BLIND SPOT WARNING AND SPEED MANIPULATION THROUGH DATA TRANSFER USING CAN PROTOCOL

A PROJECT REPORT

Submitted By

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BONAFIED CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

The motive of our project is to mitigate the number of road accidents by making the vehicles to communicate among themselves by transferring the data using CAN protocol.Speed of the adjacent vehicle is captured via wireless transceiver and logged into a dedicated Electronic control unit. The concerned vehicle's speed is sensed and captured. The ultrasonic sensors detects the presence of obstacle or vehicles resides in the region of blind spot , all these information are logged in to the ECU and transferred from one vehicle to adjacent vehicle using CAN protocol. CAN protocol involves communication between various controllers without the involvement of a host computer which finds a wide application in automotive industry. Thus, the proneness of accidents is greatly avoided which in turn pulls down the accident rate thereby saving more lives.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS	EXPANSIONS
ADAS	Advanced Driver assistance system
CAN	Controller Area Network
ITS	Intelligent Transport system
PSM	Periodic Safety Message
CSF	Crash Severity Factor
VANET	Vehicular Ad Hoc Network
TGFD	Transforming Growth Factor D
DSRC	Dedicated Short range communication
WAVE	Wireless access in Vehicular Environment
LCA	Lane Change Model
TSR	Two Second Rule
ESM	Emergency Safety Messages
MAC	Medium Access Control
SUMO	Simulation of Urban Mobility
FLS	Fixed Lane strategy
BLS	Best lane strategy
SINR	Signal to interference plus noise ratio
LTE	Long Term Evaluation
OFDM	Orthogonal Frequency Division Multiplexing
MMSP	Master Synchronous Serial port
LDR	Light Dependent Resistor
CSMA	Carrier Sense Multiple Access
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter

LIN	Local interconnect Network
MOST	Media Oriented Systems transport
LVDS	Low Voltage Differential Signaling
PKI	Asymmetric Public Key Interface
EEBL	Emergency Electronics Brake Light
BSW	Blind Spot Warning
LCW	Lane Change Warning
FCW	Forward Change Warning
DNPW	Do Not Pass Warning
IMA	Intersection Movement Assist
LTA	Left Turn Assistant
RSU	Road Side Unit

CHAPTER 1

INTRODUCTION

1.1 THEORETICAL BACKGROUND

Everyday we are communicating with each other in some way or another, be it by using words, actions or even expressions in conveying a message. We humans depend not only on face-to-face communication but the kind that brings technology to the fore to bridge that gap between people by mere seconds across vast distances. In The 5th Century, Letters And Documents Could Be Sent By using Pigeons’ Homing Abilities. Pigeons were trained by being removed from their homes and taken to a destination, from which they would returned home.

Observation stations were build on hilltop to relay these messages over long distances One of the NSA’s observatory station at Teufelsberg .These networks were replaced by telegraph network invented by “sameul morse” in 1838 . Marconi-Radio ability-first wireless telegraphy in 1897 used to send one way signals . Alexander Graham Bell, who patented the telephone, inaugurating the 1,520- km telephone line. After the invention of mobile phones till 20th century mobile were made to access only for voice and sms usage. In 21st century smart phones were biggest evolution created in the tele-communications We have seen a drastic changeover in communicational technologies and in our life styles too. There is no point in that, it doesn’t take much time for us to convert from 4G to 5G and much more advanced. Only the thing is how ethically we are perfectly synchronized with the technology in our livelihoods. On going in advance, inventors try to develop a technology that can make the machines to communicate with each other.Thus in the case of automobile industries the evolution of Vehicle to vehicle communication came into existence. The evolution of the technologies and the standards enabling a vehicle to communicate with other vehicles and the surrounding environment and become part of an extended intelligent transportation system (ITS) communication system able to support a wide range of services by using different communication media.

1.2 OBJECTIVE

Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disasters. Studies show that about 60%roadway collisions could be avoided if the operator of the vehicle was provided warning at least one-half second prior to a collision. Human drivers suffer from perception limitations on roadway emergency events, resulting in large delay in propagating emergency warning. The collision warning system is implemented as a part of vehicle safety systems, thus reducing the number of accidents. To be most effective, such a system should have the capability of supporting real time systems that can warn potential drivers of an impending collision. The proposed paper is to mitigate the road accident by controlling the speed of adjacent vehicle. Controller area network (CAN or CAN-bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host Computer. CAN is a message based protocol, designed specifically for automotive applications but now also used in other areas such as industrial automation and medical equipment. CAN is a multi-master broadcast serial bus standard for connecting electronic control units (ECUs).Each node is able to send and receive messages, but not simultaneously. The concerned vehicle's speed is sensed and captured. A comparison is made between both the data units, where communication is established via CAN protocol. The speed from both the vehicle is compared and in case of high speed of the adjacent vehicle, the speed of the concerned vehicle is reduced relatively.

1.3 V2V COMMUNICATION

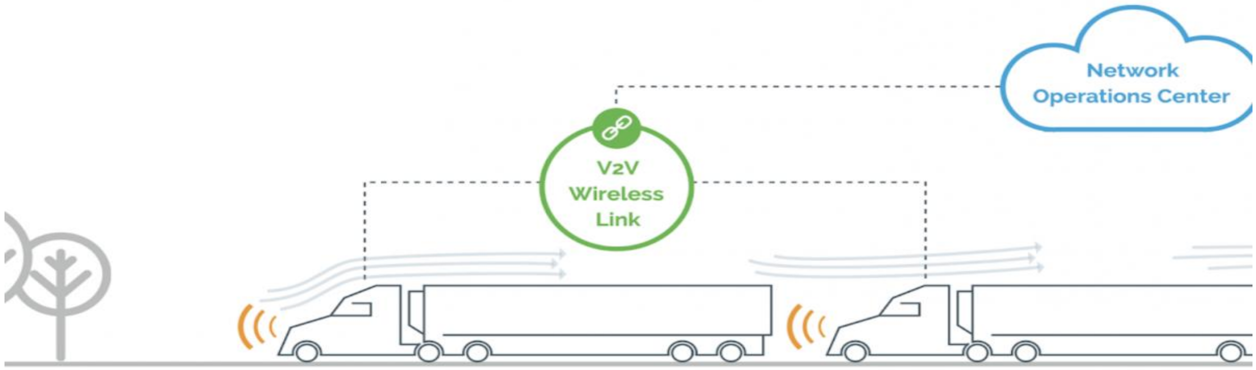


Fig 1.1: outlook of V2V communication

Vehicle-to-vehicle communication (V2V communication) is the wireless transmission of data between motor vehicles. The goal of V2V communication is to prevent accidents by allowing vehicles in transit to send position and speed data to one another over an ad-hoc mesh network. Depending upon how the technology is implemented, the vehicle's driver may simply receive a warning should there be a risk of an accident or the vehicle itself may take preemptive actions such as braking to slow down.

V2V communication is expected to be more effective than current automotive original equipment manufacturer (OEM) embedded systems for lane departure, adaptive cruise control, blind spot detection, rear parking sonar and backup camera because V2V technology enables an ubiquitous 360-degree awareness of surrounding threats. V2V communication is part of the growing trend towards pervasive computing, a concept known as the Internet of Things (IoT).In the United States, V2V is an important part of the intelligent transport system (ITS), a concept that is being sponsored by the United States Department of Transportation (DOT) and the National Highway Traffic Safety Administration

(NHTSA). An intelligent transport system will use the data from vehicle-to-vehicle communication to improve traffic management by allowing vehicles to also communicate with roadside infrastructure such as traffic lights and signs. The technology could become mandatory in the not-too-distant future and help put driverless-cars on highways across America.

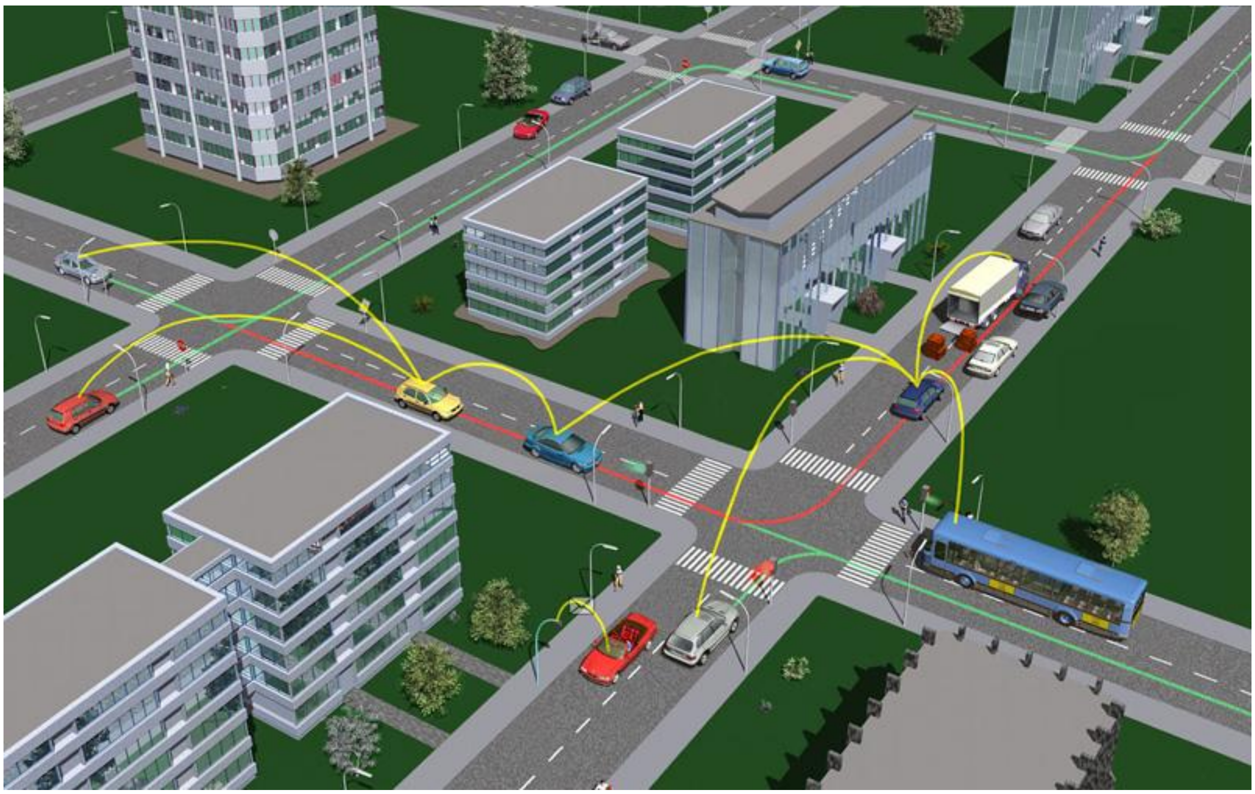


Fig 1.2: V2V communication network

The implementation of V2V communication and an intelligent transport system currently has three major roadblocks: the need for automotive manufacturers to agree upon standards, data privacy concerns and funding. As of this writing it is unclear whether creation and maintenance of the supporting network would be publicly or privately funded. Automotive manufacturers working on ITS and V2V include GM, BMW, Audi, Daimler and Volvo.

1.4 FEATURES OF CAN PROTOCOL

A vehicle contains a network of electronic devices to share information/data with each other. For example A spark ignition engine requires a spark to initiate the combustion chamber at the correct time so it communicates with engine control unit that adjusts the exact timing for ignition to provide better power and fuel efficiency.. Another example is of a transmission control unit that changes the ratio of gear automatically with the changing speed. It uses information from engine control unit and various sensors in the system. Every electronic device has an ECU/MCU (electronic/microcontroller control unit) with its own set of rules to share/transfer information. For two or more devices to interact they should have the necessary hardware and software which allows them to communicate with each other. Before CAN was introduced in the automobiles, each electronic device was connected to other device using the wires (point to point wiring) which worked fine, when the functions in the system were limited. The figure below is the pictorial view of the point to point wiring connection. One of the major problems for automotive engineers was linking the ECUs of the different devices so that real time information can be exchanged. CAN protocol was designed to address this problem. It laid down the rules through which the various electronic devices can exchange information with each other over a common serial bus.

This in turn reduced the wiring connections to a great extend thereby reducing the bulkiness and complexity of the system. The image below shows how the different devices are connected using the **CAN protocol**.

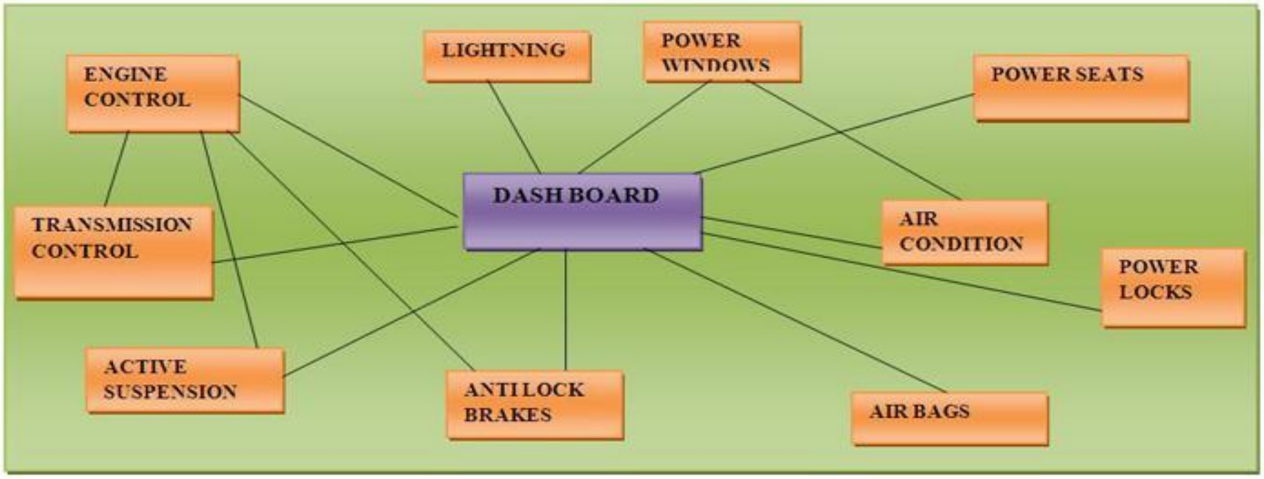


Fig 1.3. Devices that can be connected using CAN protocol.

Also the standard technology of time, asynchronous transmitter/receiver did not support multi domain communications. Domain is a group of electronic devices that have almost similar requirements to work in the system. For example CD/DVD PLAYER, GPS system, monitors and displays etc. form a single domain. Similarly air conditioning and climate control, dashboards, wipers, lights doors etc. form another domain. Hence the electronic devices implanted in a vehicle can be classified under different domain. CAN facilitates multi-domain communication for the engineers.

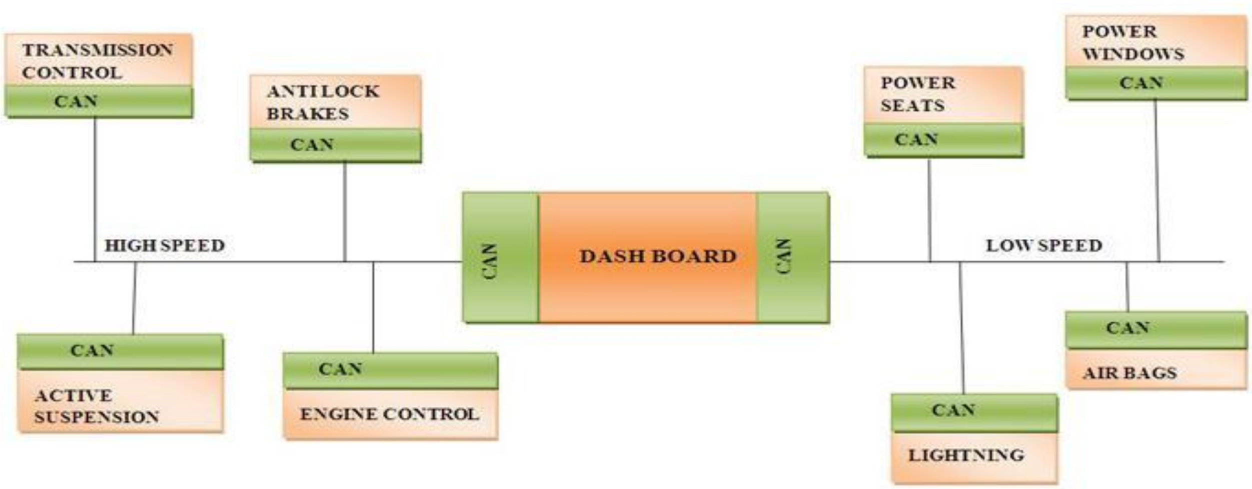


Fig1. 4. Different types of interfaces with CAN protocol.

1.5 CAN BUS

The Controller Area Network (CAN) is used in e.g. vehicles for communication between ECUs, sensors and actuators

- The CAN protocol is robust, low-cost and frame based
- Originally developed and launched by Robert Bosch in 1986
- Essential to many applications - e.g. cars, trucks, tractors, industrial robots, ...

Imagine that your car is like a human body:

The Controller Area Network (CAN bus) is the **nervous system**, enabling communication between all parts of the body.

Similarly, 'nodes' are like muscles connected via the CAN bus, which acts as a central networking system. In turn, electronic control units (ECU) are like arms and legs.

So what's an ECU?

In an automotive CAN bus system, ECUs can e.g. be the engine control unit, airbags - or the audio system.

A modern car can have up to 70 ECUs.

This is where the CAN standard comes in handy:

The CAN bus protocol allows ECUs to communicate with each other without complex dedicated wiring in between. In turn this allows for several features to be added via software alone, e.g. electronic gearbox control.

Further, an ECU can use data from another ECU, eliminating the need to install the same sensors in multiple devices.

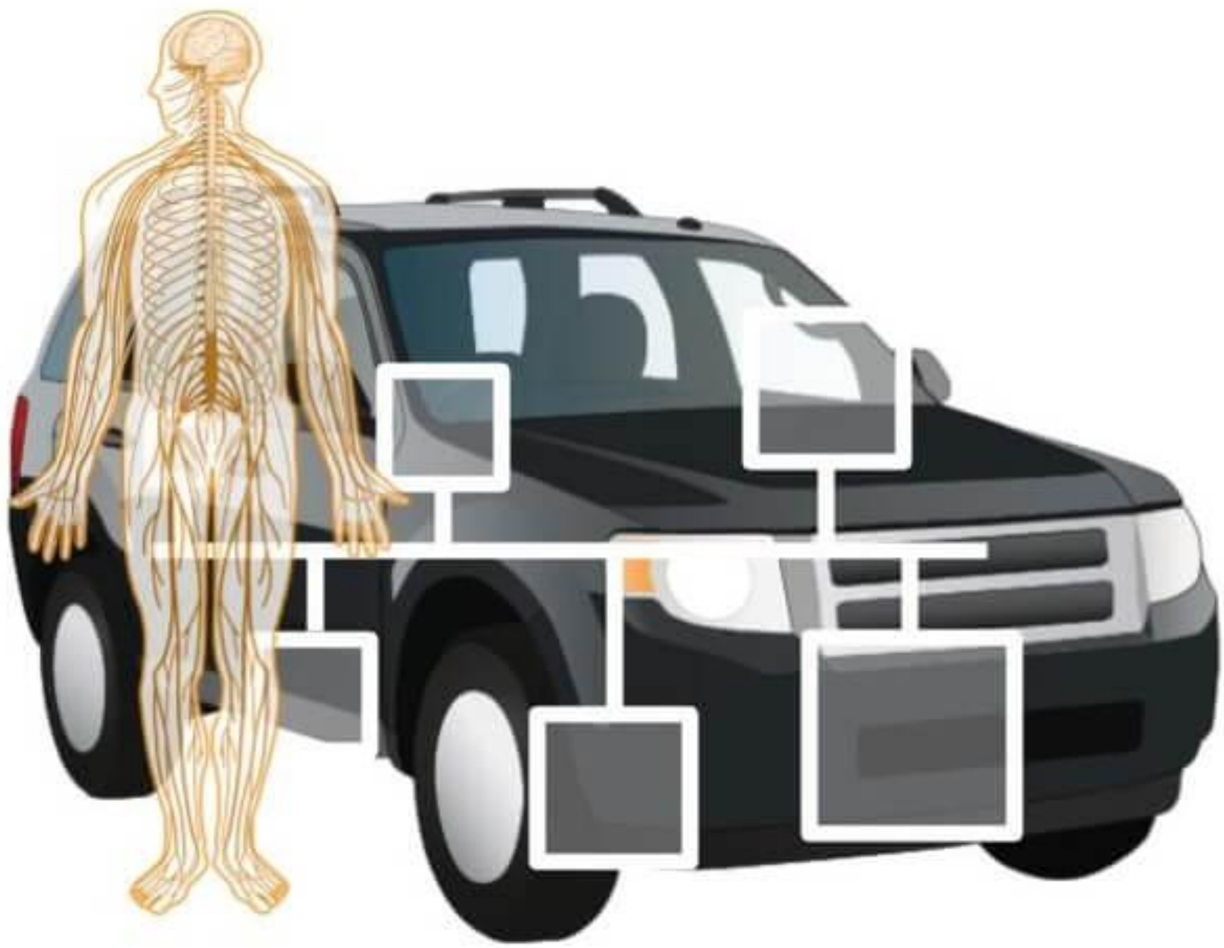


Fig 1.5 analogy of sensors network in car with the human nervous system

1.5.1 ADVANTAGES OF CAN BUS COMMUNICATION

1. **Low cost:** ECUs communicate via a single CAN interface, i.e. not direct analogue signal lines, reducing errors, weight, costs
2. **Centralized:** The CAN bus system allows for central error diagnosis and configuration across all ECUs
3. **Robust:** The system is robust towards electric disturbances and electromagnetic interference, making it ideal for e.g. vehicles

4. **Efficient:** CAN frames are prioritized by ID - the top priority gets bus access, yet frames are not interrupted
5. **Flexible:** Each CAN-connected ECU can receive all transmitted messages. It decides relevance and acts accordingly - this allows easy modification and inclusion of additional nodes

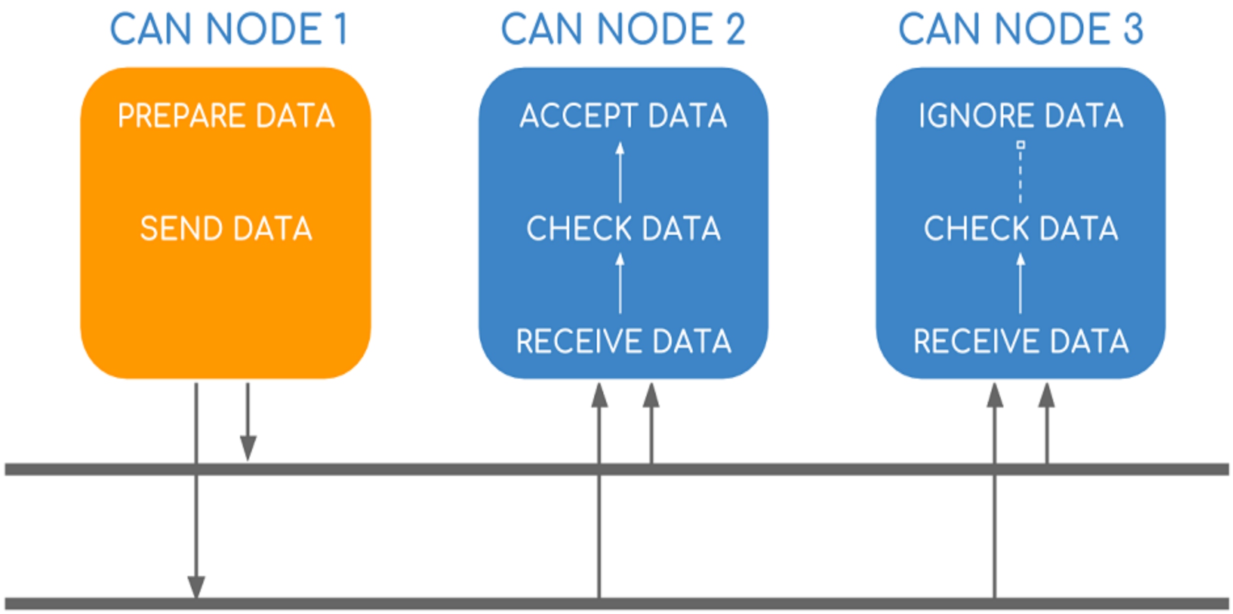


Fig 1.6 Can Bus Structure

1.5.2 THE CAN BUS PACKET FORMAT

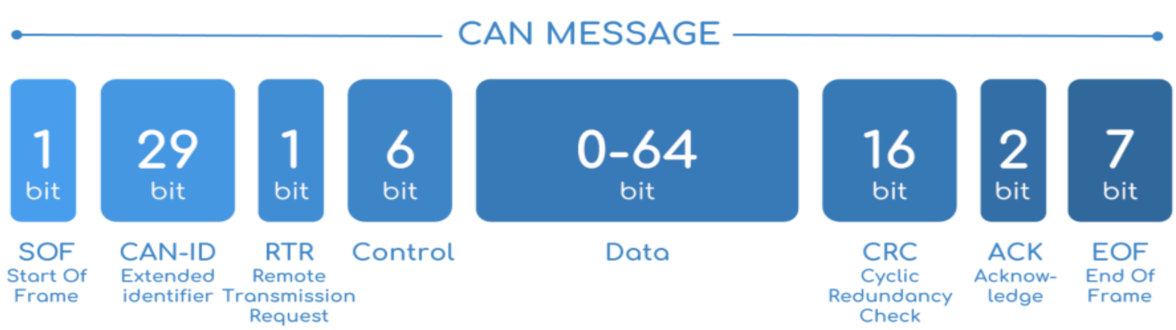


Fig 1.7 Can Bus Packet Format

The 8 Components of a CAN Bus Message

SOF: The Start of Frame is a 'dominant 0' to tell the other nodes that a CAN node intends to talk

CAN-ID: Contains the frame identifier - lower values have higher priority

RTR: The Remote Transmission Request indicates whether a node sends data or requests dedicated data from another node

Control: Informs the length of the Data in bytes (0 to 8 bytes)

Data: Contains the actual data values, which need to be "scaled" or converted to be readable and ready for analysis

CRC: The Cyclic Redundancy Check is used to ensure data integrity

ACK: The ACK slot indicates if the node has received the data correctly

EOF: Marks the end of the CAN frame

1.5.3 THE CAN BUS HISTORY IN SHORT

- **Pre CAN:** Car ECUs relied on complex point-to-point wiring
- **1986:** Bosch developed the CAN protocol as a solution
- **1991:** Bosch published CAN 2.0 (CAN 2.0A: 11 bit, 2.0B: 29 bit)
- **1993:** CAN is adopted as international standard (ISO 11898)
- **2003:** ISO 11898 becomes a standard series (11898-1, 11898-2, ...)
- **2012:** Bosch released the CAN FD 1.0 (flexible data rate)
- **2015:** The CAN FD protocol is standardized (ISO 11898-1)
- **2016:** The physical CAN layer for data-rates up to 5 Mbit/s standardized in ISO 11898-2

Today, the CAN protocol is standard in practically all vehicles (cars, trucks, buses, tractors, ...) - as well as ships, planes, EV batteries, industrial machinery and more. Further, more exotic cases include drones, radar systems, submarines or even prosthetic limbs.

CHAPTER 2

LITERATURE SURVEY

The following are the research works of various authors taken into consideration for the betterment of the proposed work.

2.1 CAN BASED ACCIDENT AVOIDANCE SYSTEM, Mayur Shinde, Nidhi Pandey, Pritham Shetty, Harsh Umrania & Prof.Manoj Mishra Electronics & Telecommunication Engineering Department, Atharva College of Engineering, Mumbai, India. International Conference on Innovative and Advanced Technologies in Engineering (March-2018).

OVERVIEW:

Safety for the automotive systems is further improved by Advanced Driver Assistance Systems (ADAS) in modern automotive systems. The CAN protocol is used for communication. The collision avoidance system is an arrangement of sensors, microcontrollers and buzzers that is placed within a car to alert its driver of any dangers that may lie ahead on the road. This project is intended for a secure and smooth journey. The car/ vehicle itself is aware of its movement. If the driver himself is not concentrating on driving or any other parameters, which may cause damage to the vehicle as well a life, this intelligent car/ vehicle warn the driver regarding the danger ahead.

DRAWBACKS:

- User ignorance causes collision to occur.
- Low efficiency .

2.2 VEHICLE TO VEHICLE COMMUNICATIONS AT SUBURBAN ENVIRONMENT USING IEEE 802.11AF COMPLIANT DEVICES, Jeric G. Brioso*, Alberto S. Bañacia*, Hirokazu Sawada†, Kentaro Ishizu†, Kazuo Ibuka†, Takeshi Matsumura†, and Fumihide Kojima† *University of San Carlos, Cebu City, Philippines 6000 †National Institute of Information and Communications Technology (NICT), Kanagawa, 239-0847 Japan, The 21st International Symposium on Wireless Personal Multimedia Communications (WPMC- 2018) 978-1-5386-5757-7/18/$31.00 ©2018 IEEE.

OVERVIEW:

In this paper, V2V communications over TVWS at suburban environment using the IEEE 802.11af-compliant devices were evaluated and characterized in terms of received signal strength and throughput as a function of the separation distance between the two vehicles. By utilizing 20 dBm or 100 mW of transmit power with 64-QAM payload modulation and 2/3 coding rate, a maximum of 4.87 Mbps throughput has been measured at -51 dBm of received power. The said data were obtained when the effective speed of the vehicles and the distance between them are 8.68 m/s and 37 m, respectively. Throughput was affected by the packet loss rate and in this study, the packet loss rate of less than 10% was obtained at received signal strength between -88 to -33 dBm in every MCS. The results suggested the feasibility of utilizing TVWS in vehicular wireless communications supporting the goals of the intelligent transportation system.

DRAWBACKS:

- Does not provide acknowledgement.
- Packet loss is present.

2.3 EMERGENCY VEHICLE TRAVERSAL USING DSRC/WAVE BASED VEHICULAR COMMUNICATION, Insaf Ismath?, Tharaka Samarasinghe?†, Dileeka Dias?, Madara Wimalarathna?, Waruna Rasanga ?, Nalin Jayaweera?, and Yohan Nugera? Department of Electronic and Telecommunication Engineering, University of Moratuwa, Sri Lanka. †Department of Electrical and Electronic Engineering, University of Melbourne, Australia. 2019 IEEE Intelligent Vehicles Symposium (IV).

OVERVIEW:

This paper studies two EV traversal algorithms, focusing mainly on their communication aspects. Fast moving dense traffic is modeled, and the traversal algorithms are implemented on top of the dedicated short-range communication (DSRC)/wireless access in vehicular environments (WAVE) protocol stack, while accounting for channel impairments such as path loss and fading. Algorithms that highlight the required packet transfers for the traversal and for safe lane changes are presented, and simulated in the VEINS framework for different traffic conditions. Simulation results show that the suitability of the EV traversal algorithms defer depending on the speed distribution of the vehicles.

DRAWBACKS:

- No Automatic breaking system.
- Expensive and inaccurate.
- Data congestion is more.

2.4 VEHICLE COLLISION DETECTION AND AVOIDANCE WITH POLLUTION MONITORING SYSTEM USING IOT, Mahesh A. Rakhonde, Prof.Dr. S. A. Khoje, Prof. R. D. Komati, VLSI & Embedded, Electronics and Telecommunication, MITCOE Pune 411038, India, 2018 IEEE Global Conference on Wireless Computing and Networking (GCWCN).

OVERVIEW:

The main aim of this technology to avoid accidents, detect in real-time and monitor pollution by vehicle emission of gases in the air. The proposed system can be divided into four major modules for understanding: Accident Detection Unit, Accident Avoidance Unit ,Vehicle Pollution Monitoring Unit and Communication Unit. In order to Maintain Safe distance Between vehicles in order to avoid Accidents and All Data is Sent to local Server using MQTT protocol. MQ7is used to measure the amount of carbon monoxide in smoke coming from silencer after fuel combustion. Tire pressure is measures using BMP180 sensors. Connection is established using MQTT protocol.

DRAWBACKS:

- Low efficiency
- No response from driver leads to false results
- Process only with less parameters.

2.5 SMART VEHICLE SAFETY MONITORING SYSTEM USING CAN PROTOCOL, Rachana Khamamkar1, Ashru Jadhav2, Shreyas Thoke3, Prof. Girish Chaple4 1,2,3,4Department of Electronics and Telecommunication, 1,2,3,4Pune Institute of Computer Technology, Pune, Maharashtra, India, ©2018 IEEE.

OVERVIEW:

The presented work cites a system predicated on Controller Area Network (CAN) protocol, harnessed to preclude failures in vehicles and assist the driver by providing apposite indications and messages. The system is a three node network comprising of an 8-bit, Master Synchronous Serial Port (MSSP) module supporting 3wire SPI (all 4 modes) slave controllers (PIC18F4550) which forms a data acquisition system and the CAN bus facilitates efficient transfer of this acquired data to the 32-bit, SPI compliant master controller (ARM7 LPC2148). In order to interface these controllers to the CAN bus, these controllers require external CAN controllers (MCP2515) and CAN transceivers (MCP2551).

DRAWBACKS:

- Less baud rate.
- No ease of acces.
- Encryption of CAN messages is not present.

2.6 VEHICLE-TO-VEHICLE COMMUNICATION TECHNOLOGY, Albert Demba(1) Dietmar P. F. Möller(2) (1)Clausthal University of Technology (TUC), Department of Informatics, Germany (2)ClausthalUniversity of Technology TUC), Institute of Applied Stochastics and OR, Germany, 978-1-5386-5398-2/18/$31.00 ©2018 IEEE.

OVERVIEW:

This student research paper explores technologies, benefits, and challenges of V2V with solutions. It focuses on countering the challenges of control systems with more emphasis on security. In this context, the technology poses security issues with interference. Thus an enhanced architectural solution is suggested that could help to guarantee system operation without interference and more physical security. A standardized space on road vehicle should be created specifically for V2V components and system status application should be added. In this regard V2V is a vehicular ad hoc network designed for automobiles to talk to each other automatically, using a wireless ad hoc network.

DRAWBACKS:

- Additional cost.
- User's ignorance.
- Interference of signals.
- Expensive.

2.7 VEHICLE SPEED CONTROL AND SAFETY PROTOTYPE USING CONTROLLER AREA NETWORK, Priyanka A. Wagh1, Rohit R. Pawar2, Dr.S.L.Nalbalwar3, IEEE Member 1,2, 3 Department of Electronics and Telecommunication Engineering, 1,2,3 Dr. Babasaheb Ambedkar Technological University, 1,2,3 Lonere, Raigad, Maharashtra, India, 978-1-5090-5595-1/17/$31.00 ©2017 IEEE.

OVERVIEW:

This paper presents the development of vehicle speed controlled driving system for a semi-autonomous vehicle to reduce or avoid emergency conditions while improving the driver-vehicle interface. In-vehicle networking works with different protocols which is a method for communicating data among distributed electronic modules via a serial data bus. CAN is a vehicle bus used for communication between microcontrollers without host computer. This system will analyze and introduce monitoring and controlling automatic headlight, vehicle speed control with obstacle detection, temperature, seat-belt and battery voltage to handle an emergency situation through two nodes which are communicating through CAN protocol. These nodes monitoring and controlling above parameters by communicating with each other.

DRAWBACKS:

- Lack of collision detection mechanism
- Fault indication using buzzer.

2.8 CRASH AVOIDANCE BASED PERIODIC SAFETY MESSAGE DISSEMINATION PROTOCOL FOR VEHICULAR AD HOC NETWORK,

Prof Suzi Iryanti Fadilah, Prof Azizul Rahman Mohd Shariff, Prof Muhammad Norhadri Md Hilmi.[School of science, University Of malaysia] IEEE2019.

OVERVIEW:

This work proposes a real time crash prediction based on TGFD crash severity Factor model for periodic safety message dissemination protocol in VANET. The proposed work was simulated using NS2 to evaluate the performance in Vehicluar networks in an open environment. Vehicles location is obtained using GPS. Adaptive TGFD-CSF based periodic safety message [PSM] is sent within a safety separation of 100m which is contrasted to standard IEEE 802.11p using a fixed PSM generation rate of 10 packets/second. The simulated results show promising improvements for dissemination od PSMs to the vehicles for prevention of road accidents in highway scenarios.

DRAWBACKS:

- Delay in transmission.
- Low accuracy.
- Packet losses may occur.

2.9 LOCATION BASED SCHEDULING FOR CELLULAR V2V SYSTEM IN HIGHWAY SCENARIOS, Prof Richard Fritzsche, Prof Andreas Festag. [Fraunhofer institute for Transportation and Infrastructure structure IVI,Dresden,Germany], IEEE 2018.

OVERVIEW:

In this paper, they have introduced a framework for location based scheduling, exposing basic relations among cell spectral efficiency, communication range and reliability**.** They show that optimal scheduling distance exist, which maximizes the cell throughput by guaranteeing range and reliability constraints. The optimized distance can be utilized by the base station scheduler, which benefits from a closed form solution for outage probability, derived in this work. For a one dimensional highway scenario considering the two closest interferers we derived a closest form solution for the outage probability. The validation results produces similar performance compared to optimal solutions, obtained by Monte Carlo simulations.

DRAWBACKS:

- Low accuracy
- Interference of signals.

2.10 DEMONSTRATION OF FORWARD COLLISION AVOIDANCE ALGORITHM BASED ON V2V COMMUNICATION, Ahmed Hosny1, Mohamed Yousef1, Wessam Gamil1, Mohamed Adel1,2, Hassan Mostafa2,3, M. Saeed Darweesh1,3 1Electronics and Communications Department, Institute of Aviation Engineering and Technology, Giza, Egypt 2Faculty of Engineering, Cairo University, Giza, Egypt 3University of Science and Technology, Nanotechnology Program, Zewail City of Science and Technology, October Gardens, 978-1-7281-1184-1/19/$31.00 ©2019 IEEE.

OVERVIEW:

This paper proposes a hardware implementation of a Vehicle-to-Vehicle (V2V) communication-based forward collision avoidance algorithm by alarming the driver about potential crashes. The proposed system benefits from the information exchange between the host vehicle and the leading vehicle to calculate the safe distance between the host vehicle and leading vehicle to guarantee the avoidance of the collision. This work tests a prototype implementation of a complete V2V communication, designed according to the Basic Safety Message (BSM) specification SAE J2735. the prototype is tested with real vehicles to verify the performance of the proposed forward collision avoidance algorithm. The performance metric in this work is the success of generating a warning message for the driver to decelerate or brake or change the lane before the collision occurs.

DRAWBACKS:

- User’s ignorance
- Interference of signal is high.

CHAPTER 3

EXISTING SYSTEM AND PROPOSED SYSTEM

3.1 EXISTING SYSTEM

Communication between vehicles is established using short range communication (SRC).The conventional system works based on the accelerator input, the rate of fuel flow given to the engine and the speed is controlled accordingly. If the vehicle needs to run at high speed the accelerator pedal has to be pressed more so that it supplies more fuel to the engine. In this method the drivers concentration is much more and always alert to take necessary control actions depends on the traffic situation.

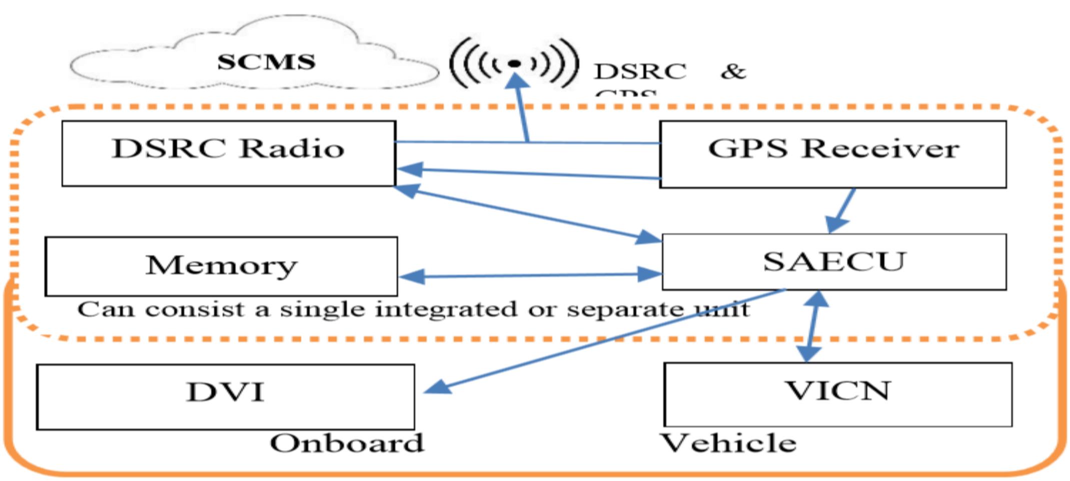


Fig 3.1 Block Diagram of existing system

Some of the hardware components in-vehicle can be integrated into a single unit or a discrete set of components and consist of the following component,

1) Dedicated Short Range (DSRC) radio: Responsible for receiving and transmitting data over antennae.

2) GPS Receiver: Provides the vehicle position, time to DSRC radio and timing signals for applications.

3) Memory: Responsible for storing the security certificates with other information and application data.

4) DSRC & GPS Antenna: Interface between the propagating radio waves and its responsible for receiving and transmitting both the DSRC and GPS signals.

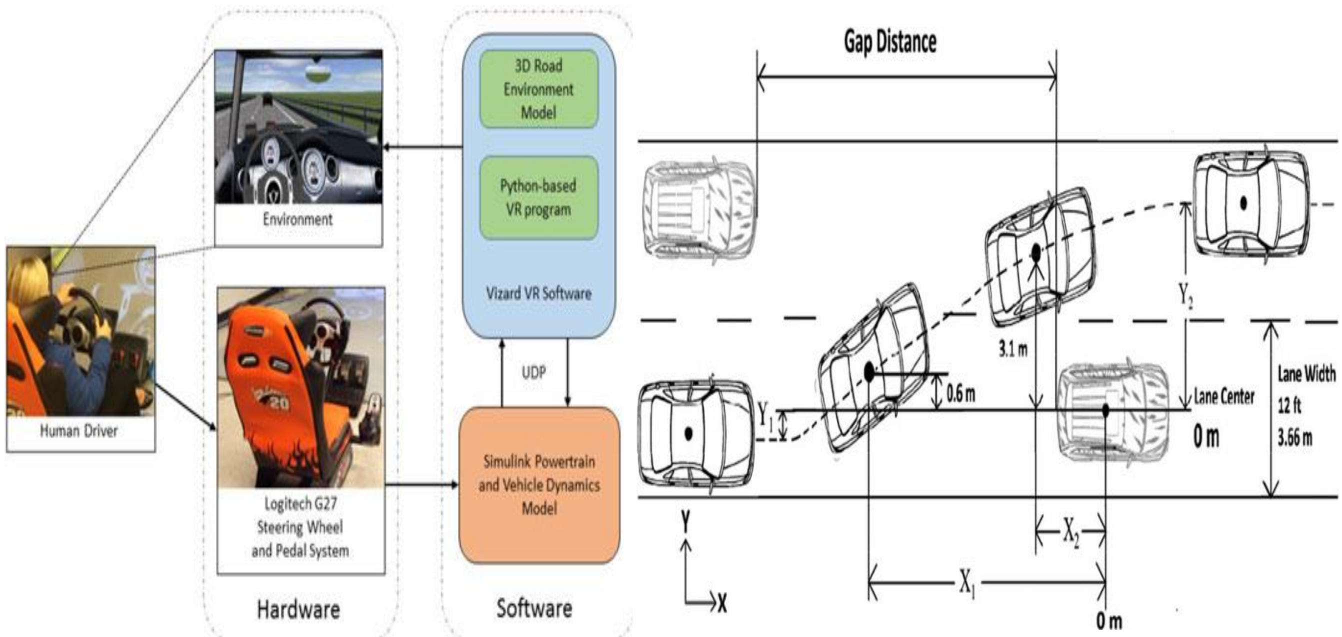


Fig 3.2 calculation of gap distance to avoid collision

3.1.1 DIS ADVANTAGES OF EXISTING SYSTEM:

The existing system even though very useful, it also has several disadvantages like

- Drivers concentration is much more and always alert to take necessary control actions depends on the traffic situation.
- Increases cost of vehicle and maintenance.
- User’s Ignorance.
- The over all collision avoidance system is controlled manually.

3.2 PROPOSED SYSTEM

In our proposed system, the vehicles are granted to communicate and share data via wireless transceiver by using CAN protocol. Speed of the adjacent vehicle and blind spot warning information are communicated via zigbee to the adjacent vehicle and are logged into a dedicated Electronic control unit (ECU).Vehicle at the blind spot region can be identified using ultrasonic sensors. Emergency electronic braking system provides automatic deceleration of vehicle to avoid collision. Alert message passes from one node controller to another.

Each autonomous and mobile node, connected to the others, forms partially connected mesh network. The individual nodes forward the packets to each other. Improve the performance by making all the vehicles close to interact each other and help the car in danger to undertake a more effective choice to solve the emerging problem. The new Intelligent Transport Systems (ITSs) will employ data from V2V communication to enhance traffic management, allowing vehicles to also communicate with road infrastructures, such as traffic lights or signs. These technologies could become mandatory in the not too distant future and contribute to building more reliable self-driving cars on motorways.

The proposed system comprises of performing the following works:

1. Collision avoidance
2. Collision detection
3. Blind spot warning

3.2.1. COLLISION AVOIDANCE

The collision avoidance system involves the usage of Speed sensors to detect the speed of the adjacent vehicle.The obtained data is then fed into the ECU of the car unit and the ECU is connected with the Zigbee for transferring the data using CAN protocol. Depending on the obtained data the the speed of the corresponding vehicle which receives the data is decelerated by reducing the motor speed. Such that the proneness to accidents can be avoided.

3.2..2. COLLISION DETECTION

The collision detection mechanism involves passing the message from one car node to another when one car gets involved in accident or collision. CAN protocol is used to communicate these messages from one node to another.

3.2.3 BLIND SPOT WARNING

This unit is concentrated separately, because most of the accidents occurs when the driver could not able to see the object which is nearer to the vehicle. The region which is not been visualized to the driver is known as the blind spot. The objects or vehicles which is present in the region of blind spot is identified using the ultrasonic sensors. The sensor data is then loaded in ECU for transferring the data to the adjacent vehicle.

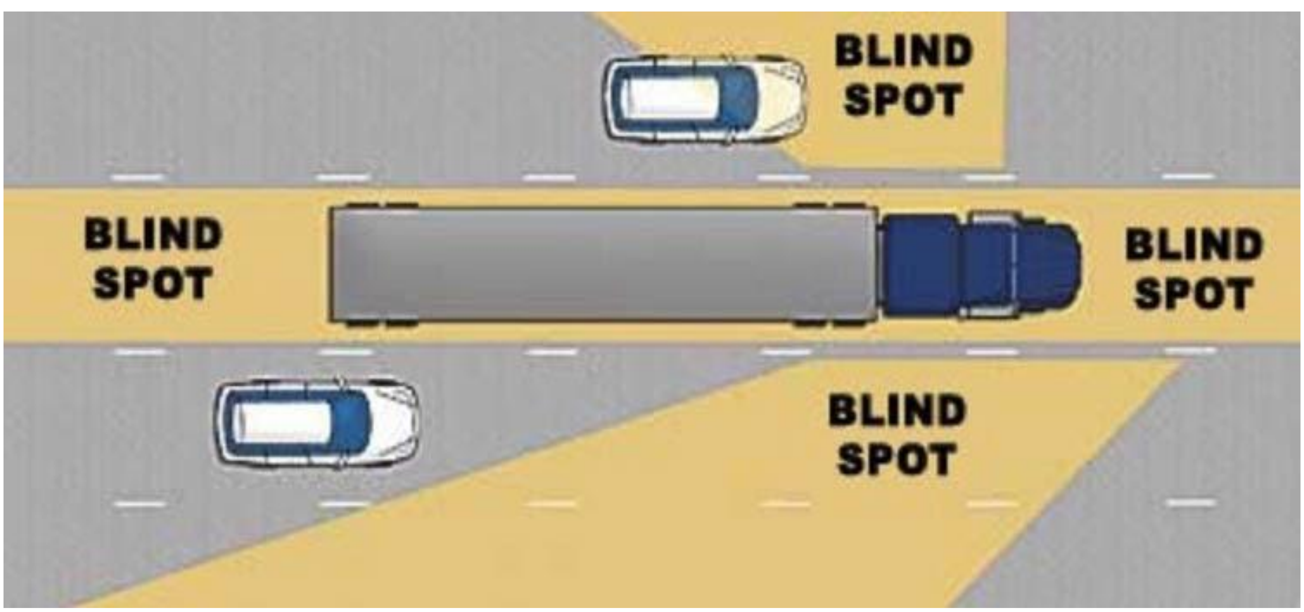


Fig 3.3 Blind Spot of a Truck

3.2.5 ADVANTAGES OF PROPOSED SYSTEM

- CAN protocol is resilient to electrical noise.
- CAN protocol implementation requires low cost.
- Blind spot warning.
- Can communicate with more number of vehicles.
- Every operations will be controlled automatically.
- Automatic breaking system.

CHAPTER 4

DESIGN METHODOLOGY

4.1 BLOCK DIAGRAM:

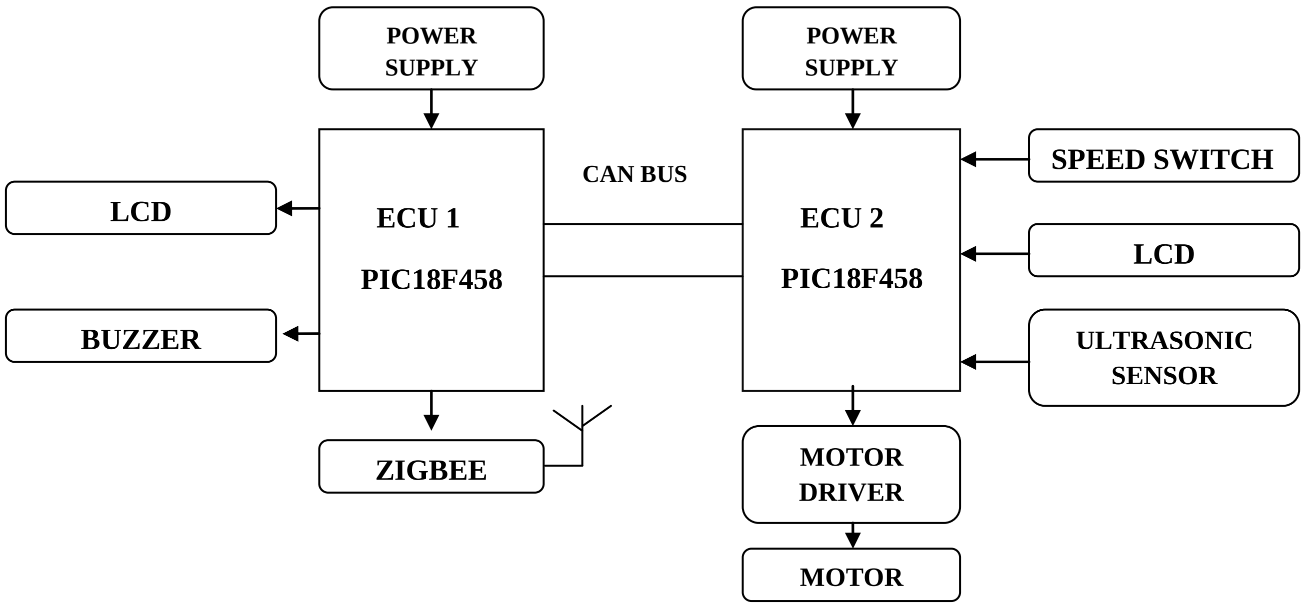


Fig 4.1 Block Diagram of Vehicle 1

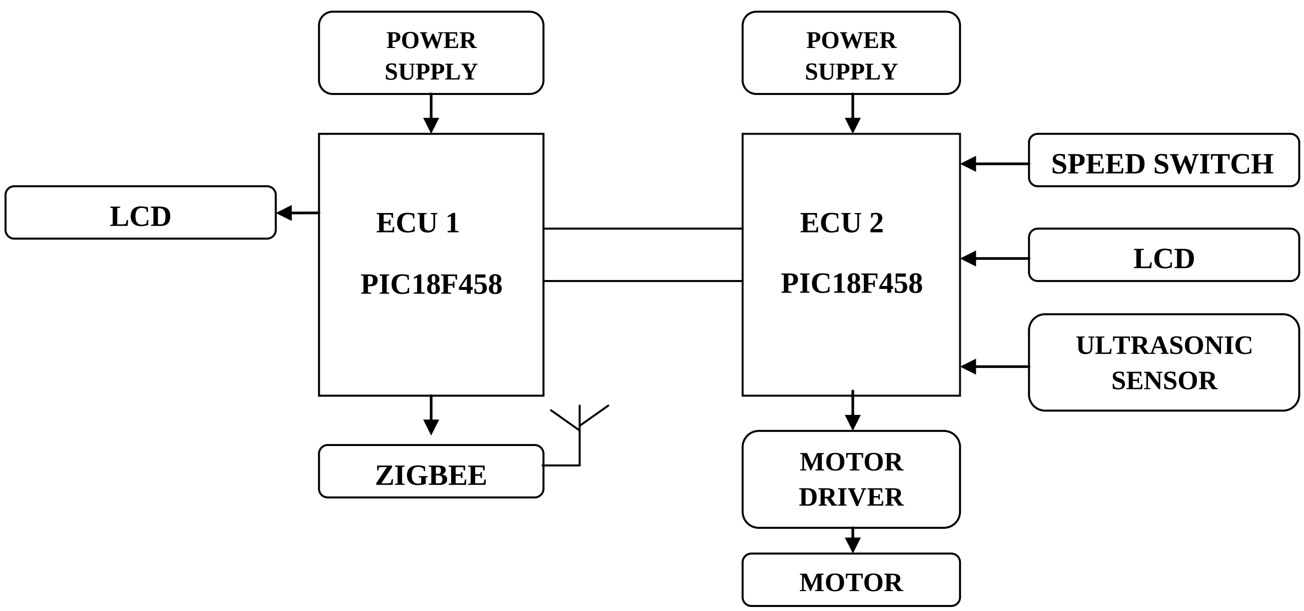


Fig 4.2 Block Diagram of Vehicle 2

4.1.1 WORKING:

The system consists of a vehicle setup which consists of different ECUs which can communicate with each other via CAN Bus. The input speed of vehicle is given through the speed switch to the ECU2 of the vehicle 1.The motor rotates according to the speed (rpm) applied on the switch. The obtained speed is then communicated to the ECU1 via CAN Bus. The ECU 1 contains the Zigbee module which transmit the obtained information to the adjacent vehicle(Vehicle 2). It also receives the same data from the Vehicle 2. The received data at ECU1 is communicated to the ECU2 again via CAN Bus. Then the speed of the motor is manipulated according to the speed of the adjacent vehicle (vehicle2). The Buzzer is used to indicate sound during speed manipulation.

The ultrasonic sensor is used to identify the objects in the region of blind spot. If there is any object or vehicle below the range of 20cm, the buzzer is ON and a alert message is passed from one vehicle 1 to vehicle 2. Then the vehicle 2 can pass an acknowledge message like

1. Wait do not overtake
2. Yes you can overtake

According to the message received the adjacent vehicle can take necessary action. All the information are displayed on the LCD display. The same process is repeated in the vehicle 2.

The power supply to the hardware setup is AC supply which is stepped down using step down transformer and converted to DC using rectifier and the given to the voltage regulator to regulate the voltage to +5v and give to the ECUs.

4.2 HARDWARE REQUIREMENTS

4.2.1 POWER SUPPLY

4.2.1.1 POWER SUPPLY UNIT DEFINITION:

A **power supply** (sometimes known as a **power supply unit** or **PSU**) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

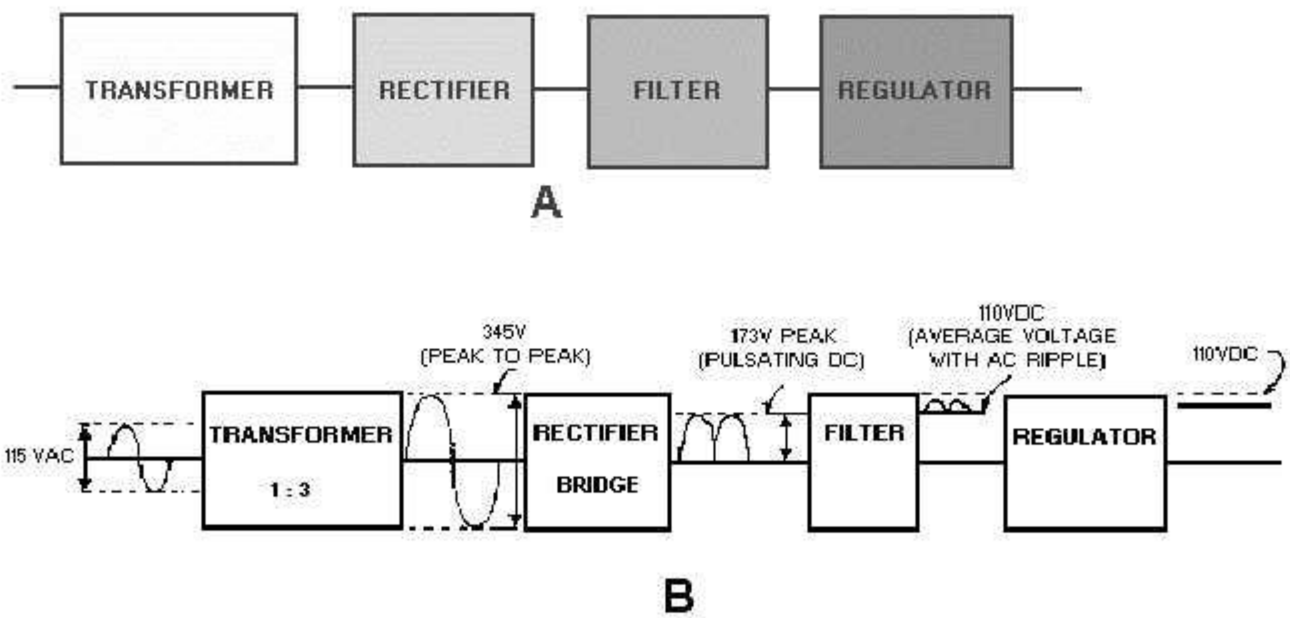


Fig 4.3 Block diagram of a basic power supply

The transformer steps up or steps down the input line voltage and isolates the power supply from the power line.

The RECTIFIER section converts the alternating current input signal to a pulsating direct current. However, as you proceed in this chapter you will learn that pulsating dc is not desirable. For this reason a FILTER section is used to convert pulsating dc to a purer, more desirable form of dc voltage.

Figure (B): Block diagram of a basic power supply. The final section, the REGULATOR, does just what the name implies. It maintains the output of the power supply at a constant level in spite of large changes in load current or input line voltages. Now that you know what each section does, let's trace an ac signal through the power supply. At this point you need to see how this signal is altered within each section of the power supply. Later on in the chapter you will see how these changes take place. In view B of figure 4-1, an input signal of 115 volts ac is applied to the primary of the transformer. The transformer is a step-up transformer with a turn’s ratio of 1:3. You can calculate the output for this transformer by multiplying the input voltage by the ratio of turns in the primary to the ratio of turns in the secondary; therefore, 115 volts ac ´ 3 = 345 volts ac (peak-to- peak) at the output. Because each diode in the rectifier section conducts for 180 degrees of the 360-degree input, the output of the rectifier will be one-half, or approximately 173 volts of pulsating dc. The filter section, a network of resistors, capacitors, or inductors, controls the rise and fall time of the varying signal; consequently, the signal remains at a more constant dc level. You will see the filter process more clearly in the discussion of the actual filter circuits. The output of the filter is a signal of 110 volts dc, with ac ripple riding on the dc. The reason for the lower voltage (average voltage) will be explained later in this chapter. The regulator maintains its output at a constant 110-volt dc level, which is used by the electronic equipment (more commonly called the load).

4.2.1.2 SUMMARY OF CIRCUIT FEATURES

- Brief description of operation: Gives out well regulated +5V output, output current capability of 100 mA
- Circuit protection: Built-in overheating protection shuts down output when regulator IC gets too hot
- Circuit complexity: Very simple and easy to build
- Circuit performance: Very stable +5V output voltage, reliable operation
- Availability of components: Easy to get, uses only very common basic components
- Design testing: Based on datasheet example circuit, I have used this circuit successfully as part of many electronics projects
- Applications: Part of electronics devices, small laboratory power supply
- Power supply voltage: Unregulated DC 8-18V power supply
- Power supply current: Needed output current + 5 mA
- Component costs: Few dollars for the electronics components + the input transformer cost

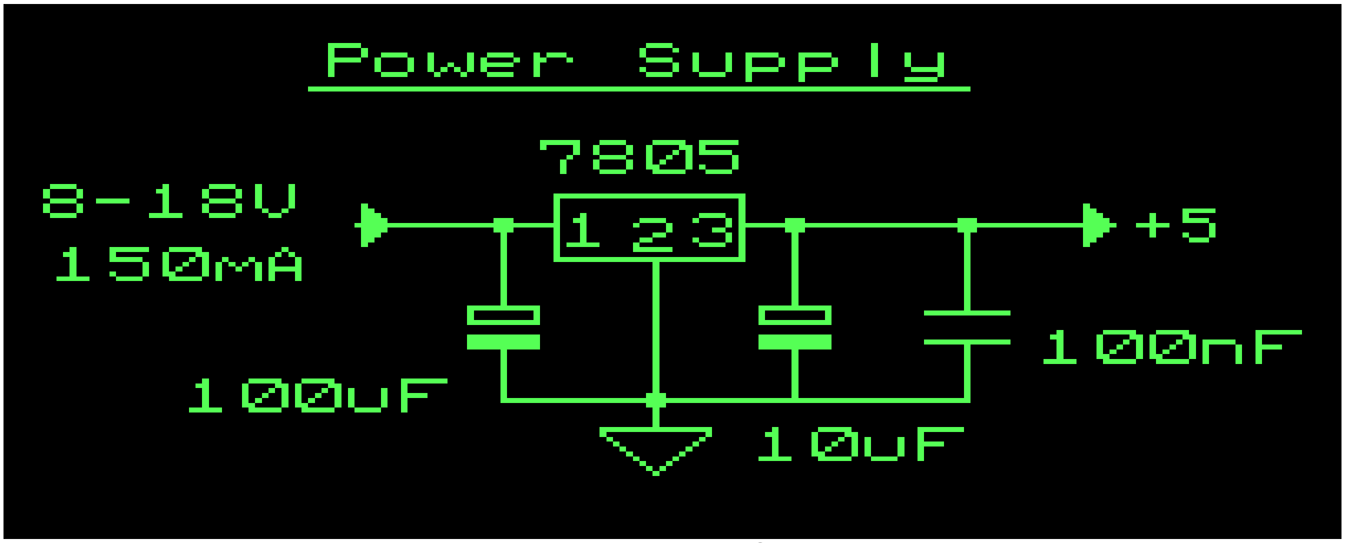


Fig 4.4 Circuit diagram of power supply

4.2.1.3 CIRCUIT DIAGRAM OF THE POWER SUPPLY

The capacitors must have enough high voltage rating to safely handle the input voltage feed to circuit. The circuit is very easy to build for example into a piece of Vero board.

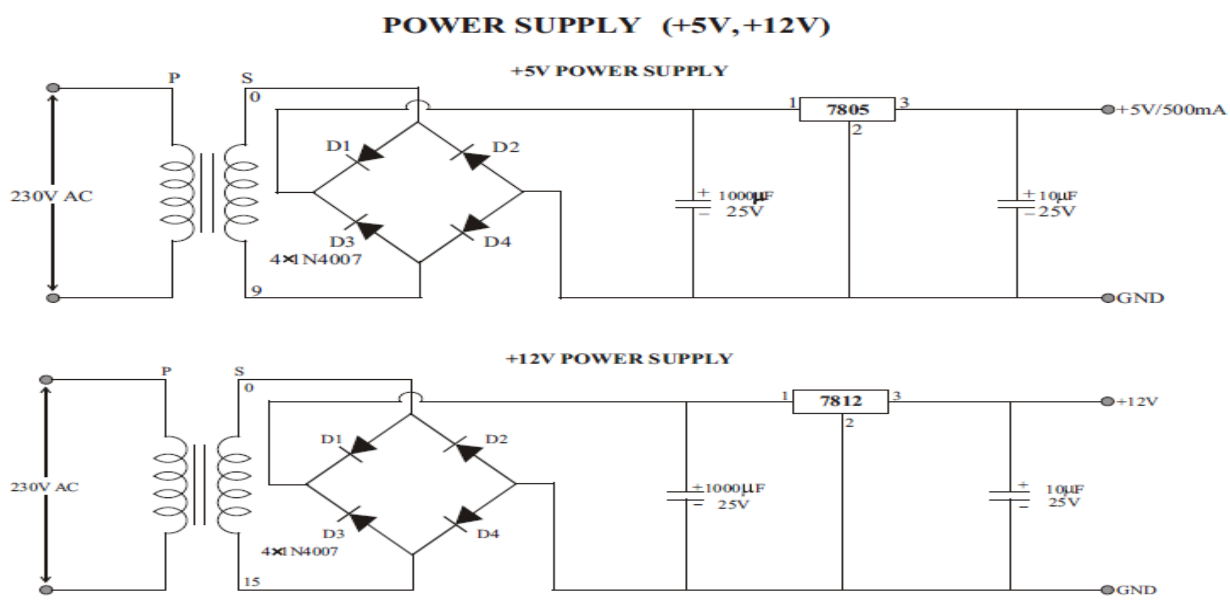


Fig 4.5 circuit diagram for +5v and +12v power supply

4.2.1.4 7805 – VOLTAGE REGULATOR IC

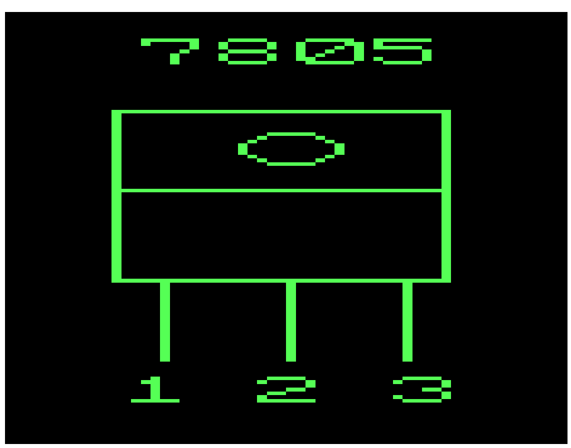


Fig 4.6 voltage regulator IC

1. Unregulated voltage in

2. Ground

3. Regulated voltage out

COMPONENT LIST:

7805 regulator IC

100 uF electrolytic capacitor, at least 25V voltage rating

10 uF electrolytic capacitor, at least 6V voltage rating

100 nF ceramic or polyester capacitor

4.2.2 PIC MICRO CONTROLLER:

A microcontroller (also microcontroller unit, MCU or μc) is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers and etc. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls office machines, appliances,power tools, and toys.

4.2.2.1 INTRODUCTION OF PIC18F4585

The PIC18f4585 CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC182580, PIC182586 and PIC164680devices. It features 200ns instruction execution, 1536bytes of EEPROM data memory, self-programming , an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital(A/D) converter, 2 capture/compare/PWM functions ,a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, AND A CAN a USART and Parallel Slave Port.

4.2.2.2 FEATURES

The high-performance RISC CPU Operating speed: 20MHZ, 200 ns instruction cycle, Operating voltage: 4.0-5.5V,Industrial temperature range (-40ºto +85ºC), 15 interrupt instructions, All single-cycle instructions except for program branches (two-cycle) and the special microcontroller features are FlashMemory: 14.3 Kbytes (8192 words),Data SRAM: 368 bytes, Data EEPROM:256 bytes, Self-reprogrammable under software control, In-Circuit Serial Programming via two pins(5V), Watchdog Timer with on-chip R C oscillator, Programmable code protection, Power-saving Sleep mode ,Selectable oscillator options. The peripheral features are 33 I/O pins; 5 I/O ports, Timer0: 16-bittimer/counter with 16-bit prescalar, timer1: 8-bit timer/counter with prescalar (Canbe incremented during Sleep via external crystal/clock) , Timer2: 8-bit timer/counter with 8-bit period register, prescalar and post scalar, Two Capture Compare (PWR modules16-bit Capture input; max resolution 12.5 ns,16-bitCompare; max resolution 200 ns, 10-bit PWM), Synchronous serial port with two modes: SPI Master and12C Master and Slave, USART/SCI with 9-bit address detection ,Parallel Slave Port (PSP),8 bits wide with external RD,WR and CS controls and Brown-out detection circuitry for Brown-out Reset. The analog features are 10-bit,8-channel A/D Converter, Analog Comparator module are 2 analog comparators, Programmable on-chip voltage reference module ,Programmable input multiplexing from device inputs and internal VREF and Comparator outputs are externally assessable.

4.2.2.3 PIN DIAGRAM

We can control each port by using an assigned address of specific ports, but there is much easier way to control the port. We are allowed to use the names of the ports without considering their addresses.

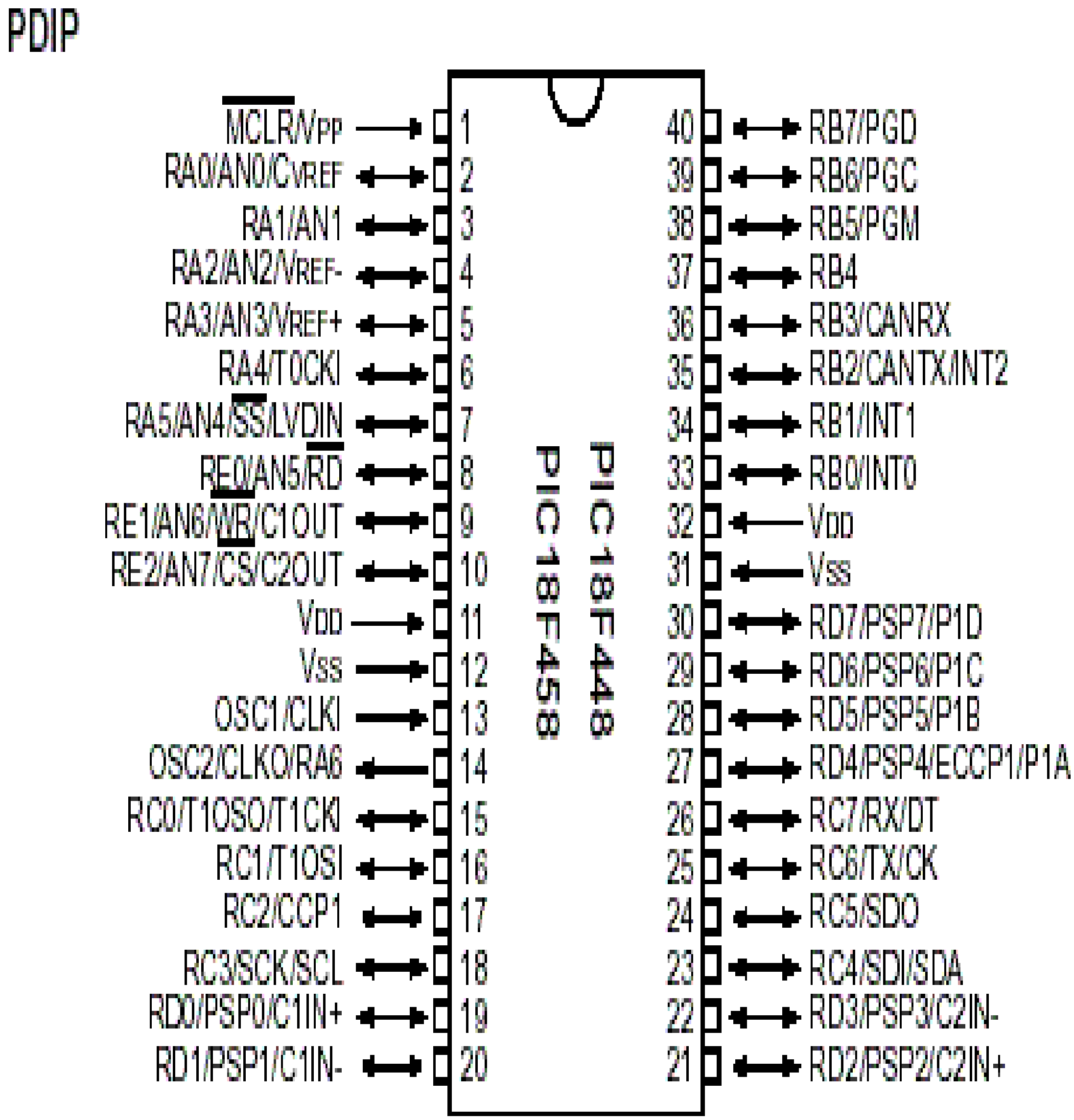


Fig 4.7 PIN Diagram of PIC18F458

4.2.2.4 PORT REGISTER

The role of the PORT register is to receive the information from an externalsource (e.g. sensor) or to send information to the external elements (e.g. LCD).

The 28-pin devices have I/O ports, while the 40/44-pin devices, likePIC18F4585, have 5 I/O ports located in the BANK 0.

1. PORTA is a 6-bit wide, bidirectional port. The corresponding data direction register is TRISA. Setting a TRISA bit (=1) will make the corresponding PORTA pin an input. Clearing a TRISA bit (=0) will make the corresponding PORTA pin an output.

2. PORTB is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISB. Setting a TRISB bit (=1) will make the corresponding PORTB pin an output.

3. PORTC is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISC. Setting a TRISC bit (=1) will make the corresponding PORTC pin an input. Clearing a TRISC bit (=0) will make the corresponding PORTC pin an output.

4. PORTD is an 8-bit port with Schmitt Trigger input buffers. Each pin is individually configurable as an input or output.

5. PORTE has three pins (RE0/RD/AN5, RE1/WR/AN6 and RE2/CS/AN7)which are individually configurable as inputs or outputs. These pins have Schmitt Trigger input buffers.

4.2.2.5 TRIS REGISTER

The TRIS register is data direction register which defines if the specific bit or whole port will be an input or an output. Each port has it own TRIS register. Here's map of the locations:

BANK 0	**BANK1**
PORTA	TRISA
PORTB	TRISB
PORTC	TRISC
PORTD	TRISD
PORTE	TRISE

Fig 4.8 Port Registers

The default mode of each TRIS is input. If you want to set a specific portas exit you must change the state of the TRIS to 0.To change a specific port to an output, one should first move to theBANK1, make the change, and then return to BANK0. The default state of thebanks is BANK0.The running program is working only with one bank at all time. If not setotherwise, then as stated, the default bank is BANK0. Part of the registers located inside BANK0, and some are not. When we need to access a register that is not located inside BANK0, we are required to switch between the banks. For example, the access to PORT registers is done inside BANK0.

However, to change port from an input to an output and vice versa, we need toaccess TRIS register that is located inside BANK1. From the moment we moveto the BANK1, the program will always work with BANK1; at this time, toaccess registers inside BANK0, we will have to return to the situation in whichour program will work BANK0.

4.2.2.6 ARCHITECHTURE DIAGRAM:

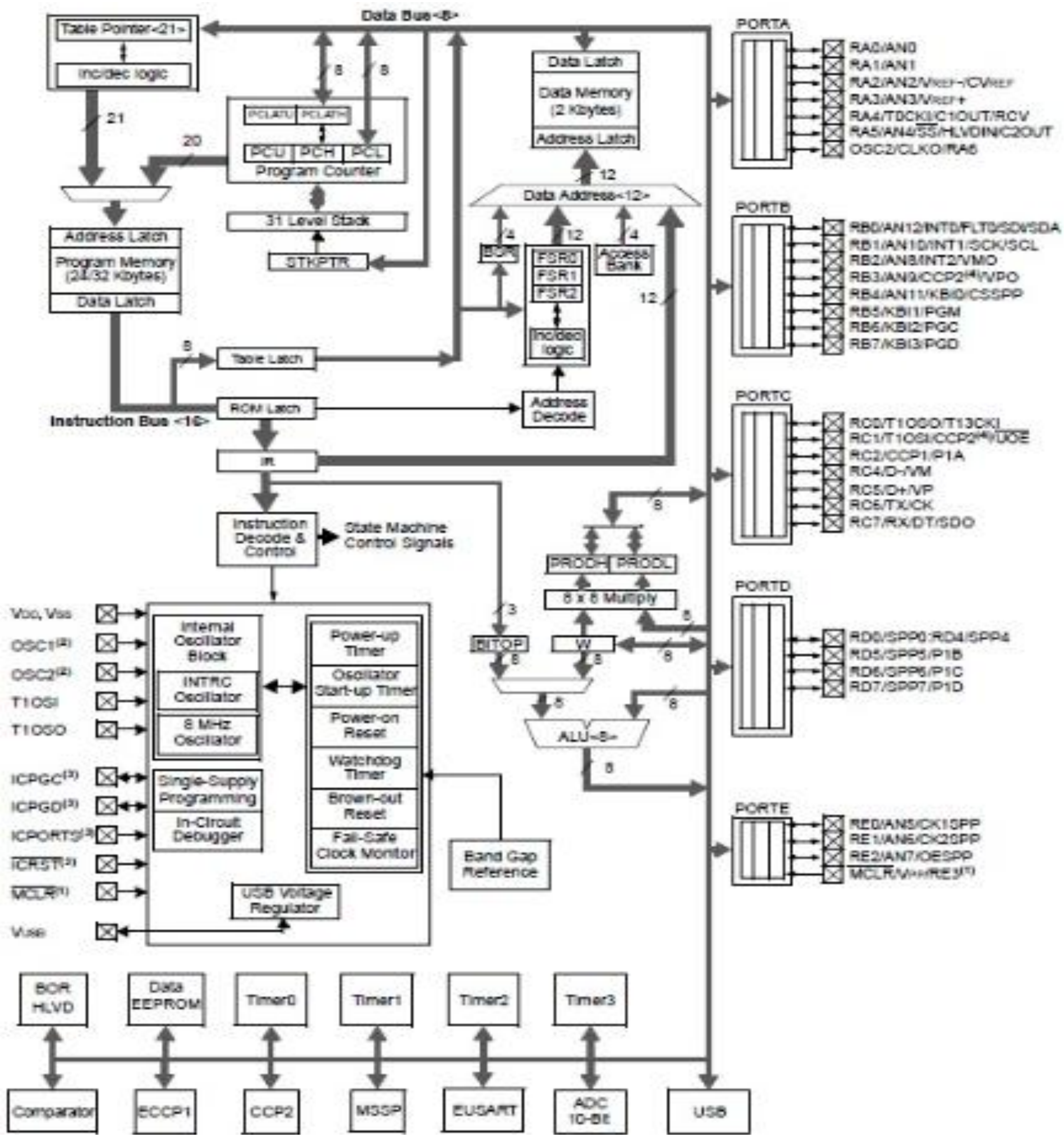


Fig 4.9 Architecture of PIC18F458

4.2.3 MEMORY OF THE PIC18F4585 DIVEDED INTO 3 TYPES OF MEMORIES

4.2.3.1 PROGRAM MEMORY

A memory that contains the program (which we had written), after we'veburned it. As a reminder, Program Counter executes commands stored in theprogram memory, one after the other.

4.2.3.2 DATA MEMORY

This is RAM memory type, which contains a special registers like SFR(Special Function Register) and GPR(General Purpose Register). The variablesthat we store in the data memory during the program are deleted after we turn ofthe micro.These two memories have separated data buses, which makes the access toeach one of them very easy

4.2.3.3 DATA EEPROM (Electrically Erasable Programmable Read-Only Memory)

A memory that allows storing the variables as a result of burning the writtenprogram.Each one of them has a different role. Program memory and Datamemory two memories that are needed to build a program, and Data EEPROMis used to save data after the microcontroller is turn off.Program Memory and Data EEPROM they are non-volatile memories, which store the information even after the power is turn off. These memories called Flash Or EEPROM. In contrast,Data Memory does not save the information because it needs power in order to maintain the information stored in the chip.

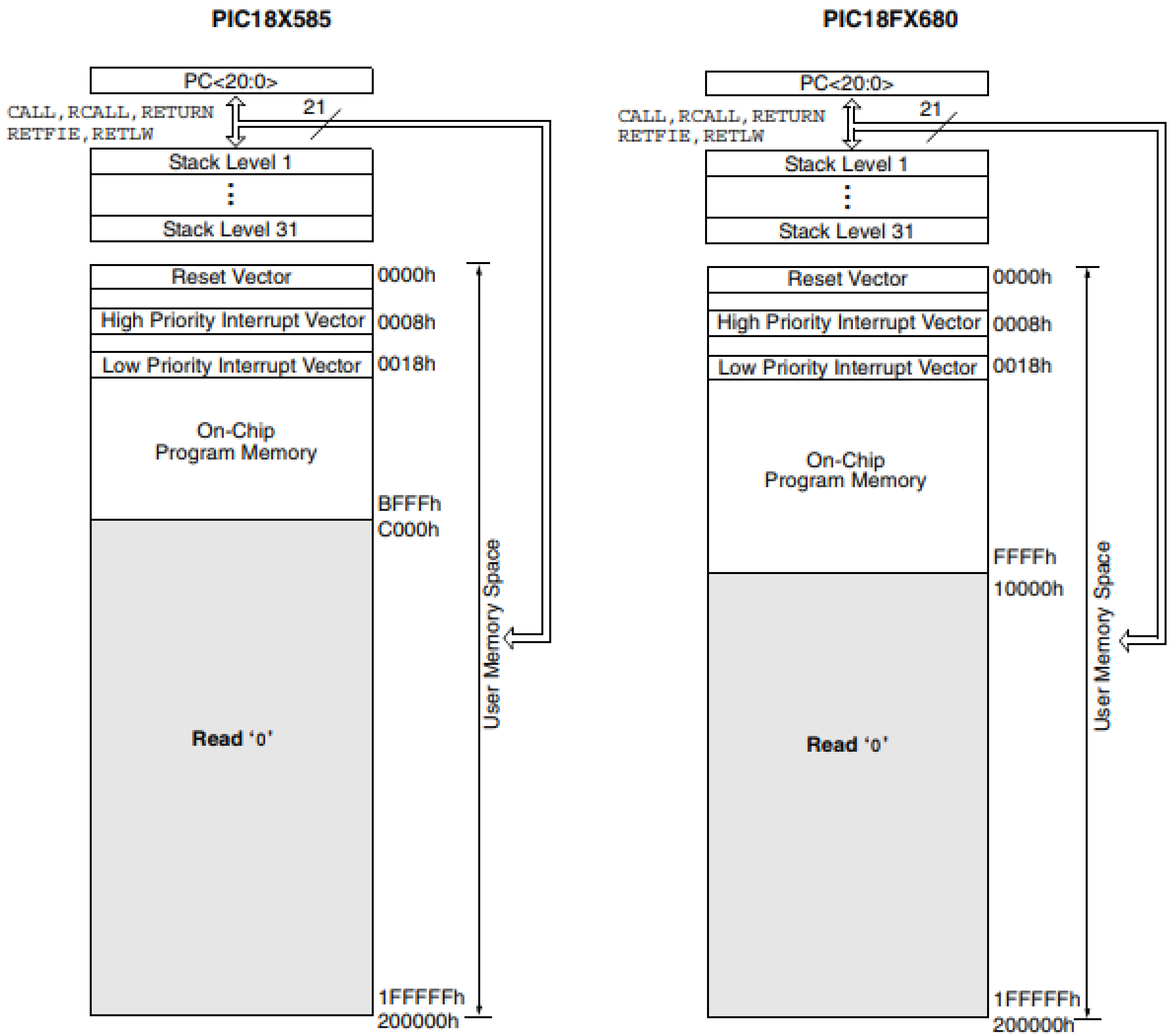


Fig 4.10 EEPROM memory of PIC microcontroller

4.2.4 PIC INTERRUPT

In this tutorial we will study about the Polling and especially on the PICInterrupt. We will look at:

- The different types of PIC interrupts
- Existing PIC interrupts
- The settings of the required registers to work with PIC interrupts

The implementation of the external PIC interrupts (C program and a video) Computer systems includes microcontroller, which includes timers, serial communication system, analog digital converter, and much more. Many times it is also external systems, located outside the micro itself which are communicating with micro through control lines. An example of such a system is a digital thermometer, which is measure the temperature and at the end of measurements transmitting the results to the PIC microcontroller.

4.2.4.1 THERE ARE TWO TYPES OF PIC INTERRUPTS

SOFTWARE INTERRUPTS- come from a program that runs by the processor and “request” the processor to stop running the program, go to make an interrupt and then to request to continue to execute the program.

For example: Procedure - when there is a procedure call, the processor stops the execution of the program, jumps to the place in memory that reserved for a procedure – executes the procedure and only then returns back to the program and continues to execute.

HARDWARE INTERRUPTS - these are sent to microcontroller by hardware devices as a third-party; some of them can be blocked - (masking) by Interrupts Enable bit (IE). When the interrupts is “blocked”, the PIC microcontroller does not “see” the request for the interrupts and will not execute it. In fact the blocked interrupt will not be executed until it will be unblocked.

4.2.5 CAN TECHNOLOGY

The Controller Area Network (CAN) module is a serial interface which is useful for communicating with other peripherals or microcontroller devices. This interface, or protocol, was designed to allow communications within noisy environments. The ECAN module is a communication controller, implementing the CAN 2.0A or B protocol as defined in the BOSCH specification. The module will support CAN 1.2, CAN 2.0A, CAN 2.0B Passive and CAN 2.0B Active versions of the protocol. The module implementation is a full CAN system; however, the CAN specification is not covered within this data sheet. Refer to the BOSCH CAN specification for further details.

4.2.5. 1 THE MODULE FEATURES:

- Implementation of the CAN protocol CAN 1.2, CAN 2.0A and CAN 2.0B
- Device Net TM data bytes filter support
- Standard and extended data frames
- 0-8 bytes data length
- Programmable bit rate up to 1 Mbit/sec
- Fully backward compatible with PIC18XXX8 CAN module
- Three modes of operation: - Mode 0 – Legacy mode - Mode 1 – Enhanced Legacy mode with Device Net support - Mode 2 – FIFO mode with Device Net support
- Support for remote frames with automated handling
- Double-buffered receiver with two prioritized received message storage buffers
- Six buffers programmable as RX and TX message buffers
- 16 full (standard/extended identifier) acceptance filters that can be linked to one of four masks
- Two full acceptance filter masks that can be assigned to any filter
- One full acceptance filter that can be used as either an acceptance filter or acceptance filter mask
- Three dedicated transmit buffers with application specified prioritization and abort capability
- Programmable wake-up functionality with integrated low-pass filter

• Programmable Loopback mode supports self-test operation

• Signaling via interrupt capabilities for all CAN receiver and transmitter error states

• Programmable clock source

• Programmable link to timer module for time-stamping and network synchronization

• Low-power Sleep mode

4.2.5.2 CAN BUFFERS AND PROTOCOL ENGINE BLOCK DIAGRAM

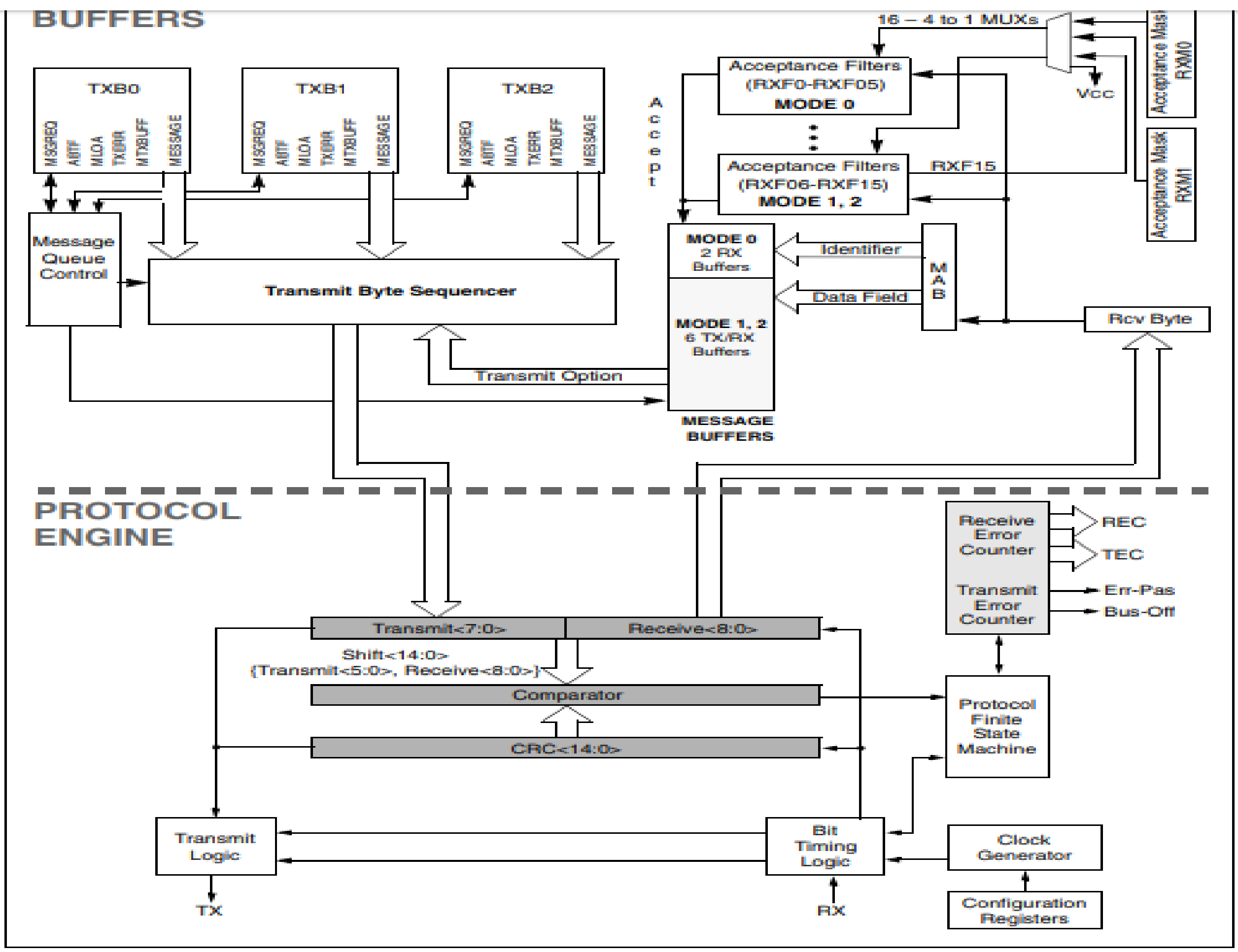


fig 4.11 CAN buffers and protocol engine block diagram

4.2.6 LIQUID CRYSTAL DISPLAY(LCD)

4.2.6.1 INTRODUCTION

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs does not emit light directly. They are used in a wide range of applications, including computer monitors television, instrument panels, aircraft cockpit displays, etc. LCDs have displaced cathode ray tube (CRT) displays in most applications. They are usually more compact, lightweight, portable, less expensive, more reliable.

Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes and two polarizing filters, the axes of transmission of which are (in most of the cases) perpendicular to each other. With no actual liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer. In most of the cases the liquid crystal has double refraction.

The surfaces of the electrodes that are in contact with the liquid crystal material are treated so as to align the liquid crystal molecules in a particular direction. Electrodes are made of a transparent conductor called Indium Tin Oxide(ITO).

Before applying an electric field, the orientation of the liquid crystal molecules is determined by the alignment at the surfaces of electrodes. In a twisted nematic device the surface alignment directions at the two electrodes are perpendicular to each other, and so the molecules arrange themselves in a helical structure, or twist. This reduces the rotation of the polarization of the incident light, and the device appears grey. If the applied voltage is large enough, the liquid crystal molecules in the center of the layer are almost completely untwisted and the polarization of the incident light is not rotated as it passes through the liquid crystal layer. This light will then be mainly polarized perpendicular to the second filter, and thus be blocked and the pixel will appear black. By controlling the voltage applied across the liquid crystal layer in each pixel, light can be allowed to pass through in varying amounts thus constituting different levels of gray.

4.2.6.2 PIN DESCRIPTION

The most common used LCDs found in the market today are 1 line,2line, or 4 line LCDs which have only one controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2HD44780 controllers. More LCDs with 1 controller has 14 pins and LCDs with 2 controller has 16pins.

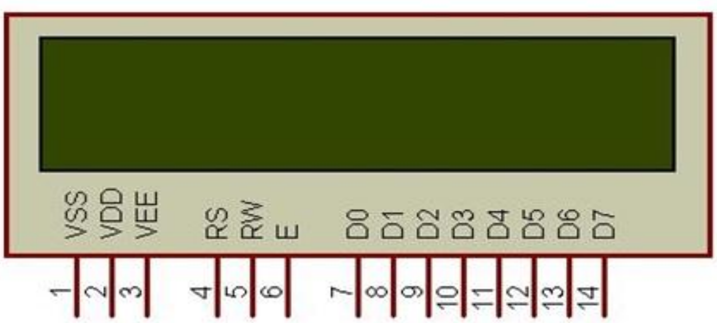


Fig 4.12 Pin diagram of 2x16 LCD

4.2.6.3 FEATURES

- 5 x 8 dots with cursor.
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)

- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply.

PIN NO.,	SYMBOL	FUNCTION
1.	Vss	GND
2.	Vdd	+3V or +5V
3.	Vo	Contrast Adjustment
4.	RS	H/L Register Select Signal
5.	R/Ŵ	H/L Read and Write Signal
6.	E	H→L Enable Signal
7.	DB0	H/L Data Bus Line
8.	DB1	H/L Data Bus Line
9.	DB2	H/L Data Bus Line
8.	DB3	H/L Data Bus Line
11.	DB4	H/L Data Bus Line
12.	DB5	H/L Data Bus Line
13.	DB6	H/L Data Bus Line
14.	DB7	H/L Data Bus Line
15.	A/Vee	+4.2V for LED/Negative Voltage Output
16.	K	Power Supply for B/L (0V)

Table 4.1 .Pin details of LCD

DISPLAY CHARACTER ADDRESS CODE

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address	00	01														0F
DD RAM Address	40	41														4F

Table 4.2 Address code for displaying character

BF- BUSY FLAG

Busy flag is an status indicator flag for LCD. When we send a command or data to the LCD for processing, this flag is set (BF=1) and as soon as the instruction is executed successfully this flag is cleared (BF=0). This is helpful in producing and exact amount of delay for the LCD processing. To read busy flag, the condition RS=0 and R/W=1 must be met and the MSB of the LCD data bus (D7) act as busy flag. When BF =1 means LCD is busy and will not accept next command or data and BF=0 means LCD is ready for the next command or data to process.

4.2.6.4 INSTRUCTION AND DATA REGISTER

There are two 8-bit registers in HD44780 controller Instruction and Data register. Instruction register corresponds to the register where you send commands to LCD e.g LCD shift command, LCD clear, LCD address etc. and Data register is used for storing data which is to be displayed on LCD. when send the enable signal of the LCD is asserted, the data on the pins is latched in to the data register and data is then moved automatically to the DDRAM and hence is displayed on the LCD.

Data register is not only used for sending data to DDRAM but also for CGRAM, the address where you want to send the data, is decided by the instruction you send to LCD. We will discuss more on LCD instruction set further in this chapter.

4.2.6.5 COMMANDS AND INSTRUCTION SET

Only the instruction register (IR) and the data register (DR) of the LCD can be controlled by the MCU. Before starting the internal operation of the LCD, control information is temporarily stored into these registers to allow interfacing with various MCUs, which operate at different speeds, or various peripheral control devices. The internal operation of the LCD is determined by signals sent from the MCU. These signals, which include register selection signal (RS), read/write signal (R/W), and the data bus (DB0 to DB7), make up the LCD instructions (Table 3).

No.	Instruction	Hex	Decimal
1	Function Set: 8-bit, 1 Line, 5x7 Dots	0x30	48
2	Function Set: 8-bit, 2 Line, 5x7 Dots	0x38	56
3	Function Set: 4-bit, 1 Line, 5x7 Dots	0x20	32
4	Function Set: 4-bit, 2 Line, 5x7 Dots	0x28	40
5	Entry Mode	0x06	6
6	Display off Cursor off (clearing display without clearing DDRAM content)	0x08	8
7	Display on Cursor on	0x0E	14
8	Display on Cursor off	0x0C	12
9	Display on Cursor blinking	0x0F	15
10	Shift entire display left	0x18	24
12	Shift entire display right	0x1C	30
13	Move cursor left by one character	0x10	16
14	Move cursor right by one character	0x14	20
15	Clear Display (also clear DDRAM content)	0x01	1

Table 4.1 LCD instructions Commands

There are four categories of instructions that:

- Designate LCD functions, such as display format, data length, etc.
- Set internal RAM addresses
- Perform data transfer with internal RAM
- Perform the miscellaneous functions feasible.

4.2.7 ZIGBEE (RF Trans receiver 2.4 Ghz, SPI Interface, 30 meters)

This is an FSK Transceiver module, which is designed using the Chipcon IC(CC2500). It is a true single-chip transceiver, It is based on 3 wire digital serial interface and an entire Phase-Locked Loop (PLL) for precise local oscillator generation .so the frequency could be setting. It can use in UART / NRZ Manchester encoding / decoding. It is a high performance and low cost module.

It gives 30 meters range with onboard antenna. In a typical system, this trans receiver will be used together with a microcontroller. It provides extensive hardware support for packet wake on radio . It can be used in2400-2483.5 MHz ISM/SRD band systems. (eg. RKE-two way Remote Keyless Entry, wireless alarm and security systems, AMR-automatic Meter Reading ,Consumer Electronics, Industrial monitoring and control, Wireless Game Controllers, Wireless Audio/Keyboard/Mouse). It could easily to design product requiring wireless connectivity. It can be used on wireless security system or specific remote-control function and others wireless system handling, data buffering, burst transmissions ,clear channel assessment, link quality indication and

Fig 4.13 Zigbee module

4.2.7.1 FEATURES

- Low power consumption.
- Integrated bit synchronizer.
- Integrated IF and data filters.
- High sensitivity (type -104dBm)
- Programmable output power -20dBm~1dBm
- Operation temperature range : -40~+85 deg C
- Operation voltage: 1.8~3.6 Volts.
- Available frequency at : 2.4~2.483 GHz

4.2.7.2 APPLICATION

- Car & Home security system
- Remote keyless entry / Garage door controller
- Wireless game controllers/mouse/keyboard/audio
- Automation system

4.2.7.3 PIN DIAGRAM

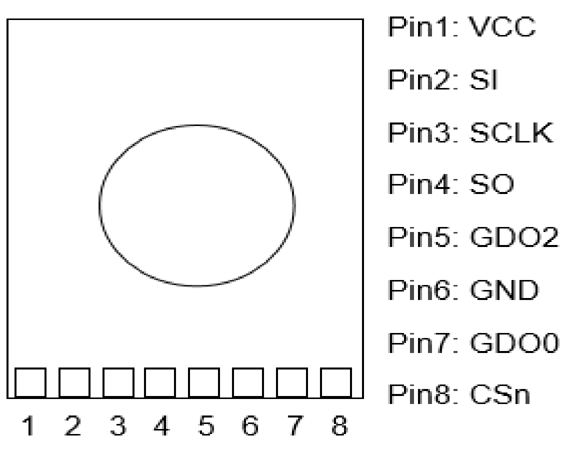


Fig 4.14 ZIGBEE Pin Diagram

Pin #	Pin name	Pin Type	Description
1	VCC	Power	1.8~3.6V power supply
2	SI	Digital Input	Serial configuration interface, data input
3	SCLK	Digital Input	Serial configuration interface, clock input
4	SO	Digital Output	Serial configuration interface, clock input Optional general output pin when CSN is high
5	GDO2	Digital I/O	Digital output pin for general use >Test signals >FIFO status signals >Clear Channel indicator >Clock output, down-divided from Xosc >Serial output RX data
6	GND	Ground	
7	GDO0	Digital I/O	Digital output pin for general use: >Test signals >FIFO status signals >Clear Channel indicator >Clock output RX data >Serial output RX data >Serial input TX data Also used as analog test I/O for prototype/production testing
8	CSn	Digital Input	Serial configuration interface ,chip select

Fig 4.15 ZIGBEE Pin Description

4.2.8 MCP2551

HIGH-SPEED CAN TRANSCEIVER

4.2.8.1 Features

- Supports 1 Mb/s operation
- Implements ISO-11898 standard physical layer requirements
- Suitable for 12V and 24V systems
- Externally-controlled slope for reduced RFI emissions
- Detection of ground fault (permanent Dominant) on TXD input
- Power-on Reset and voltage brown-out protection
- An unpowered node or brown-out event will not disturb the CAN bus
- Low current standby operation
- Protection against damage due to short-circuit conditions (positive or

negative battery voltage)

- Protection against high-voltage transients
- Automatic thermal shutdown protection
- Up to 112 nodes can be connected
- High-noise immunity due to differential bus implementation

4.2.8.2 PIN DETAILS

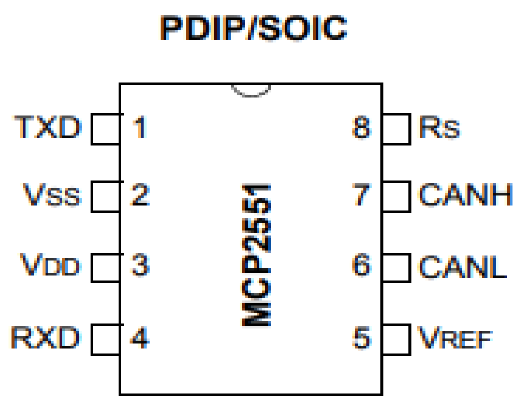


Fig 4.16. PIN diagram of MCP2551

Pin Number	Pin Name	Pin Function
1	TXD	Transmit Data Input
2	VSS	Ground
3	VDD	Supply Voltage
4	RXD	Receive Data Output
5	VREF	Reference Output Voltage
6	CANL	CAN Low-Level Voltage I/O
7	CANH	CAN High-Level Voltage I/O
8	RS	Slope-Control Input

Fig 4.17: PIN functions of MCP2551

4.2.8.3 CIRCUIT BLOCK DIAGRAM

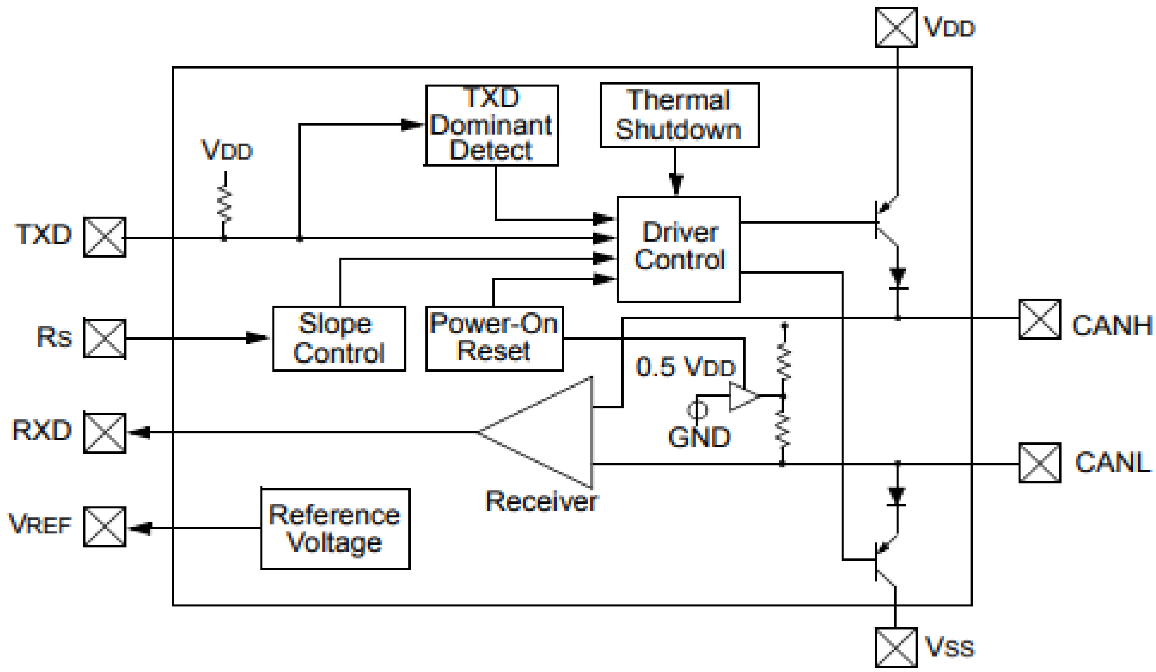


Fig 4.18: Circuit Block Diagram of MCP2551

4.2.8.4 OVERVIEW OF THE DEVICE SUMMARY:

The MCP2551 is a high-speed CAN, fault-tolerant device that serves as the interface between a CAN protocol controller and the physical bus. The MCP2551 provides differential transmit and receive capability for the CAN protocol controller and is fully compatible with the ISO-11898 standard, including 24V requirements. It will operate at speeds of up to 1 Mb/s. Typically, each node in a CAN system must have a device to convert the digital signals generated by a CAN controller to signals suitable for transmission over the bus cabling (differential output). It also provides a buffer between the CAN controller and the high-voltage spikes that can be generated on the CAN bus by outside sources (EMI, ESD, electrical transients, etc.)

4.2.8.5 TRANSMITTER FUNCTION

The CAN bus has two states: Dominant and Recessive. A dominant state occurs when the differential voltage between CANH and CANL is greater than a defined voltage (e.g.,1.2V). A recessive state occurs when the differential voltage is less than a defined voltage (typically 0V). The dominant and recessive states correspond to the low and high state of the TXD input pin, respectively. However, a dominant state initiated by another CAN node will override a recessive state on the CAN bus. 1.1.1 MAXIMUM NUMBER OF NODES The MCP2551 CAN outputs will drive a minimum load of 45Ω, allowing a maximum of 112 nodes to be connected.

4.2.8.6 RECEIVER FUNCTION

The RXD output pin reflects the differential bus voltage between CANH and CANL. The low and high states of the RXD output pin correspond to the dominant and recessive states of the CAN bus, respectively. 1.3 Internal Protection CANH and CANL are protected against battery short circuits and electrical transients that can occur on the CAN bus. This feature prevents destruction of the transmitter output stage during such a fault condition. The device is further protected from excessive current loading by thermal shutdown circuitry that disables the output drivers when the junction temperature exceeds a nominal limit of 165°C. All other parts of the chip remain operational and the chip temperature is lowered due to the decreased power dissipation in the transmitter outputs.

4.2.8.7 OPERATING MODES

The RS pin allows three modes of operation to be selected:

• High-Speed

• Slope-Control

• Standby

When in High-speed or Slope-control mode, the drivers for the CANH and CANL signals are internally regulated to provide controlled symmetry in order to minimize EMI emissions. Additionally, the slope of the signal transitions on CANH and CANL can be controlled with a resistor connected from pin 8 (RS) to ground, with the slope proportional to the current output at RS, further reducing EMI emissions.

1. HIGH-SPEED High - speed mode is selected by connecting the RS pin to VSS. In this mode, the transmitter output drivers have fast output rise and fall times to support high-speed CAN bus rates.
2. 2 SLOPE-CONTROL Slope-control mode further reduces EMI by limiting the rise and fall times of CANH and CANL. The slope, or slew rate (SR), is controlled by connecting an external resistor (REXT) between RS and VOL (usually ground). The slope is proportional to the current output at the RS pin. Since the current is primarily determined by the slope-control resistance value REXT, a certain slew rate is achieved by applying a respective resistance.
3. 3 STANDBY MODE The device may be placed in standby or “SLEEP” mode by applying a high-level to RS. In SLEEP mode, the transmitter is switched off and the receiver operates at a lower current. The receive pin on the controller side (RXD) is still functional but will operate at a slower rate. The attached microcontroller can monitor RXD for CAN bus activity and place the transceiver into normal operation via the RS pin (at higher bus rates, the first CAN message may be lost).

4.2.9 WORKING PRINCIPLE OF DC MOTOR

A motor is an electrical machine which converts electrical energy into mechanical energy. The principle of working of a DC motor is that "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". The direction of this force is given by Fleming's left hand rule and it's magnitude is given by F = BIL. Where, B = magnetic flux density, I = current and L = length of the conductor within the magnetic field.

Fleming's left hand rule: If we stretch the first finger, second finger and thumb of our left hand to be perpendicular to each other AND direction of magnetic field is represented by the first finger, direction of the current is represented by second finger then the thumb represents the direction of the force experienced by the current carrying conductor.

When armature windings are connected to a DC supply, current sets up in the winding. Magnetic field may be provided by field winding (electromagnetism) or by using permanent magnets. In this case, current carrying armature conductors experience force due to the magnetic field, according to the principle stated above.
Commutator is made segmented to achieve unidirectional torque. Otherwise, the direction of force would have reversed every time when the direction of movement of conductor is reversed the magnetic field.

4.2.9.1 INTERFACING DC MOTOR TO MICRO CONTROLLER

We can’t drive a DC Motor (depends) directly with a Microcontroller, as DC Motors requires high current and high voltage than a Microcontroller can handle. Microcontrollers usually operates at +5 or +3.3V supply and it I/O pin can provide only up to 25mA current. Commonly used DC Motors requires 12V supply and

300mA current, moreover interfacing DC Motors directly with Microcontrollers may affect the working of Microcontroller due to the Back EMF of the DC Motor. Thus it is clear that, it not a good idea to interface DC Motor directly with Microcontrollers.

The solution to above problems is to use H-bridge circuit.

It is a special circuit, by using the 4 switches we can control the direction of DC Motor. Depending upon our power requirements we can make our own H-bridge using Transistors/MOSFETs as switches. It is better to use ready made ICs, instead of making our own H-bridge. L293D and L293 are two such ICs. These are dual H-bridge motor drivers, ie by using one IC we can control two DC Motors in both clock wise and counter clockwise directions. The L293D can provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V while L293 can provide up to 1A at same voltages. Both ICs are designed to drive inductive loads such as dc motors, bipolar stepping motors, relays and solenoids as well as other high-current or high-voltage loads in positive-supply applications. All inputs of these ICs are TTL compatible and output clamp diodes for inductive transient suppression are also provided internally. These diodes protect our circuit from the Back EMF of DC Motor.

4.2.9.2 PIN Diagram of L293D

In both ICs, drivers are enabled in pairs, with drivers 1 and 2 are enabled by a high input to 1,2EN and drivers 3 and 4 are enabled by a high input to 3,4EN. When drivers are enabled, their outputs will be active and in phase with their inputs. When drivers are disabled, their outputs will be off and will be in the high-impedance state.

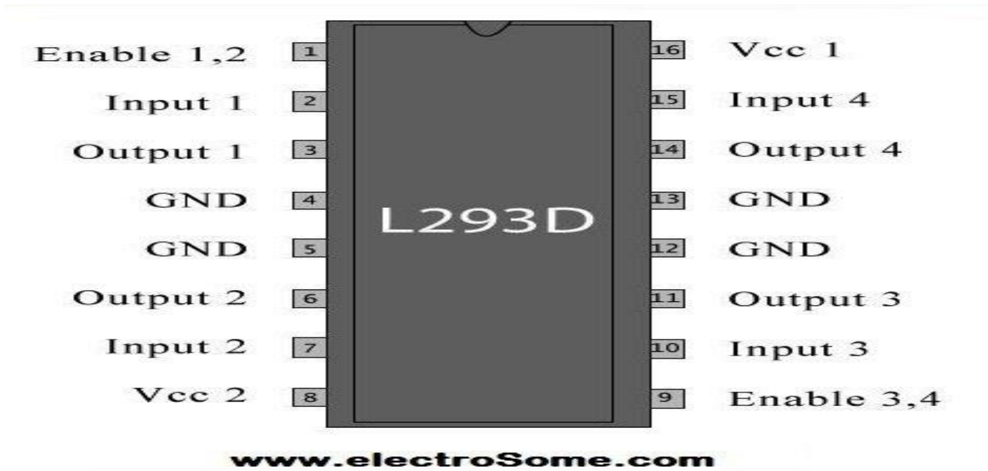


Fig 4.19 PIN Diagram of L293D

4.2.10 ULTRASONIC SENSOR MODULE -HC - SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

4.2.10.1 WORKING PRINCIPLE

1. Using IO trigger for at least 8us high level signal
2. The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
3. The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

4.2.10.2 FORMULA

Test distance = (high level time × velocity of sound (340m/s) / 2

4.2.10.3 ELECTRIC PARAMETERS:

Working Voltage	DC 5 V
Working Current	15mA
Working Frequency	40Hz
Max Range	4m
Min Range	2cm
MeasuringAngle	15 degree
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and the range in proportion
Dimension	45*20*15mm

Table 4.4 Electric Parameters Of Ultrasonic Sensor

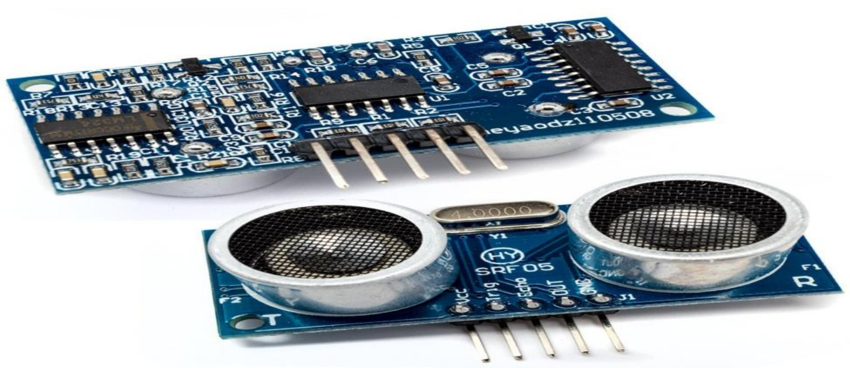


Fig 4.20 ultrasonic sensor

4.2.10.4 WORKING:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. As the distance to an object is determined by measuring the time of flight and not by the intensity of the sound, ultrasonic sensors are excellent at suppressing background interference. Virtually all materials which reflect sound can be detected, regardless of their colour. Even transparent materials or thin foils represent no problem for an ultrasonic sensor. microsonic ultrasonic sensors are suitable for target distances from 20 mm to 10 m and as they measure the time of flight they can ascertain a measurement with pinpoint accuracy. Some of our sensors can even resolve the signal to an accuracy of 0.025 mm. Ultrasonic sensors can see through dust-laden air and ink mists. Even thin deposits on the sensor membrane do not impair its function. Sensors with a blind zone of only 20 mm and an extremely thin beam spread are making entirely new applications possible today: Fill level measurement in wells of microtiter plates and test tubes, as well as the detection of small bottles in the packaging industry, can be implemented with ease. Even thin wires are reliably detected.

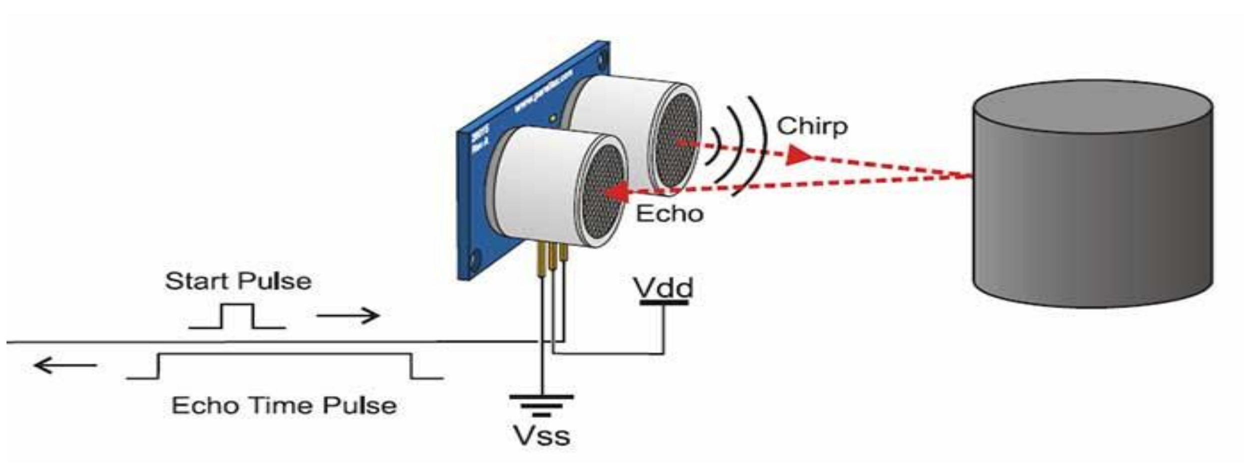


Fig 4.21 working of ultrasonic sensor

4.2.11 BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. It generates consistent single tone sound just by applying D.C voltage. Using a suitably designed resonant system, this type can be used where large sound volumes are needed.

4.2.11.1 FEATURES

- Input supply: 5 VDC
- Current consumption: 9.0 mA max.
- Oscillating frequency: 3.0 ±0.5 KHz
- Sound Pressure Level: 85dB min.

4.2.11.2 APPLICATIONS

- Novelty uses
- Security alarms
- Judging Panels
- Annunciator panels

4.3 SOFTWARE REQUIREMENTS

4.3.1 MPLAB COMPILER:

The MPLAB X IDE is the new graphical, integrated debugging tool set for all of Microchip's more than 800 8-bit, 16-bit and 32 bit MCUs and digital signal controllers, and memory devices. It includes a feature-rich editor, source-level debugger, project manager, software simulator, and supports Microchip's popular hardware tools, such as the MPLAB ICD 3 in-circuit debugger, PIC kit Tm 3,and MPLAB PM3 programmer. **B**ased on the open-source Net Beans platform, MPLAB X runs on Window OS MACOS and LINUX, support many third-party tools, and is compatible with many Net Beans plug-ins.

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of EMBEDDED applications employing Microchip's PIC and DSPIC microcontrollers. MPLAB IDE runs as a32-bit application on MS Window, is easy to use and includes a host of free software components for fast applications developments 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 tool 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.

Download MPLAB IDE and use the tutorial in the MPLAB IDE User's Guide at the bottom of this page to explore how easy it is to create an application's. Write assembly code, build and assemble your project with MPLAB's wizards, then test your code with the build-in simulator and debugger. When you are ready to test your own application, select one of the low-cost debugger/programmers to program a device and analyze your hardware.

4.3.2 EMBEDDED C:

Embedded c is a set of language extension for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements(if, switch, case),loops(while, for),functions, arrays and strings, structures and union, bit operations, macros, etc.

During infancy years of microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. there used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check for correct execution of the program .But they were too costly and were not quite reliable as well .As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controller.

4.3.3 PROTEUS 8 PROFESSIONAL:

It is a software suite containing schematic**,** simulation as well as PCB designing.

- ISIS is the software used to draw schematics and simulate the circuits in real time The simulation allows human access during run time,thus providing real time simulation.
- **ARES** is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components.
- The designer can also develop 2D drawings for the product.

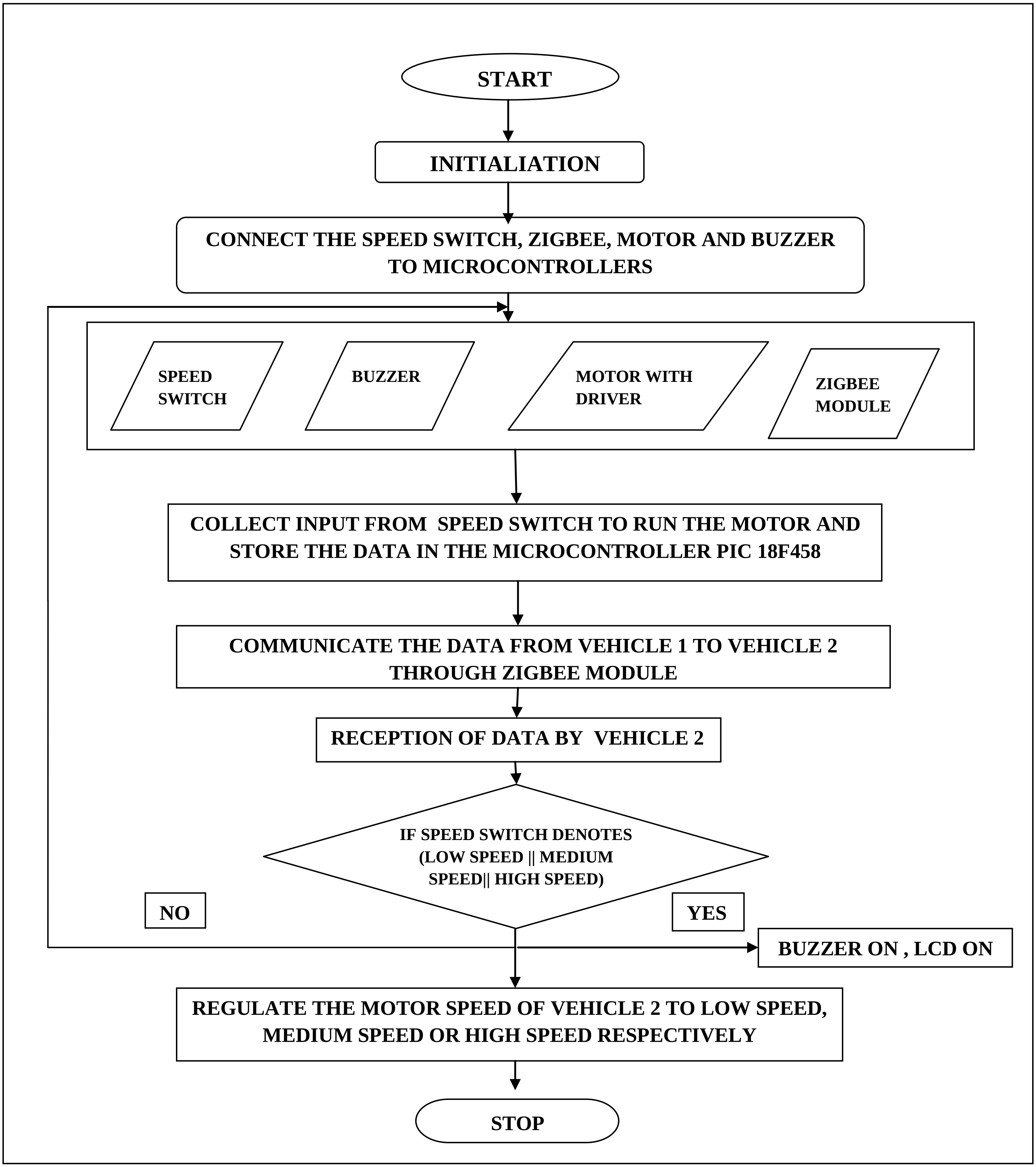
Features

ISIS has wide range of components in its library. It has sources, signal generators, measurement and analysis tools like oscilloscope**,** voltmeter, ammeter etc., probes for real time monitoring of the parameters of the circuit, switches, displays, loads like motors and lamps, discrete components like resistors, capacitors, inductors, transformers, digital and analog Integrated circuits, semi-conductor switches, relays, microcontrollers, processors, sensors etc.

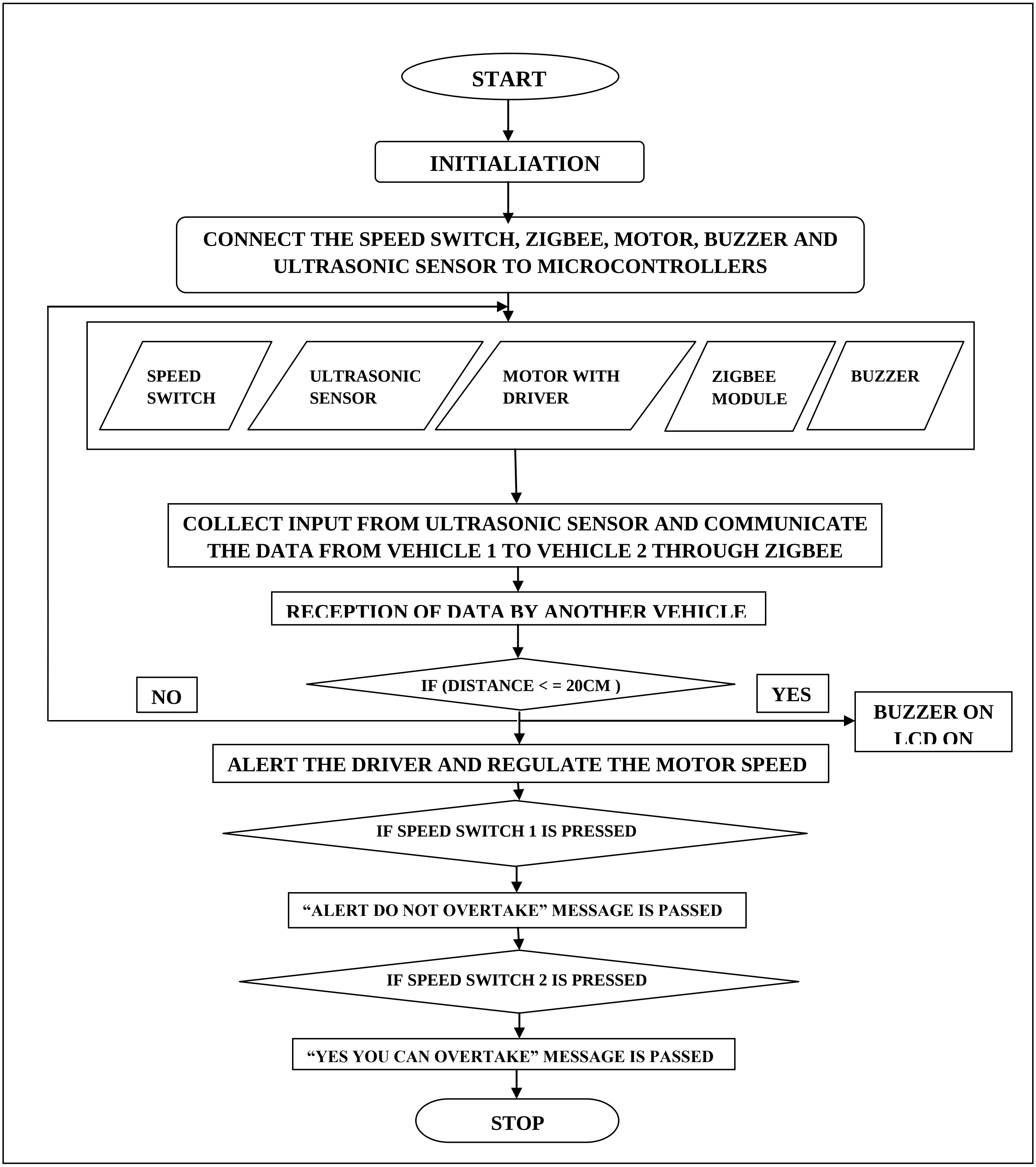
ARES offers PCB designing up to 14 inner layers, with surface mount and through hole packages. It is embedded with the foot prints of different category of components like ICs, transistors, headers, connectors and other discrete components. It offers Auto routing and manual routing options to the PCB Designer. The schematic drawn in the ISIS can be directly transferred ARES.

4.3 FLOW CHART:

4.3.1 FLOW CHART FOR SPEED MANIPULATION



4.3.2 FLOW CHART FOR BLIND SPOT WARNING



4.5 ALGORITHM:

STEP 1 : Start the process by initializing the operation.

STEP 2 : Connect the Speed switch, zigbee module, ultrasonic sensor,buzzer and Motor to the Microcontroller.

STEP 3 : Collect the input form the Speed switch to run the motor and the communicate the information to adjacent vehicle via Zigbee module.

STEP 4 : If the button 1. Low speed 2. Medium speed 3. High speed is pressed in the speed switch the corresponding speed data is transferred to the adjacent vehicle.

STEP 5 : According to the received speed data the speed of the adjacent vehicle's motor is manipulated.

STEP 6 : If the ultrasonic sensor measures the distance below 20cm, the buzzer is ON to alert the driver by providing Beep sound.

STEP 7 Then the driver can instruct the adjacent vehicle by providing to action like 1. Wait slow your Speed,

2. Yes you can Overtake.

STEP 8 : The same process is repeated for another vehicle.

STEP 9 : Stop.

CHAPTER 5

RESULT

5.1 OUTPUT

5.1.1 SIMULATION USING PROTEUS

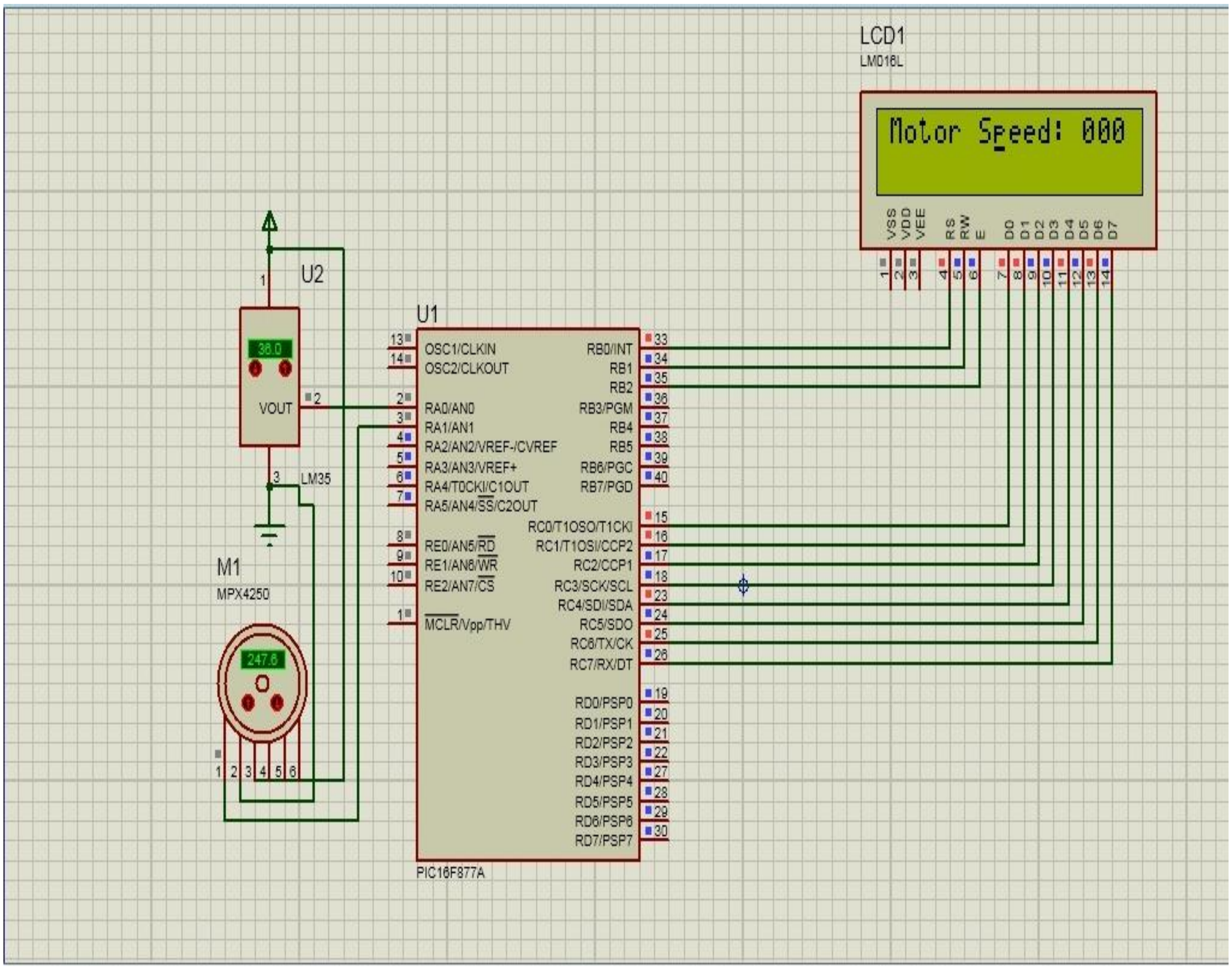


Fig 5.1 Simulation of Motor Interfacing with PIC18F458

Design Simulation of interfacing the DC Motor with the PIC18F458 Microcontroller to Monitor the Speed regulation At By applying Different Speed Values To it.

5.1.2 HARDWARE KIT

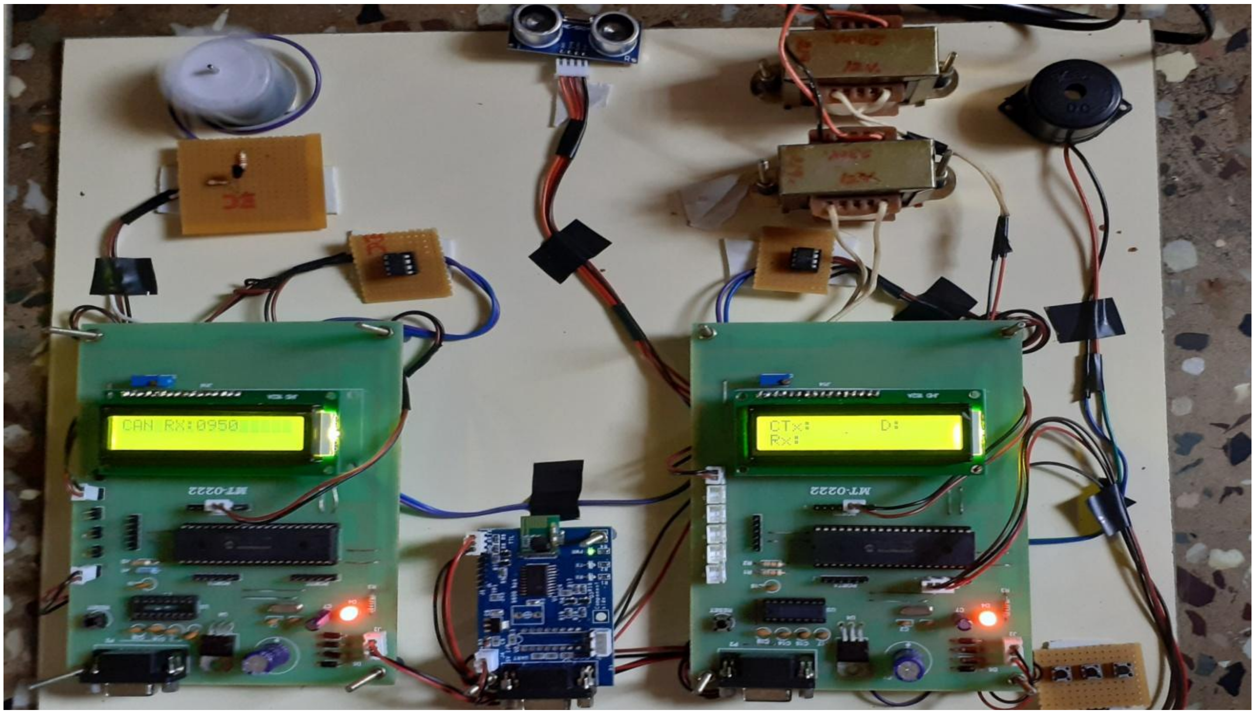


Fig 5.2 Vehicle 1 Hardware Module

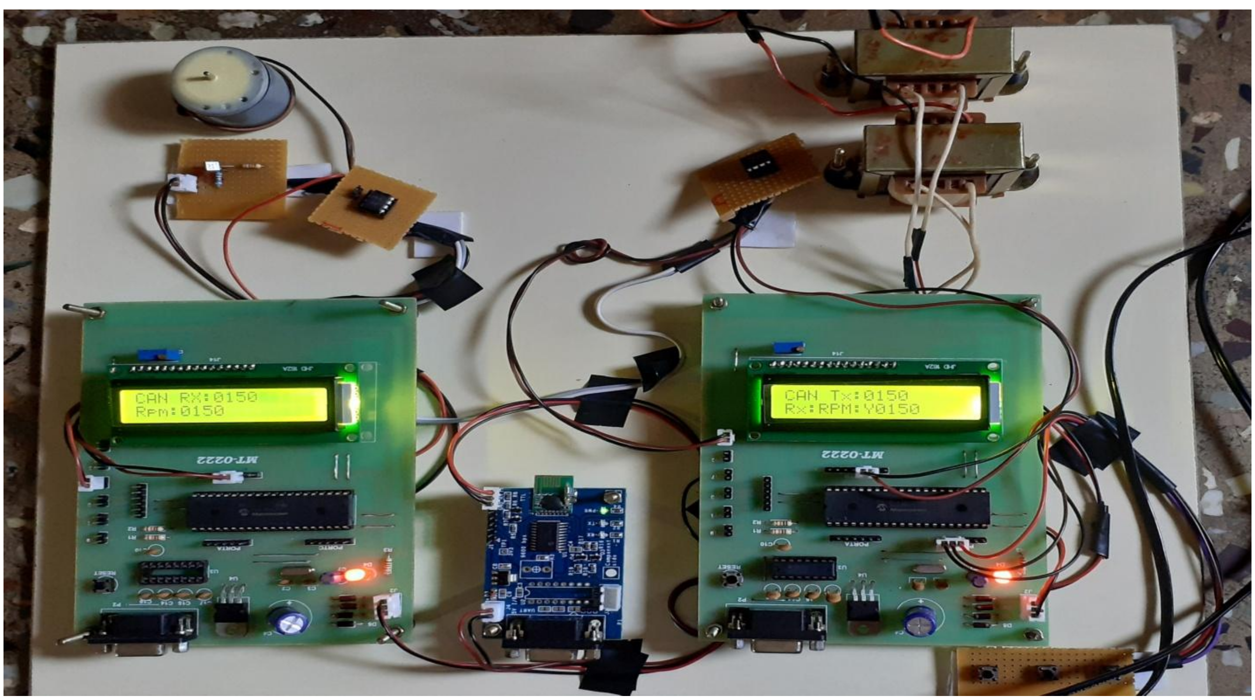


Fig 5.3 Vehicle 2 Hardware Module

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

To avoid accidents and collision many type of experiments are conducted.

Thus, in a nutshell, a vehicle safety and communication between vehicles has been conceived based on the CAN protocol. It is an emerging technology which may be predominant and will come in to existence may be within a decade. Yet, still, the further edification of this systems are possible such as,

i. The collected data can be uploaded on a centralized server for ease of access.

ii. Encryption on the CAN messages can help secure the communication over the CAN bus.

iii. On large scale, the system may also employ RTOS.

It's evident that technology has great capabilities to help future generation transportation systems. V2V communication has unique characteristics to enable future generation intelligent transportation systems. We are planning to provide a few safety application through our proposed system in order to provide efficient output at reliable cost.

6.2 FUTURE SCOPE

- Real time implementation of Blindspot warning among vehicles and improving its accuracy.
- Increasing the number of nodes or vehicles and uploading the data in cloud to provide IOT monitoring.
- Enhancing the idea with V2X, V2I and RSU communications.

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APPENDIX

- **Ultrasonic sensor**

- **DC Motor**

- **CAN IC**

- **ZIGBEE**