Project Report

on

Intelligent Transport System Based on Vehicle to Infrastructure System

submitted in the partial fulfillment of the requirements of
Final Year Course of

Bachelor of Engineering
in

Electronics and Telecommunication Engineering

by

Mr. OMKAR PABSHETWAR (B120373089)
Mr. PRABHAT VISHWAKARMA (B12037134)
Mr. KARAN ZENDE (B120373139)

Under the guidance of

Dr. D. G. BHALKE

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-411033, INDIA

2016-17

DEPARTMENT OF E&TC ENGINEERING
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-411048, INDIA
2016-17

CERTIFICATE

This is to certify that the Project Report entitled

Intelligent Transport System Based on Vehicle to Infrastructure System
submitted by

Mr. OMKAR PABSHETWAR(B120373089)
Mr. PRABHAT VISHWAKARMA(B120373134)
Mr. KARAN ZENDE(B120373139)

Is a record of bonafied work carried out by them in the Department of Electronics Telecommunication Engineering, under my guidance in the fulfillment for the award of completion of final year of engineering in Electronics Telecommunication Engineering of Savitribai Phule Pune University,Pune.

(Dr. D. G. BHALKE)
Project Guide

(Dr.A.N.Paithane) (Dr. R. K. JAIN)
HOD E&TC Principal

Date: 6/6/17

ACKNOWLEDGEMENT

It gives us immense pleasure in presenting the report on

Intelligent Transport System Based on Vehicle to Infrastructure System

We are extremely thankful to Dr. D.G.BHALKE for his insightful comments and constructive suggestions to improve the quality of project work.

We also wish to extend our thanks to Ms.B.R.Thawali,Project co-ordinator for her supervision throughout the course of present work.

We would like to place on record our deep sense of gratitude to Dr.A.N.Paithane, HOD,Department of Electronics Telecommunication Engineering, for his stimulating guidance and continuous encouragement.

We wish to express our sincere thanks to Dr.R.K.Jain, Principal, Rajarshi Shahu College of Engineering,Tathawade,for providing us all the necessary facilities.

Lastly we are thankful to Teaching and non-teaching faculty of the Department for their continuous co-operation.

Mr. OMKAR PABSHETWAR (B120373089)
Mr. PRABHAT VISHWAKARMA (B12037134)
Mr. KARAN ZENDE (B120373139)

Abstract

Vehicles equipped with intelligent systems designed to prevent accidents, such as collision warning systems (CWSs) or lane-keeping assistance (LKA), are now on the market. The next step in reducing road accidents is to coordinate such vehicles in advance not only to avoid collisions but to improve traffic flow as well. To this end, vehicle-to-infrastructure (V2I) communications are essential to properly manage traffic situations. This paper describes the AUTOPIA approach toward an intelligent traffic management system based on V2I communications. A fuzzy-based control algorithm that takes into account each vehicle's safe and comfortable distance and speed adjustment for collision avoidance and better traffic flow has been developed. The proposed solution was validated by an IEEE-802.11p-based communications study. The entire system showed good performance in testing in real-world scenarios, first by computer simulation and then with real vehicles. Intelligent Transportation Systems (ITS) have been under development since the 80s as part of a global strategy for solving many of our modern life transportation problems. These systems enable people to reach their destinations in a safe, efficient, and comfortable way. In order to reach that goal, several radio access technologies (RAT) such as UMTS, WiFi, WiMAX and 5.9 GHz have been proposed for next generation ITS. Yet, the coexistence of these technologies in the vehicles raises the challenge of choosing the most appropriate RAT. In order to address this problem and define optimal rules for the communication technology selection, comparisons on the network performance have to be done. In this paper, we compare two of the most promising infrastructure-based wireless technologies :RFID communication based technology used . We investigate, through simulation, the potential and limitations of both technologies as a communication media for vehicle-to-infrastructure (V2I) communications. The performance of the two systems is evaluated for different vehicle speeds, traffic data rates, and network deployments.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

This chapter includes an overview of the project, including basic technologies used in system, software and hardware. The use of v2v and v2i technologies have been underlined in this chapter. How the use of v2i system is inculcated in this project is also been focused here.

In V2I, the infrastructure plays a coordination role by gathering global or local information on traffic and road conditions and then suggesting or imposing certain behaviours on a group of vehicles. In a more sophisticated scenario, the velocities and accelerations of vehicles and inter vehicle distances would be suggested by the infrastructure on the basis of traffic conditions, with the goal of optimizing overall emissions, fuel consumption, and traffic velocities. Suggestions to vehicles could be broadcast to drivers via road displays or directly to vehicles via wireless connections. Vehicle-to-Infrastructure (V2I) Communications for Safety is the wireless exchange of critical safety and operational data between vehicles and roadway infrastructure, intended primarily to avoid motor vehicle crashes.

Vehicle to infrastructure (V2I) communications for safety is a key research program of the Intelligent Transportation Systems Joint Program Office (ITS JPO) program within the U.S. Department of Transportations (U.S. DOT) Research and Innovative Technology Administration (RITA).In V2I, the infrastructure plays a coordination role by gathering global or local information on traffic and road conditions and then suggesting or imposing certain behaviours on a group of vehicles. One example is ramp metering, already widely used, which requires limited sensors and actuators (measurements of traffic density on a

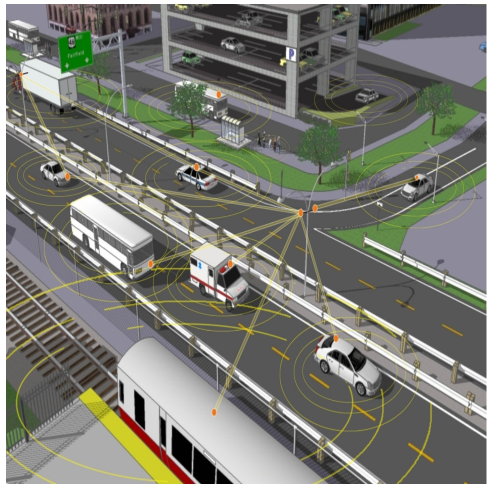

Figure 1.1: RF communication

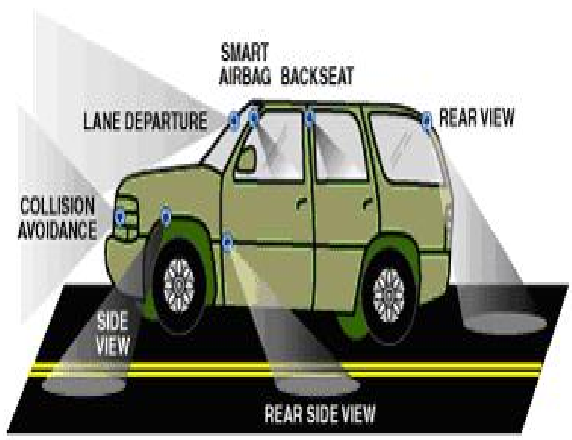

Figure 1.2: Safety Module

highway and traffic lights on ramps). In a more sophisticated scenario, the velocities and accelerations of vehicles and inter vehicle distances would be suggested by the infrastructure on the basis of traffic conditions, with the goal of optimizing overall emissions, fuel consumption, and traffic velocities. Suggestions to vehicles could be broadcast to drivers via road displays or directly to vehicles via wireless connections. Looking further ahead, in some cases suggestions could be integrated into the vehicle controls and implemented semi automatically (always taking onto account the restrictions on automatic vehicle driving imposed by the Vienna Convention on Road Traffic, discussed later).As far as V2I communication is concerned, the reported performance results are overly optimistic due to the fact that both models discussed therein unrealistically assumed that all of the

SUs present at the time the snapshot was taken will successfully complete their service. In reality, vehicles, being mobile, they reside within the coverage range of S for a limited period of time and then depart. Thus, any request associated with a vehicle that went out of range has to be discarded. Moreover, the two models assume single request generation per arriving vehicle. However, an arriving vehicle may generate a randomly-sized bulk of requests. This is especially true since several passengers may be travelling on board of an arbitrary vehicle and each one of these passengers may independently require access. The M/M/m and M/G/m models fail to capture these particular aspects.

Chapter 2

Literature Survey / Review of Related Literature

This chapter focuses on the study materials used for this project. Various literature papers have been surveyed and some of the technologies from them are been used to develop this project.

Vehicular ad hoc network (VANET), a part of mobile ad hoc networks (MANETs), is a capable method for smart transportation organisation. It has no fixed setup and instead relies on the vehicles themselves to deliver network functionality. Still, due to mobility constraints, driver performance, and high mobility.Many Vehicle-to-Vehicle Communication protocols are available for transmitting Emergency warning messages during collision. Here we have compared three different protocols.

2.1 Car to car communication for accurate vehicle localization

The reliable knowledge of the ego position of vehicles is an important requirement for many automotive applications. Only, with exact positioningboth in terms of accuracy and integrityAdvanced Driver Assistance Systems (ADASs) like blind spot detectors or green driving assistants can be realized and successfully deployed. During the last years, satellite-based positioning sensors like the Global Positioning System (GPS) have emerged as standard solution for the localization task. Low-cost single frequency GPS receivers are nowadays integrated in almost any mid-range vehicle. While for most comfort applications (e.g. navigation systems). the typical performance of standalone Global Navigation Satellite System (GNSS) localization with app. 20m is , good position in quality cannot be assumed in general.For example, in dense urban areas where GPS signals may be blocked by buildings or vegetation, the localization accuracy may decrease dramatically.

2.2 Vehicle to infrastructure control

In the V2V concept, when two or more vehicles or roadside stations are in radio communication range, they connect automatically and establish an adhoc network enabling the sharing of position, speed, and direction data. Every vehicle is also a router and allows sending messages over multihop to more distant vehicles and roadside stations. The routing algorithm is based on the position of the vehicles and is able to handle fast changes of the network topology. Control technology comes into play at local and higher layers of the architecture. Uncertainties, delays, partial measurements, safety and performance objectives, and other aspects must be considered, and the system must be capable of making automatic or semiautomatic decisions.

2.3 An intelligent V2I based traffic management system

A V2I-based trafc management system with a twofold objective: First, our approach proposes a solution to the problem of regulating trafc ow in urban areas, in which different bottleneck situations may coexist. Second, it contributes to avoiding accidents by alerting the driver in advance of potential collisions. The system includes an intelligent controller that uses a reference safety distance and the appropriate speed as fuzzy inputs. The output sent to the driver is information on how the vehicle is being driven. In this paper, for the sake of simplicity, only information on longitudinal actions has been communicated. The system has been tested in simulation and on a real test track.The results have shown it to perform well.This work constitute starting point for the development of a complete trafc control system.In particular,the authors would like to highlight that this paper presents the rst results on how to manage four real vehicles approaching an intersection from different directions. Future work will study new challenges involving scenarios with trafc light control and lateral maneuvers.

Table 2.1: Survey table

Paper title	Author	Publisher	Features	Remark
Car to car communication for accurate vehicle localization	Marcus Obst et al.	2012-9th international multi-conference	To transmit GPS measurement between vehicles	CoVeL apporach
Vehicle to infrastructure control	T.Samad A.M. Annawamy	IEEEcss the impact of control technology 2011	V2I and V2V interaction	–
An intelligent V2I based traffic management system	Vicente milanes Jorge villagra Jorge godoy Javier simo	IEEE transaction on intelligent transportation systems vol.13 mar.2012	Data communication Traffic management V2I communication	ADAS(Advance driver assistance system)
DSA based V2I communication under microscope	Maurice khabbaz Chadi Assi Wissam Fawaz	IEEE WCNC14 Track4	Dyanamic spectrum access, V2I,Sru	VDSA(vehicular dynamic spectrum access)

2.4 DSA based V2I communication under microscope

This paper investigated a DSA-based V2I communication system operating under scarce spectral resources conditions. Following a comprehensive description of how this type of communication takes place in the context of a limited spectral resources scenario, a brief realistic modelling overview was provided with guidelines on how to account for fundamental factors that have been overlooked in existing work. Then, extensive simulations were conducted in order to examine the systems performance. Results show that the AR reneging and force-termination probabilities have a cataclysmic impact on the systems performance as well as on an end-users Quality-of-Service (QoS) satisfaction. A comparison with the results of a study proposed in an existing work where these probabilities are not taken into account shows a dramatic performance deviation of more than 80 percent. Fortunately, the EDF service discipline incurred a signicant improvement in the performance of the system as it almost nullied the reneging probability.

Chapter 3

Methodology

To design and implement ITS based V2I system for safety of vehicle and communication between vehicle and traffic signal.

3.1 Objectives

1.To improve the road safety.
2.To avoiding the risk of car accidents such as cooperative collision warning, pre-crash sensing,lane change, traffic violation warning.
3.Providing efficient traffic signal system for the vehicle to cross the road without accidents.

3.2 System overview

1.The design and implementation stage of the project, involved the Bluetooth embedded hardware device implementation and the software application development for Android. The Blue-tooth embedded device is a micro-controller based system.

2.Blue-tooth Wireless technology is short range communications technology intended to replace the cables connecting portable or fixed device. It transmits data via low Blue-tooth technology has the ability to handle both data and voice transmissions at a time.

3.Sonar sensor can determine the distance to an object by measuring the difference in time between the sound wave being transmitted and the echo being received and also capture the material property and structure of the object by measuring the strength of the reflection.

4.PIC micro controller is a small computer on a single integrated circuit consisting internally of a relatively simple CPU, clock, timers, I/O ports, and memory. Micro-controllers are used in automatically controlled products and devices.
Micro-controllers are designed for small or dedicated applications. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, micro-controllers make it economical to digitally control even more devices and processes.

3.3 Block Diagram of vehicle unit

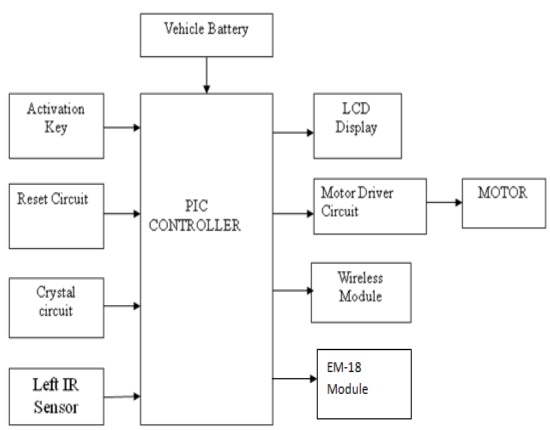

Figure 3.1: Vehicle Unit Block Diagram

Vehicle Unit Description:
Initially switch ON the vehicle unit, Initialisation of LCD, Sensor, Rf module, Em-18

module is done with help of pic micro-controller. Welcome message display on LCD. when sensors detect the obstacle the data is send to the controller to change the direction of vehicle in opposite direction. Various check points are sensed with the help of Em-18 module, and this data is sent to other unit i.e. traffic signal unit. Power supply is through battery, and direct Dc input is also available. Rf module is interfaced for communication between traffic unit and vehicle unit. Buzzer is used to make beep sound after detection of obstacle by IR sensors.

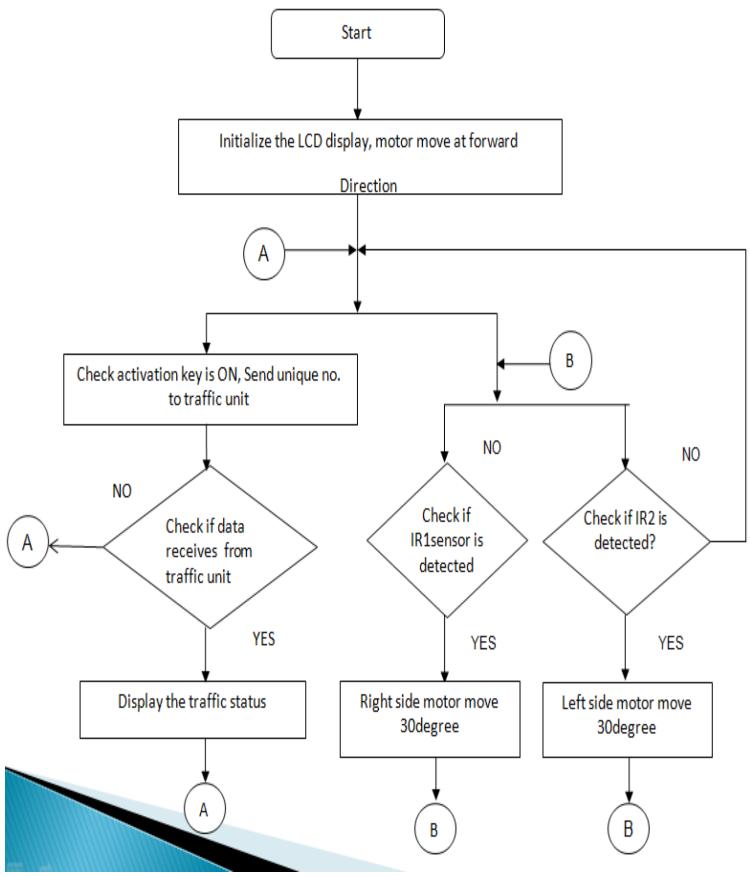

Figure 3.2: Flowchart vehicle unit

The following Flowchart shows the complete process of traffic unit step by step. Working of Vehicle unit is understood with the help of flowchart.

3.4 Diagram Traffic unit

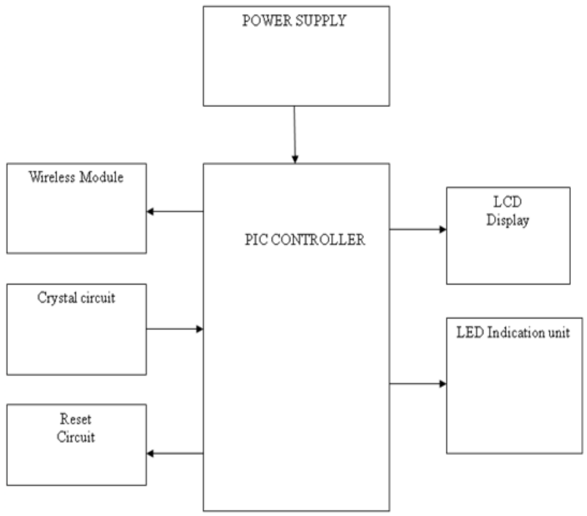

Figure 3.3: Traffic Unit Block Diagram

Traffic Unit Description:

The traffic Unit works parallel with the vehicle unit.Initially after power ON the Traffic signals are checked indicating Red light Green light Yellow light. When the checkpoint is detected by vehicle signal is send to traffic unit with help of Rf module, after detecting the signal the traffic signal is made green of that lane for the vehicle. Four group of Led's are used to show the traffic signal operation.

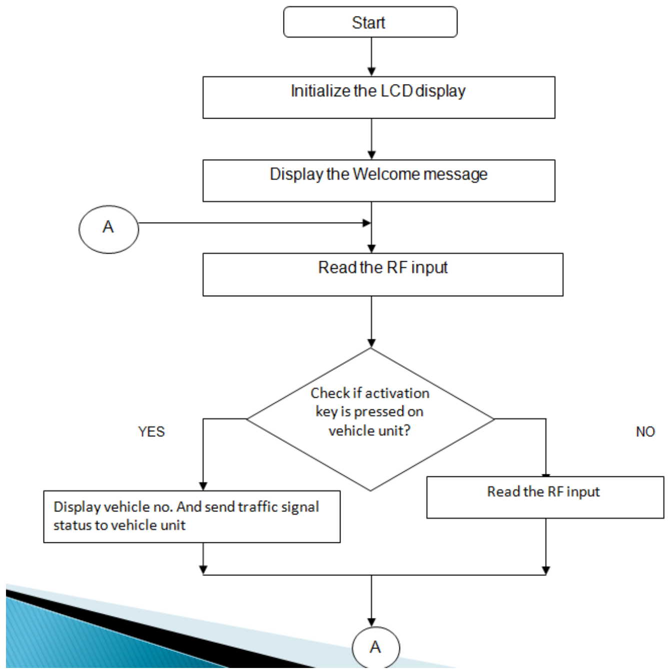

Figure 3.4: Flowchart traffic unit

The following Flowchart shows the complete process of traffic unit step by step. Working of traffic unit is understood with the help of flowchart.

Chapter 4

Hardware Design

This chapter is entirely based on the system hardware and its construction. The design of various units has been mention in this chapter which includes power supply, relay circuits, motor driver circuits, sensors, lcd etc.

4.1 Power supply

The power supply module is used to supply the controller with the desired voltage level it requires.

1) Transformer:

Requirement: We Require 5vn and 12v Ac voltage at the Transformer output.

Transformer is the main component of the power supply module. There are two types of transformer namely Step up and Step Down. We have used Step down transformer as we have to generate 5 volts and 12 volts DC supply from the 230 volts input AC supply so we have used 15 volts / 250 mA transformers which mean its output will be 15 volts AC with current rating of 250 mA.

2) Rectifier:

Requirement: We Require 5v and 12v Rectified output at output of Rectifier.

Rectifier is used to rectify the negative half cycles of the output signal of the secondary of the transformer. So at the input of the rectifier We have AC signal with both positive and negative cycles and at the output of the rectifier We have signal with only positive cycles but as this signal is also AC We have to use capacitor to filter out the AC of the output signal. There are mainly three types of rectifiers namely half wave, Full wave and Bridge rectifier. Out of these three we have used Bridge rectifier since it give more efficiency. A full wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output by reversing the negative (or positive) portions of the alternating current waveform .The positive (negative) portions thus combine with the reversed negative (positive) portions to produce an entirely positive (negative) voltage/current waveform. For single phase AC is center tapped, and then two diodes back to back (i.e. anode to anode or cathode to cathode) form a full wave rectifier.

Rectifier designing 1N4007 diodes are used to build circuit of full wave bridge rectifier

Surge overload rating - 50 amperes peak

Ideal for printed circuit board

Reliable low cost construction utilizing molded plastic technique results in inexpensive product

Mounting Position:
Any For diode design:-

$$\text{PIV} = \text{Vm}$$
$$\text{Vm} = \text{E0 max} + 2\ \text{Vf} = 10.7 + 1.4\ \text{V} = 12.1\ \text{V}$$
$$\text{I0} = \text{Il}/2$$
$$= 116.2\ \text{mA}/\ 2$$
$$= 58.1\ \text{mA}$$

Peak repetitive current

$$\text{Ifm} = [\text{Il}\ (\text{t1}+\text{t2})]/\text{t2}$$
$$\text{T2} = \text{time for 90 - time for 1}$$

$$= 5ms - 3.4ms$$
$$=1.2ms$$
$$Ifm = 116.2mA(8.6ms+1.2ms) /1.2ms$$
$$= 833mA$$

From above specification diode 1N4007 is selected **3) Filter capacitor:** As mentioned above we have to use filter capacitor to remove the AC signal from the output of rectifier. Filter capacitor is used in order to remove ripples from the pulsating DC and convert it to unregulated DC.

A capacitor is an electrical device that can store energy in the electric field between a pair of closely spaced conductors (called plates). When voltage is applied to the capacitor, electric charges of equal magnitude, but opposite polarity, build up on the plate.

Capacitors are used in electrical circuits as energy storage devices. They can also be used to differentiate between high frequency and low frequency signals and this makes them useful in electronic filters. These small deviations from the ideal behavior of the device can become significant when it is operating under certain conditions, i.e. high frequency, high current, or temperature extremes.

PIV =100V

I = 1A

For filter capacitor design :- C= (I1 * t1)/Vr

Vr= ripple voltage

Il = load current

T1= time during which the capacitor being discharge by load current

Vr = ripple voltage 10 percent of output voltage

Vr = 1.0 V

Frequency 50 HZ

$$T1 = 1/50 = 20 \text{ ms}$$
$$T \text{ for } 360 = 20\text{ms}$$
$$\text{For } 180 = 10\text{ms}$$
$$\text{For } 60 = 20\text{ms} * (60/360)$$
$$= 3.4\text{ms}$$

For bridge :-

$$T1 = [\text{time for } 90 + \text{time for } 1]$$
$$= 5\text{ms} + 3.4\text{ms}$$
$$= 8.4\text{ms}$$

I1 = load current supplied to various IC

I1 = current required for LCD + o/p current of PIC16F877 + o/p current of max232 + Current required Ultrasonic Sensor + Current required for RF Module+ Current required Relay+ Current required for LED

For circuit current I1:

= 3mA + 25mA + 8mA + 30mA + 20mA+30mA+ 15mA

= 131mA

C = I1 * T1/ Vr

= 131* 8.4 * $10^{-}6/1$

= 1100.4 F

Thus this 1100.4Fvalue can be approximated to 1000 F. Thus we will use 1000 F capacitor before IC 7812, which is used for improving Frequency Response

4) Voltage regulator:
Requirement: We Require 5v and 12v Regulated voltage at the output of the voltage regulator.

Voltage regulators are used after the filter capacitor so as to generate constant DC voltage supply of 5 volts. We have used 7805 as a voltage regulator. Both of them are three pin IC which are namely input, ground and output. We have to give output of filter capacitor to the input of regulator, and we get 5 volts supply at the output pin of the respective regulator.

Transformer selection: we require 15V for min input for IC 7805

= Drop across IC 7805 + Required Output voltage

= 3 V+ 5V

= 8 V

So at Input of 7805 we required 8 V with margin

Consider drop across diode 0.7V so 4 diode conducts drop is 2.8 V

= 2.8V +8 V

= 10.8 V. So at secondary we required 10 V

4.1.1 Relay Driver Circuit

Relays are components which allow a low-power circuit to switch a relatively high current on and off, or to control signals that must be electrically isolated from the controlling circuit itself. To make a relay operate, we have to pass a suitable pull-in and holding

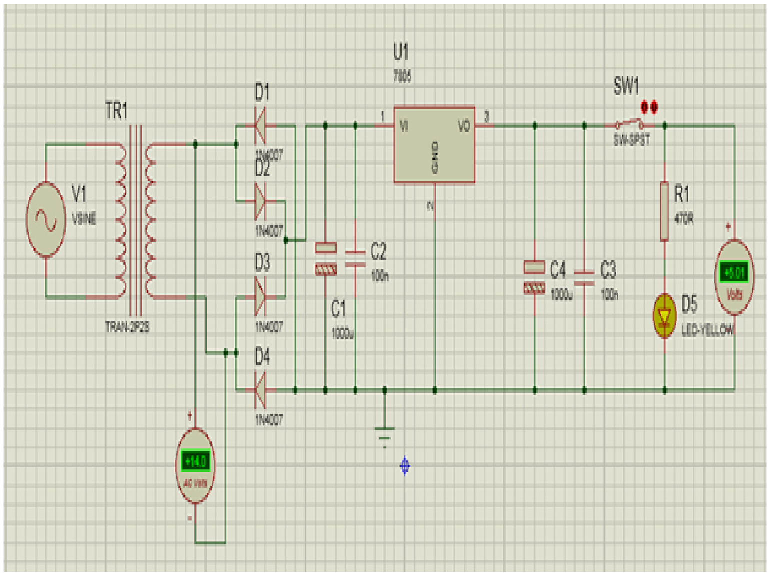

Figure 4.1: Power supply proteous simulation

current (DC) through its energizing coil. And generally relay coils are designed to operate from a particular supply voltage, often 12V, in case of many small relays used for electronics work.

We have to provide enough base current to turn the transistor on and off.NPN transistor BC547 is used to control a Relay with a 12V coil, operating from a +12V supply. Series base resistor R1 is used to set the base current for transistor, so that the transistor is driven into saturation (fully turned on) when the relay is to be energized. Thus the transistor will have minimal voltage drop, and hence dissipate very little power as well as delivering most of the 12V to the relay coil

Basic transistor relay driver, actuated on HIGH input (NPN):

This circuit will drive a relay coil from a low power output. It is used to switch high loads or a load that needs AC current to operate. The relay will be actuated when the input ofthe circuit goes high. The protection diode Dp is used to protect the transistor from the reverse current generated from the coil of the relay during the switch off time. The values for Rb and Qs vary accordingly.

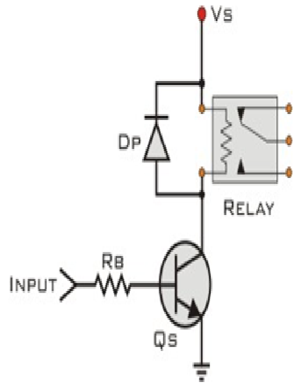

Figure 4.2: relay driver circuit

4.1.2 Relay

Relay acts as a switch which will be used to control the window. According to the output of the comparator, the relay driver circuit shall work and relay shall be turned ON or OFF

Figure 4.3: relay

4.2 Vehicle Unit

4.2.1 Micro-controller

A microcontroller is a small computer on a single integrated circuit consisting internally of a relatively simple CPU, clock, timers, I/O ports, and memory. Microcontrollers are used in automatically controlled products and devices. Microcontrollers are designed for small or dedicated applications. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers

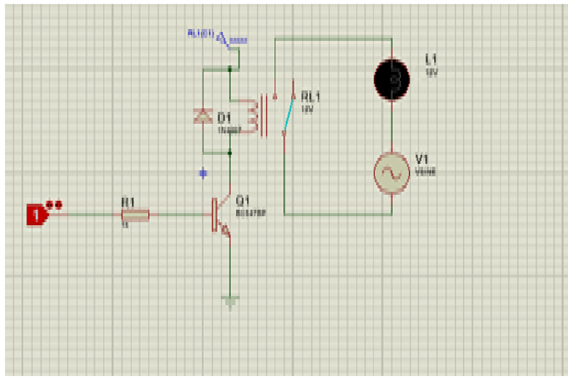

Figure 4.4: driver circuit proteous simulation

make it economical to digitally control even more devices and processes.

PIC Microcontroller (16F877A)
Requirement: We have to control and to monitor the Vehicle Unit through the Controller.

The first and foremost criterion is that it must meet the task at hand efficiently and cost effectively. In analysing the needs of a microcontroller-based project, it is seen whether an 8- bit, 16-bit or 32-bit microcontroller can best handle the computing needs of the task most effectively.

Among the other considerations in this category are:

(a)Speed: The highest speed that the microcontroller supports.

(b) Packaging: It may be a 40-pin DIP (dual inline package) or a QFP (quad flat package), or some other packaging format. This is important in terms of space, assembling, and prototyping the end product.

(c) Power consumption: This is especially critical for battery-powered products. (d) The number of I/O pins and the timer on the chip.

(e) How easy it is to upgrade to higher performance or lower consumption versions.

(f) Cost per unit: This is important in terms of the final cost of the product in which a microcontroller is used.

The second criterion in choosing a microcontroller is how easy it is to develop products around it. Key considerations include the availability of an assembler, debugger, compiler, technical support.Thus the pic microcontroller pic16f877a, satisfying the criterion necessary for the proposed application is chosen for the task.

Key Features	PIC16F873A	PIC16F874A	PIC16F876A	PIC16F877A
Operating Frequency	DC – 20 MHz	DC – 20 MHz	DC – 20 MHz	DC – 20 MHz
Resets (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
Flash Program Memory (14-bit words)	4K	4K	8K	8K
Data Memory (bytes)	192	192	368	368
EEPROM Data Memory (bytes)	128	128	256	256
Interrupts	14	15	14	15
I/O Ports	Ports A, B, C	Ports A, B, C, D, E	Ports A, B, C	Ports A, B, C, D, E
Timers	3	3	3	3
Capture/Compare/PWM modules	2	2	2	2
Serial Communications	MSSP, USART	MSSP, USART	MSSP, USART	MSSP, USART
Parallel Communications	—	PSP	—	PSP
10-bit Analog-to-Digital Module	5 input channels	8 input channels	5 input channels	8 input channels
Analog Comparators	2	2	2	2
Instruction Set	35 Instructions	35 Instructions	35 Instructions	35 Instructions
Packages	28-pin PDIP 28-pin SOIC 28-pin SSOP 28-pin QFN	40-pin PDIP 44-pin PLCC 44-pin TQFP 44-pin QFN	28-pin PDIP 28-pin SOIC 28-pin SSOP 28-pin QFN	40-pin PDIP 44-pin PLCC 44-pin TQFP 44-pin QFN

Figure 4.5: Performance Comparison of PIC Microcontrollers

PIC 16F874A :- Current: 25mA sink/source per I/O

Operating voltage:2.0V to 5.5V

Operating speed: DC 40 MHz clock input

Table 4.1: Performance Comparison of Controllers

Parameters	8051	PIC	AVR	ARM
Bus width	8-bit for standard core	8/16/32-bit	8/32-bit	32-bit mostly also available in 64-bit
Communication Protocols	UART, USART,SPI,I2C	PIC, UART, USART, LIN, CAN, Ethernet,SPI, I2S	UART, USART, SPI, I2C, (special purpose AVR support CAN, USB, Ethernet)	UART, USART, LIN, I2C, SPI, CAN, USB, Ethernet, I2S, DSP, SAI (serial audio interface), IrDA
Speed	12 Clock/instruction cycle	4 Clock/instruction cycle	1 clock/ instruction cycle	1 clock/ instruction cycle
Memory	ROM, SRAM, FLASH	SRAM, FLASH	Flash, SRAM, EEP- ROM	Flash, SDRAM, EEP- ROM
ISA	CLSC	Some feature of RISC	RISC	RISC
Power Consumption	Average	Low	Low	Low
Families	8051 variants	PIC16,PIC17, PIC18, PIC24, PIC32	Tiny, Atmega, Xmega, special purpose AVR	ARMv4,5,6,7 and series
Community	Vast	Very Good	Very Good	Vast
Manufacturer	NXP, Atmel, Silicon Labs, Dallas, Cyprus, Infineon, etc.	Microchip Average	Atmel	Apple, Nvidia, Qualcomm, Samsung Electronics, and TI etc.
Cost	Very Low	Average	Average	Low
Other Feature	Known for its Standard	Cheap	Cheap, effective	High speed operation Vast

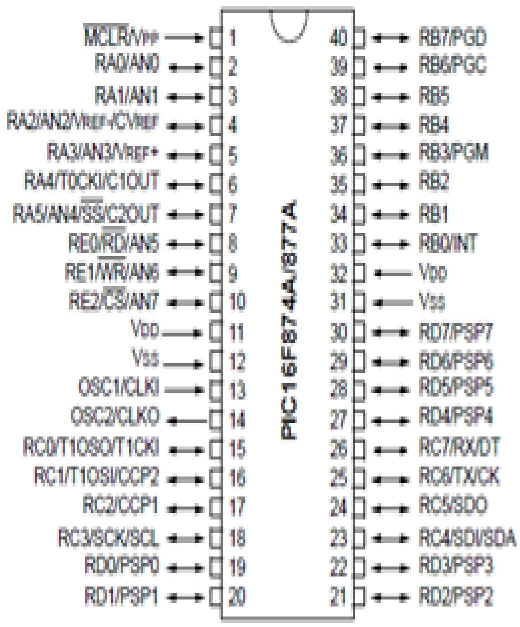

Figure 4.6: Pin Diagram of PIC16F877A:

Up to 8K x 14 words of Flash Program Memory,

Up to 368 x 8 bytes of Data Memory (RAM),

Up to 256 x 8 bytes of EEPROM Data Memory

40 pinPIC16f877A microcontrollers

256 Bytes EEPROM data memory

4.2.2 Ir sensor

Requirement: We have to sense the Road edges of the Road.
sensors available are ultrasonic sensors, ir sensors, infra-red etc.. SENSOR: These are the basic components for the automatic A.C. supply switching. Here we have used 38 kHz infra-red IR receiver for detecting if a person has entered or left the room in which we intend to switch the supply. These detector modules need to have infra-red rays of

38 kHz which we have given through the IR LEDs via a 555 timer.

A 555 timer in an oscillating mode so that it generates a 38 kHz square wave. Using the switching output of the 555 timer to drive an infra-red (IR) LED; meaning the LED will turn off at about 38,000 times per second. This is done so that the receiver will detect the signal using a IR receiver sensor that is tuned to detect that frequency and turn the red LED on.

You might be asking yourself how this works. The answer is fairly simple, this will be similar to how your remote control works. When you press a button it sends an infra-red signal to a receiver built into your TV; the TV then carries out the command you send it. This works very similar to it, albeit, a bit more dumb. the IR LED will constantly be sending out a signal and when the car starts to pull into the garage the car's head lights will bounce the signal back to the IR receiver and turn the red LED light on

Diagram: -

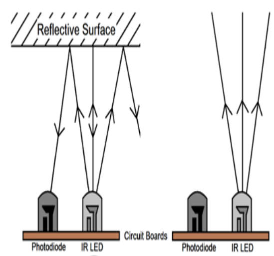

Figure 4.7: IR Sensor

4.2.3 Reset circuit

This circuit gives the microcontroller the starting pulse required to start the operation from the start. Unless this pulse is given, the microcontroller doesnt start functioning.

Working: - The circuit gives the required starting pulse to the microcontroller to start the operation from the very beginning. The PIC microcontroller requires the active high reset pulse. So the capacitor is connected to positive supply and the resistor is grounded.

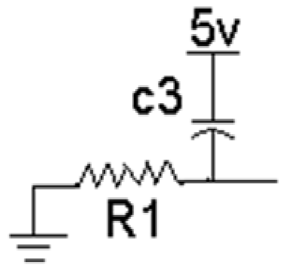

Figure 4.8: Reset Circuit

4.2.4 Crystal circuit

Requirement: We have to supply 12Mhz frequency to Micro-controlller.

This circuit gives the required clock pulses to the microcontroller to give it the sense of the reference time.

The circuit consists of one crystal and two capacitors. The crystal is used to give the

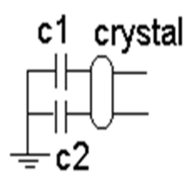

Figure 4.9: Crystal Circuit

microcontroller the required periodic pulses to make it function properly. The crystal used in the project is of 12 MHz. The two capacitors are connected to two pins of the crystal and are grounded at the other ends. The values of the capacitors are selected by referring the datasheet of PIC16F877A.

4.2.5 Motor Driver Circuit

Requirement: We require to Control Speed, Rotation, Power of 12v DC Motor.

Osc Type	Crystal Freq.	Cap. Range C1	Cap. Range C2
LP	32 kHz	33 pF	33 pF
	200 kHz	15 pF	15 pF
XT	200 kHz	47-68 pF	47-68 pF
	1 MHz	15 pF	15 pF
	4 MHz	15 pF	15 pF
HS	4 MHz	15 pF	15 pF
	8 MHz	15-33 pF	15-33 pF
	20 MHz	15-33 pF	15-33 pF

Figure 4.10: Crystal Oscillator selection specifications

Features of the DC Motors driver:

600MA. Output current capability per channel

1.2a peak output current (non repetitive)per channel

Enable facility

Over temperature protection

Logical 0 input voltage up to 1.5v

4.2.6 Motor

Features of the DC Motors used:

60 RPM 12V DC motors

5 kg cm torque

6mm shaft diameter with internal hole

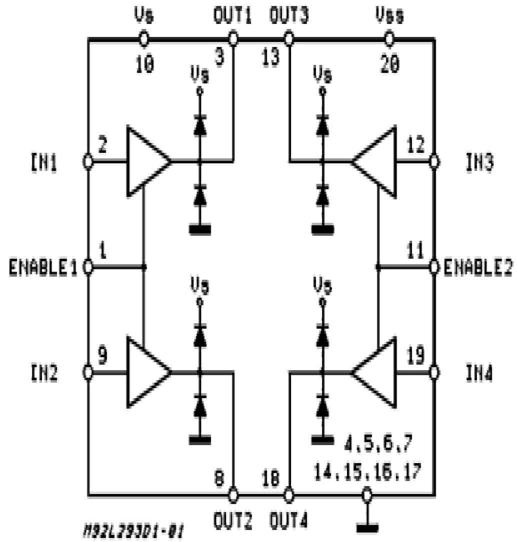

Figure 4.11: motor driver

125gm weight

No-load current = 60 mA(Max),

Load current = 300 mA(Max)

4.2.7 Battery

Requirement: We require the portable power supply for the circuit. BATTERY Batteries store energy being produced by given generating source and when this source is unavailable this energy can be used by loads. The inclusion of storage in any energy generating system will increase the availability of the energy.

Specification: - Operating voltage:-12vDC Current Rating :-1.3Ahr Type:-rechargeable Material used :-lead acid

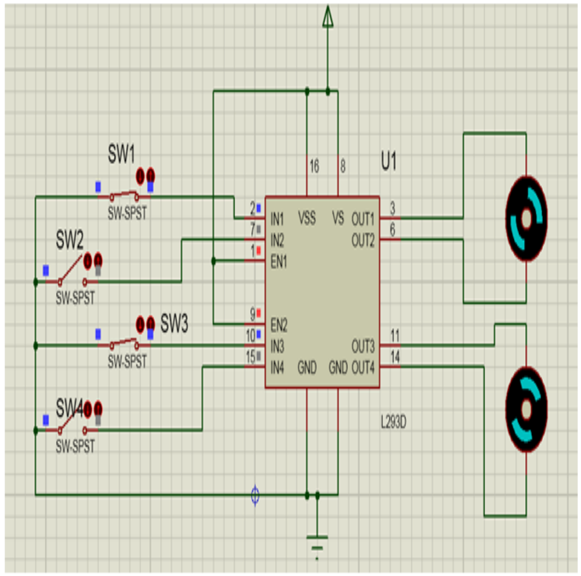

Figure 4.12: Motor driver circuit

Figure 4.13: motor

4.2.8 RF Module

Requirement: We require the Communication between the Vehicle Unit and the Car Unit. Different types of communication module are Gsm module, RF module, Radar etc. An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and/or receiver. RF Module:

RF waves are electromagnetic waves which propagate at the speed of light, or 186,000 miles per second(300,000 km/s).

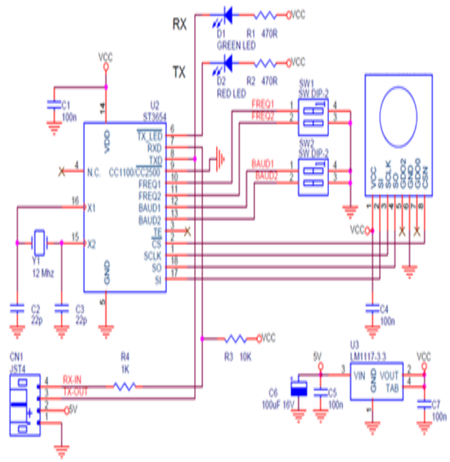

Figure 4.14: RF module interfacing with PIC16F877A

4.2.9 MAX232

Usually all the digital ICs work on TTL or CMOS voltage levels which cannot be used to communicate over RS-232 protocol. So a voltage or level converter is needed which can convert TTL to RS232 and RS232 to TTL voltage levels. The most commonly used RS-232 level converter is MAX232.This IC includes charge pump which can generate RS232 voltage levels (-10V and +10V) from 5V power supply. It also includes two receiver and two transmitters and is capable of full-duplex UART/USART communication.RS-232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications, for the transfer of data between the microcontroller and a PC. The voltage levels of a microcontroller and PC are not directly compatible with those of RS-232, a level transition buffer such as MAX232 be used.

MAX 232:

MAX232 IC is used for serial communication.

MAX232 is compatible with RS-232 standard, and consists of dual transceiver.

Each receiver converts TIA/EIA-232-E C levels into 5V TTL/CMOS levels.
Each driver converts TTL/COMS levels into TIA/EIA-232-E levels.

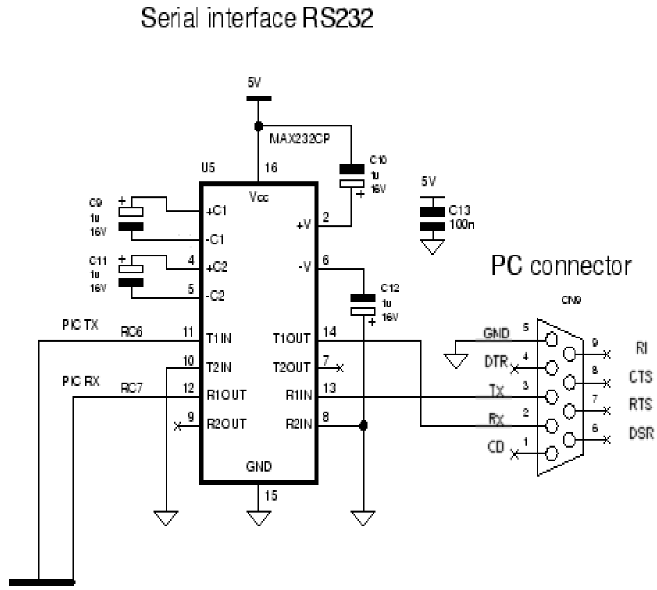

Figure 4.15: Interface RS232

4.2.10 LCD Display

LCD's are very simple to interface with the controller as well as are cost effective.The LCD requires 3 control lines (RS, R/W EN) 8 (or 4) data lines. The number on data lines depends on the mode of operation. If operated in 8-bit mode then 8 data lines + 3 control lines i.e. total 11 lines are required. And if operated in 4-bit mode then 4 data lines + 3 control lines i.e. 7 lines are required. How do we decide which mode to use? Its simple if you have sufficient data lines you can go for 8 bit mode if there is a time constrain i.e. display should be faster then we have to use 8-bit mode because basically 4-bit mode twice as more time as compared to 8-bit mode When RS is low (0), the data is to be treated as a command. When RS is high (1), the data being sent is considered as text data which should be displayed on the screen.When R/W is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively reading from the LCD. Most of the times there is no need to read from the LCD so this line can directly be connected to Gnd thus saving one controller line.The ENABLE pin is used to latch the data present on the data pins. A HIGH - LOW signal is required to latch the data. The LCD interprets and executes our command at the instant the EN line is brought low. If you never bring EN low, your instruction will never be executed.

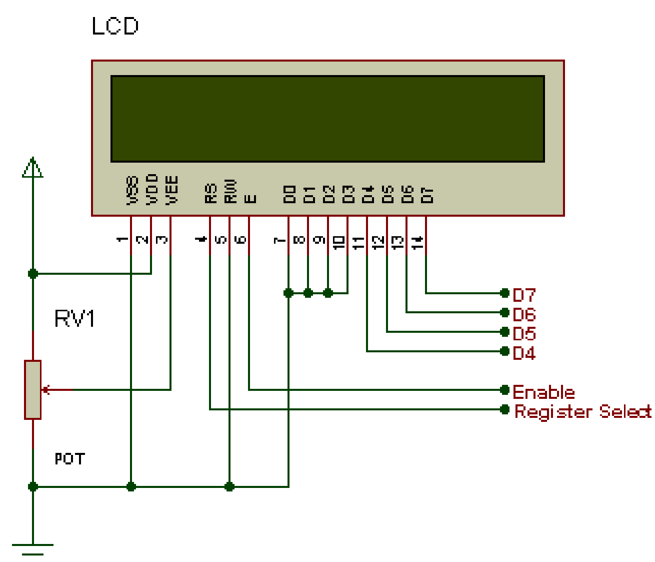

Figure 4.16: LCD display

Commands used in LCD

01: Clear display screen

02: Return home

04: Decrement cursor (shift left)

06: Increment cursor (shift right)

05: Shift display right

07: Shift display left

08: Display off, cursor off

0A: Display off, cursor on

0C: Display on, cursor off

0E: Display on, cursor blinking

0F: Display on, cursor blinking

10: Shift cursor position to left

14: Shift cursor position to right

18: Shift entire display to left

1C: Shift entire display to right

80: Force cursor to beginning of first line

LCD DISPLAY:

Standard LCD module from LAMPEX is used for the DISPLAY.

Display format CHARA. X LINE 16 x 2 mm.

Font matrix of W x H 5 x 8 mm.

Viewing area of W x H 64.0 x 14.0 mm.

PCB size W x H 80.0 x 36.0 mm.

Supply voltage of 5 V and current of 3mA.

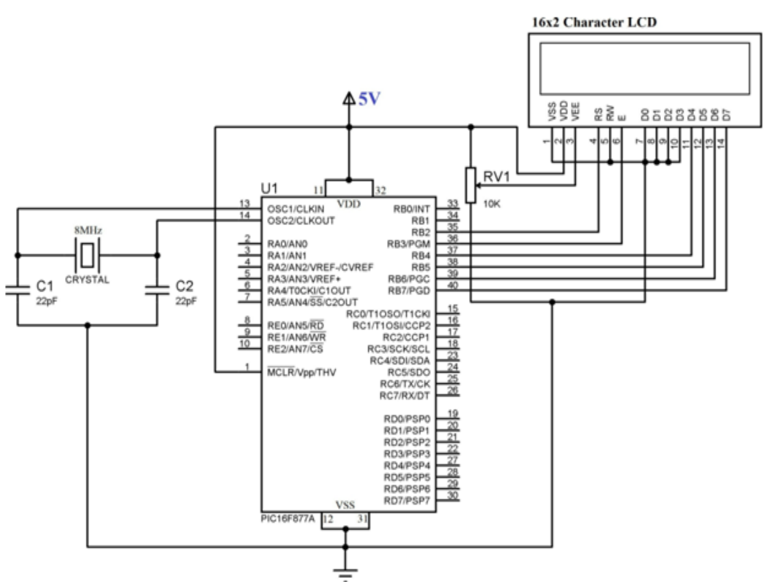

Figure 4.17: Lcd interfacing

4.2.11 Em18 reader module

This module directly connects to any microcontroller UART or through a RS232 converter to PC.It gives UART/Wiegand26 output. This RFID Reader Module works with any 125 KHz RFID tags

Specifications:

5VDC through USB (External 5V supply will boost range of the module)
Current: ¡50mA Operating Frequency: 125Khz Read Distance: 10cm Size of RFID reader module: 32mm(length) * 32mm(width) * 8mm(height)

Figure 4.18: Em 18 Reader module

RS232 interface format:
10 ASCII DATA (card no.)+ 2 ASCII DATA (XOR result)
E.g. Card number is 4500C5D1E9B8 read from reader then the card number on card will be as below.
Preamble
00C5D1E9 value in Hex = 12964329. / B8 is XOR value for (45 XOR 00 XOR C5 XOR D1 XOR E9)
Hence number on the card is 0012964329. 1. Data baud rate: 9600 bps 2. Data bit 8 bits 3. Parity check: None 4. Stop bit

Thus we understood the different components used in power supply design, we also studied different components and modules required in the designing the system.

Chapter 5

Software design

In this chapter, the various software used in the development of this project has been mentioned. Software such as Proteus, pickit2, MpLab, etc. are discussed here with their working algorithm.

5.1 Description Of Software Used

A) Proteus

The Proteus software has been used for the circuit design and simulation.Proteus is a software technology that allows creating clinical executable decision support guidelines with little effort. Indeed, it should be fun creating your own guidelines.Once a guideline for a condition has been created, it can be executed to provide stepwise advice for any patient having that condition.

A software tool that allows creating and executing clinical decision support guidelines using the Proteus approach is available. The tool called Protean may be downloaded from here. Protean allows creating new guidelines or editing existing ones very easily. Much of the editing is done by dragging and dropping.

Proteus is an ambitious approach with a potential to touch many aspects of health-care. Several prototype software tools developed have validated the core features of the Proteus approach. The experience of development carried out to date suggests that a

more exhaustive implementation be created and tested with healthcare professionals. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design.
It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. All PCB Design products include an auto router and basic mixed mode SPICE simulation capabilities.

Schematic Capture:

Schematic capture in the Proteus Design Suite is used for both the simulation of designs and as the design phase of a PCB layout project. It is therefore a core component and is included with all product configurations.

Microcontroller Simulation:

The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables it's used in a broad spectrum of project prototyping in areas such as motor control,temperature control and user interface design.It also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as a training or teaching tool.

Support is available for co-simulation of:

1.Microchip Technologies PIC10, PIC12, PIC16,PIC18,PIC24,dsPIC33 Microcontrollers.
2.Atmel AVR (and Arduino), 8051 and ARM Cortex-M3 Microcontrollers.
3.NXP 8051, ARM7, ARM Cortex-M0 and ARM Cortex-M3 Microcontrollers.
4.Texas Instruments MSP430, PICCOLO DSP and ARM Cortex-M3 Microcontrollers.
5.Parallax Basic Stamp, Freescale HC11, 8086 Microcontrollers.

PCB Design:

The PCB Layout module is automatically given connectivity information in the form of a netlist from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. Design Rule Checking does not include high speed design constraints.PCB's of up to 16 copper layers can be produced with design size limited by product configuration.

3D Verification:

The 3D Viewer module allows the board under development to be viewed in 3D together with a semi-transparent height plane that represents the boards enclosure. STEP output can then be used to transfer to mechanical CAD software such as Solidworks or Autodesk for accurate mounting and positioning of the board.

B)MPLAB:

MPLAB IDE is a software program that runs on a PC (Windows, Mac OS, Linux) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers.

MPLAB Integrated Development Environment brings many changes to the PICmicrocontroller development tool chain. Unlike previous versions of the MPLAB IDE which were developed completely in-house, MPLAB IDE is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily, while also providing us with a much more extensible architecture to bring you even more new features in the future.

MPLAB IDE is a free, integrated toolset for the development of embedded applications on Microchip's PIC and dsPIC microcontrollers. It is called an Integrated Development Environment, or IDE, because it provides a single integrated environment to develop code for embedded microcontrollers.

MPLAB IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools.

Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.

Components of MPLAB

The MPLAB IDE has both built-in components and plug-in modules to configure the system for a variety of software and hardware tools.

Project Manager:

The project manager provides integration and communication between the IDE and the language tools.

Editor:

The editor is a full-featured programmer's text editor that also serves as a window into the debugger.

Assembler/Linker and Language Tools:

The assembler can be used stand-alone to assemble a single file, or can be used with the linker to build a project from separate source files, libraries and recompiled objects. The linker is responsible for positioning the compiled code into memory areas of the target microcontroller.

Debugger:

The Microchip debugger allows breakpoints, single stepping, watch windows and all the features of a modern debugger for the MPLAB IDE. It works in conjunction with the editor to reference information from the target being debugged back to the source code.

Execution Engines:

There are software simulators in MPLAB IDE for all PICmicro MCU and dsPIC DSC devices. These simulators use the PC to simulate the instructions and some peripheral functions of the PICmicro MCU and dsPIC DSC devices. Optional in-circuit emulators and in-circuit debuggers are also available to test code as it runs in the applications hardware

.

Key Features:

MPLAB IDE is a Windows Operating System (OS) based Integrated Development Environment for the PIC MCU families and the dsPIC Digital Signal Controllers. **The MPLAB IDE provides the ability to:**

1.Create and edit source code using the built-in editor.

2.Assemble, compile and link source code.

3.Debug the executable logic by watching program flow with the built-in simulator or in real time with in-circuit emulators or in-circuit debuggers.

4.Make timing measurements with the simulator or emulator.

5.View variables in Watch windows. 6.Program firmware into devices with device programmers.

C) PICKIT 2

The pickit 2 is a low-cost in-circuit debugger (ICD) and in-circuit serial programmer(ICSP). Pickit 2 is intended to be used as an evaluation, debugging and programming aidIn a laboratory environment.

ThePickit 2 offers these features:

1. Real-time and single-step code execution.
2.Breakpoints, Register and Variable Watch/Modify
3.In-circuit debugging 4.Target Vdd monitor
5.Diagnostic LEDs
6.MPLAB IDE user interface
7.USB interface to a host PC / USB POWERED
8.40 Pin Target Board With FRC Cbale
9.ICSP FRC connecter Easy to interface to all our NSK boards.

The Pickit 2 allows you to:

1.Debug your source code in your own application
2.Debug your hardware in real-time.

5.2 Proteus software simulation

Simulation of Vehicle unit

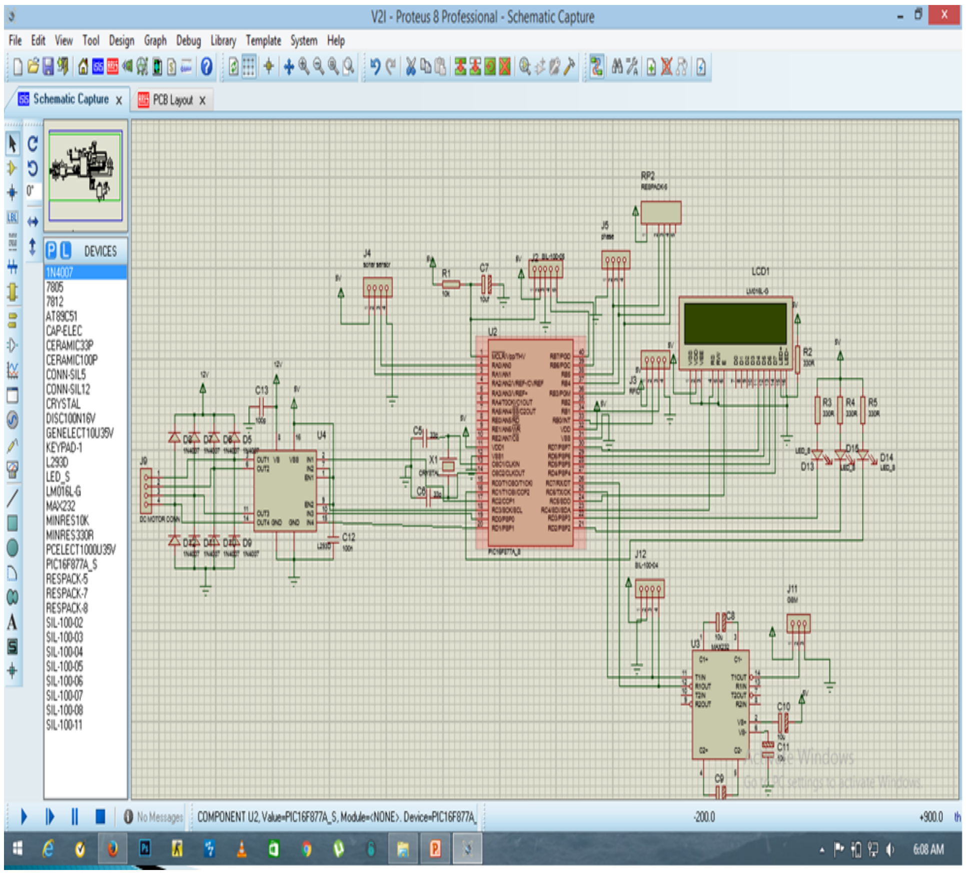

Figure 5.1: Vehicle unit simulation on proteus

Simulation of traffic unit

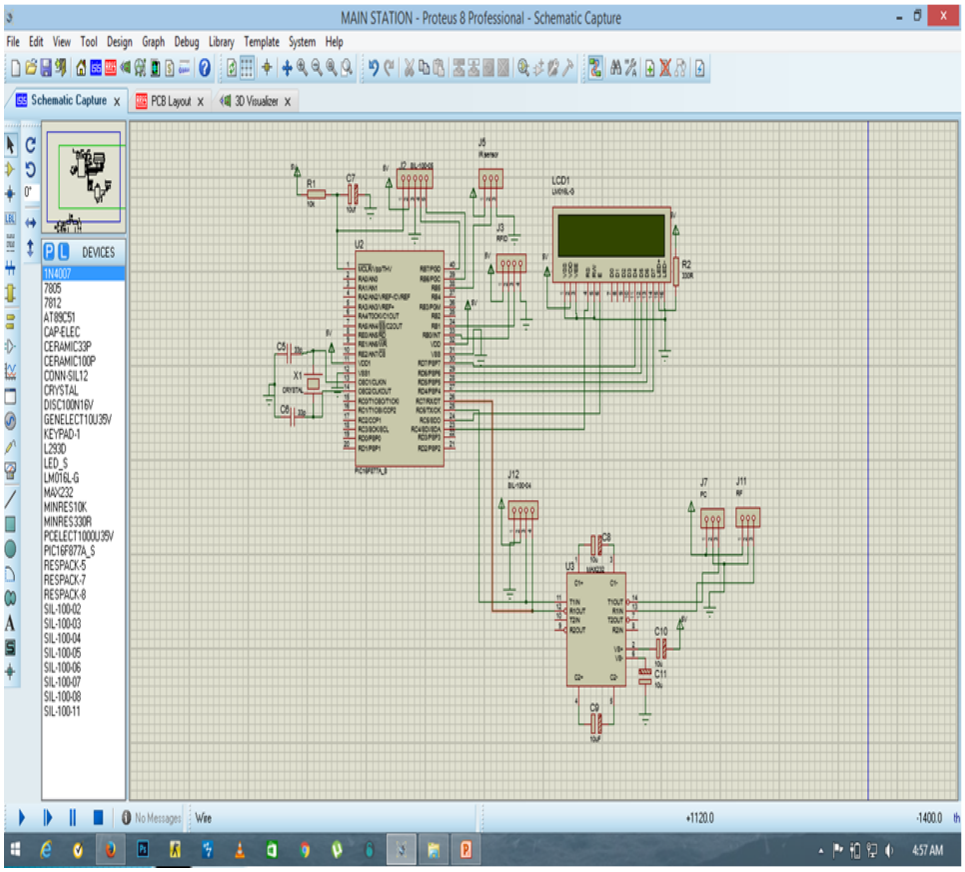

Figure 5.2: Traffic unit simulation on proteus

Concluding this chapter by successfully understanding the software's used in this project.

Chapter 6

Testing and Results

6.1 Working of vehicle unit on proteus

In this section, we shall present some of the test results in both the simulations and the real environment.
For these tests, an inter-section was selected as the region of interests in ceit represents the most difficult scenario in which the V2I-based traffic management system will have to work.

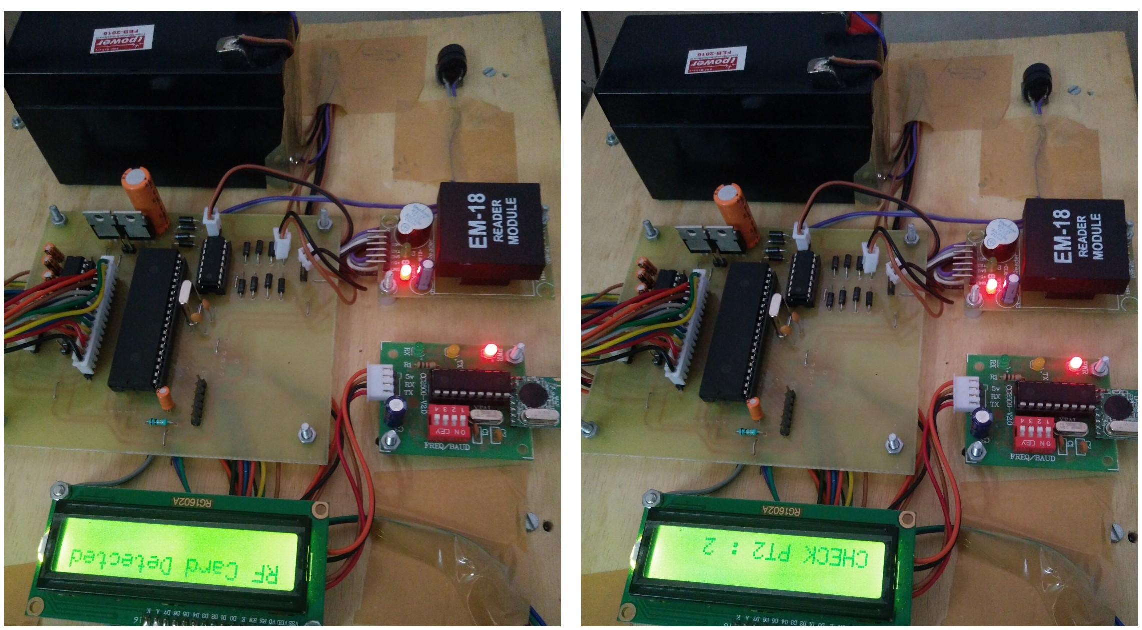

Figure 6.1: Testing of traffic signal unit

Figure 6.2: Edge detection

Ir sensors are used for the road edge detection of vehicle and with the help of em module, vehicle status is sent to traffic unit through Rf communication as shown in the figure 7.1.

we have successfully tested the output of vehicle unit and traffic unit. results are shown in the figure above. The parameters considered are Road edge detection and traffic signal unit.

Chapter 7

conclusion

7.1 Applications

The safety applications aim to decrease the number of accident by prediction and notifying the drivers of the information obtained through the communications between the vehicles and sensors installed on the road.

1. Warning for hazardous situations (such as congestions, accidents, obstacles etc.),
2. Merging assistance,
3. Intersection safety,
4. Speed management,
5. Rail crossing operations,
6. Priority assignment for emergency vehicles.

7.2 Advantages

1.Consistent and Smoother i.e The performance indicators showed that the driver behaviour changed and became more consistent and smother.
2.Traffic Safety i.e Evaluate the impact of V2I communication on improving driver behaviour.
3.Mobility i.e The ability to improve traffic safety and mobility while reducing environmental impacts.

7.3 Limitations

1.When road width is small, Frequent sensing takes place.
2.When traffic is more there is sensing from both sensors.

7.4 Conclusion

We have presented a V2I-based traffic management system with a two fold objective: First, our approach proposes a solution to the problem of regulating trafc ow in urban areas, in which different bottleneck situations may coexist. Second, it contributes to avoiding accidents by alerting the driver in advance of potential collisions. The system includes an intelligent controller that uses a reference safety distance and the appropriate speed as fuzzy inputs. The output sent to the driver is information on how the vehicle is being driven.

7.4.1 Paper published

We successfully published the paper, details are,Paper ID: IJATES/ March /2017/124, Volume No: 05, Issue No. 03, March 2017.

7.5 Future Scope

Vehicle to infrastructure communication for safety program is that each vehicle on the roadway will eventually be able to communicate with other vehicles, and that this rich set of data and communications will support a new generation of active safety applications and systems. In future this system can be implemented in automatic cruise control purpose with additional safety module to control the vehicle. Traffic control module can be modified further for more efficient signal system.

7.6 References

[1]Vicente Milans, Jorge Villagr, Jorge Godoy, Javier Sim, Joshu Prez, and Enrique Onieva. An Intelligent V2I-Based Trafc Management System. IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, 13(1), March 2012.

[2] M. Mazidi. 8051 Microcontroller and Embedded Systems. Pearson Publications, 2007.

[3] T.Samad and A.M. Annawamy. Vehicle-to-Vehicle/Vehicle-to-Infrastructure Contro. The Impact of Control Technology, 2009, II Edition.

[4]Maurice Khabbaz, Chadi Assi and Wissam Fawaz. DSA-based V2I Communication Under The Microscope. In IEEE WCNC(Services, Applications, and Business), Dec 2013.

[5] Min Wu. Context-Aware Heterogeneous V2I Communications . Onur Altintas and Haris Kremo Toyota InfoTechnology Center Co., LTD. Tokyo, Japan, 2001. [6] J.M.Barton.Method and Apparatus for Embedding Authentication Information Within Digital Data .U.S. Patent 5646997. 1997.

[7] Mauro Biagi, Stefano Rinauro, Stefania Colonnese, Gaetano Scarano, Roberto Cusani. Dynamic Network Selection in V2I Systems. IEEE VEHICULAR NETWORKING CONFERENCE. Volume 14 no.4. Dec-2013.

7.7 Appendix A:Components List and Cost

7.8 Appendix B: Data-sheets

Table 7.1: Components List and Cost

Sr.No	Component Name	Quantity	Cost/Component	Total Cost
1	3 Pin Connector Pair	1	3.90/-	Rs. 3.90
2	16 Pin Connector Pair	1	40/-	Rs. 40
3	2 Pin Connector Pair	1	2.60/-	Rs. 2.60
4	4 Pin Connector Pair	1	5.20/-	Rs. 5.20
5	Ir sensor	1	500/-	Rs. 500
6	PIC16F877A	1	150/-	Rs. 150
7	12V 2CORelay	1	31/-	Rs. 31
8	DB9 Connector (Female)	1	10/-	Rs. 10
9	Bridge	1	6/-	Rs. 6
10	Regulator 7805	1	9/	Rs. 9
11	Regulator 7812	1	9/	Rs. 9
12	Crystal Oscillator	1	12/-	Rs. 12
13	Rfid module	1	1200/-	Rs. 1200
14	40 Pin Base	2	5/-	Rs. 10
15	24 Pin IC Base	1	3/-	Rs. 3
16	Capacitor 1000/25V	2	5/-	Rs. 10
17	Capacitor 10uF	1	2/-	Rs. 2
18	4K7 9Pin	4	2/-	Rs. 8
19	33pF	4	0.50/-	Rs. 2
20	Resistor	4	1/-	Rs. 4
21	Main PCB	2	150/-	Rs. 300
22	PCB Film	2	250/-	Rs. 500
23	Liquid Crystal Display	2	200/-	Rs.400
24	Transformer	1	80/-	Rs. 80
25	Etching solution	1	65/-	Rs.65
26	Soldering material and flux	1	50/-	Rs.50
27	Cabinet	2	80/-	Rs.160
28	Nut bolts	-	50/-	Rs.50

Sr.No	Component Name	Quantity	Cost/Component	Total Cost
29	other	-	1000/-	Rs.1000
30	Rf module	2	400/-	Rs.800
31	Em-18	1	1000/-	Rs.1000
32	Battery	1	650/-	Rs.650
33	Wheels	4	25/-	Rs.100
34	Motor	2	400/-	Rs.800
35	Total	-	-	Rs.8622.7