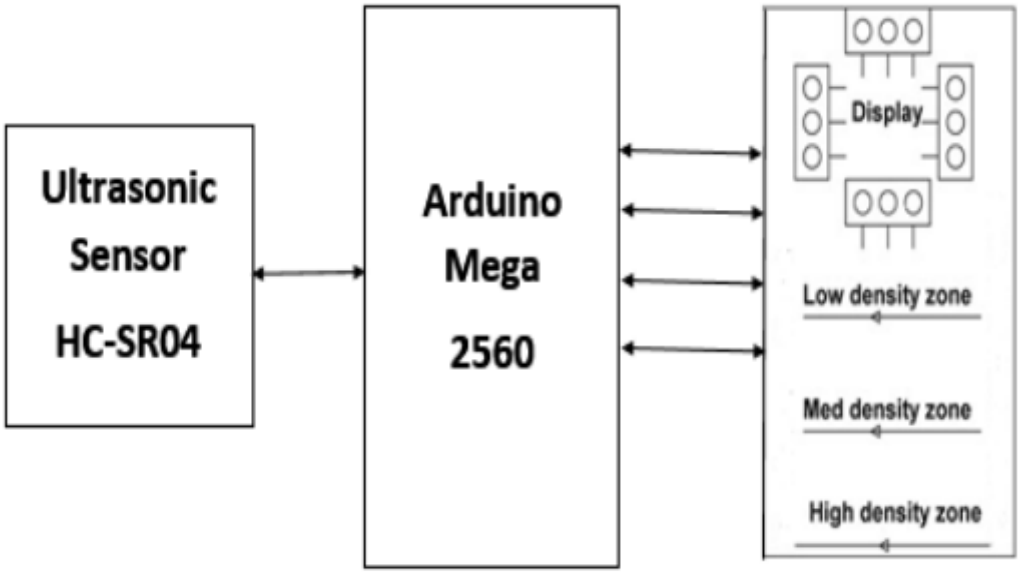
METHODOLOGY

In this project methodology model takes the fundamental process activities of Project Plan, specification, Analysis, Design, development, validation and evolution and represents them as separate process phases.

5.1 Objective

As stated in the introduction section there is a lot of problems caused by the traffic vehicles. The main problem is on signals and as well as highways. In order to deal with this 2 methods are deployed, first one deals with the traffic congestion on the traffic signals which will be handled by controlling signal smartly depending upon the traffic density, the second one deals with the congestion caused by the vehicles on the highway one way is to increase the highway capacity i.e increasing the number of lanes on highway, but eventually they will get filled as more people will try to take that highway. So, the only way is to find a way for controlling the management on the highway, which is ensured by proper spacing between the vehicles which is done by the system implemented by us which give distance information to the drivers and warn them if the threshold level is crossed which will be ensured by the ultrasonic sensors.

5.2 Block Diagram



Ultrasonic sensors (HC-SR04) are interfaced with aurduino mega 2560. Depending upon the information obtained from the sensors, the traffic is released**.**

As per the information the traffic is divided and is displayed as 3 types,

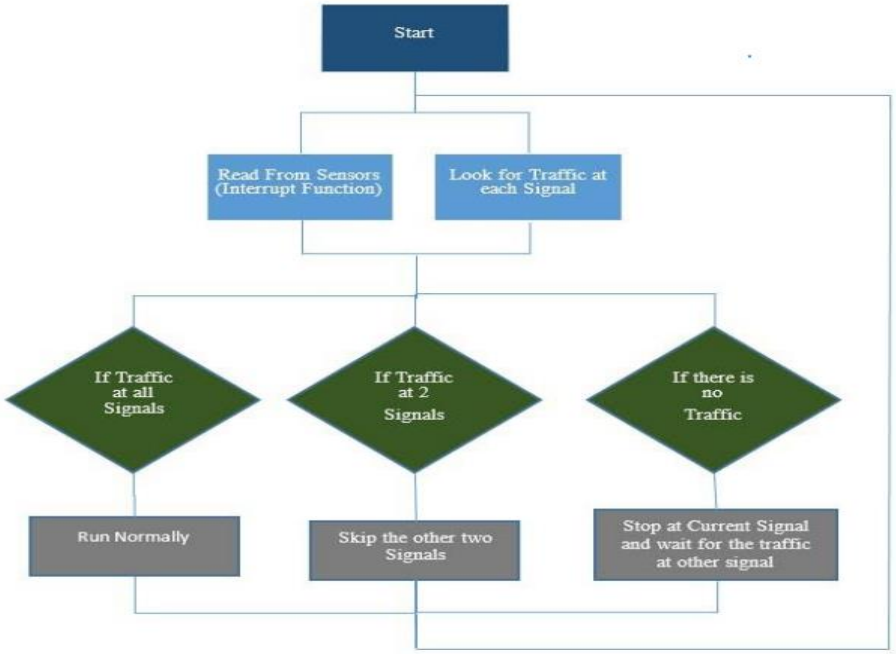
1.Low density zone

2.Hedium density zone

3.High density zone

Depending on the density of the traffic management of congestion takes place at signal.

5.3 Flow Chart



Depending upon the traffic encountered at the different signals, we get the following cases and actions:

CASE: IF TRAFFIC AT ALL SIGNALS This case is considered if traffic density is same at all signals (4), the timer is set to default time(60sec) for all signals and the following action will take place.

ACTION: RUN NORMALLY

CASE: IF TRAFFIC AT 2 SIGNALS This case is considered if traffic density is at two signals (4), it will consider the timer for two signals where the traffic is present and other two signals are with no traffic and left as it is and the following action will take place.

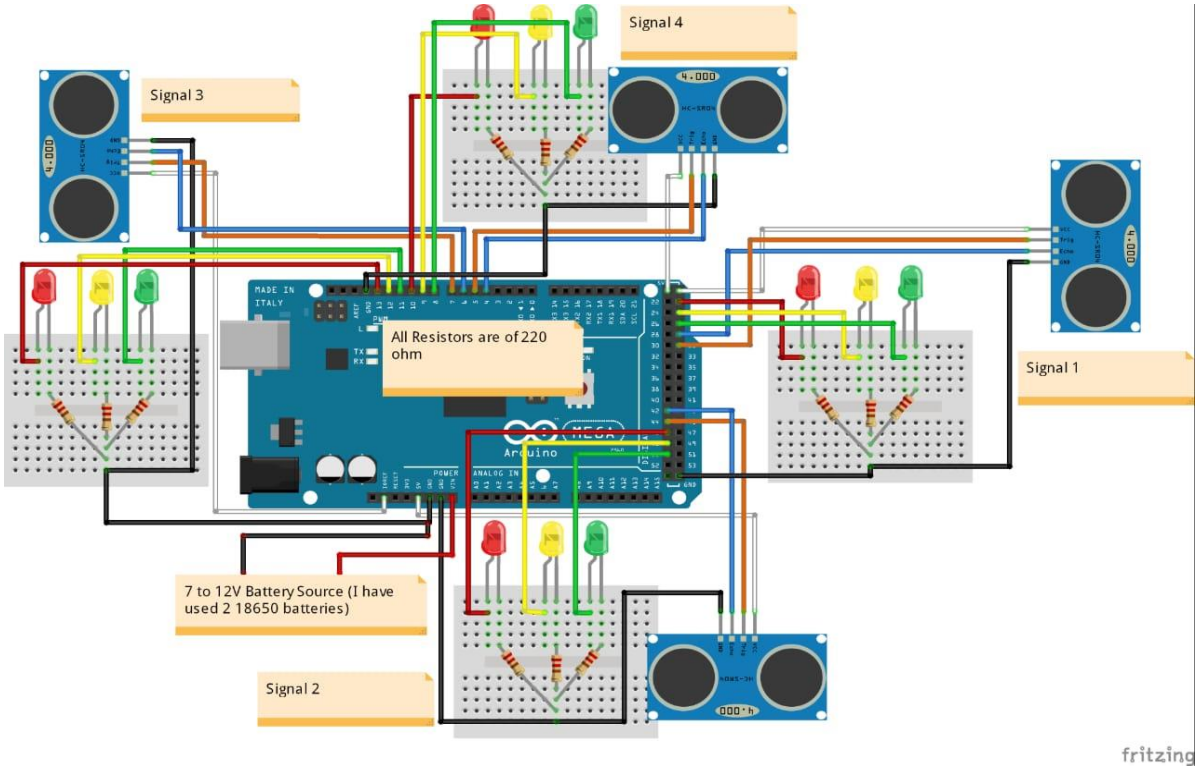
ACTION: SKIP THE OTHER TWO SIGNALS

CASE: IF THERE IS NO TRAFFIC This case is considered if there is no traffic, it will stop the current signal operations and wait for the traffic and following action will take place.

ACTION: STOP AT CURRENT SIGNAL AND WAIT FOR THE TRAFFIC AT OTHER SIGNAL

5.4 Working

PART A(MANAGING TRAFFIC AT SIGNALS)



Four ultrasonic sensors are interfaced with the Arduino. Arduino will read from these sensors and will calculate the distance. This sensor can measure from 2 to 400 cm. Ultrasonic sensor basically emits an ultrasonic wave from the trigger and it is received by the echo after deflecting an object. In order to generate a wave, we will have to set the trigger at high for 10 us which will send an 8 cycle sonic burst at 40 KHz which will hit the object and after hitting the object, the wave will be received by the echo. The echo will then tell us the time that the wave have traveled in us (micro seconds). We will then convert this time into distance travelled by using S = v*t. We are going to interface ultrasonic distance sensor HC-SR04 (proximity sensor) with Arduino and LCD. Ultrasonic sensor is used to measure the distance. It is also known as the proximity sensor or the sonar sensor. It sends an ultrasonic wave (sound wave) which comes back after hitting the object and tells us the time traveled by it. By using this time we calculate the distance traveled. The working of distance sensor is explained briefly in this tutorial. LED's are connected to the Arduino through the 220 ohm resistors. It is necessary to use the resistor with the LED.

The resistor limits the current flowing through the LED. If you won't use it then the LED will burn out soon. You can use the resistor of value from 100 ohm to 10k ohm with the LED. Larger the value of LED, lesser the current will pass. We will first use

the Arduino blink example and will flash the led for a second using the Arduino digitalWrite function and then we will make one way traffic light project. Arduino LED interfacing is the most basic task to do. So in this tutorial, I will try to take you through every basic thing so that you have a great understanding of how the LED works with Arduino.

CODE EXPLANATION

First of all, we included the timer one library. This library is used to repetitively measure a period of time in microseconds and at the end of each period, an interrupt function will be called.

We have used this library because we want to read from the sensors and control LED's at the same time. We will have to use the delay in between the traffic signal so we can't read from the sensors continuously. Therefore we have used this library which will allow us to call a function in which we will read from the sensors continuously and in the loop function, we will control the traffic signals.

```
#include<TimerOne.h>
```

In the setup function, we have used the Timer1.initialize(microseconds) function. This must be called before you use any of the other methods of timerone library. "Microseconds" is actually the period of time the timer takes. It is optionally to specify the timer's period here. The default period is 1 second. Keep in mind that it breaks analogWrite() on digital pins 9 and 10.

```
Timer1.initialize(100000);
```

Timer1.attachInterrupt(softInterr) calls a function each time the timer period finishes. We have set the timer period at 100000 so our function will be called after 100 milli seconds.

```
Timer1.attachInterrupt(softInterr);
```

In the loop function it is looking if there is any vehicles under the 5 cm distance or not. If there will be vehicle, then the function to that signal will be called.

CODE FOR TRAFFIC SIGNAL

```
#include<TimerOne.h>
int signal1[] = {23, 25, 27};
int signal2[] = {46, 48, 50};
int signal3[] = {13, 12, 11};
int signal4[] = {10, 9, 8};

int redDelay = 5000;
int yellowDelay = 2000;

volatile int triggerpin1 = 31;
volatile int echopin1 = 29;
volatile int triggerpin2 = 44;
volatile int echopin2 = 42;
volatile int triggerpin3 = 7;
volatile int echopin3 = 6;
volatile int triggerpin4 = 5;
volatile int echopin4 = 4;

volatile long time;                 // Variable for storing the time traveled
volatile int S1, S2, S3, S4;          // Variables for storing the distance covered

int t = 5;  // distance under which it will look for vehicles.
void setup(){
  Serial.begin(115200);
  Timer1.initialize(100000);  //Begin using the timer. This function must be called first.
"microseconds" is the period of time the timer takes.
  Timer1.attachInterrupt(softInterr); //Run a function each time the timer period finishes.

  // Declaring LED pins as output
  for(int i=0; i<3; i++){
    pinMode(signal1[i], OUTPUT);
    pinMode(signal2[i], OUTPUT);
    pinMode(signal3[i], OUTPUT);
    pinMode(signal4[i], OUTPUT);
  }

  // Declaring ultrasonic sensor pins as output
  pinMode(triggerpin1, OUTPUT);

  pinMode(echopin1, INPUT);

 pinMode(triggerpin2, OUTPUT);
  pinMode(echopin2, INPUT);
```

```
 pinMode(triggerpin3, OUTPUT);
  pinMode(echopin3, INPUT);
  pinMode(triggerpin4, OUTPUT);
  pinMode(echopin4, INPUT);
}

void loop()
{
  // If there are vehicles at signal 1
  if(S1<t)
  {
    signal1Function();
  }

  // If there are vehicles at signal 2
  if(S2<t)
  {
    signal2Function();
  }

  // If there are vehicles at signal 3
  if(S3<t)
  {
    signal3Function();
  }

  // If there are vehicles at signal 4
  if(S4<t)
  {
    signal4Function();
  }
}

// This is interrupt function and it will run each time the timer period finishes. The timer
period is set at 100 milli seconds.
void softInterr()
{
  // Reading from first ultrasonic sensor
  digitalWrite(triggerpin1, LOW);


delayMicroseconds(2);

digitalWrite(triggerpin1, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerpin1, LOW);
```

```
 time = pulseIn(echopin1, HIGH);
  S1= time*0.034/2;

  // Reading from second ultrasonic sensor
  digitalWrite(triggerpin2, LOW);
  delayMicroseconds(2);
  digitalWrite(triggerpin2, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerpin2, LOW);
  time = pulseIn(echopin2, HIGH);
  S2= time*0.034/2;

  // Reading from third ultrasonic sensor
  digitalWrite(triggerpin3, LOW);
  delayMicroseconds(2);
  digitalWrite(triggerpin3, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerpin3, LOW);
  time = pulseIn(echopin3, HIGH);
  S3= time*0.034/2;

  // Reading from fourth ultrasonic sensor
  digitalWrite(triggerpin4, LOW);
  delayMicroseconds(2);
  digitalWrite(triggerpin4, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerpin4, LOW);
  time = pulseIn(echopin4, HIGH);
  S4= time*0.034/2;

  // Print distance values on serial monitor for debugging
  Serial.print("S1: ");
  Serial.print(S1);
  Serial.print("  S2: ");
  Serial.print(S2);
  Serial.print("  S3: ");
  Serial.print(S3);

Serial.print("  S4: ");

Serial.println(S4);
}

void signal1Function()
{
  Serial.println("1");
```

```
low();
  // Make RED LED LOW and make Green HIGH for 5 seconds
  digitalWrite(signal1[0], LOW);
  digitalWrite(signal1[2], HIGH);
  delay(redDelay);

  // if there are vehicels at other signals
  if(S2<t || S3<t || S4<t)
  {
    // Make Green LED LOW and make yellow LED HIGH for 2 seconds
    digitalWrite(signal1[2], LOW);
    digitalWrite(signal1[1], HIGH);
    delay(yellowDelay);
  }
}

void signal2Function()
{
  Serial.println("2");
  low();
  digitalWrite(signal2[0], LOW);
  digitalWrite(signal2[2], HIGH);
  delay(redDelay);

  if(S1<t || S3<t || S4<t)
  {
    digitalWrite(signal2[2], LOW);
    digitalWrite(signal2[1], HIGH);
    delay(yellowDelay);
  }
}

void signal3Function()
{

Serial.println("3");
  low();

  digitalWrite(signal3[0], LOW);
  digitalWrite(signal3[2], HIGH);
  delay(redDelay);
 if(S1<t || S2<t || S4<t)
  {
    digitalWrite(signal3[2], LOW);
    digitalWrite(signal3[1], HIGH);
    delay(yellowDelay);
```

```
}
}
void signal4Function()
{
  Serial.println("4");
  low();
  digitalWrite(signal4[0], LOW);
  digitalWrite(signal4[2], HIGH);
  delay(redDelay);

  if(S1<t || S2<t || S3<t)
  {
    digitalWrite(signal4[2], LOW);
    digitalWrite(signal4[1], HIGH);
    delay(yellowDelay);
  }
}

// Function to make all LED's LOW except RED one's.
void low()
{
  for(int i=1; i<3; i++)
  {
    digitalWrite(signal1[i], LOW);
    digitalWrite(signal2[i], LOW);
    digitalWrite(signal3[i], LOW);
    digitalWrite(signal4[i], LOW);
  }
  for(int i=0; i<1; i++)
  {
    digitalWrite(signal1[i], HIGH);

digitalWrite(signal2[i], HIGH);
    digitalWrite(signal3[i], HIGH);
    digitalWrite(signal4[i], HIGH);
  }
}
```

PART B(MAINTAINING DISTANCE BETWEEN VEHICALS)

Many road traffic accidents are caused by drivers driving too fast and too close to the vehicle in front. It's vital you keep a safe separation distance but how can you judge it?

A driver needs to be able to judge a safe separation distance at all times, in all kinds of traffic, in all weather and road conditions. It is much safer for you and the people in front, and your passengers. Plus, if you hit the car in front of you, you are considered to blame. You have no choice as to the space left behind you, but you can control the amount of space in front.

Tailgating – what is that?

Driving extremely close to the car in front is called 'tailgating', and is particularly dangerous. If you are being tailgated by someone, then gently ease off the gas and allow the space in front of you to increase. You really don't want to put yourself in a position where you have to brake from being too close to the car in front. If the tailgater is still close behind and happens to hit you in the rear, then, if you have left plenty of space in front of you, your vehicle will not impact the one in front, possibly preventing a major pile up. It also makes the insurance situation a little less complicated!

What exactly is a safe separation distance?

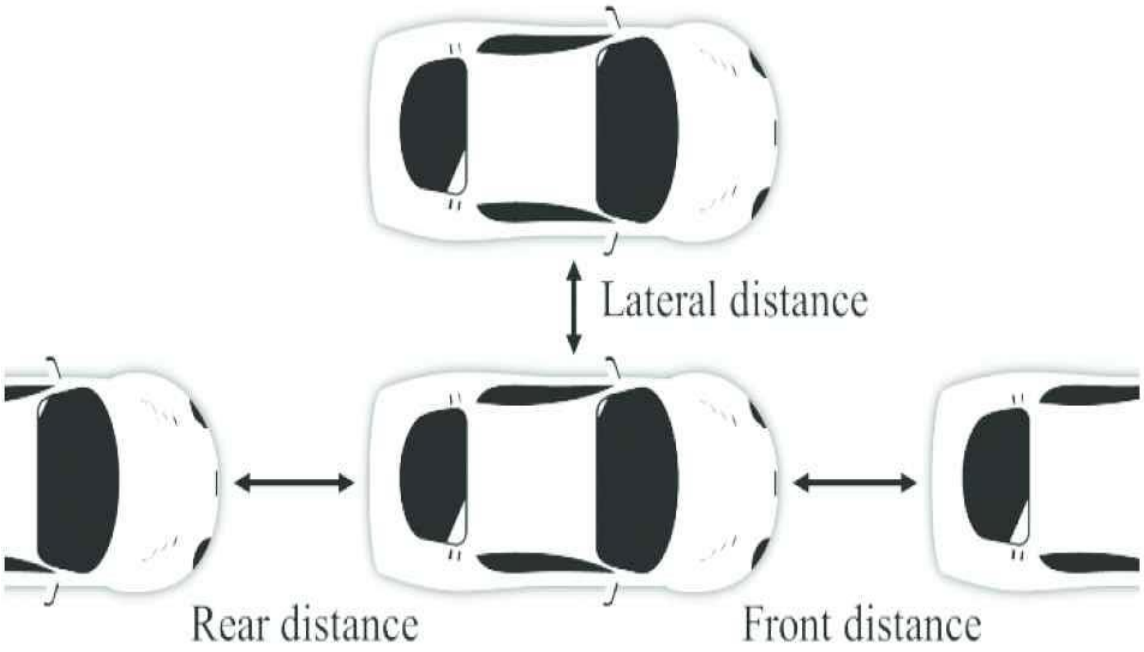
A safe separation distance is a safety margin or empty road between you and the vehicle in front. Think about what happens as a pedestrian, when you are walking close behind someone on the street, and they stop suddenly, for some reason or other. What happens? You bump into them or take a sideways swerve to avoid bumping into them. However, if there was more than just a couple of feet between you and this person, you would notice him stopping in good time to avoid him safely. This is how it works on the road, too. If we follow too closely to the vehicle in front, we leave no time and no space for things to change rapidly. Leaving you having to do an emergency stop or dangerous avoidance maneuver, in order not to hit the back of his car. And even this is not guaranteed. Too close means trouble waiting to happen.

These distances are for a well-maintained car, with good brakes and tyres , an alert driver, and a dry road, in daylight. You need to leave enough space for this to happen safely. As The Highway Code suggests, at 30mph your car will take approximately 23 meters to come to a stop. Maintaining the correct following distance provides you with enough time and space to react and avoid a collision in the event the vehicle directly in front of you comes to a sudden stop. The more distance you maintain between your car and the vehicle in front of you, the more time and space you will have to respond appropriately if its driver slams on the brakes.

While most people recognize the importance of maintaining some distance from a vehicle in front of them, it isn't always easy to know exactly what the correct

distance is at a given speed, or how to calculate it accurately.Traffic accident analysis reports in many countries have similar conclusions. Statistics of traffic accidents show one of the most common causes of traffic accidents to be the "failure to observe a safe distance behind another vehicle". There are three safe distance required in car-following front safe distance, rear safe distance, and lateral safe distance, as shown in Figure . Everybody knows that keep safe distance in driving is very important. Considering the three safe distances, the front distance can almost completely controlled by the driver. Studies have shown that leaving more space between vehicles helps to reduce traffic accidents and allows for smoother traffic

Distances that should be concerned by the driver. There are many factors that may have influence on safe distance. For example, speed of the vehicle, driver's attentiveness, size and condition of the vehicle, road surface, and weather conditions are all factors of the driving safety distance.



Chapter 6

ADVANTAGES , DISADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES

- The time which was wasted while idling is saved.
- The fuel is used efficiently and wear and tear is prevented from smooth flow.
- Emergency vehicles will have better chance of clearance soon as system is properly organized.
- As traffic is removed smoothly road rage will not take place.
- System allows user to forecast about their upcoming travel schedule.
- This system increases the work efficiency as people can be productive.

6.2 DISADVANTAGES

- It is costlier than the existing solutions.

6.3 APPLICATIONS

- This model will solve the basic problem of traffic which is faced by us.
- Basic steps will make sure that the human delay reaction will not start a traffic jam.
- Due to slow reactions of human phantom zones are formed which result in the never ending traffic jam. Proper spacing between from behind and front will compensate for the slow human reaction and won't start jams.
- The traffic light system will make sure that the side which has more traffic will be cleared first and the lights which have no traffic will be left as it is.

Chapter 7

RESULT AND DISCUSSION

As mentioned in our above setup implementation, it is observed that traffic lights are getting better in controlling of traffic. The ultrasonic sensor makes the traffic lights smarter which in turn makes them control traffic efficiently i.e the side which has more traffic is dealt as priority and side which has no traffic is left as it is because it doesn't require attention and it is just a waste of time. The main purpose of this project is, if there will be no traffic on the signal, other signal Continuous growth of population all over the world creates a great challenge to the transport management systems. The conventional methods are no longer effective enough for solving complex and challenging transportation management problem. More economical, more efficient. and thus more intelligent methods have to be developed to deal with these challenging problems. Due to the increased amount of vehicles, it is necessary to take effective steps in order to control the traffic and hence avoid all types of losses that are caused due to traffic. Once we have predicted a high traffic density for a network segment, we can initiate strategies to avoid this problem. In order to detect the traffic different sensors are being used and different techniques are used to determine the traffic and thus solve the problem related to traffic. The safe distance will be automatically adjusted with the speed and weather conditions. The faster the speed or the poor weather conditions, the longer the safe distance is. The safe distance will be automatically adjusted with the road slope. The safe distance of the downhill road will be automatically extended. This technology is applicable to the automobile manufacturing industry and the automobile maintenance industry

Chapter 8

CONCLUSION AND FUTURESCOPE

CONCLUSION

Continuous growth of population all over the world creates a great challenge to the transport management systems. The conventional methods are no longer effective enough for solving complex and challenging transportation management problem. More economical, more efficient and thus more intelligent methods have to be developed to deal with these challenging problems. Due to the increased amount of vehicles, it is necessary to take effective steps in order to control the traffic and hence avoid all types of losses that are caused due to traffic. Once we have predicted a high traffic density for a network segment, we can initiate strategies to avoid this problem. In order to detect the traffic different sensors are being used and different techniques are used to determine the traffic and thus solve the problem related to traffic. The safe distance will be automatically adjusted with the speed and weather conditions. The faster the speed or the poor weather conditions, the longer the safe distance is. The safe distance will be automatically adjusted with the road slope. The safe distance of the downhill road will be automatically extended. This technology is applicable to the automobile manufacturing industry and the automobile maintenance industry.

FUTURESCOPE

Since the project is a prototype that was developed under some limitations and in short time, there are some tasks that should be done in the future and would develop the system to a more mature state. Planning should focus on reduction of the traffic load on existing road network through various travel demand management measures. Emphasis should be placed on mass transport system. Video image processing is recommended over other fixed sensors due to its high efficiency, easy installation and large experience base. The proposed solution works well for Indian traffic conditions and can be quickly imported into any devices. Our image sources include highly congested road sections in Bangalore, Chennai, Mumbai and Delhi where we gathered hours of traffic data in the form of image sources and collocated traffic video among several cameras. The evaluation results show our ability to successfully identify the traffic density in highly noisy images. The proposed system can be used in any traffic management solution towards real-time traffic density estimation and prediction. Work still remains to be done in order to improve the computation time and efficient processing of video frames. Further enhancements are required in vehicle occlusion detection and classification. With the front distance detection system, the vehicle can be alerted when the safe distance is insufficient, to remind the driver to decelerate properly to avoid the occurrence of chasing. The technology can also be applied to the automatic following system, which can keep the distance of vehicles in a safe region

to improve the driver's acceptance of the following system. In addition to being integrated into the safety design of a new car to improve the safety factor of the vehicle, the technology can also be used for retrofitting old vehicles as a driving safety facility.

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