Sudan University of Science and Technology
College of Graduate Studies

Car crash avoidance system using Ultrasonic Sensor

نظام منع تصادم السيارات بإستخدام حساس الموجات فوق الصوتيه

A Thesis submitted in partial fulfillment of the requirements for the degree of M.Sc in Mechatronicscs Engineering

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الأيــة

قال تعالي :

(اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ * خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ * اقْرَأْ وَرَبُّكَ الْأَكْرَمُ * الَّذِي عَلَّمَ بِالْقَلَمِ * عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ * كَلَّا إِنَّ الْإِنْسَانَ لَيَطْغَى * أَنْ رَآهُ اسْتَغْنَى * إِنَّ إِلَى رَبِّكَ الرُّجْعَى * أَرَأَيْتَ الَّذِي يَنْهَى * عَبْدًا إِذَا صَلَّى * أَرَأَيْتَ إِنْ كَانَ عَلَى الْهُدَى * أَوْ أَمَرَ بِالتَّقْوَى * أَرَأَيْتَ إِنْ كَذَّبَ وَتَوَلَّى * أَلَمْ يَعْلَمْ بِأَنَّ اللَّهَ يَرَى * كَلَّا لَئِنْ لَمْ يَنْتَهِ لَنَسْفَعًا بِالنَّاصِيَةِ * نَاصِيَةٍ كَاذِبَةٍ خَاطِئَةٍ * فَلْيَدْعُ نَادِيَهُ * سَنَدْعُ الزَّبَانِيَةَ * كَلَّا لَا تُطِعْهُ وَاسْجُدْ وَاقْتَرِبْ)

صدق الله العظيم

سوره العلق الايه (1-19)

Dedication

For all people that I love them

For every one stand behind me and encouraged me

To produce this work

Acknoledgement

My gratitude and thanks to our god. I wish to express my deepest gratitude to my supervisor ***DR. AlaEldin Awouda*** *for his conistant help, support and guidance during this work.*

Iam very thankful to Many people have helped me through my way to keep this research project alive.

Finally, special thanks to my family for the patience and cooperation during the preparation of this work.

ABSTRACT

The main objective of this project is to develop a system in which it counteracts a situation where the driver is travelling too close to another vehicle or fixed object in front. However this project to develop a system which will first realize the scenario and then act on it. The realizing part can be achieved by installing ultrasonic sensor at the front of the vehicle. This sensor will calculate distance of the gap between the vehicle and the heading vehicle. The acting part of the system will be either slowing down the vehicle or come to a complete stop.

Reportprocess to detect when the incident may help to save lives in the event of medical help to arrive in a short time after knowing and accurately identify the scene.

المستخلص

الهدف الرئيس من هذا البحث هو بناء نظام قادرعلي التحكم في سرعه السياره إعتماداً علي المسافه بينها وين السياره الاخري.
وفي حاله وقوع حادث يتم الكشف عن موقع الحادث والتبليغ لتقليل نسبه الوفيات، تم تحقيق هذه الدائرة عملياً بإستعمال متحكم دقيق، وعن طريق برمجة المتحكم الدقيق يتم التحكم في سرعة المحرك وفقأ للمعلومات الوارده من الحساس الموجات فوق الصوتية الذي يتم وضعه في مقدمة المركبة.

LISTOFCONTENTS

LISTOFTABLES

NO TITLE PAGE

LISTOF FIGURES

LIST OFABBREVIATIONS

AVR	Automation voltage regulator
ADC	Analog to digital convertor
CPU	Central Processing Unit
CISC	*Complex instruction set computer*
Com 1	Communications port 1
DC	Direct Current
GSM	*Global System for Mobile*
GPS	*Global Positioning System*
JTAG	*Joint Test Action Group*
LCD	Liquid Crystal Display
LCU	Logic control unit
LDR	Light dependent resistor
LED	Light Emitting Diode
MC	Micro control unit
PWM	Pulse width modulation
RISC	Reduce instruction set computer
TTL	Transistor–Transistor Logic

CHAPTER ONE

INTRODUCTION

1. INTRODUCTION

1.1 Over View:

Studies have shown that the rate of accidents in the world (65%), in Sudan by (143%), and the expected increase in the year 2020's (193%) in the absence of the development of the necessary measures and raise traffic awareness. [1].

The industry strategy for automotive safety systems has been evolving over the last 20 years. Initially, individual passive devices and features such as seatbelts, airbags, knee bolsters, crush zones, etc. was developed for saving lives and minimizing injuries when an accident occurs. Later, preventive measures such as improving visibility, headlights, windshield wipers, tire traction, etc. were deployed to reduce the probability of getting into an accident. Now we are at the stage of actively avoiding accidents as well as providing maximum protection to the vehicle occupants and even pedestrians. Systems that are on the threshold of being deployed or under intense development include collision avoidance systems. In this dissertation, advanced ideas such as pre-crash sensing, ultrasonic sensor is used to sense the object in front of the vehicle and gives the signal to the micro controller unit. Based on the signal received from the ultrasonic sensor, the micro controller unit sends a signal to the braking unit for applying the brake automatically as per braking and throttle control logic fed in to the micro controller unit. To avoid the collision between the vehicles during the period of running conditions and automatically applying the brake by means of actuators, Distance measuring sensors and Electronic control module and hence able to issue warnings to drivers concerning any imminent dangers. As a consequence for the medium term, driver assistance and communication systems will both be featured as integrated vehicle modules to reduce traffic accidents significantly. The top model in our range, the phaeton, is already available with the option of Automatic Distance Control (ADC), which is geared to maintain automatically a minimum distance from the vehicle ahead through system-initiated braking and acceleration. It isll known that driver errors are the main cause for to increased severity, of most accidents. An increasing amount of automotive systems, such as brakes, steering system and suspension, is controllable by means of electronics and software. The expanded use of electronics, micro controllers, sensors, actuators, etc. in the automotive industry will have a major impact on the architecture of future safety systems.

1.2 Objectives:

1- To determine the distance between car with an object behind it.

2 - To inform the driver the state of car condition either they are in safe, warning or stop zone through the colors of LED and display of LCD.

3- The vehicle should slow down until stop movement completely if the car in stop zone.

4- An accident detection system which detects the accidents and by using GPS and GSM we send the information of the location of the accident place to the police station and relatives.

5- Simulate the proposal system and Performance evolution.

1.3 Problem statements:

Every year, hundreds case of road accident increase in our country, Sudan. the number of the people died because of road accident is increasing year by year. The table 1.1 shows us the statistic of an accident in Sudan from 2000 to2014. In particular compiled by Sudan Police, these statistics show how many accidents occur in Sudan.

One of the factors is the driver failure to control the vehicle in emergency situation. The situation that the driver face is:

a) Emergency Stop.

b) Safety distance between vehicles,

c) High speed driving.

In case of accident ,Location cannot be detected Lack of an intelligent systems,

Year	Death	Serious Harm	Simple Harm	Driving Under The Influence of Alcohols	Driving Negligently	Traffic violations	Total	Percentage

which use to detects accident, reported the concerned authorities.

Will be making model simulates the system to avoid the accident and reporting.

1.4 Problem Solution:

In this project the development of the system which will first realize the scenario and then act on it. The realizing part can be achieved by installing sensors at the front of the vehicle. These sensors will calculate distance of the gap between the vehicle and the adjacent vehicle. In accident case, reported accidents by using GSM and GPS to save the people. Performance evaluation of the design circuit will be done during the solution for more accurate result.

Table 1.1: statistics of the accidents in Sudan from (2000 -2014).

2010	891	3695	6156	260	33752	524852	569606	%18.9
2011	821	3663	4665	270	33017	396160	438596	%14.5
2012	768	3058	4651	245	32902	527824	569448	%18.9
2013	677	3010	4605	253	32213	545962	586720	%19.5
2014	709	2904	4351	198	31970	812013	852145	%28.2
Total	3966	16330	24428	1226	133854	2806811	3016515	%100

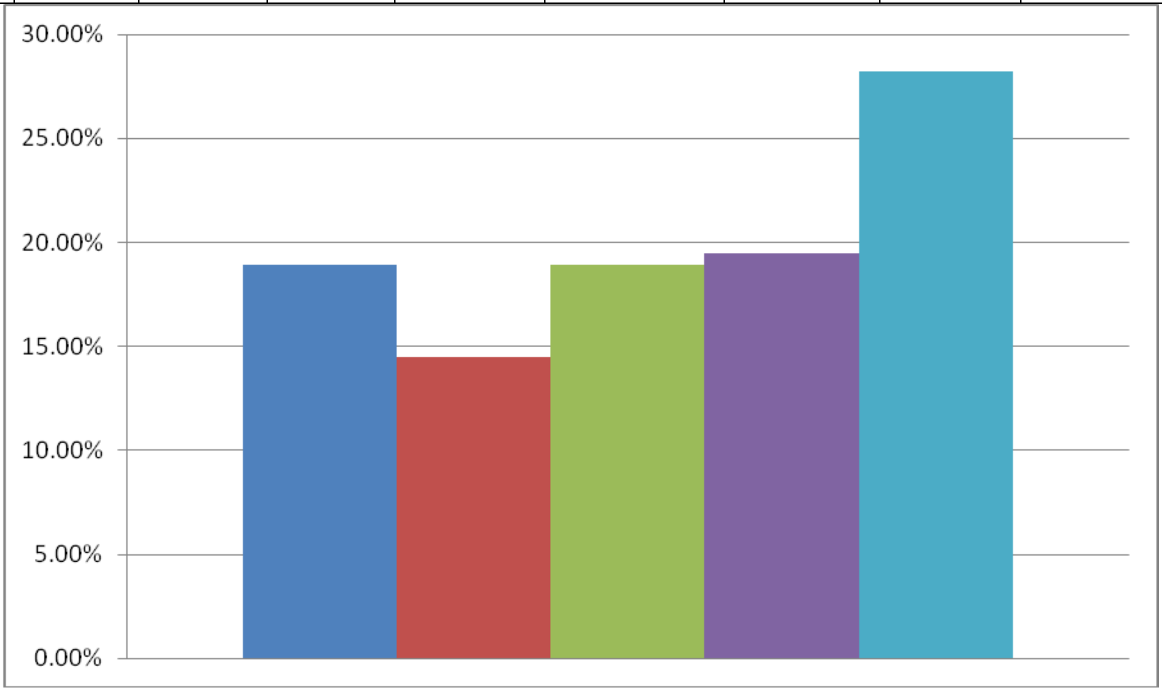

Figure 1.1: Statistics Road Accidents in Sudan (2010_2014)

Source: Khartoum State Traffic Police.

1.5 Methodology:

There are two main scopes in this project which is software development and hardware development. This project scope is limited to design an automotive system that consists of distance measurement and controlling the velocity of the vehicle. The realizing part can be achieved by installing sensors at the front of the vehicle. These sensors will calculate distance of the gap between the vehicle and the adjacent vehicle the acting part of the system will be divided into **two categories**. **The first category** is when the distance of the gap between the vehicle and a fixed object is close and the driver is still driving at a high speed. The system will counteract in this situation by momentarily taking over the driving system and applying the brakes to lower the speed to widen the gap between the car and the object or come to a complete stop if the car in critical state .

The second besides this facility**, in accident case** we also provide an accident detection system which detects the accidents, and send the information of the location of the accident place to the police station and relatives by using GPS and GSM, which is most useful information to save the people.

1.6 Chapter Organization:

CHAPTER ONE: proposed introduction for project also objective. CHAPTER TWO: show the Related Works and basic component.
CHAPTER THREE: discuss system design and description of all sensors and control of motor, select location by GPS and send report by GSM. CHAPTER FOUR: show the result of simulation work and many scenarios. CHAPTER FIVE: proposed conclusion and recommendations.

CHPATER TWO

LITRARURE REVIEW AND THEORETICAL BACKGROUND

2. Literature Review

2.1 Literature Review and Related Works Covered:

- **Automatic vehicle over speed, accident alert and locator system for public transport (Buses).**

In paper use system to monitor the speed and accident use GSM and GPS .and developed SMS application by use Microsoft visual studio package Microsoft SQL saver was used for storing data and used specializes web the administrator the control data base serves was able to extract. GPS receiver with active antenna .GSM modems SIM900D PIC18F4520 microcontroller, mobile phone handset Nokia 110 and laptop computer.

1– On Board Processing Unit (OBPS)

2– Control Database Server (CDS)

3– Mobile Phone Handsets[2]

- **A Design & Implementation of Collision Avoidance System (CAS) for Automobiles using Embedded System.**

In paper use advance ideas such as pre-crash sensing, ultrasonic sensor is used to sense the object in front of Based on the signal received from the ultrasonic sensor the micro controller unit sends a signal to the braking unit for applying the brake automatically as per[3]

- **Car Authentication and Accident Intimation System Using GPS and GSM.**

in paper use There are three main modules when an accident happen GPS co-ordinates of the location are messaged to the nearby hospitals a text message is sent to the owner thereby intimating the status of the car The serial communication interface UART is used for the communication between the Microcontroller (PIC

16F877A), GSM and GPS module. The RS232 communication standard is used for the following purposes.[4]

- **Automatic Vehicle Accident Detection System Based on ARM &GPS.**

  in paper use an MEMS sensor, GPS & GSM The system detects the vehicle accident with the help of vibration sensor or MEMS sensor case reason like having heart attack problem at that time a message is transmitted to the medical help center by just pressing a single switch.[5]

- **Accident messaging system.**

  In paper use accident technique occurs MEMS sensor detect and sends electrical signal to the ADC channel of the PIC microcontroller By using GPS , we get particular location where accident occurs, then GSM modem sends message to authorized mobile number[6]

- **CAN BASED COLLISION AVOIDANCE SYSTEM FOR AUTOMOBILES.**

  In paper having two nodes each node Contain ATMEGA 16 and MCP2515 In first node we are interfacing GP2D12 to find the object, second node contains DC motor initially motor is rotating with maximum speed. If any object is found in front of GP2D12 in node1 motor will stop in node2 by using CAN protocol. For this we have to develop two different application programs in embedded .[7]

- **Autonomous Remote Control Car with Lane Detection and Collision Avoidance System.**

  In paper using RFID If the wrong goods are taken out of the vehicle, the buzzer gets activated. The obstacle detection can be done by ultrasonic sensors. If any obstacle in the route is detected, the message is sent to the control station of the industry using the GSM module and use LCD to display commonly used in Various devices and circuits [8]

- **Advanced Accident Avoidance System for Automobiles.**

In paper used to system

1. Collision Avoidance System (CAS)
2. Automated Accident Detection and
3. Information system (AADIS).[9]

- **Automatic Vehicle Accident Detection and Messaging System Using GPS and GSM Modems.**

The aim of our work is to find the vehicle accident location by means of sending a message using a system which is placed inside of vehicle system. use microcontroller AT89C52 GSM and GPS and used 9.pin "AT STYLE [10]

- **Development and Testing of a Vehicle Collision Avoidance System Based on GPS and Wireless Networks for Open-Pit Mines.**

in paper use 3D graphics technology to reduce powered haulage equipment accidence in open pit mining operations and testing results of GPS accuracy Level achieved are presented[11]

- **Automatic Accident Alert and Safety System using Embedded GSM Interface.**

The system envisioned is an automatic collision detection and warning system relying on GPS module and a GSM modem. The vehicle to be safeguarded is to be fitted with the system sturdily ensuring good mechanical coupling with the entire chassis. In the case of an accident the system detects it using the fact that the vehicle would be suddenly decelerated in such a condition. An accelerometer continuously monitors the acceleration of the vehicle and will detect decelerations greater than threshold value and send the data to the microcontroller via an ADC. The controller compares this with the threshold set value and immediately sends an SOS message to preset numbers. With this message the controller also transmits the

GPS coordinates of the vehicle which it continuously obtains from the GPS module. [12]

- **SMART CAR SYSTEM USING SENSOR, GPS AND GSM.**

To improve overall system, Microcontroller featured with GSM and GPS interface. GPS device received valid GPS signals from satellite and send calculated longitude and latitude and speed of the vehicle to microcontroller at every one second. Microcontroller continuously monitor the speed received from GPS if there is a huge predefined difference between two consecutive readings of speed from the GPS[13]

- **Accident Prevention and Reporting System Using GSM (SIM 900D) and GPS (NMEA 0183).**

Our system consists of two parts, alarming part and messaging part. The hardware includes SONAR ranging modules, vibration sensor, three modules GPS receiver (NMEA), Microcontroller (AT89S51), GSM modem (SIM 900D) and an Alarm. When distance is too short between the vehicle and obstacle then alarm will be "ON" as an indicator to move vehicle in other direction which is safer but when a vehicle faces accident despite of alarm, immediately vibration sensor will detect the signal and then Microcontroller sends the alert message through the GSM modem including the location to predefined numbers that can be reserved for a rescue team. Our designed system[14]

- **Intelligent accident identification system using GPS, GSM modem.**

The concept of this scheme is to green the traffic signal in the path of ambulance automatically with the help of RF module. So that the ambulance can reach the spot in time and human life can be saved and the accident location is identified sends the accident location immediately to the main server. The main server finds the nearest ambulance to the accident zone and sends the exact accident location to the emergency vehicle. The control unit monitors the ambulance and provides the shortest path to the ambulance at the same time it controls the traffic light according to the ambulance location and thus arriving at the hospital[15]

- **Vehicle Accident Detection and Reporting System Using GPS and GSM.**

Accelerometer sensor can be used in car security system to sense vibrations in vehicle and GPS to give location of vehicle, so dangerous driving can be detected. When accident occurs, Accelerometer will detect signal and will send signal to AVR controller, microcontroller will enable airbag to blow and message with accident location is sent to preprogrammed numbers such as ambulance, police station, etc. via GSM.[16]

2.2 System Component:

This section will discuss about components that had been used included Ultrasonic sensor (HC-SR04), power supply 9V, microcontroller ATMEGA 16, DC Motor, and Liquid crystal display (LCD) Global Positioning System (GPS). Global System for Mobile (GSM)

Microprocessor:

A microprocessor uses microelectronic fabrication techniques to shrink the CPU to a very small size; usually a single "chip."

Microcontrollers:

“Microcontrollers”. Micro because they’re small and controller because they “control” machines, gadgets, whatever, Microcontroller’s by definition then, are designed to connect to machines, rather than people.

A microcontroller is a small, low-cost computer-on-a-chip which usually includes:-

1- An 8 or 16 bit microprocessor (CPU).

2- A small amount of RAM.

3- Programmable ROM and/or flash memory.

4- Parallel and/or serial I/O.

5- Timers and signal generators.

6- Analog to Digital (A/D) and/or Digital to Analog (D/A) conversion.

Often it used to run dedicated code that controls one or more tasks in the operation of a device or a system. Also called embedded controllers, because the microcontroller and support circuits are often built into, or embedded in, the devices they control. Devices that utilize microcontrollers include car engines, consumer electronics (VCRs), microwaves, cameras, pagers, cell phones computer peripherals (keyboards, printers, modems), test/measurement equipment (signal generators, millimeters, oscilloscopes Microcontrollers usually must have low-power requirements (05 - 1 W) as opposed to ~10 - 50 W for general purpose desktop CPUs) since many devices they control are battery-operated.

Table: 2.1:The difference between microprocessor and microcontroller.

MICROPROCESSOR	**MICROCONTROLLER**
A microprocessor is a chip that dependent on the chip of many functions.	A microcontroller is a single chip micro-computer that has everything in –built.
A microprocessor contains ALU register and control circuit.	A contains the circuitry of a microcontroller and has built in RAM, ROM I/O devices, timers and counter.
It has few bit manipulation instruction.	It has many bit manipulation instruction.
it has less number of multifunctional pins.	It has more number of multifunctional pins.

They have large memory address space.	They have small memory address space.
Design is very flexible.	Design is less flexible.
A microprocessor based system required more hardware.	Microcontroller based system required less hardware.
Access time for memory and I/O	Less access time for built-in memory.

AVR Microcontroller:

AVR also known as Advanced Virtual RISC, is a customized Harvard architecture 8 bit RISC solitary chip micro-controller. It was invented in the year 1966 by Atmel. Harvard architecture signifies that program & data are amassed in different spaces and are used simultaneously. It was one of the foremost micro-controller families to employ on-chip flash memory basically for storing program, as contrasting to one time programmable EPROM, EEPROM or ROM, utilized by other micro-controllers at the same time. Flash memory is a non-volatile (constant on power down) programmable memory.

2.2.1 ATmega16:

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

Features:

1- High-performance , Low-power
2- Advanced RISC Architecture
3- High Endurance Non-volatile Memory segments
4- JTAG (IEEE std. 1149.1 Compliant) Interface

– Real Time Counter with Separate Oscillator
– Four PWM Channels

– 8-channel, 10-bit ADC

5- Special Microcontroller Features

– Power-on Reset and Programmable Brown-out Detection.

– Internal Calibrated RC Oscillator

– External and Internal Interrupt Sources

– Six Sleep Modes: Idle, ADC Noise Reduction, Power-save.

6- I/O and Packages

– 32 Programmable I/O Lines

– 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF

7- Operating Voltages

– 2.7V - 5.5V for ATmega16L

– 4.5V - 5.5V for ATmega16

8- Speed Grades

– 0 - 8 MHz for ATmega16L

– 0 - 16 MHz for ATmega16

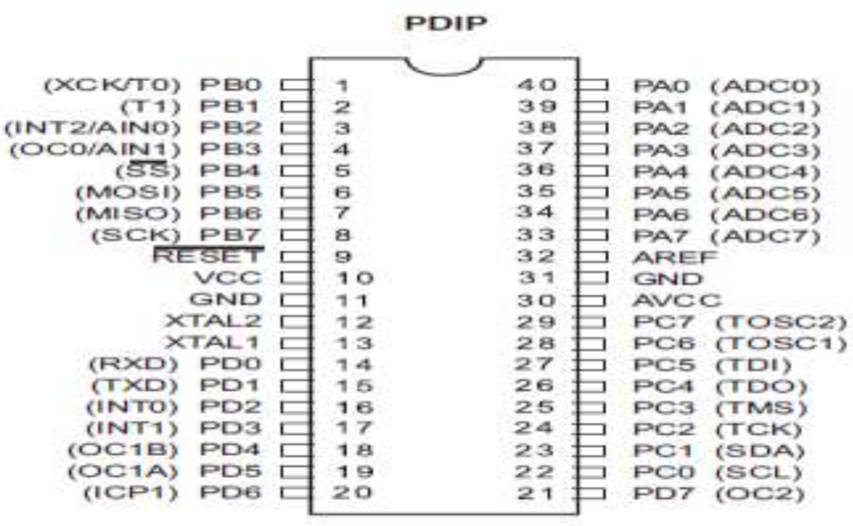

Figure: 2.2 Pins out ATMEGA 16.

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Table: 2.2 ATMEGA 16 pins layout.

VCC	DIGITAL SUPPLY VOLTAGE
GND	Ground.
Port A	Port A serves as the analog inputs to the A/D Converter. Port A also serves as an 8-bit bi-directional I/O port
Port B	Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit).
Port C	Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit).
Port D	Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit).
RESET	Reset Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running.
XTAL1	Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.
XTAL2	Output from the inverting Oscillator amplifier.
AVCC	AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.
AREF	AREF is the analog reference pin for the A/D Converter.

2.2.2 Ultrasonic sensor:

Ultrasonic transducers are transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers; many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions, convert it to an electrical signal, and report it to a computer.

Measurement Principle :

Ultrasonic sensors transmit ultrasonic waves from its sensor head and again receive the ultrasonic waves reflected from an object. By measuring the length of time from the transmission to reception of the sonic wave, it detects the position of the object.

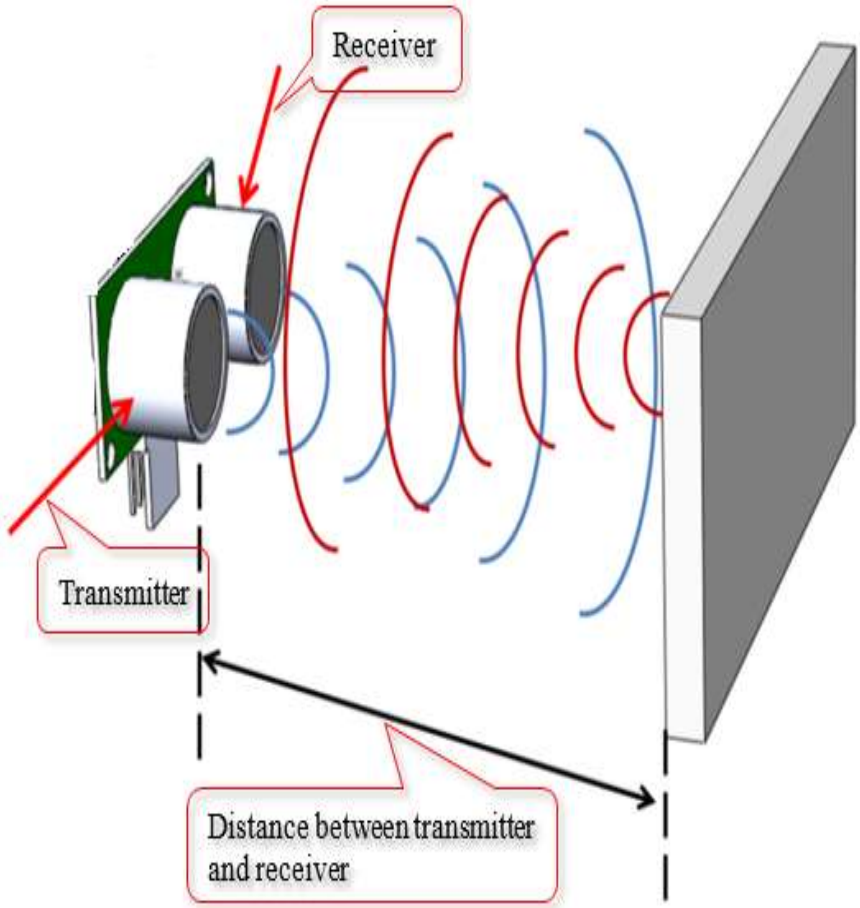


Figure: 2.3 Principle use of ultrasonic sensor.

The advantages of Ultrasonic sensor.

1-Measures and detects distances of moving objects.

2- Impervious to target materials, surface and color.

3- Solid-state units have virtually unlimited, maintenance-free lifespan.

4- Detects small objects over long operating distances.

5- Resistant to external disturbances such as vibration, infrared radiation, ambient noise and EMI radiation.

6- Ultrasonic sensors are not affected by dust, dirt or high-moisture environments.

7- Ultrasonic sensors are not affected by dust, dirt or high-moisture environments.

8-Discrete distances to moving objects can be detected and measured.

The disadvantages of Ultrasonic sensor:

1- Overheating of a wave emitter precludes the energy of ultrasonic waves emitted there from being enhanced to a practical level.

2- Interference between the projected waves and the reflected waves takes place, and development of standing waves provides adverse effects.

3- It is impossible to discern between reflected waves from the road surface and reflected waves from other places or objects.

4- There is no effective measure for removing the influences of factors other than road surface irregularities for example, winds, temperature variations, etc., which can change the intensity of reflected waves.

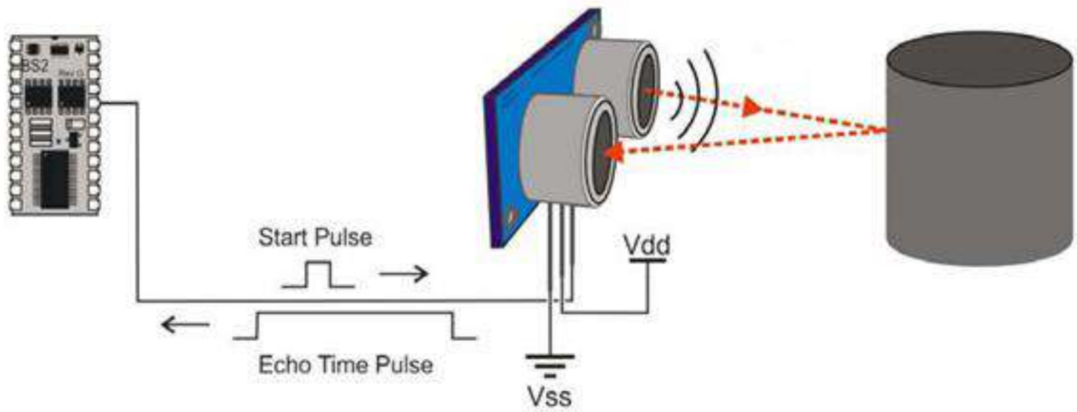


Figure: 2.4 Concept of ultrasonic sensor.

Figure: 2.5 Ultrasonic sensors.

2.2.3 ULN2003A:

The ULN2003A is a high-voltage, high-current Darlington transistor array. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode fly back diodes for switching inductive loads

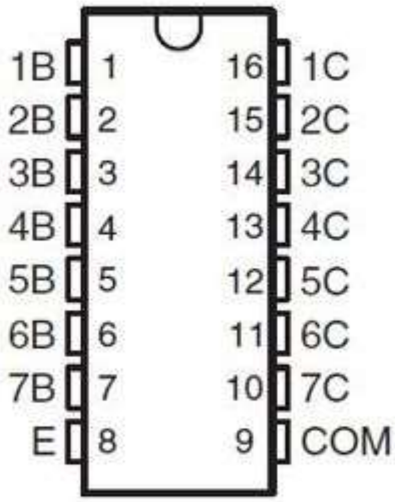


Figure: 2.6 ULN2003A.

2.2.4 555 timers:

The 555 timer is an 8-pin IC that is capable of producing accurate time delays and/or oscillators. In the time delay mode, the delay is controlled by one external resistor and capacitor. In the oscillator mode, the frequency of oscillation and duty cycle are both controlled with two external resistors and one capacitor.

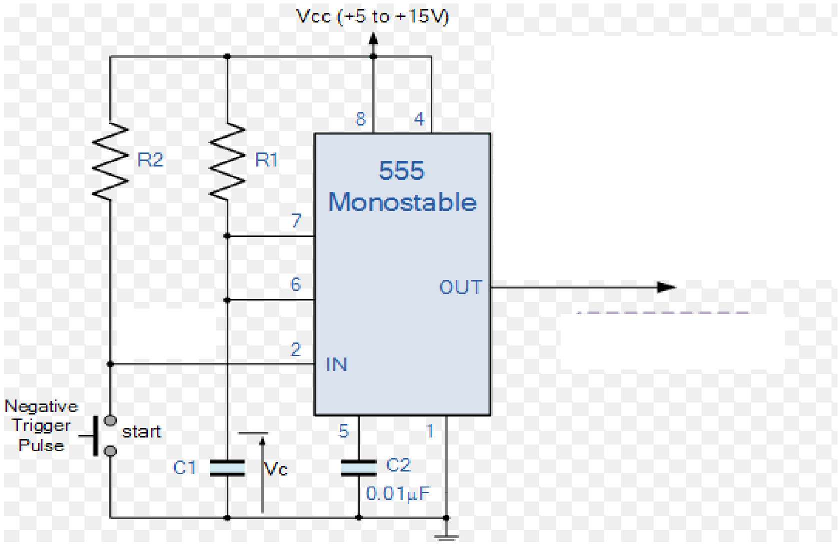


Figure: 2.7 555 timer.

2.2.5 MAX232

The MAX232 is a hardware layer protocol converter IC manufactured by the Maxim Corporation. Commonly known as a RS-232 Transceiver, it consists of a pair of drivers and a pair of receivers. At a very basic level, the driver converts TTL and CMOS voltage levels to TIA/EIA-232-E levels, which are compatible for serial port communications. The receiver performs the reverse conversion.

Used in embedded microcontroller systems, and computers, this IC has been one of the most popular components in production for well over two decades. If you have a microcontroller circuit that requires communication through a serial port, then this is the chip to use. This is a versatile IC, which is one of those wonderful components that solve so many signal conversion problems.

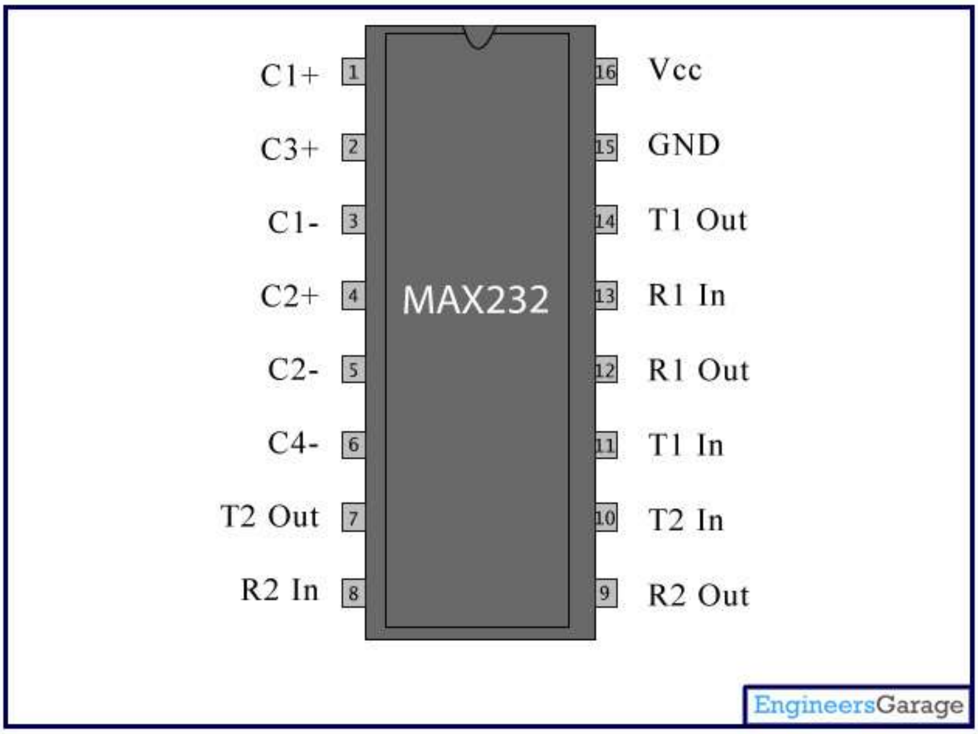


Figure: 2.8 MAX 232.

2.2.6 LCD (liquid crystal display)

The technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. An LCD is made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time (your mouse will appear to move more smoothly across the screen, for example). Active matrix is the superior technology.

The 16x2 size of LCD is use in the main microcontroller circuit to display the status of the main circuit function. Resistor value between 1Kohm to 10Kohm is use for the brightness of the LCD and the 10 ohm resistor with respective to the ground is use to light up the back light of the LCD.

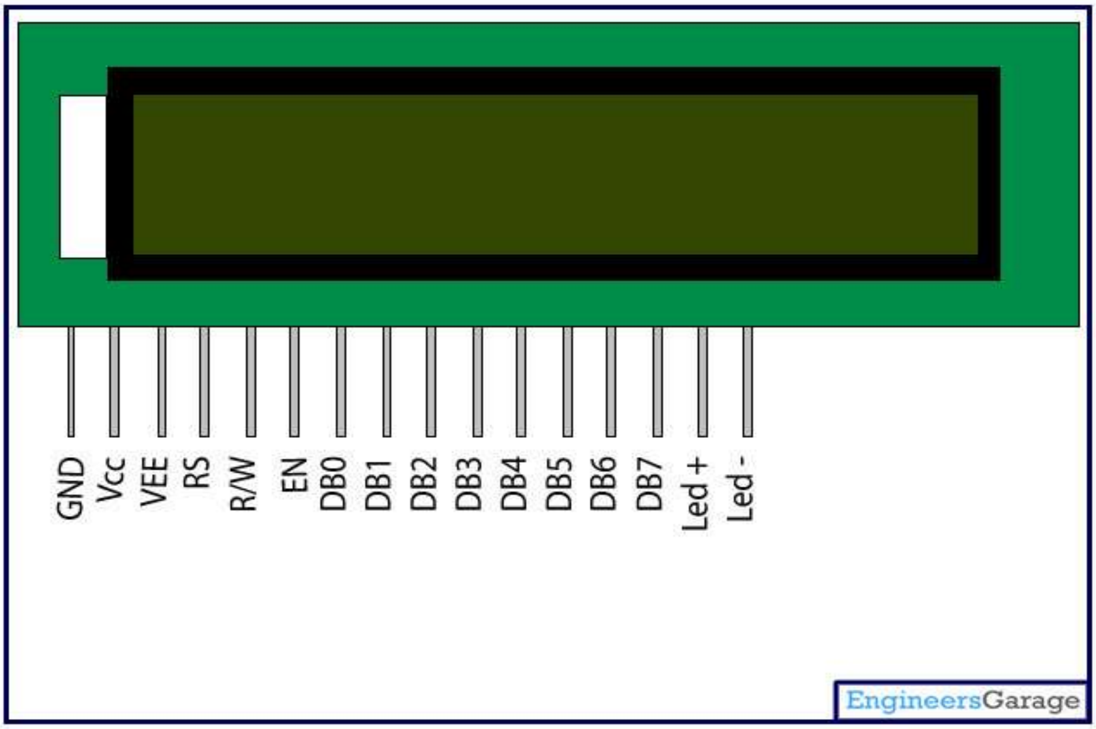


Figure 2.9: (16 x 2) size LCD use in the main circuit.

Table2.3: Connectivity of the LCD being use.

PIN	NAME	PIN FUNCTION	CONNECTION
1	VSS	Ground	GND

2	Vdd	Positive supply for LCD	5V
3	VO	Brightness adjust	Connected to a preset to adjust brightness
4	RS	Select register, select instruction or data register	PIN PIC
5	R/W	Select read or write	GND
6	E	Start data read or write	PIN PIC
7	DB0 To DB7	Data bus pin	PIN PIC
8	LED+	Backlight positive input	VCC
9	LED-	Backlight negative input	GND

2.2.7 DC motor:

DC motor used in this project is the small car (toy car) with a capacity of 12 volt.

Figure 2.10: DC motor 12V.

2.2.8 GSM MODUIE (SIM900):

GPRS module is a breakout board and minimum system of SIM900 Quad-band/SIM900A Dual-band GSM/GPRS module. It can communicate with controllers via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands). This module supports software power on and reset. IO List: GND , +5V , RX , TX , PWR , RST.

Booting the GSM Module:

1. Insert the SIM card to GSM module and lock it.

2. Connect the adapter to GSM module and turn it ON.

3. Now wait for some time (say 1 minute) and see the blinking rate of 'status LED' or 'network LED' (GSM module will take some time to establish connection with mobile network).

4. Once the connection is established successfully, the status/network LED will blink continuously every 3 seconds. You may try making a call to the mobile number of the SIM card inside GSM module. If you hear a ring back, the GSM module has successfully established network connection.

Features

1- Quad-Band 850/ 900/ 1800/ 1900 MHz

2- Dual-Band 900/ 1900 MHz
3- GPRS multi-slot class 10/8GPRS mobile station class B
4- Compliant to GSM phase 2/2+Class 4 (2 W @850/ 900 MHz)
5- Class 1 (1 W @ 1800/1900MHz)
6- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
7- Low power consumption: 1.5mA(sleep mode)
8- Operation temperature: -40°C to +85 °C

Figure 2.11: GSM MODUIE (SIM900).

2.2.9 GPS MODEM (SKYLAB SKM53):

GPS modem is a device which receives signals from satellite and provides information about latitude, longitude, altitude, time etc. The GPS navigator is more famous in mobiles to track the road maps. The GPS modem has an antenna which receives the satellite signals and transfers them to the modem. The modem in turn converts the data into useful information and sends the output in serial RS232 logic level format. The information about latitude, longitude etc is sent continuously and accompanied by an identifier string, SKM53 Series with embedded GPS antenna. It is based on MediaTek3329 single-chip architecture.SKM53 can be applied in a portable device and receiver, car holder, personal locator, speed camera detector and vehicle locator

Features

1. Ultra high sensitivity: -165dBm.
2. tracking/66 acquisition-channel receiver.
3. WAAS/EGNOS/MSAS/GAGAN support.
4. NMEA protocols (default speed: 9600bps).
5. Internal back-up battery.
6. One serial port.
7. Embedded patch antenna 18.2 x 18.2 x 4.0 mm.
8. Operating temperature range: -40 to 85℃.
9. RoHS compliant (Lead-free).
10. Tiny form factor ： 30mm x20mm x 8.5mm.

Figure 2.12: GPS MODULE (SKYLAB SKM53).

CHPATER THREE

SYSTEM DESIGN

3. SYSTEM DESIGN

3.1 Project Overview

The main aim of thesis work is implementation of the Car crash avoidance system using ATMEGA16 Microcontroller. To implement this prototype car avoidance system is considered which consists of D.C motors , ultrasonic sensor , and display module.

Besides this facility the system provides an accident detection which detects the accidents and by using GPS and GSM we send the information of the location of the accident place to the police station and relatives. This is most useful information to save the persons.

3.2 control system

This project is mainly focus on DC motor speed and distance control system by using microcontroller. The actual distance has been measured using ultrasonic sensor and feedback to microcontroller. Microcontroller has been used as the controller to control DC motor speed and desired spacing between both vehicles. The controller will determine duty cycle of pulse-width-modulation (PWM) in microcontroller. Based on the data of distance calculation. AVR Microcontroller produces the intelligent control setting by giving a 5V high bit of control signal to one of six condition lines. These six of control conditions include: speed up, speed down, speed remain, brake/stop, Determine the location and send the location.

The basic structure diagram of system positioning control system model is show in figure 3.1. The system includes ATMEGA16, DC motor (driver module), ultrasonic sensor, LCD display module, GSM, GPS.

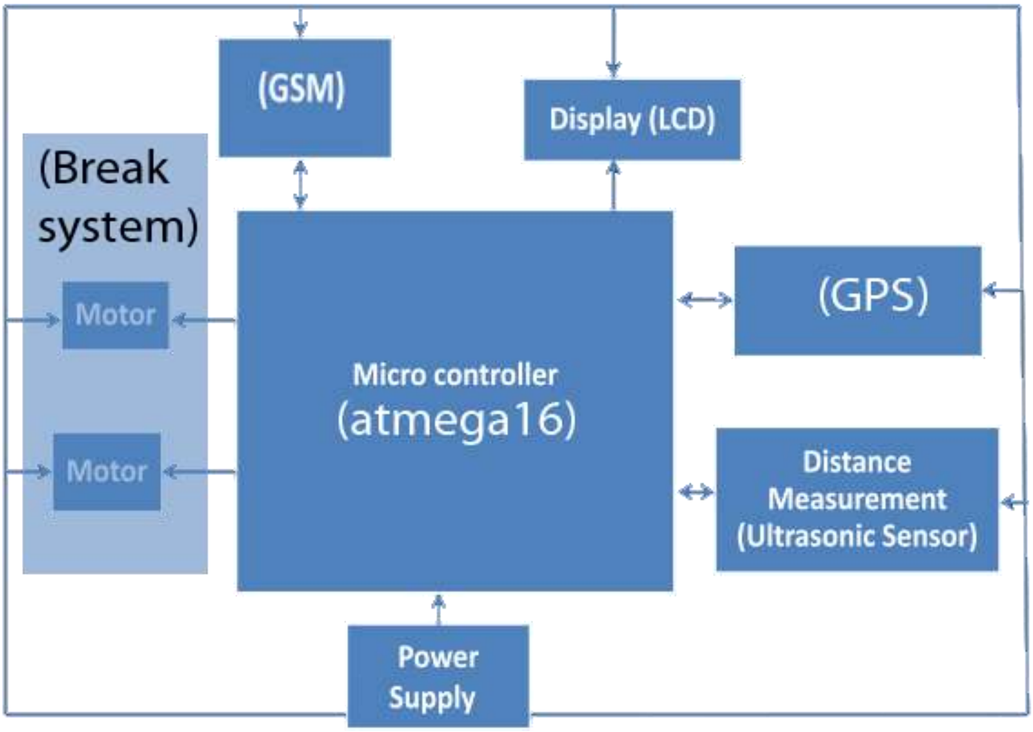


Figure: 3.1 The General block diagram.

3.3 circuit diagram and analysis:

In the following section, the system will be described in details:

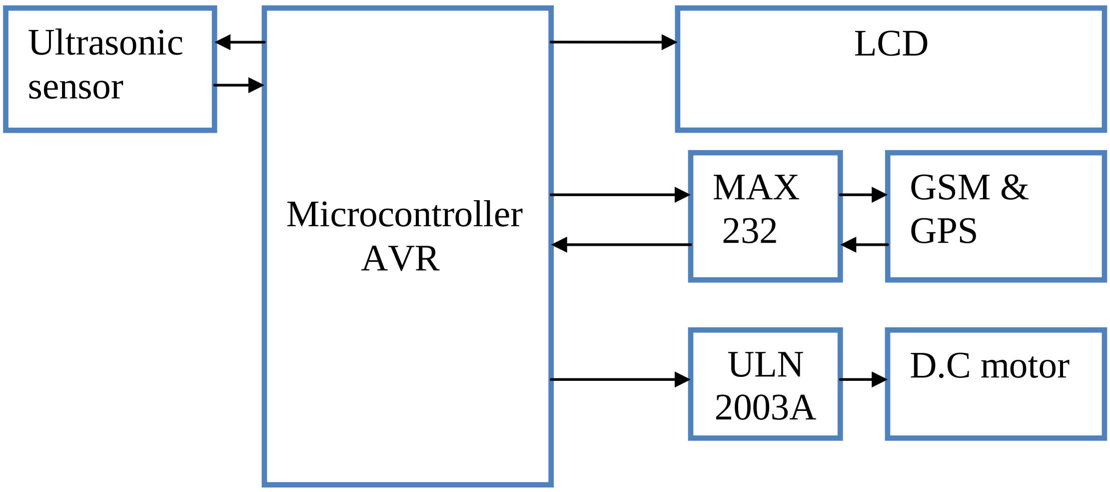


Figure 3.2: Main control system block diagram.

1. Ultrasonic sensor: The microcontroller sends TRIG and Ultrasonic sensor feedback is ECHO signal back to microcontroller. the microcontroller Calculated the Distance by use feedback of Ultrasonic sensor

2. Max 232: to convert signal voltage levels signal to (up to convert) or from (down convert) GSM &GPS need to convert or modulation amplitude.
3. ULN 2003A: to drives a motor to Acceleration or Slow or stop the speed of motor, that use supply voltages of 6 V to 15 V.
4. Microcontroller: to control the motor **.**
5. And GSM & GPS and read from sensor.
6. LCD : to display all of the activities that the microcontroller is working on (distance and Location)
7. Motor: dc motor to drive car.

The microcontroller send trig to sensor., after which time the "Echo" send the signal to microcontroller, and microcontroller measure a distance using calculations . Based on the distance the microcontroller take action if the distance between car and object , If the distance far large no action just motor going highest speed, display the distance and the location, if the distance in middle the microcontroller send signal to drives motor to Slow the speed, if a distance is close the microcontroller send signal to stop motor , when the collision car Collision cars Collision cars send to max 232 To activate the GPS to select the location and after send the location of collision to The selected number is often the relatives or the police center.

3.3.1 Ultrasonic sensor:

Is a popular and low cost solution for non-contact distance measurement function. It is able to measure distances from 2cm to 400cm with an accuracy of about 3mm. This module includes ultrasonic transmitter, ultrasonic receiver and its control circuit, Module has 4 pins

1. **VCC** – 5V, of the power supply
2. **TRIG** – Trigger Pin
3. **ECHO** – Echo Pin
4. **GND** – **-** the power supply

TRIG and ECHO pins can be used to interface this module with a microcontroller unit. These are TTL (0 – 5V) input output pins.

- **Steps that must be followed to work the sensor :**
  1. Microcontroller send trig to "Trig" pin of the sensor high for 10μs. This initiates a sensor cycle.
  2. The sensor Generates 8 pulses everyone 40KHz, 8 x 40 kHz pulses will be sent from the transmitting piazza transducer of the sensor, after which time the "Echo" pin on the sensor will go from low to high.
  3. The 40 kHz sound wave will bounce off the nearest object and return to the sensor.
  4. When the sensor detects the reflected sound wave, the Echo pin will go low again.
  5. The distance between the sensor and the detected object can be calculated based on the length of time the Echo pin is high.

If no object is detected, the Echo pin will stay high for 38ms and then go low.

accord to Not available ultrasonic sensor in simulation program (Proteus) It has been replaced 555 timer Circuit in Projects Theory of work are the same but with the existence of differences The production Series of pulses Via 555 timer the pulses insert to microcontroller Similarity of output of sensor.

ITS:

1. Working Voltage : 5V(DC)
2. Working Current : 15mA
3. Working frequency : 40HZ
4. Output: 0-5V (Output high when obstacle detected in range)
5. Beam Angle: Max 15 degree.
6. Distance: 2cm - 400cm.
7. Accuracy: 0.3cm.

8. Input trigger signal : 10us impulse TTL
9. Echo signal: PWM signal (time required for sound signal to travel twice between source and obstacle).
10. Size: 45mm*20mm*15 mm.

3.3.2 555 timer:

The 555 timer is an extremely versatile integrated circuit which can be used to build lots of different circuits. You can use the 555 effectively without understanding the function of each pin in detail.

Frequently, the 555 is used in actable mode to generate a continuous series of pulses.

Table 3.1: DIP 555 timer pin description.

Table 3.1: DIP 555 timer pin description.

PIN	NAME	PURPOSE
1	GND	Ground reference voltage, low level (0 V)
2	TRIG	The OUT pin goes high and a timing interval starts when this input falls below 1/2 of CTRL voltage (which is typically 1/3 V_{CC}, CTRL being 2/3 V_{CC} by default if CTRL is left open).
3	OUT	This output is driven to approximately 1.7 V below $+V_{CC}$, or to GND.
4	RESET	A timing interval may be reset by driving this input to GND, but the timing does not begin again until RESET rises above approximately 0.7 volts. Overrides TRIG which overrides THR.
5	CTRL	Provides "control" access to the internal voltage divider (by default, 2/3 V_{CC}).
6	THR	The timing (OUT high) interval ends when the voltage at THR ("threshold") is greater than that at CTRL (2/3 V_{CC} if CTRL is open).
7	DIS	Open collector output which may discharge a capacitor between intervals. In phase with output.
8	VCC	Positive supply voltage, which is usually between 3 and 15 V depending on the variation.

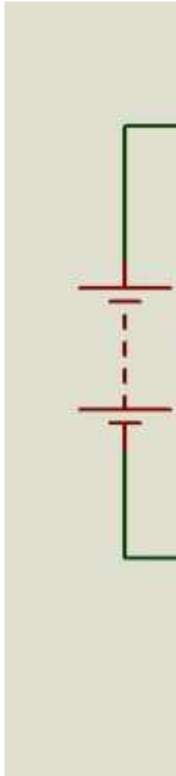


Figure: 3.3 The 555 timer (sensor).

This is a pulse generator with adjustable duty cycle made with the 555 timer IC. The circuit is an astable multivibrator with a 50% pulse duty cycle. The difference from the standard design of a 555 timer is the resistance between pins 6 and 7 of the IC composed of P1, P2, R2, D1 and D2.

The diodes D1 and D2 set a definite charging time for C1 which produces a 50% duty cycle in a normal case. The duty cycle (n) is dependent on P1 and P2 in the following manner:

$$n = 1 + P2/P1$$

If P2 = 0 (n = 100%) then the frequency can be approximately calculated with the following formula:

$$f = 0.69/((2*P1 + P2 + 4.7k\Omega)*C1)$$

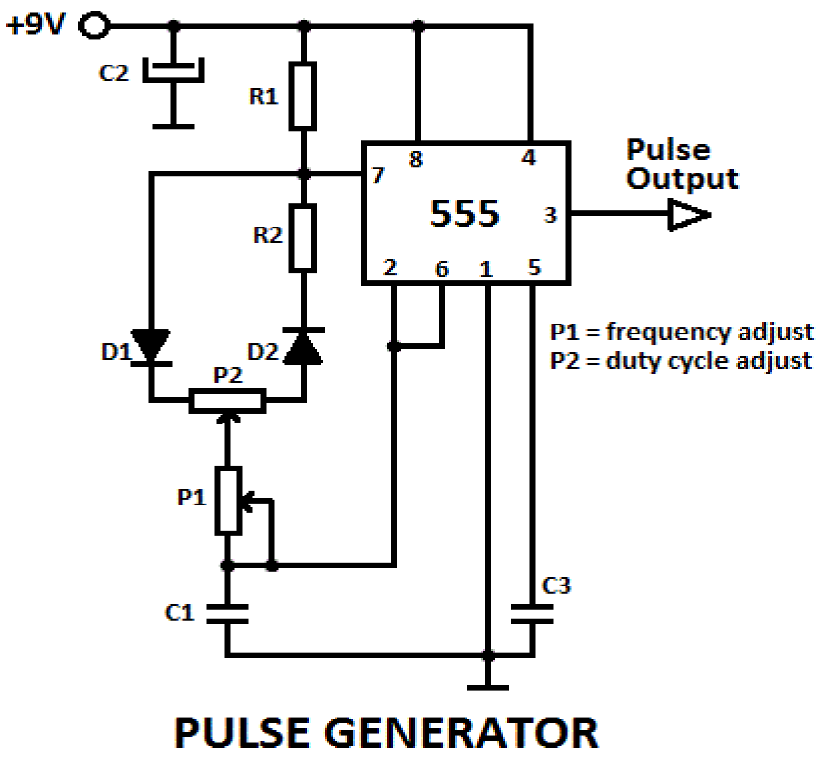


Figure: 3.4 Pulse generator circuit diagram.

3.3.3 Max 232:

This module is primary of interest for people building their own electronics with an RS-232 interface. Off-the-shelf computers with RS-232 interfaces already contain the necessary electronics, and there is no need to add the circuitry (Max 232) max232 to convert signal from TTL level

(microcontroller) to RS232 level (PC ,COM) the microcontroller use binary 0 , 1 levels volt for 0 logic and 5+ volt to 1 logic but the RS 232 (PC,COM) was defined at a different level - for logic 0 it ranges from +3v to +15 v and for logic 1 its -3v to -15v.

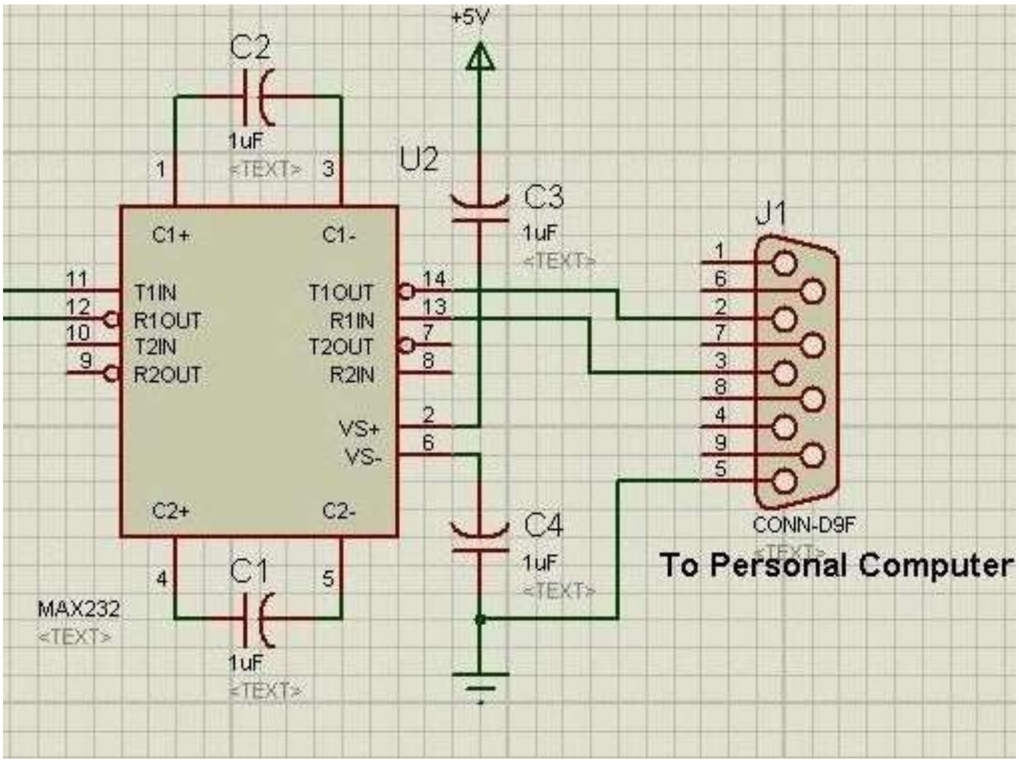


Figure: 3.5 Max 232 pin configuration.

- **Features**

1. Meets or Exceeds TIA/EIA-232-F and ITU Recommendation V.28
2. Operates From a Single 5-V Power Supply With 1.0-μF Charge-Pump Capacitors
3. Operates up to 120 Kbit/s
4. Two Drivers and Two Receivers
5. ±30-V Input Levels
6. Low Supply Current: 8 mA Typical.

Table 3.2: Pin Description.

PIN NO	FUNCTION	NAME
1	Capacitor connection pins	Capacitor 1 +
2		Capacitor 3 +
3		Capacitor 1 -
4		Capacitor 2 +
5		Capacitor 2 -
6		Capacitor 4 -
7	Output pin; outputs the serially transmitted data at RS232 logic level; connected to receiver pin of PC serial port	T_2 Out
8	Input pin; receives serially transmitted data at RS 232 logic level; connected to transmitter pin of PC serial port	R_2 In
9	Output pin; outputs the serially transmitted data at TTL logic level; connected to receiver pin of controller.	R_2 Out
10	Input pins; receive the serial data at TTL logic level; connected to serial transmitter pin of controller.	T_2 In
11		T_1 In
12	Output pin; outputs the serially transmitted data at TTL logic level; connected to receiver pin of controller.	R_1 Out
13	Input pin; receives serially transmitted data at RS 232 logic level; connected to transmitter pin of PC serial port	R_1 In
14	Output pin; outputs the serially transmitted data at RS232 logic level; connected to receiver pin of PC serial port	T_1 Out
15	Ground (0V)	Ground
16	Supply voltage; 5V (4.5V – 5.5V)	Vcc

Table 3.3: Pin of TX and RX.

MICROCONTROLLER	MAX232		RS232
Tx	$T_{1/2}$ In	$T_{1/2}$ Out	Rx
Rx	$R_{1/2}$ Out	$R_{1/2}$ In	Tx

Because the simulation does not cover MAX232 and GSM, GPS virtual terminal is used to replace those components.

3.3.4 ULN 2003A:

The ULx200xA devices are high-voltage, high-current Darlington transistor arrays. Each consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs can be paralleled for higher current capability, ULN2003 is for 5V TTL, CMOS logic devices.

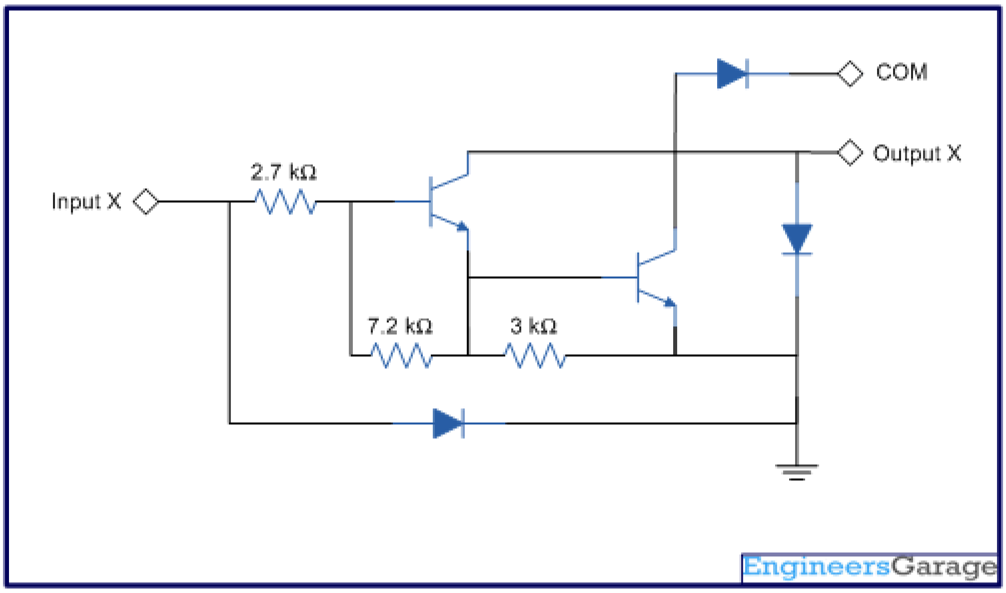


Figure: 3.6 UNL2003 pin out.

Table 3.4: Pin Description.

PIN NO	FUNCTION	NAME
1	Input for 1st channel	Input 1
2	Input for 2nd channel	Input 2
3	Input for 3rd channel	Input 3
4	Input for 4th channel	Input 4
5	Input for 5th channel	Input 5
6	Input for 6th channel	Input 6
7	Input for 7th channel	Input 7

8	Ground (0V)	Ground
9	Common free wheeling diodes	Common
10	Output for 7th channel	Output 7
11	Output for 6th channel	Output 6
12	Output for 5th channel	Output 5
13	Output for 4th channel	Output 4
14	Output for 3rd channel	Output 3
15	Output for 2nd channel	Output 2
16	Output for 1st channel	Output 1

- **Features**
    1. 500-mA-Rated Collector Current (Single Output).
    2. High-Voltage Outputs: 50 V.
    3. Output Clamp Diodes.
    4. Inputs Compatible with Various Types of Logic.
    5. Relay-Driver Applications.

3.3.5 Virtual Terminal (GSM and GPS module):

Virtual Terminal is a tool in Proteus, which is used to view data coming from Serial Port (DB9) and also used to send the data to the Serial Port.

Use a Virtual Terminal like GSM and GPS module in the beginning the microcontroller Claim to enter the location in Virtual Terminal Similar to GPS the microcontroller store the location when car Accident is Happen the microcontroller send the location via Virtual Terminal and Display Similar to GPS.

- **features**
    1. Fully bi-directional - received serial data is displayed as ASCII characters whilst key presses are transmitted as serial ASCII data.
    2. Simple two wire serial data interface: RXD for received data and TXD for transmitted data.
    3. Simple two wire hardware handshake interface: RTS for ready-to-send and CTS for clear-to-send.
    4. Baud rate from 300 TO 57,600 baud.
    5. 7 or 8 data bits.
    6. Odd, even or no parity.
    7. 0, 1 or 2 stop bits.
    8. XON/XOFF software handshaking in addition to hardware handshaking.

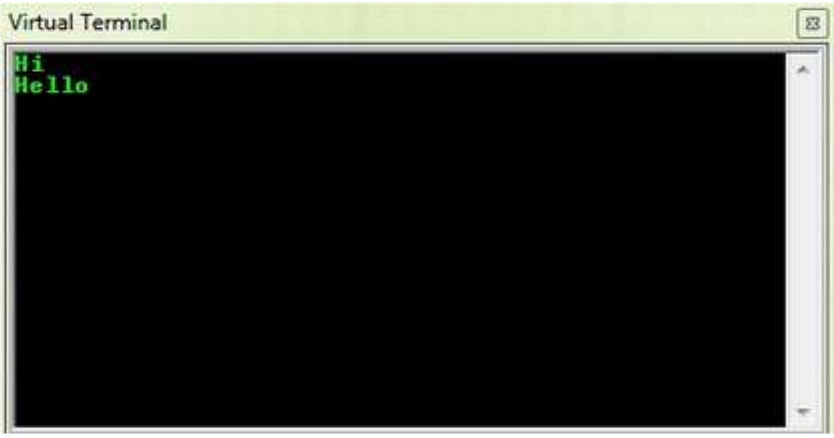


Figure: 3.7 Virtual Terminal.

3.3.6 Pulse-Width-Modulation (PWM) in Microcontroller:

PWM is a technique used to generate analog output signal using digital signals. It is commonly used to control average power delivered to a load, motor speed control, generating analog voltage levels and for generating analog waveforms. MCU can only generate two levels on its output lines, HIGH=5v and LOW=0V. But what if we want to generate 2.5v or 3.1v or any voltage between 0-5 volt output use the Idea of PWM like digital to analog converter

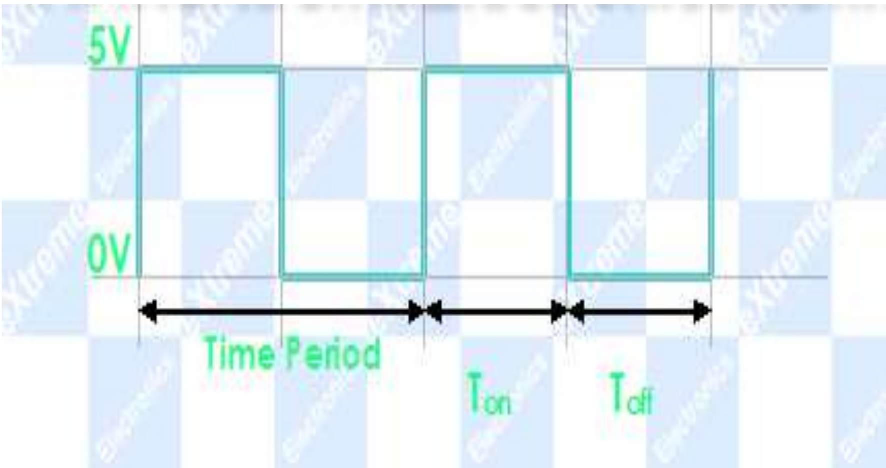


Figure: 3.8 A PWM Waveform(a).

In the figure 3.8 you can see a PWM signal. As you can see it is just a digital signal can easily be generated by microcontroller, but let me clarify some of its properties.

1. The signal remains "ON" for some time and "OFF" for some time.
2. Ton = Time the output remains high.
3. Toff = Time the output remains Low.
4. When output is high the voltage is 5v'
5. When output is low the voltage is 0v
6. T = Time Period = Ton + Toff

- **Duty Cycle.**

It is defined by

$$\frac{Ton}{time\ period} * 100$$

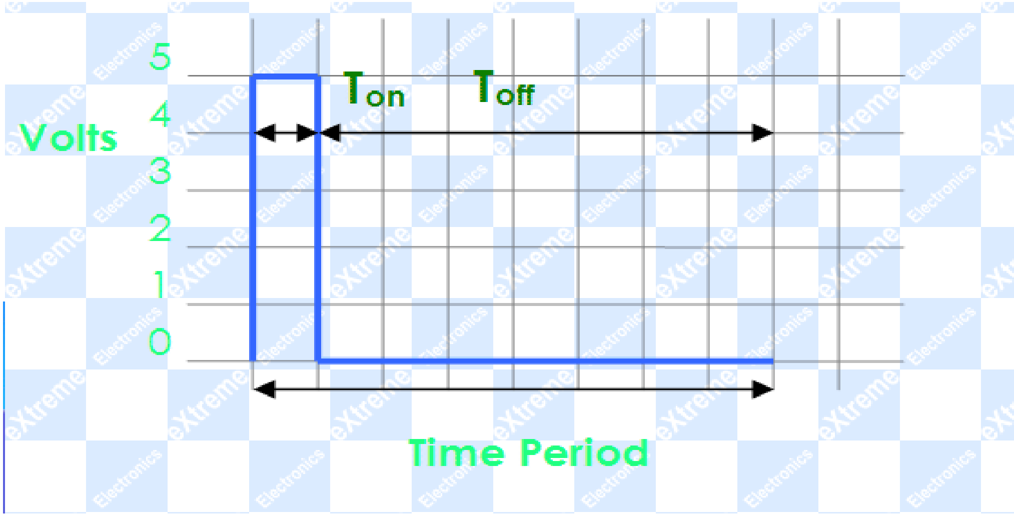


Figure: 3. 9 A PWM Waveform (b).

Duty Cycle = 12.5% Analog Voltage Out = 12.5% of Vcc (5v) = 0.625 Volts

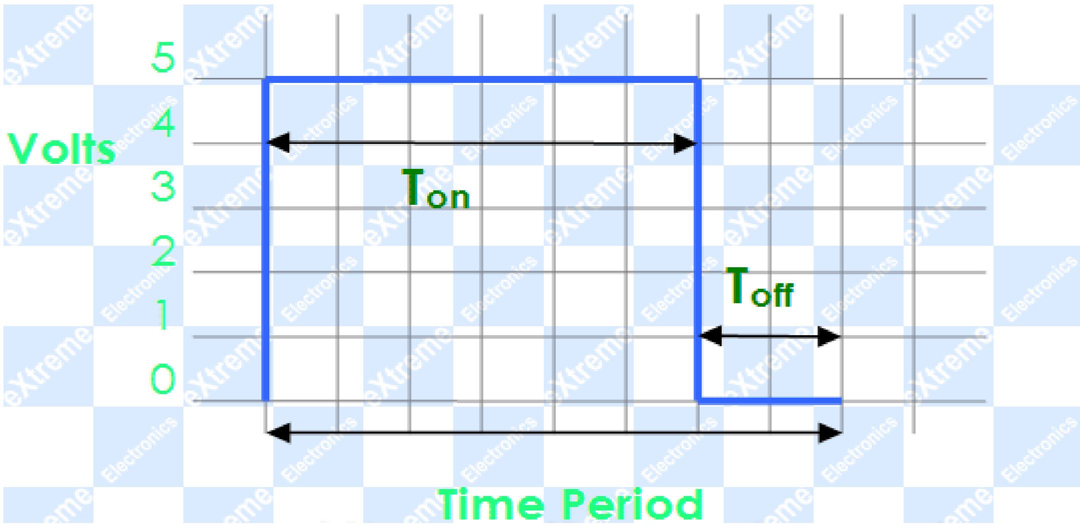


Figure: 3.10 A PWM Waveform(c).

Duty Cycle = 75% Analog Voltage Out = 75% of Vcc (5v) = 3.75 Volts.

The speed of a DC motor is directly proportional to the supply voltage, The average voltage supply to the motor depends on the duty ratio. Thus by controlling duty ratio (control width of time on), average output voltage can control the motor .The Pulse- Width Modulation (PWM) in microcontroller is used to control duty cycle of DC motor drive, PWM is an entirely different approach to control the speed of a DC motor. Power is supplied to the motor in square wave of constant voltage but varying pulse-width or duty cycle.

3.3.7 ATMEGA 16

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing, Know more about RISC and CISC Architecture) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.

ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively.

ATmega16 is a 40 pin MCU. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD.

The feedback of sensor (555timer) connected to pin1 (XCK/T0) PB0 the pin work like Counter to calculate the number of pulses incoming the duration of any pulse is constant 1.08 ms .

Calculate of distance by Multiply the number of pulse with duration of pulse the distance in Millimeter convert in meter by division 1*10-3 ,After that Multiply the result with Speed of sound 340 and distance the result by 2 Because of the distance incidence signal and reflected signal due object .

In pin 40 (ADC0) PA0 we have switch the switch Allows the signal of sensor Pass to microcontroller when pin 40 no signal feed to microcontroller.

microcontroller have some cases depend on distance, when on object Before a car microcontroller pin 19 (OC1A) PD5 PWM Channel Outputs control of speed Through ULN2003A and can Slow down motor when the object nearby and the PWM make 0 if Really very near object, when a car accident microcontroller use pin 14 (RXD) PD0 to Receive location from GPS TX (Virtual Terminal) and transmit by pin 15 (TXD) PD1 to GPS RX (Virtual Terminal) all due max 232.

all these Activities Display by LCD 16*2 ,LCD various interfaces (8-bit/4-bit), and have 8 Data bus line Here 4 line Just use (D4,D5,D6,D7) all this JTAG Interface.

D4 connect with pin 26 PC4 (TDO), D5 connect with pin 27 PC5 (TDI), D6 connect with 28 PC6 (TOSC1), D6 connect with 29 PC7 (TOSC2), and pin 6 (E) connected with pin 22 PC0 (SCL).

Pin 5 (RW),pin 3 (VDD),pin 1 (Vss) in LCD connected with Ground ,pin2 connected with VCC , Pins connections descriptions in ATMEGA 16 is show in table 3.5.

Table 3.5: Pins connections descriptions in ATMEGA 16.

NAME	PURPOSE
Port A	Pin A.0: connected to switch.
Port B	Pin B.0: connected to sensor (555 timer) T0: Timer0 External Counter Input.
Port C	Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected For each bit). In system designed used port C to connected LCD
Port D	Pin D.5 PWM Channel Outputs to motor Through ULN2003A

3.4 control system Flow charts and state Diagram:

The flow charts show in figure 3.7 illustrate the general flow
Chart of the control system, the number indicate the conditions.

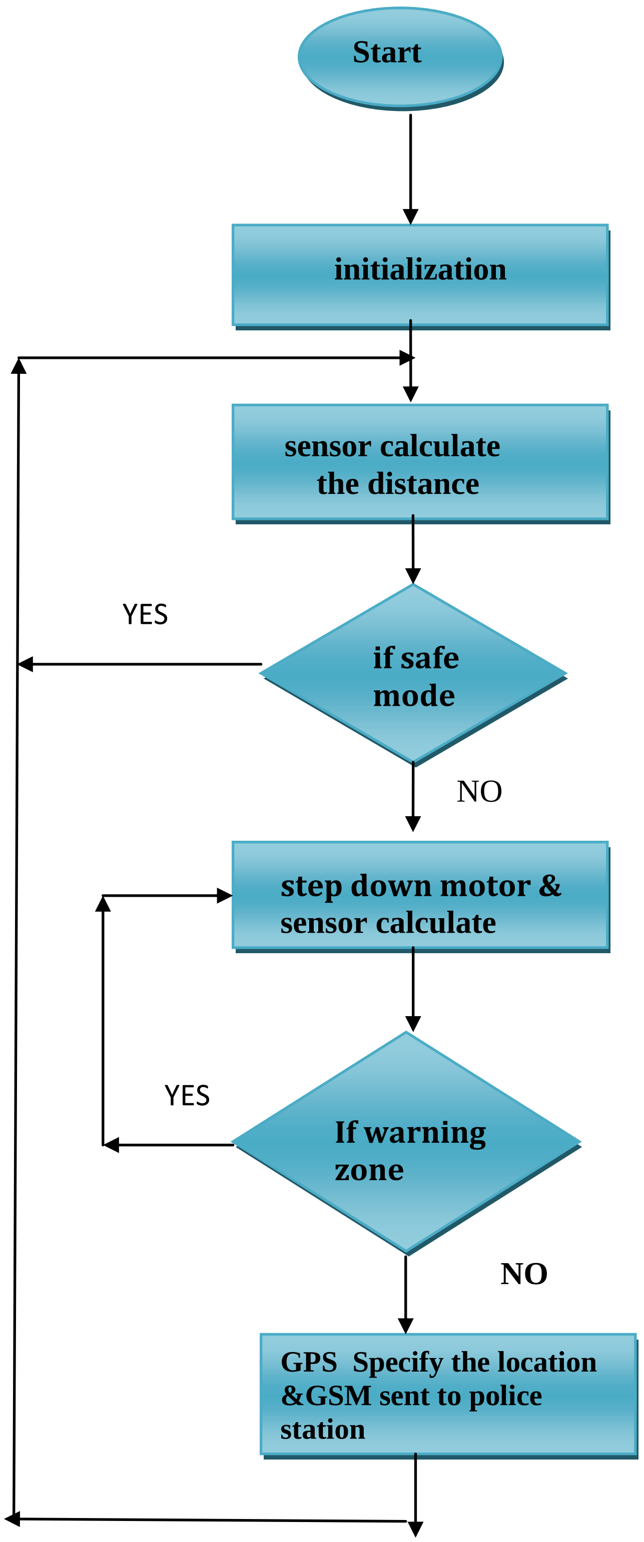


Figure: 3.11 General flow chart.

CHAPTER FOUR

SIMULATION AND RESULT

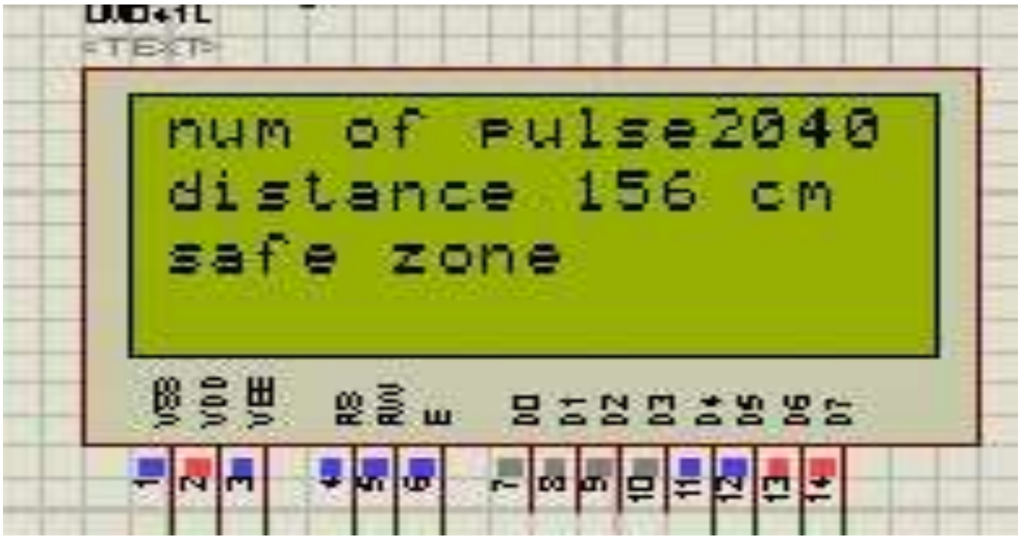
4. SIMULATION AND RESUIL

In this chapter the system that where described in chapter three would be tested classified through simulation, Circuit will be described .The output of sensor income for the microcontroller, and there by control the output.

We have six scenarios all scenarios Depends on The distance and connected to Pin A.0 Condition is closed.

4.2ReadDestance:

After reading the number of pulses incoming, Distance are displayed on the screen after calculations.



The relationship between the number of pulses and the distance show in Table 4.1

Table 4.1: The relationship between the number of pulses and the distance.

NUMBER OF PULSES	DISTANCE IN CM
885	68
1123	94
1441	110
1887	145
2040	156
4044	311

4.1.1 Scenario 1:

The distance between the Object and the car is very close, its 68cm (less than 100cm is danger) this inevitably means an accident. The LCD display that as "Danger zone" with a lighting of a red LED, sound alarm (buzzer).also the GPS (Virtual Terminal) Orders you enter the location and GSM (Virtual Terminal) Displays or sends the location. Here will inevitably be the speed of the motor is zero

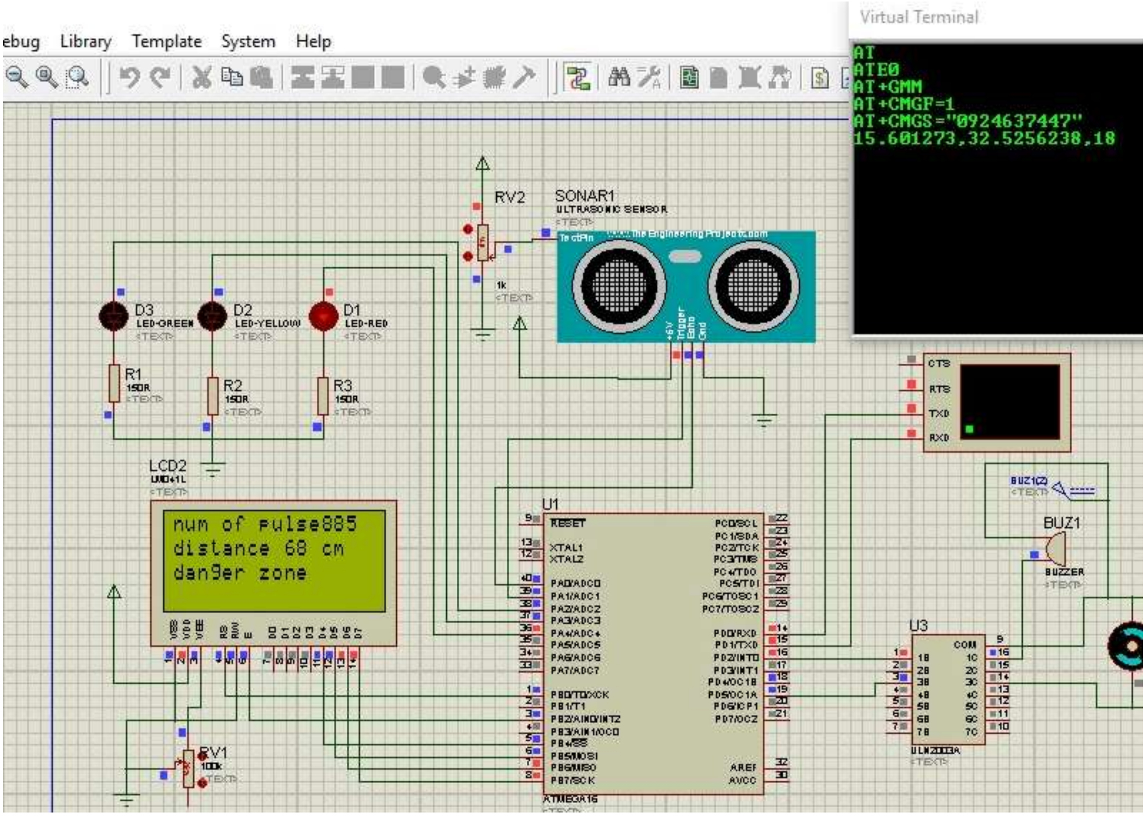


Figure: 4.1: The LCD show the accident case & The output of Virtual Terminal.

4.1. 2Scenario 2:

The distance between the Object and the car is very close, its 94cm (less than 100cm is danger) this inevitably means an accident. The LCD display that as

“Danger zone” with a lighting of a red LED, sound alarm (buzzer).also the GPS (Virtual Terminal) Orders you enter the location and GSM (Virtual Terminal) Displays or sends the location. Here will inevitably be the speed of the motor is zero.

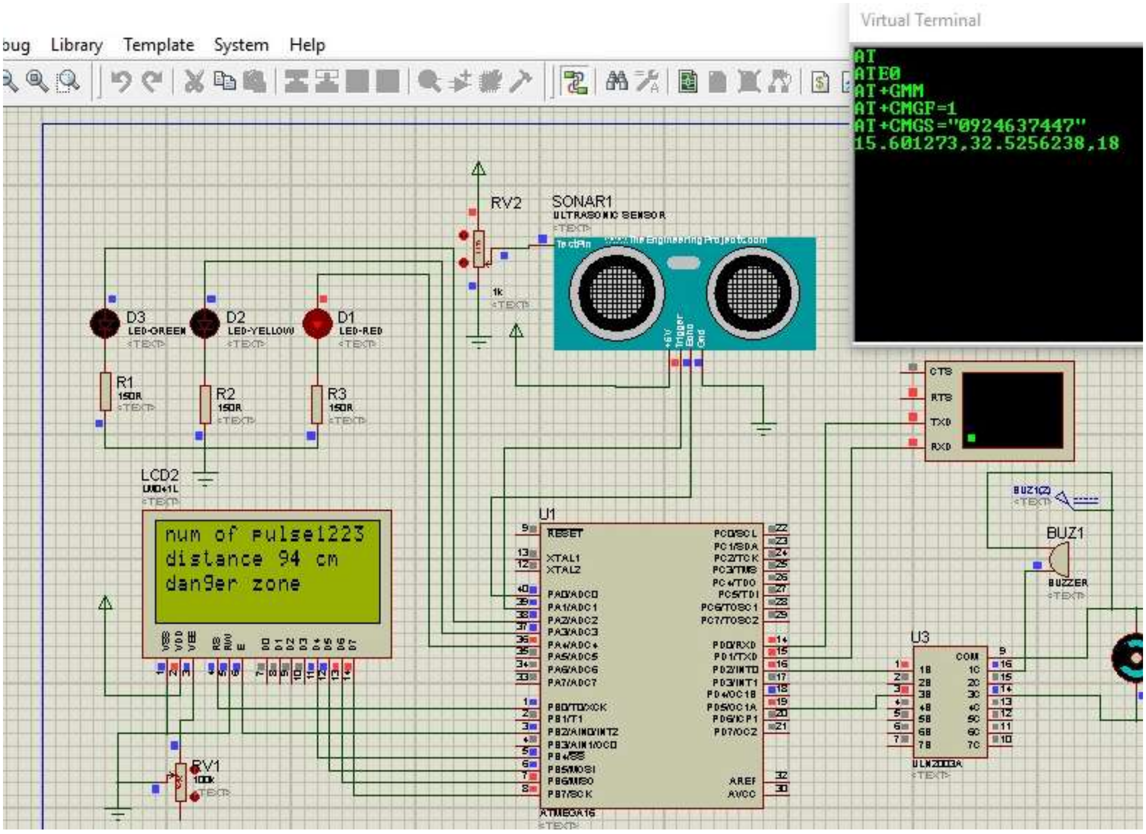


Figure: 4.2: The LCD show the accident case & The output of Virtual Terminal.

4.1.3 Scenario 3:

The distance between the Object and the car is Acceptable its 110cm (between100-151 cm), But with a probability of danger so the speed of motor will be reduced, the LCD display that as “warning zone” with a lighting of a yellow LED.

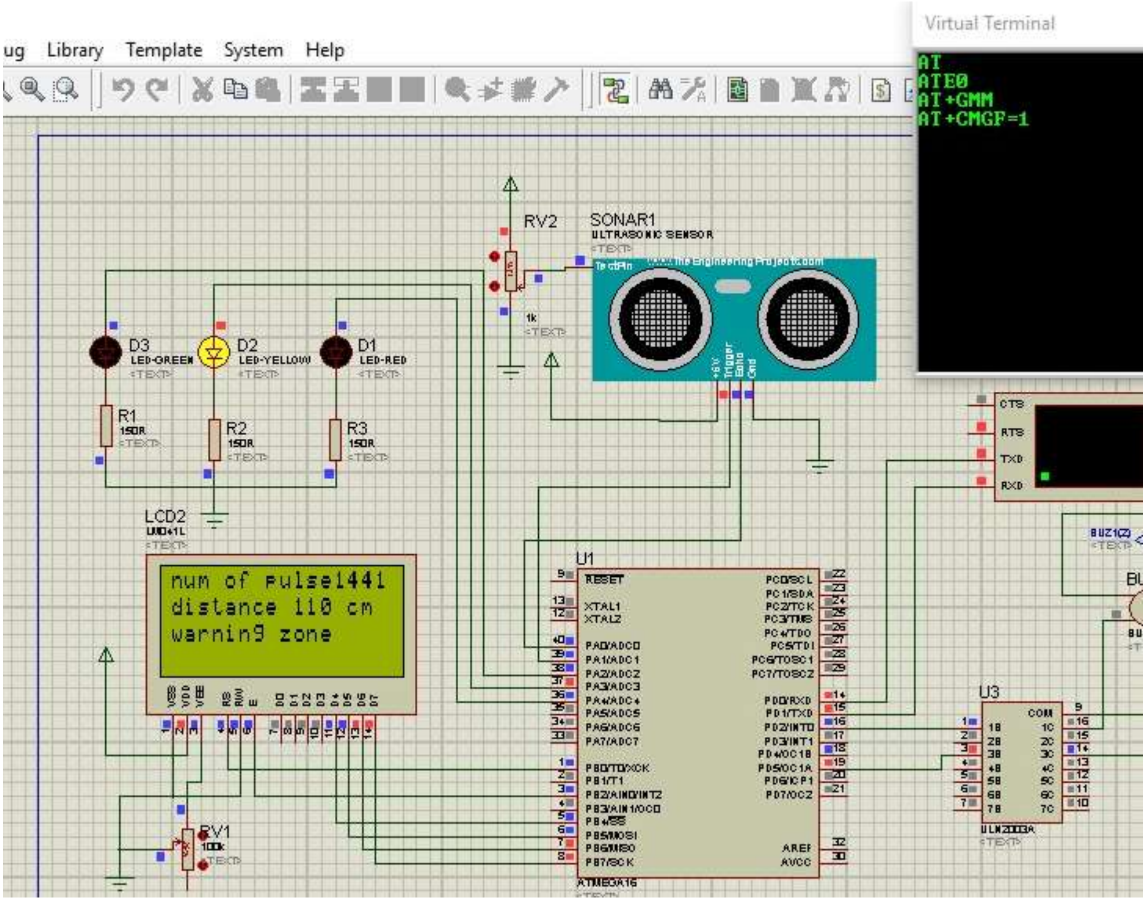


Figure: 4.3: The LCD show the medium distance.

4.1.4 Scenario 4:

The distance between the Object and the car is Acceptable its 145cm (between100-151cm), But with a probability of danger so the speed of motor will be reduced, the LCD display that as “warning zone” with a lighting of a yellow LED.

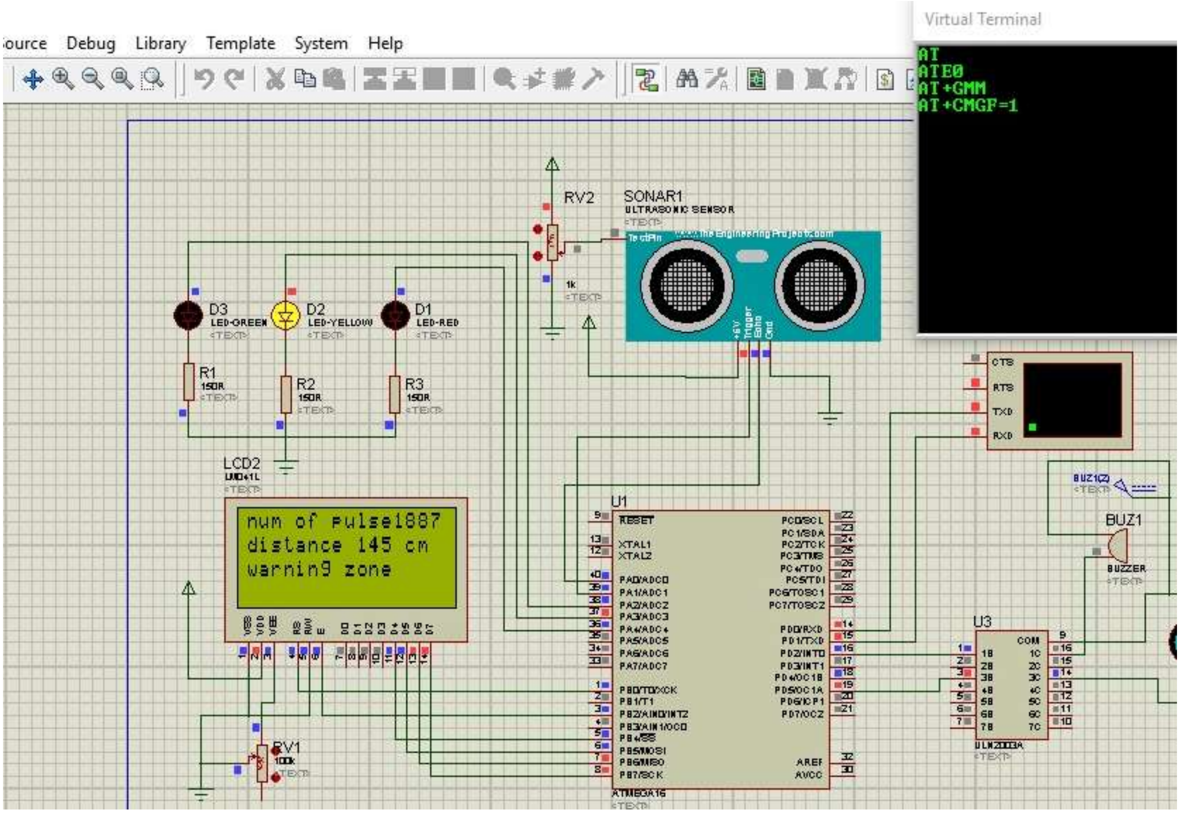


Figure: 4.4 The LCD show the warning zone.

4.1.5 Scenario 5:

The distance between the Object and the car is safe its 156 cm (above 150cm is safe), the Speed motor can become high. And the LCD displays that as "safe zone" with a lighting of a green LED.

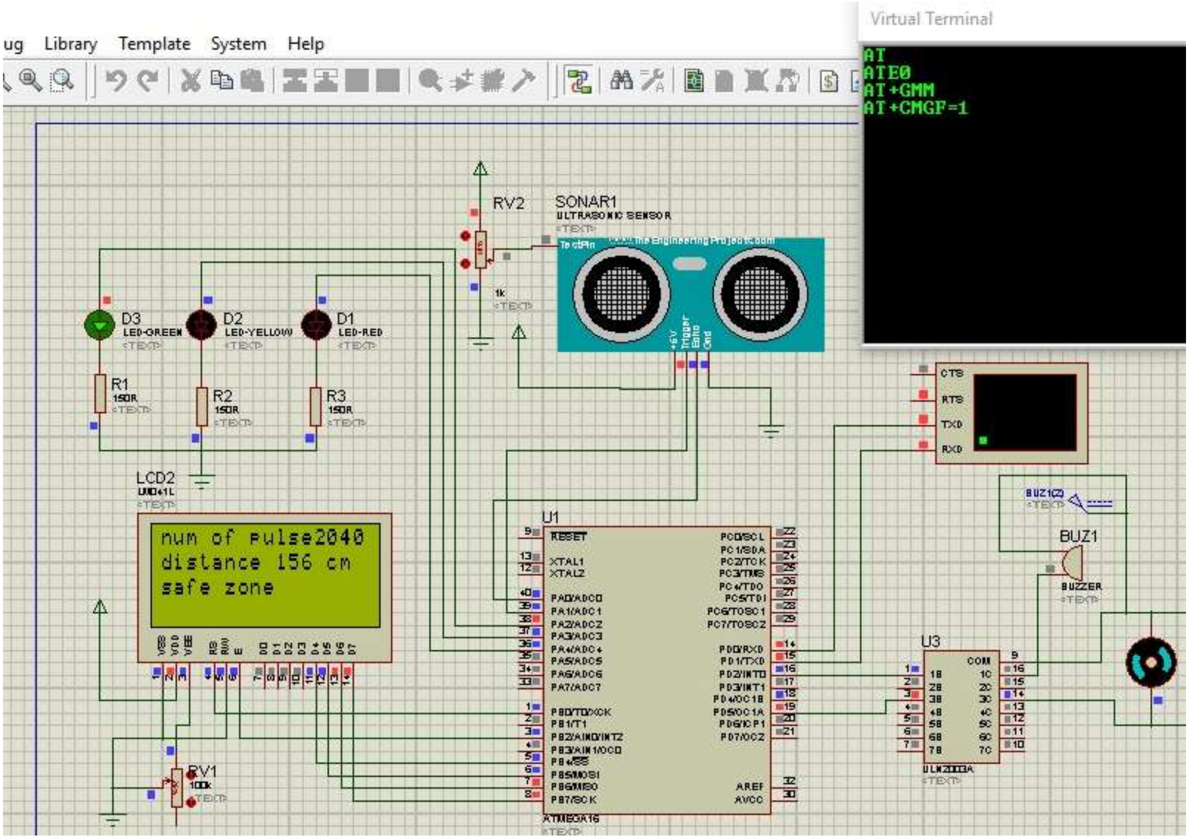


Figure: 4.5 The LCD show the safe zone.

4.1.6 Scenario 6:

The distance between the Object and the car is safe its 311 cm (above 150cm is safe), the Speed motor can become high. And the LCD displays that as “safe zone” with a lighting of a green LED.

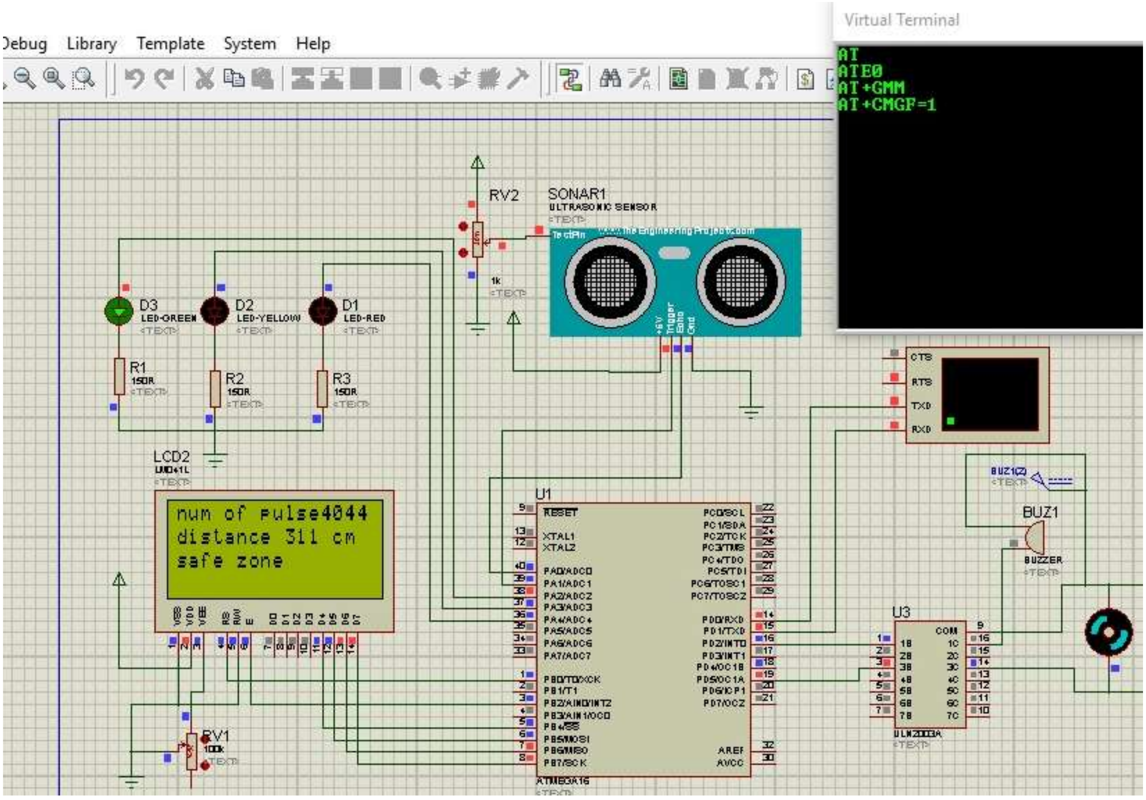


Figure: 4.6 The LCD show the safe zone.

4.2 Practical Implementation

The Practical Implementation is listed in the table below:

Component	Component Pin	Connection description
Ultrasonic Sensor **(linked with micro-controller across port A)**	Pin 1(VCC) Pin 2 (Trigge r) Pin 3(Echo) Pin 4(GND)	Power supply (5V) Pin 40 port A.0 Pin 39 port A.1 Ground of Power supply

LCD (Linked with micro- controller across port B).	pin 1 (VSS) pin 2 (VDD) Pin 3 (VEE) Pin 4 (RS) Pin 5 (RW) Pin 6 (E) D4 D5 D6 D7	Ground Power supply(5V) Variable resistance Pin 1 PB0 (XCK) Ground Pin 3 PB2 (AINO) Pin 5 PB4 (SS) Pin 6 PB5 (MOSI) Pin 7 PB6 (MISO) Pin 8 PB7 (SCK)
ULN2003A (Linked with microcontroller across port D & used to Interface between a microcontroller and motor and buzzer).	1B 3B COM and3C COM and 1C	Pin 16 PD 2 (IN T0) Pin 19 PD 5 (OC1A) motor, First motor & Second which are connected in parallel Buzzer (which Alarm in case Object closer (danger zone)
GSM& GPS module (SIM 900)	TX RX	Pin 14 PD0 (RX). Pin 15 PD1 (TX).

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATION

5. CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions:

In this project an intelligent collision avoidance system. Was built based on an ATMEGA16L microcontroller able to interface with the sensor and COM1 9 pin (hardware interface) and interface with the user with LCD rather to the accompanying simulation .the microcontroller has been programmed to work as the controller of the Avoid the accident incident knowing Report the accident location.

At the end of the project, the circuit module has been successfully constructed and demonstrated, has achieved the objective where the system is intended to prevent the accident during driving Based on distance detected and control condition by sensor in front of the car adjust the speed of vehicle to establish a safe stopping distance.

The accident position factor is very important for saving lives

By location Detection system and sending the accident position.

Based on software and algorithms support, could operate well within an expected performance. However, the models development still has some limitation. Several suggestions for the future improvement are proposed in the following section.

5.2 Recommendation:

This project is recommended for whoever wants to continue in this side because it's very important to execute in real time as in bigger aspects. This is recommended to look in time in order to achieve the wanted results and the objective goals.

Suggested Future work:

- Increase the number of sensor.
- Add Camera work video call for the hospital to find out the number of injured and the quality of injury.
- Instead of using GPS (delay) can be used as the sender of which cell (tower) number to specify the location.
- Implement more efficient braking method to reduce the time for the car to stop.
- Use high range sensor that more accurate and less sensitive to disturbances.

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Appendix “A”

```
$regfile = "m16def.dat"
$crystal = 8000000
$baud = 19200
'-----------------------------------------------------

Config Com1 = Dummy , Synchrone = 0 , Parity = None , Stopbits = 1 , Databits =
8 , Clockpol = 0
Config Lcd = 16 * 4
Config Lcdpin = Pin , Db4 = Portb.4 , Db5 = Portb.5 , Db6 = Portb.6
 Db7 = Portb.7 , E = Portb.2 , Rs = Portb.0
Config Timer1 = Pwm , Pwm = 8 , Compare A Pwm = Clear Up
Prescale = 1
'-----------------------------------------------------

Pwm1a = 200
Dim Gps As String * 200
Gps = "15.601273,32.5256238,18"
'-----------------------------------------------------

Config Pina.0 = Input                          'echo
Config Porta.1 = Output                        'triggr
Config Portd.2 = Output                        'buzzer
Config Portd.4 = Output                        'motor
Config Portd.5 = Output                        'motor
Config Porta.2 = Output                        'led g
Config Porta.3 = Output                        'led y
Config Porta.4 = Output                        'led r
'-----------------------------------------------------

Dim S1 As Long
Dim Cm1 As Long
Dim Sr As String * 200
Dim I As Word
'-----------------------------------------------------

Sr = "AT+CMGS="
Sr = Sr + Chr(&H22)
Sr = Sr + "0924637447"                         '                    '
Sr = Sr + Chr(&H22)
'-----------------------------------------------------
```

```
Cls
Lcd "WAITING GSM"
Waitms 8
Cls
Lcd " start checking "
Waitms 8
Print "AT"                                          'TEST
Waitms 1
Print "ATE0"                                        'OFF DABLL CHER
Waitms 1
Print "AT+GMM"                                      'MODEL
Waitms 1
Print "AT+CMGF=1"                                   'ASCII
Waitms 1
'-----------------------------------------------------

Do
Gosub Ultrsonic1
Cls
 Locate 1 , 1
 Lcd "num of pulse" ; S1
 Locate 2 , 1
 Lcd "distance " ; Cm1 ; " cm"
'-----------------------------------------------------

If Cm1 >= 151 Then
Waitms 20
 Locate 3 , 1
Lcd "safe zone"
 Cursor Off
Portd.2 = 0
Pwm1a = 400
Porta.2 = 1
Porta.3 = 0
Porta.4 = 0
Waitms 1
 S1 = 0
 Waitms 100
End If
'-----------------------------------------------------
```

```
If Cm1 >= 101 And Cm1 =< 150 Then
 Locate 3, 1
 Lcd "warning zone"
  Cursor Off
Portd.2 = 0
Pwm1a = 300
Porta.2 = 0
Porta.3 = 1
Porta.4 = 0
Waitms 1
 S1 = 0
Waitms 100
End If
'-----------------------------------------------------


If Cm1 <= 100 Then
 Locate 3 , 1
 Lcd "danger zone"
 Cursor Off
Portd.2 = 1
Pwm1a = 200
Porta.2 = 0
Porta.3 = 0
Porta.4 = 1
Waitms 1
 S1 = 0
 Print Sr
 Waitms 1
 Print Gps
Waitms 1
 Printbin &H1A
 Waitms 1
End If
'-----------------------------------------------------


Loop
Ultrsonic1:
Ff1:
```

```
Porta.1 = 0
 Waitus 100
Porta.1 = 1
 Waitus 10
Porta.1 = 0
If Pina.0 = 0 Then
Gosub Ff1
End If
'-----------------------------------------------------

Dd1:
If Pina.0 = 1 Then
Incr S1
Goto Dd1
End If
'-----------------------------------------------------

 Cm1 = S1 / 13
'-----------------------------------------------------

Return
End
```

APPANDENCE ‘B’

ULN2001A-ULN2002A
ULN2003A-ULN2004A

SEVEN DARLINGTON ARRAYS

- SEVEN DARLINGTONS PER PACKAGE
- OUTPUT CURRENT 500mA PER DRIVER (600mA PEAK)
- OUTPUT VOLTAGE 50V
- INTEGRATED SUPPRESSION DIODES FOR INDUCTIVE LOADS
- OUTPUTS CAN BE PARALLELED FOR HIGHER CURRENT
- TTL/CMOS/PMOS/DTL COMPATIBLE INPUTS
- INPUTS PINNED OPPOSITE OUTPUTS TO SIMPLIFY LAYOUT

DIP16

ORDERING NUMBERS: ULN2001A/2A/3A/4A

SO16

ORDERING NUMBERS: ULN2001D/2D/3D/4D

2.1 DESCRIPTION

The ULN2001A, ULN2002A, ULN2003 and ULN2004A are high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channelrated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned oppositethe outputs to simplify board layout.

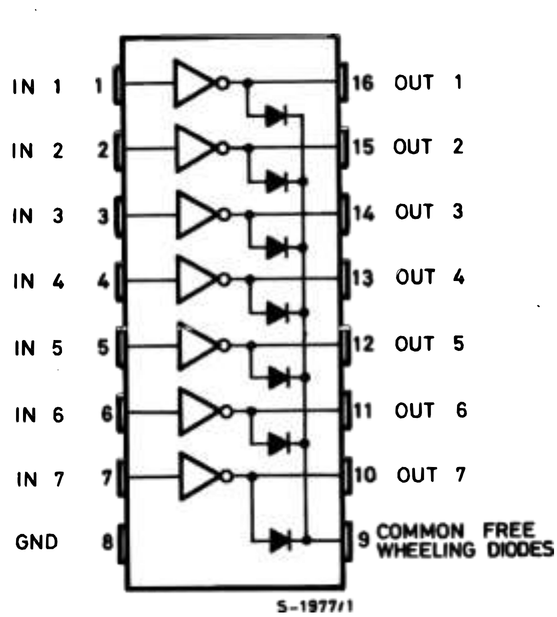
The four versions interface to all common logic families :

ULN2001A	General Purpose, DTL, TTL, PMOS, CMOS
ULN2002A	14-25V PMOS
ULN2003A	5V TTL, CMOS
ULN2004A	6–15V CMOS, PMOS

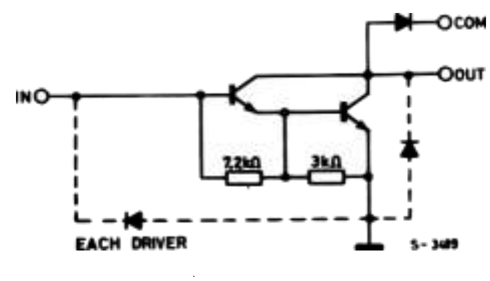
These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, thermal printheads and high power buffers.

The ULN2001A/2002A/2003A and 2004A are supplied in 16 pin plastic DIP packages with a copper leadframe to reduce thermal resistance. They are available also in small outline package (SO-16) as ULN2001D/2002D/2003D/2004D

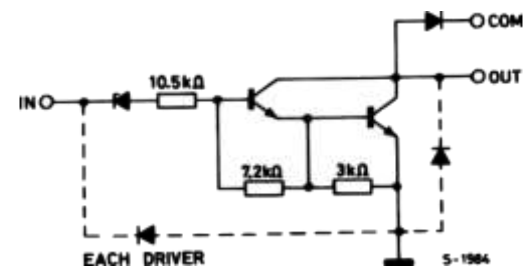
2.2 PIN CONNECTION



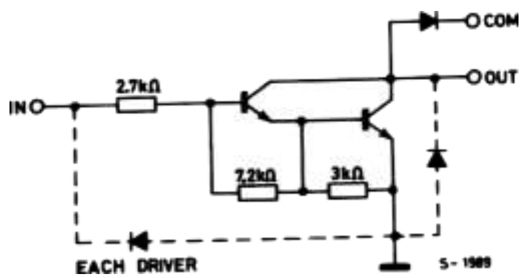
2.3 SCHEMATIC DIAGRAM



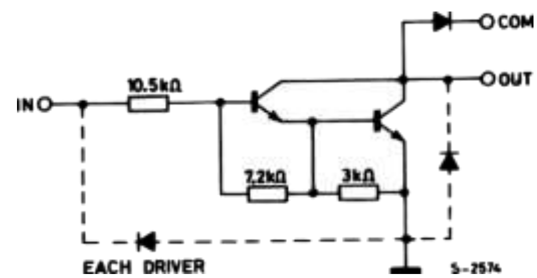
Series ULN-2001A
(each driver)



Series ULN-2002A
(each driver)



Series ULN-2003A
(each driver)



Series ULN-2004A
(each driver)

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_o	Output Voltage	50	V
V_{in}	Input Voltage (for ULN2002A/D - 2003A/D - 2004A/D)	30	V
I_c	Continuous Collector Current	500	mA
I_b	Continuous Base Current	25	mA
T_{amb}	Operating Ambient Temperature Range	– 20 to 85	°C
T_{stg}	Storage Temperature Range	– 55 to 150	°C
T_j	Junction Temperature	150	°C

THERMAL DATA

Symbol	Parameter	DIP16	SO16	Unit
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient Max.	70	120	°C/W

APPANDENCE 'C'

3 Features

- High-performance, Low-power Atmel® AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 × 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 16 Kbytes of In-System Self-programmable Flash program memory
  - 512 Bytes EEPROM
  - 1 Kbyte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program True Read-While-Write Operation
  - Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC
    8 Single-ended Channels
    7 Differential Channels in TQFP Package Only
    2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
- Operating Voltages
  - 2.7V - 5.5V for ATmega16L
  - 4.5V - 5.5V for ATmega16
- Speed Grades
  - 0 - 8 MHz for ATmega16L
  - 0 - 16 MHz for ATmega16
- Power Consumption @ 1 MHz, 3V, and 25°C for ATmega16L
  - Active: 1.1 mA

8-bit AVR® Microcontroller with 16K Bytes In-System Programmable Flash

ATmega16

ATmega16L

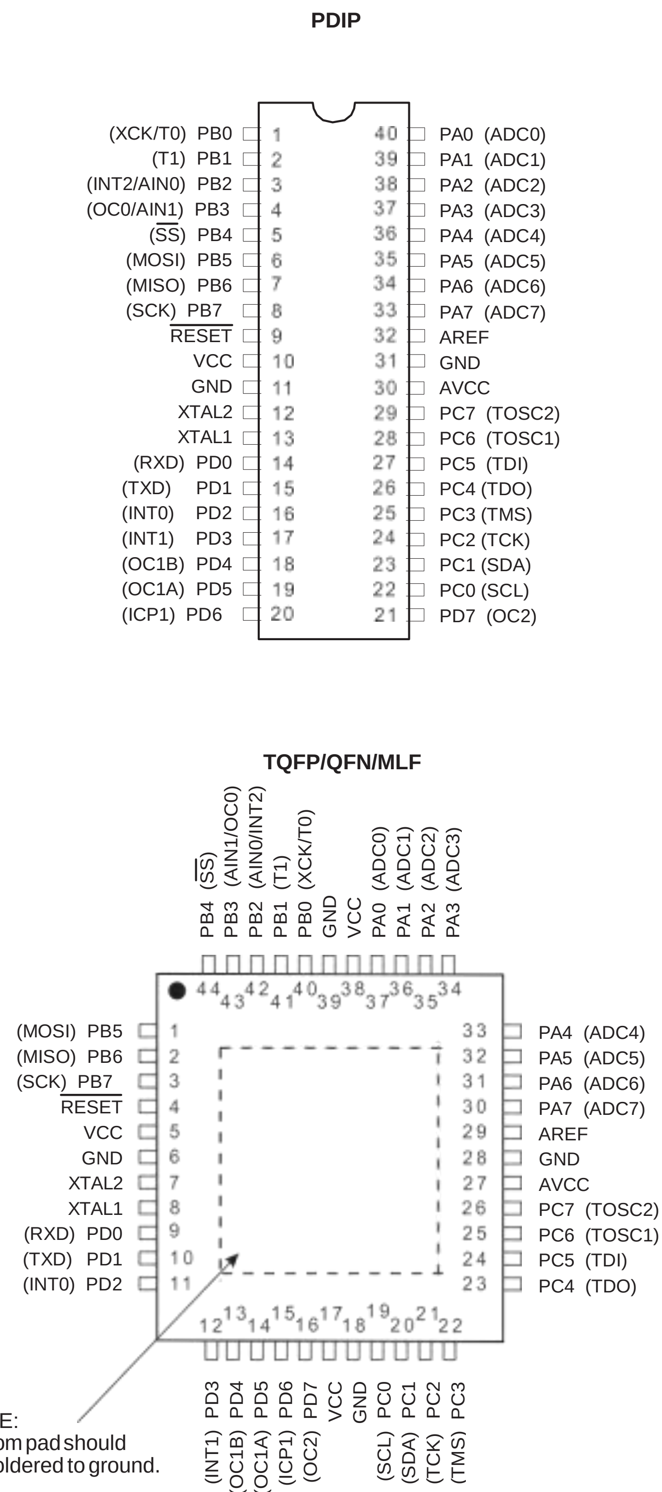
Summary

Rev. 2466TS–

– **Idle Mode: 0.35 mA**
– **Power-down Mode: < 1 µA**

4 Pin Configurations

Figure 1. Pinout ATmega16



Disclaimer

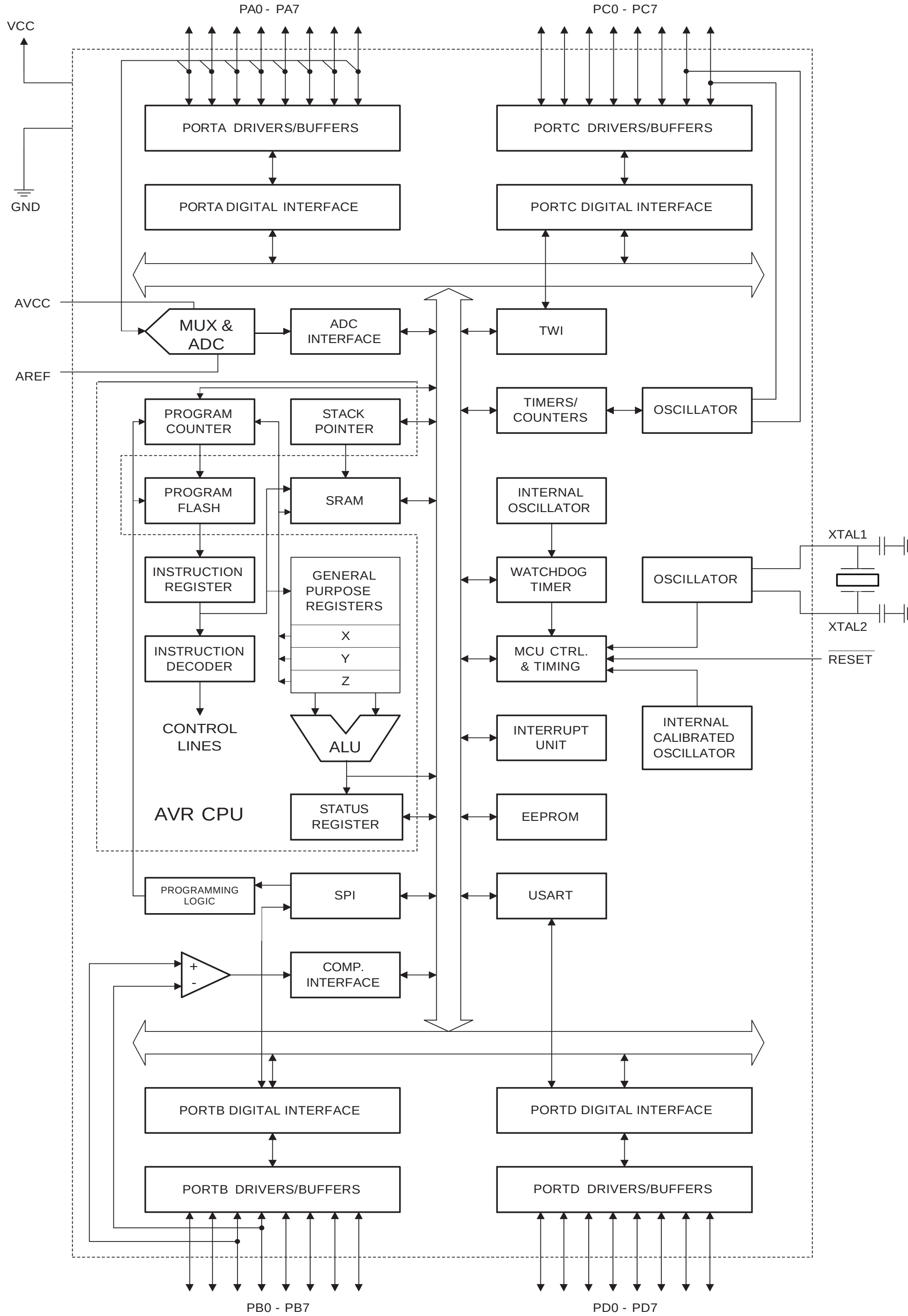
Typical values contained in this datasheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.

Overview

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power con- sumption versus processing speed.

Block Diagram

Figure 2. Block Diagram



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