CONSTRUCTION AND PERFORMANCE TEST OF AN AUTOMATIC COLLISION AVOIDANCE VEHICLE TO PREVENT ACCIDENT

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A thesis submitted in partial fulfillment of the requirements for the degree of
B.Sc Engineering in Mechanical Engineering

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First, we started in the name of almighty Allah. This thesis is accomplished under the supervision of **Shahinur Rahman**, Lecturer, Department of Mechanical, Sonargaon University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestion, constructive criticism and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

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“AUTHOR”

Abstract

The main aim of the project to develop a system automatic accident avoidance car using ultrasonic sensor. Whenever any obstacle is detected in running vehicle depends on distance automatically control the speed of vehicle. The ultrasonic sensor system continuously sends signals and monitors any car or other obstacles are in front of car. The distance up to which ultrasonic sensor can work may be up to 50 cm. When any obstacle or vehicle detected by ultrasonic sensor system it will send signal to the Arduino pro mini controller. After receiving this signal embedded board sends a signal to the motor to reduce the car speed automatically which can control car speed immediately. Vehicle is controlled automatically without any manual operation when the vehicle is at 50cm distance away from the front vehicle. When the car come closer to an obstacle then it will reduce its speed 50cm to 30cm distance, if obstacle don't move in-front of the car then our vehicle will stop automatically. Many accidents at High-ways are taking place due to the close running of vehicles, all of sudden, if the in front vehicle driver reduces the speed or applied breaks, then it is quite difficult to the following vehicle driver to control his vehicle, resulting accident. To avoid this kind of accident, the warning system, which contains alarm and display system can arrange at rear side of each and every vehicle.

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Chapter 1

Introduction

1.1 Introduction

This Road accidents are a global tragedy with the everising trend. Today's world people are earning more money and buying more vehicles. People are transporting goods to places most of the time, and there are always people that need to get to places. Be it cars or two-wheelers, taxis, trucks, buses, etc, the number of vehicles on the road is increasing day by day. While this shows a good scale of development, it also means that there are higher chances of road accidents.[1] Almost every day, we come across the news of some accident on the television, radio, and the internet. Most people continue to neglect and ignore the dangers involved in their reckless driving and so, these accidents happen.

There were 1.35 million road traffic deaths globally in 2016, with millions more sustaining serious injuries and living with long-term adverse health consequences [2] Recent past few years It has become a national problem. Road traffic accidents in Bangladesh are multi factorial. Rapid urbanization and motorization can be identified as vital factors leading to higher number of road traffic accidents. At least 7,855 people were killed and 13,330 others injured in 5,516 road crashes across the country in 2019.It means more than 21 people lost their lives on roads each day. World Bank statistics says that annual fatality rate from road accidents are found to be 85.6 fatalities per 10,000 vehicles [3].Traffic hazards and road accidents have increased the sufferings of people.

One of the main reasons is the lack of emergency facilities available in our country. In most of the cases, when an accident occurs, relatives of that injured person get the news of his/her accident not in time and the emergency rescue teams reach late on the accident spot and the traffic in between the accident spot and hospital sometimes increase the chances of death of the victim. Tracing the accident spot is the major issue faced by emergency units. The guardian reported in 2016 that thirty five patients had died in the past five years due to the late arrival of the ambulance [4].

The main aim of the project is to develop a system automatic speed control of vehicle and accident avoidance using eye blink sensor and ultrasonic sensor. Whenever any obstacle is detected in a running vehicle it depends on distance and automatically controls the speed of the vehicle. The Objective of this project is to develop a system to keep the vehicle secure and protect it by the occupation of the intruders[5].

1.2 Motivation

Road accident is increasing day by day, the vehicle controlling system is digitized slowly. Many things have to be done manually in many vehicle controlling system. Even if we work on ways to reduce damage from various accidents in today's cars, it is not possible to reduce accidents. Road accidents are increasing day by day. Due to this, the death rate is increasing. In our daily life we have to get into the car. But no one knows when a sudden car accident will occur. So we got interested in making this system to solve this problem. Our system will automatically slow down when a vehicle comes within a certain distance. After that, if the car in front does not move, then this car will stop automatically. This will save many lives. We believe that our system will be a blessing for this era.

1.3 Objective

The objectives of this project are:

a) To study about C**onstruction and Performance Test of an Automatic Collision Avoidance Vehicle to Prevent Accident.**
b) To design and construct **an Automatic Collision Avoidance Vehicle to Prevent Accident.**
c) To reduce human death rate in road accident.
d) To test the performance of the system and work on it in future modification.

1.4 Organization of the Book

- **Chapter 1: Introduction.** This chapter is all about background study, motivation, Objectives and thesis book organization.

- **Chapter 2: Literature Review-** Here briefly describe about previous book review, Block diagram, Circuit Diagram, Components List and Summary of this chapter.

- **Chapter 3: Hardware and Software Analysis-** This chapter is discussed about our project hardware and Software . Here we describe our hole instrument details.

- **Chapter 4: Methodology–** Here briefly discuss about project methodology, working principle and our system overview.

- **Chapter 5: Result and Discussion–** Here briefly discuss about project discussion, result analysis, advantages, application and our system overview.

- **Chapter 6: Conclusion** – This chapter is all about our thesis future recommendation and this project conclusion.

Chapter 2

Literature Review

2.1 Introduction

This chapter mainly reviews literature, reviews of various types of work and highlights the importance of C**onstruction and Performance Test of an Automatic Collision Avoidance Vehicle to Prevent Accident** in such situations.

2.2 Literature Review

M F. Saaid, (2014) This paper represents the GPS and GSM to test the accuracy of the location that is send to the system through micro-controller.The hardware and program development is done by research and error as the controller does not interact with both module at the same time. The experiment is done in three set of tests so that the system accuracy can be determine when stationary and in motion on vehicle, output controlling to the system. The result of the test concludes that the system can provide standard GPS coordinate when requested via Short Message Service. The system can also be used to control an actuator **[1]**.

Arindam Mondal, (2015) This paper is con cured with the orbit tracking by multiple agents. The control scheme has three aspects connectivity assurance, collision avoidance, and formation. The concept of this has been used to acquire and maintain the desired formation pattern along with velocity .The proposed control pattern is further extended to the problem of target system. It includes the roundedness of control actions. The realization of proposed system is manifested through extensive simulations in 2D and 3D environments using 6 and 60 agents, respectively **[2].**

Md. Shahinoor Mannan (2015) this paper presents a proxy approach towards picture and practise of GSM based remote device controller using SIM548C. By using GS to avoid the early developments of the system .The possible future transformation of long distance controller systems to choose GSM Module SIM548C including its

GPRS and GPS features. Brief picture of the developed prototype based on DTMF over GSM network is conferred. The extant applications of long distance controller systems are including but not limited to some respected places, thus the convention and practice of such systems to control and track moving objects. **[3]**

Dr. P. A. Harsha Vardhini (2016) This paper presents an adequate practice of security system for the moving vehicles using SMS alert system. The system uses micro controller and the components used in the intended work are related with detecting the accident, saving the phone numbers, and sending the SMS. The major elemental is the Atmel micro controller AT89S52 which performs all the operations related to controlling. The security for the vehicles is detected by using vibration sensor. This detection is sent in the form of an SMS alert to mobile using GSM. The embedded system enclosed with the fundamental is fit inside the vehicle for accident detection. **[4]**

Yufeng Lian (2016) This paper presents a control expedient for prolonged collision avoidance to improve the safety of four wheeler motor driven electric vehicles. The two major system in collision avoidance. It has safety between driving roads with an adhesive deficient in tire and road and the contribution is a new braking force based on constrained adorning braking strength extension. RCP and HIL simulation experiments are drifting out to manifest the effectiveness and affability in practise are elongated in CA system. **[5]**

Amir Khajepour (2016) This paper is presented to maintain a collision free way for autonomous vehicles. In this path planning, a 3D virtual dangerous electric field is formulated as an increasing functions of the road and obstacle. The Multi-constrained Model Predictive Control problem are calculated the angle from the front steering to prevent the vehicle from a moving obstacle.The simulations are combined in the case where moving obstacles exist. The results show that the proposed path planning approach is effective for many driving scenarios and controller provides dynamic tracking performance and good movement-ability. **[6]**

Joseph Funke(2016) This paper presents a new supremacy structure that includes path tracking, vehicle stabilization, and collision avoidance and mediates to conflicting objectives by specific collision avoidance.The system is enforced by using model predictive and feedback controllers. It includes stabilization and collision avoidance. Experimental data from an autonomous vehicle demonstrate the controller safely driving at the vehicle's handling limits and suddenly introduced in the middle of a turn it avoiding an obstacle. **[7]**

Ping-Fan Ho (2017) This paper present a Wi-safe Compared to vision based and radar PCA systems, It has an advantage of Non Line of Sight and assist drivers in discovering pedestrians in NLOS and blind spots where the views of drivers are blocked by buildings, vehicles, or other obstacles. Wi-safe can save split seconds. Instead of using wireless access in vehicular environments dedicated short-range communications to protect pedestrians. The results show that Wi-safe can achieve and even exceed the PCA requirements. **[8]**

Yucong Lin (2017) This paper was contrive to avoid collisions with moving obstacles, such as commercial aircraft and the safe operation of unmanned aerial vehicles. The exertion of sampling based path planning methods for a UAV to avoid collision with comical aircraft. The variations and utilization are along with collision prediction using reachable set. The methods are in software and hardware loop simulations and real fl-flight experiments. It generates collision free paths in real time for the different types of UAVs among moving obstacles, angles and speeds. **[9]**

Maneuvers Scott Schnell (2017) This paper presents a combined driver model that will identify different individual driver behaviors. The driver model consists of a compensatory transfer function and an anticipatory component and is integrated with the design of the individual drivers desired path. The utility of the proposed model is stability to predict a drivers steering wheel. It is compared by two different drivers model parameter sets to the group average to show that each driver has a unique set of parameters. The model is validated by showing that its daily driving parameters differ from its predicted CA parameters. **[10]**

Lorenzo Sabatini (2017) This paper for achieving complex dynamic behaviors in multi-robot systems. In this system partitioned into two subgroups are dependent and independent robots. Independent robots are used to control input and their motion. Dependent robots solve a tracking problem to defined fixed point trajectories. The control strategy is explicitly addresses the collision avoidance problem in a non conflicting manner. The combination of these control actions allows the robots to execute in a safe way. And the proposed methodology is validated by means of simulations and experiments on real robots. **[11]**

Milton Cesar Paes Santos(2017) This paper for unmanned aerial vehicle UAV navigation and positive potential function is designed to take into the movement of obstacles. Thus, the controller with potential function that the UAV moves close to zero to ensure safe navigation in dynamic and unknown environments. An indoor framework with just one RGB D sensor, which is a combination of a RGB camera with a depth sensor based on infrared light, was used to estimate the positions of the UAV and obstacles. Thus the experiment is carried out to simulate to run using a Parrot AR. **[12]**

2.3 Block Diagram

In our project we have set up a **Construction and Performance Test of an Automatic Collision Avoidance Vehicle to Prevent Accident**. In this circuit we have used one Arduino Pro Mini micro controller for master controller unit. Here we also use a Battery, ultrasonic sensor, Motor Driver, Gear Motor, LCD display etc. In this diagram we will show by block the individual parts.

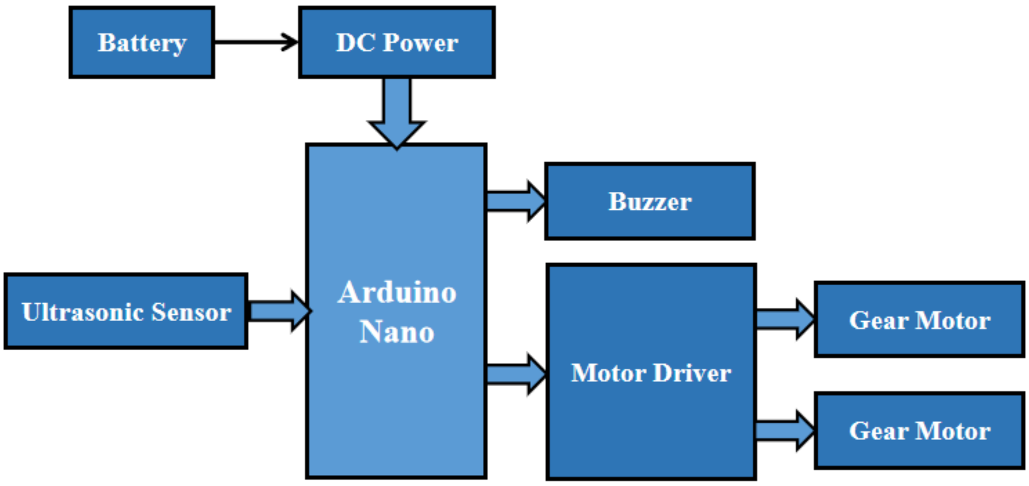

Figure 2.1: Block Diagram of **an Automatic Collision Avoidance Vehicle to Prevent Accident**

2.4 Circuit Diagram

The schematic diagram here is representing the electrical circuit and the components of the **Automatic Collision Avoidance Vehicle to Prevent Accident**. Here we connect equipment with smart wire connection.

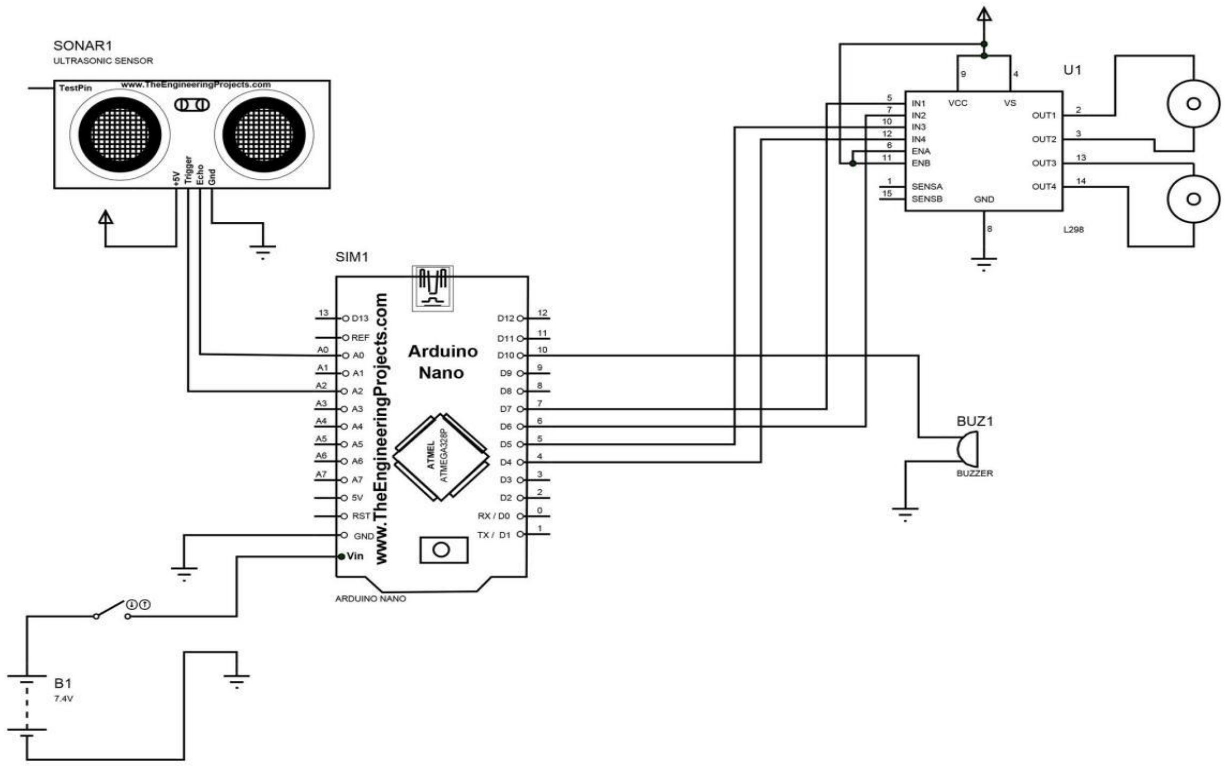

Figure 2.2: Schematic Diagram of **an Automatic Collision Avoidance Vehicle to Prevent Accident**

2.5 Components List

Hardware Part:

1. Arduino Nano
2. Battery
3. Motor Driver
4. DC Gear Motor
5. Ultrasonic Sensor
6. Electronic Beep Buzzer
7. Voltage Regulator
8. Resistor

Software Part:

1. Arduino IDE
2. Proteus

2.6 Summary

The above discussion gives an idea about the C**onstruction and Performance Test of an Automatic Collision Avoidance Vehicle to Prevent Accident**. All that work on robots has already been done here, and the results of their work, the use of **Accident Avoidance** in the situation are described in detail. From this we also got the direction of work of the project.

Chapter 3

Hardware and Software Analysis

3.1 Arduino Pro Mini

The Arduino Pro Mini is a micro-controller board based on the ATmega168. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable to provide USB power and communication to the board.

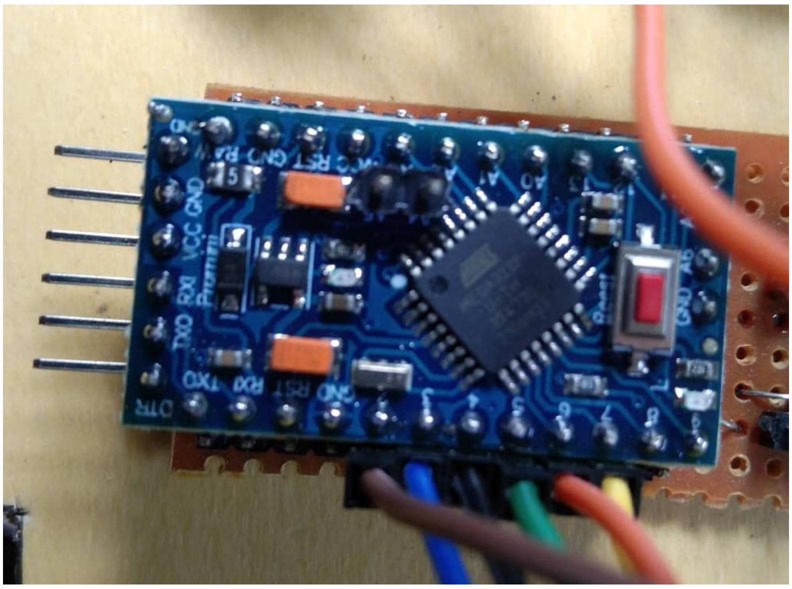

Figure 3.1: Arduino Pro Mini

Specification

- Micro-controller ATmega168
- Operating Voltage: 3.3V or 5V (depending on model)
- Input Voltage: 3.35 -12 V (3.3V model) or 5 - 12 V (5V model)
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA

- Flash Memory: 16 KB (of which 2 KB used by boot loader)
- SRAM: 1 KB
- EEPROM: 512 bytes
- Clock Speed: 8 MHz (3.3V model) or 16 MHz (5V model)

Pin Out

Each of the 14 digital pins on the Pro Mini can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions. They operate at 3.3 or 5 volts (depending on the model). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the TX-0 and RX-1 pins of the six pin header.

- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

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

  The Pro Mini has 6 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). Four of them are on the headers on the edge of the board; two (inputs 4 and 5) on holes in the interior of the board. The analog inputs measure from ground to VCC. Additionally, some pins have specialized functionality:

- I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library.

There is another pin on the board:

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

  See also the mapping between Arduino pins and ATmega168 ports.

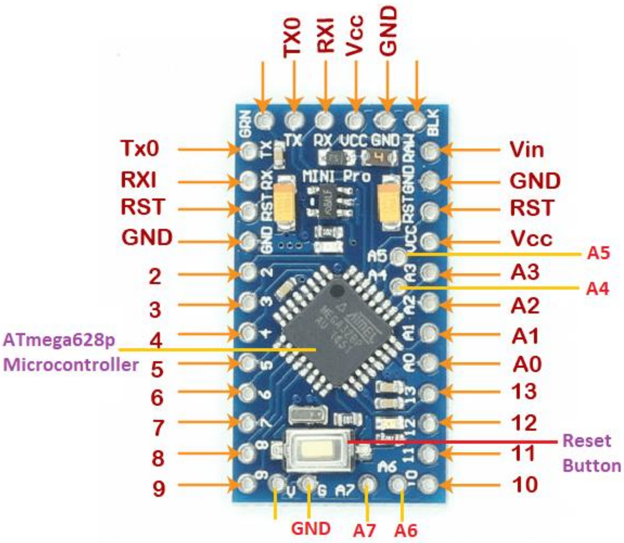

Figure 3.2: Arduino Pro Mini Pin Out

3.2 5V Regulator IC

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

7805 IC Rating:

- Input voltage range 7V- 35V
- Current rating Ic = 1A
- Output voltage range $V._{Max}$=5.2V, $V._{Min}$=4.8V

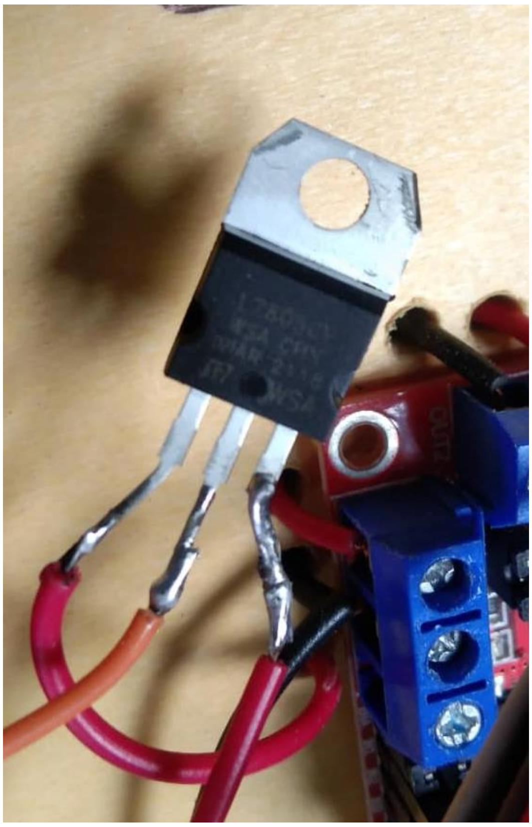

Figure 3.3: 5V Regulator IC

3.3 Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

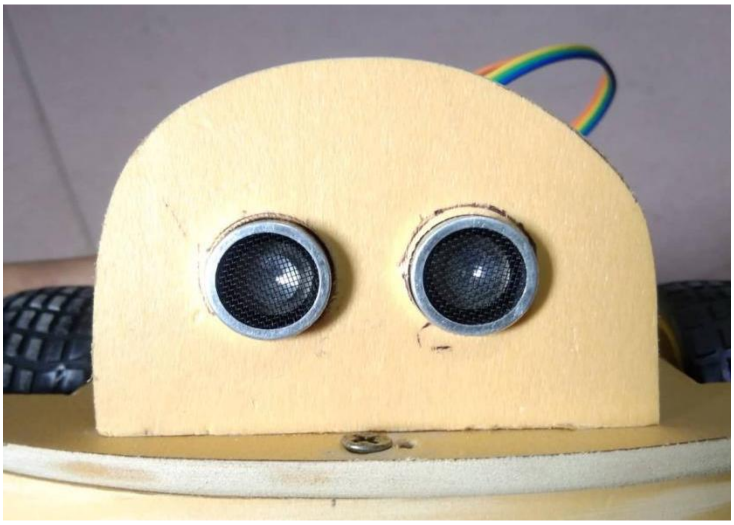

Figure 3.4: Ultrasonic Sensor

HC-SR04 Ultrasonic Sensor - Working

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

Distance = Speed × Time

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

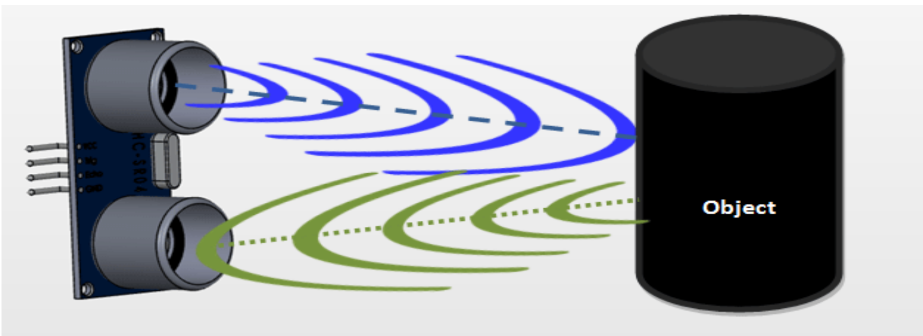

Figure 3.5: Working of sensor

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

How to use the HC-SR04 Ultrasonic Sensor

HC-SR04 distance sensor is commonly used with both micro-controller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. The following guide is universally since it has to be followed irrespective of the type of computational device used.Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the micro controller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information, the distance is measured as explained in the above heading.

Applications

- Used to avoid and detect obstacles with robots like biped robot, obstacle avoider robot, path finding robot etc.
- Used to measure the distance within a wide range of 2cm to 400cm
- Can be used to map the objects surrounding the sensor by rotating it
- Depth of certain places like wells, pits etc can be measured since the waves can penetrate through water

Ultrasonic Sensor Pin Configuration

Table 01: Ultrasonic Sensor Pin Description

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

HC-SR04 Sensor Features

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

3.4 Battery

Ultra-Fire 18650 3.7V 3000mAh Rechargeable Lithium Batteries Without Protection has high discharge performance Li-ion Rechargeable Battery. More than 500 charge-discharge cycles.

Figure 3.6: Battery

Specification:

- Type: B8630
- Capacity: 3000mAh
- Rated Voltage: 3.7V
- Charge Termination Voltage: 4.2V
- Discharge Termination Voltage: 2.75V
- Maximum Charge Current: 6000mAh
- Maximum Discharge Current: 6000mAh
- Material: Lithium

3.5 DC Gear Motor

Gear motors are mechanisms that adjust the speed of electric motors, leading them to operate at a certain speed. They are composed of a series of gears that make up a kinematic chain, working on a set of rotary parts. Their main purpose is to allow the reduction from an initial high speed to a lower one without negatively affecting the mechanism. In addition to this adjustment, a gear motor is in charge of adjusting the mechanical power of a system.

Figure 3.7: Gear Motor

Mechanical components that complement gear motors

Gear motors are composed of an electric motor and gears, which form the kinematic chain – the fundamental component of the gear ratio.

Kinematic chain

A motor’s speed reducer is composed of a speed reducer and its gears. This speed reducer is basically a variable speed drive that allows for the speed to be reduced and increased at the output shaft.

Gears

Gears are toothed wheels made of metal or plastic (and new materials with each passing day) that transmit motion when meshing with each other. They are defined by their number of teeth and their size. In addition, they may have straight-cut or helical teeth.

Motors

The five types of motors that see the most use in gear motors are:

- Brushed motors, with brushes normally made out of carbon. They are bidirectional and may be used with DC or AC. They have a service life of about 3000 hours.

- Asynchronous motors, which are brushless single-direction motors. They are highly limited.

- Synchronous brushless motors, which may be single-direction or bidirectional. They have a constant speed if the frequency of the power source is stable.

- Brushless DC motors that use a driver and can attain high speeds.

- Stepper DC brushless motors. They can be positioned with an average precision of 7.5º.

3.6 L293D Motor Driver IC

The **L293D** is a popular 16-Pin **Motor Driver** IC. As the name suggests it is mainly used to drive **motors**. A single **L293D** IC is capable of running two DC **motors** at the same time; also the direction of these two **motors** can be controlled independently.

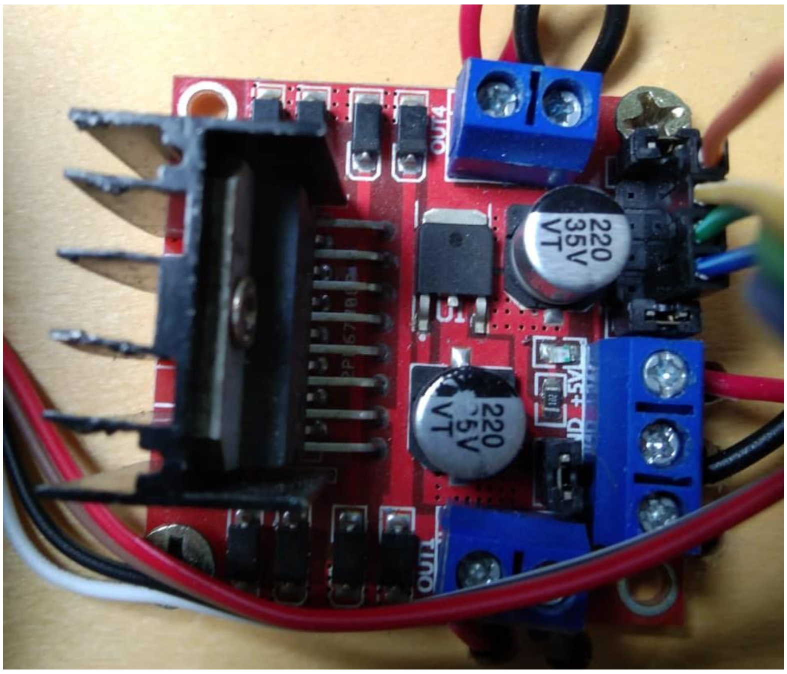

Figure 3.8: Motor driver IC L293D

Working Process

L293D IC is a typical **Motor Driver** IC which allows the DC **motor** to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC **motors** instantaneously in any direction. It means, by using a **L293D** IC we can control two DC **motors**.

Features

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible
- Motor voltage Vcc2 (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA

L293D Pin Configuration

Table 02: Motor Driver Pin out

Pin Number	Pin Name	Description
1	Enable 1,2	This pin enables the input pin Input 1(2) and Input 2(7)
2	Input 1	Directly controls the Output 1 pin. Controlled by digital circuits
3	Output 1	Connected to one end of Motor 1
4	Ground	Ground pins are connected to ground of circuit (0V)
5	Ground	Ground pins are connected to ground of circuit (0V)
6	Output 2	Connected to another end of Motor 1
7	Input 2	Directly controls the Output 2 pin. Controlled by digital circuits
8	Vcc2 (Vs)	Connected to Voltage pin for running motors (4.5V to 36V)

9	Enable 3,4	This pin enables the input pin Input 3(10) and Input 4(15)
10	Input 3	Directly controls the Output 3 pin. Controlled by digital circuits
11	Output 3	Connected to one end of Motor 2
12	Ground	Ground pins are connected to ground of circuit (0V)
13	Ground	Ground pins are connected to ground of circuit (0V)
14	Output 4	Connected to another end of Motor 2

Use of a L293D Motor Driver IC

Using this L293D motor driver IC is very simple. The IC works on the principle of **Half H-Bridge**, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a set up which is used to run motors both in clock wise and anti clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time, the circuit to achieve the same is shown below.

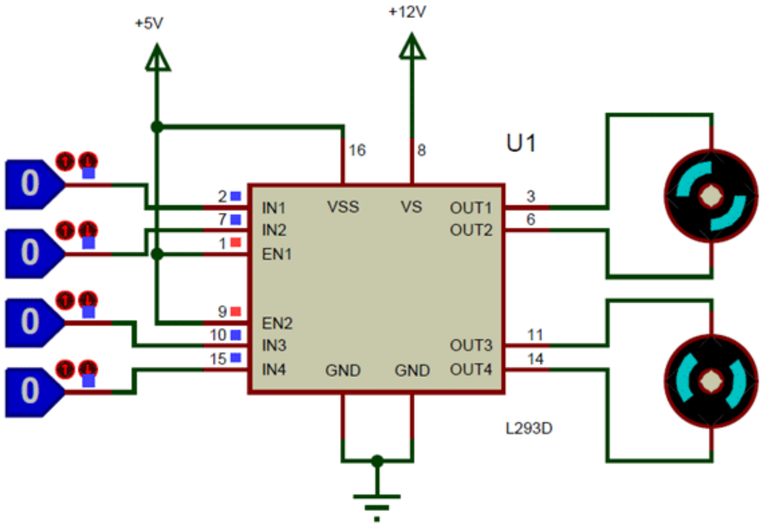

Figure 3.9: L293D circuit Diagram

All the Ground pins should be grounded. There are two power pins for this IC, one is the Vss(Vcc1) which provides the voltage for the IC to work, this must be connected to +5V. The other is Vs(Vcc2) which provides voltage for the motors to run, based on the specification of your motor you can connect this pin to anywhere between 4.5V to 36V, here I have connected to +12V.

The Enable pins (Enable 1,2 and Enable 3,4) are used to Enable Input pins for Motor 1 and Motor 2 respectively. Since in most cases we will be using both the motors both the pins are held high by default by connecting to +5V supply. The input pins Input 1,2 are used to control the motor 1 and Input pins 3,4 are used to control the Motor 2. The input pins are connected to the any Digital circuit or micro-controller to control the speed and direction of the motor.

Applications

- Used to drive high current Motors using Digital Circuits
- Can be used to drive Stepper motors
- High current LED's can be driven
- Relay Driver module (Latching Relay is possible)

3.7 Buzzer

Audio signal device that can be music, electromechanical or piezoelectric (short piano). Typical uses of sound and beep include user authentication, such as alarms, timers, mouse clicks, or stairs. When the force is applied, the current passes through the wire coil inside the coil that emits the magnetic field. Shaking the signal through the coil, the noise emits a variable magnetic field that vibrates the disc. This movement makes a resounding noise.

<u>Specifications</u>

- Working Voltage: 1.0 ~ 20.0V
- Rated Voltage: 3.0V
- Diameter: Ø12.5mm
- Overall View: 6.3mm

- Sleep: 15,000pF
- Current Use: ≤2mA
- Resonance Frequency: 4,000Hz
- Voice Pressure Level at 10cm: ≥75db
- Self-driving: No

Figure 3.10: Buzzer

3.8 The Smoothing Capacitor

When there is a potential difference across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge (+Q) to collect on one plate and negative charge (-Q) to collect on the other plate. If a battery has been attached to a capacitor for a sufficient amount of time, no current can flow through the capacitor. However, if an accelerating or alternating voltage is applied across the leads of the capacitor, a displacement current can flow.

Figure 3.11: Capacitor

An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge (Q) on each conductor to the potential Difference (V). The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF (10−12 F) to about 1 mF (10−3 F). The capacitance is greater when there is a narrower separation between conductors and when the conductors have a larger surface area.

In practice, the dielectric between the plates passes a small amount of leakage current and also has an electric field strength limit, known as the breakdown voltage. The conductors and leads introduce an undesired inductance and resistance. Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow.

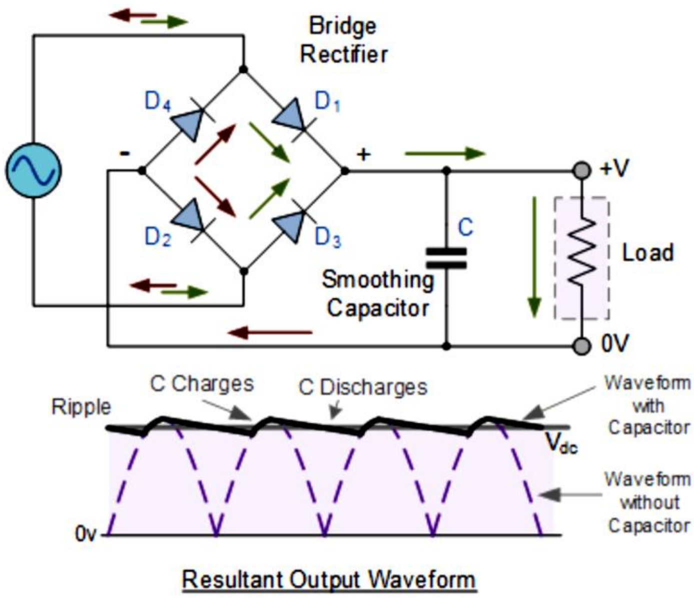

Figure 3.12: The Smoothing Capacitor with Full Bridge Rectifier

The full-wave bridge rectifier however, gives us a greater mean DC value (0.637 Vmax) with less superimposed ripple while the output waveform is twice that of the frequency of the input supply frequency. We can improve the average DC output of the rectifier while at the same time reducing the AC variation of the rectified output by using smoothing capacitors to filter the output waveform. Smoothing or reservoir capacitors connected in parallel with the load across the output of the full wave bridge rectifier circuit increases the average DC output level even higher as the capacitor acts like a storage device as shown below. Too low a capacitance value and the capacitor has little effect on the output waveform. But if the smoothing capacitor is sufficiently large enough (parallel capacitors can be used) and the load current is not too large, the output voltage will be almost as smooth as pure DC.

3.9 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the sometime, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances, such as those founding thermostats, visitors, trimmers, photo resistors, hamsters and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law.

Figure 3.13: Resistor

Theory of operation:

The behavior of an ideal resistor is dictated by the relationship specified by
Ohm’s law:

$$V = I.R$$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I), where the constant of proportionality is the resistance (R).

Equivalently, Ohm's law can be stated:

$$I = V/R$$

This formulation states that the current (I) is proportional to the voltage (V) and inversely proportional to the resistance (R). This is directly used in practical computations. For example, if a 300 ohm resistor is attached across the terminals of a12 volt battery, then a current of12 / 300 = 0.04 amperes flows through that resistor.

3.10 Arduino IDE

The digital microcontroller unit named as Arduino Nano can be programmed with the Arduino software IDE. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Nano from the Tools, Board menu (according to the microcontroller on our board). The IC used named as ATmega328 on the Arduino Nano comes pre burned with a boot loader that allows us to upload new code to it without the use of an external hardware programmer. Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the microcontroller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.The Arduino Nano is one of the latest digital microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .in file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial Communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication.

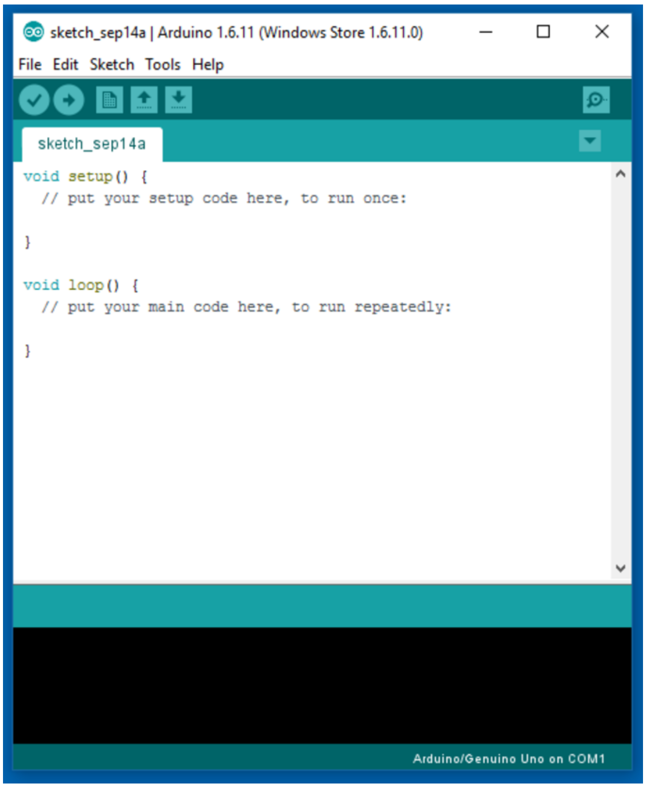

Figure 3.14: Arduino Software Interface IDE

The Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Lab to compile programs, and for uploading the programs it uses argued. As the Arduino platform uses Atmel micro-controllers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog. Beginning with version 1.0, files are saved with a .ino file extension. Previous versions use the .pde extension. You may still open .pde named files in version 1.0 and later, the software will automatically rename the extension to .ino.

Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

Uploading

Before uploading your sketch, you need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below. On the Mac, the serial port is probably something like /dev/tty.usbmodem241 (for a Uno or Mega2560 or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board), or /dev/tty.USA19QW1b1P1.1 (for a serial board connected with a Keyspan USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the ports section of the Windows Device Manager. On Linux, it should be /dev/ttyACMx , /dev/ttyUSBx or similar. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and begin the upload. With older boards (pre-Diecimila) that lack auto-reset, you'll need to press the reset button on the board just before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error.

When you upload a sketch, you're using the Arduino Bootloader, a small program that has been loaded on to the microcontroller on your board. It allows you to upload code without using any additional hardware. The Bootloader is active for a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the microcontroller. The Bootloader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more #include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code. There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. See these instructions for installing a third-party library.

Third-Party Hardware

Support for third-party hardware can be added to the hardware directory of your sketchbook directory. Platforms installed there may include board definitions (which appear in the board menu), core libraries, Bootloaders, and programmer definitions. To install, create the hardware directory, then unzip the third-party platform into its own sub-directory. (Don't use "Arduino" as the sub-directory name or you'll override the built-in Arduino platform.) To uninstall, simply delete its directory.

Serial Monitor

This displays serial sent from the Arduino or Genuino board over USB or serial connector. To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the drop-down menu that matches the rate passed to Serial begin in your sketch. Note that on Windows, Mac or Linux the board will reset (it will rerun your sketch) when you connect with the serial monitor.

3.11 Proteus Software

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronics design engineers and technicians to create schematics and electronics prints for manufacturing printed circuit boards. The first version of what is now the Proteus Design Suite was called PC-B and was written by the company chairman, John Jameson, for DOS in 1988. Schematic Capture support followed in 1990 with a port to the Windows environment shortly thereafter. Mixed mode SPICE Simulation was first integrated into Proteus in 1996 and micro-controller simulation then arrived in Proteus in 1998. Shape based auto routing was added in 2002 and 2006 saw another major product update with 3D Board Visualization. More recently, a dedicated IDE for simulation was added in 2011 and MCAD import/export was included in 2015. Support for high speed design was added in 2017. Feature led product releases are typically biannual, while maintenance-based service packs are released as required.

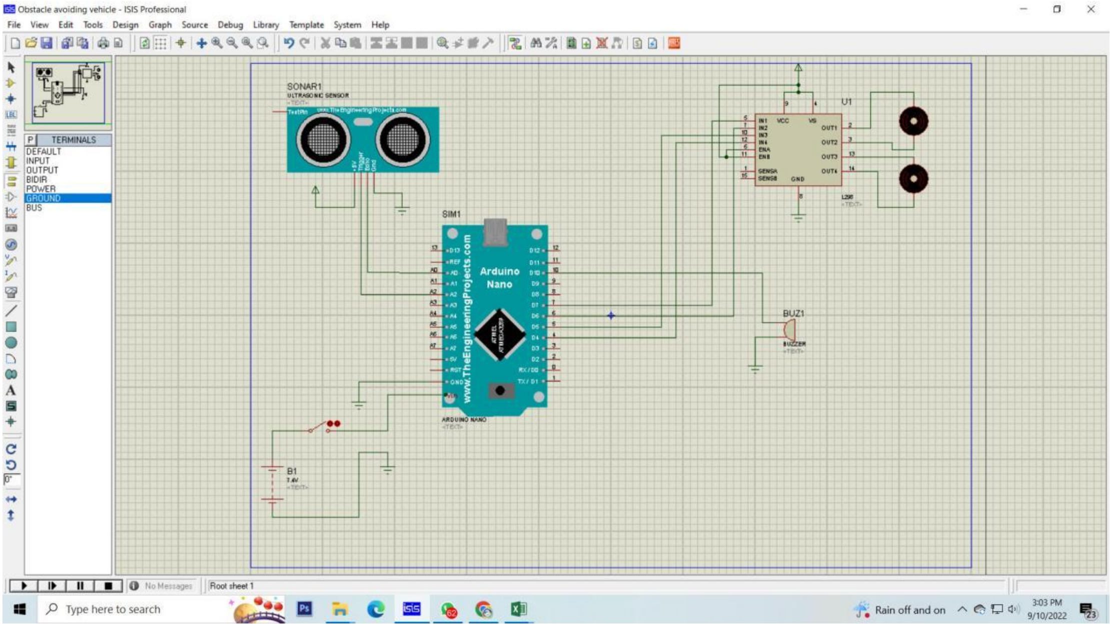

Figure 3.15: Proteus Software Interface

Chapter 4

Methodology

4.1 Our methodologies for the project

- Creating an idea for the design and construction of C**onstruction and Performance Test of an Automatic Collision Avoidance Vehicle to Prevent Accident** . And designing a block diagram to know which components we need to construct it.
- Collecting all the components for our desired system.
- Setting up all the components in a system. Then assembling all the blocks in a system and finally running the system to check if it actually works or not.

4.2 Working Principle

We are taking main power from the battery of this system. Here we used the Arduino Pro Mini micro-controller to make the car work automatically. We also used here Ultrasonic sensors, Motor drivers, voltage regulators, Gear motors etc. Vehicle is controlled automatically without any manual operation when the vehicle is at 50cm distance away from the front vehicle. When the car come closer to an obstacle then it will reduce its speed 50cm to 30cm distance, if obstacle don't move in-front of the car then our vehicle will stop automatically before being hit. This is the main purpose of our system.

Programming Code:

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27 ,16,2);

int buzzar = A0;
```

```
#define trigPin 2
#define echoPin 4
long duration;
long distance;
int motor1 = 3;
int motor2 = 5;

int motor3 = 6;
int motor4 = 9;


 void setup() {
Serial.begin (9600);

  pinMode(motor1,OUTPUT);
   pinMode(motor2,OUTPUT);
    pinMode(motor3,OUTPUT);
     pinMode(motor4,OUTPUT);
      pinMode(buzzar, OUTPUT);
      pinMode(trigPin, OUTPUT);
       pinMode(echoPin, INPUT);

  delay(100);
}
void(* resetFunc) (void) = 0; //declare reset function @ add
void loop() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Measure the response from the HC-SR04 Echo Pin
   duration = pulseIn(echoPin, HIGH);
```

```
  distance= duration*0.034/2;

Serial.println(distance);
  delay(20);
 forward();
  if(distance < 70){
  Buzzer();
  }

  if(distance < 50){
  slow();
  }
    if(distance < 20){
  Stop();
  }
delay(200);
}

void forward()
{
	analogWrite(motor1, 255);
	digitalWrite(motor2, LOW);
	analogWrite(motor3, 255);
	digitalWrite(motor4, LOW);

}

void slow()
{
	analogWrite(motor1, 130);
	digitalWrite(motor2, LOW);
	analogWrite(motor3, 130);
	digitalWrite(motor4, LOW);

}
```

```
void backward()
{
	digitalWrite(motor1, LOW);
	analogWrite(motor2, 255);
	digitalWrite(motor3, LOW);
	analogWrite(motor4, 255);
}
void right()
{
	digitalWrite(motor1, LOW);
	analogWrite(motor2, 255);
	analogWrite(motor3, 255);
	digitalWrite(motor4, LOW);
}

void left()
{
	analogWrite(motor1, 255);
	digitalWrite(motor2, LOW);
	digitalWrite(motor3, LOW);
	analogWrite(motor4, 255);
}
void Stop()
{
	digitalWrite(motor1, LOW);
	digitalWrite(motor2, LOW);
	digitalWrite(motor3, LOW);
	digitalWrite(motor4, LOW);
}
```

4.3 Our Final System View

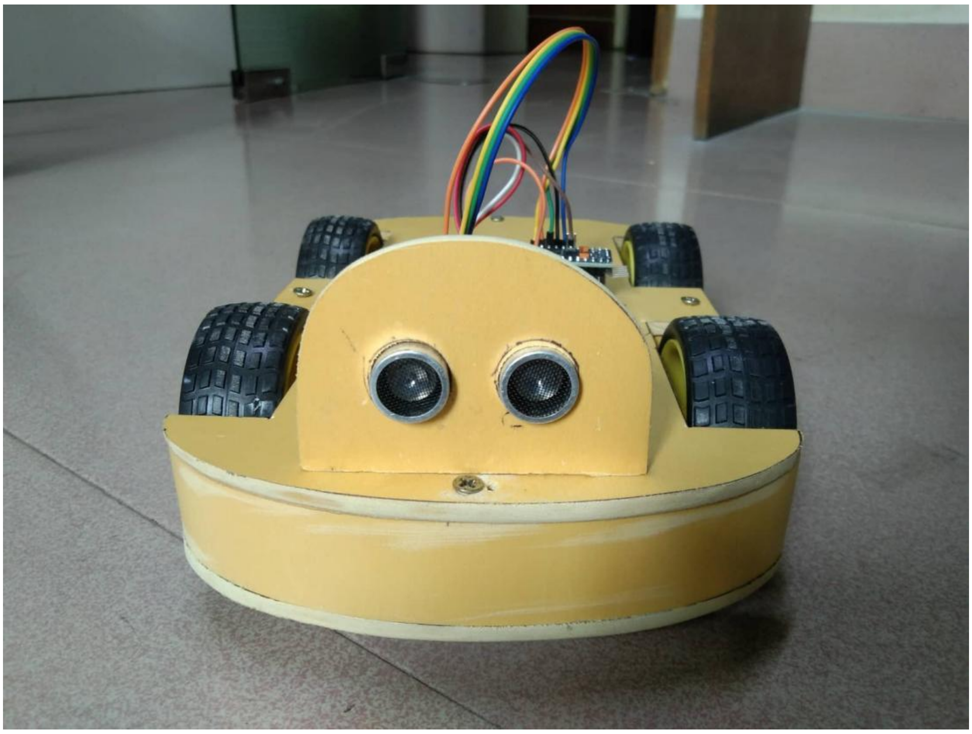

Figure 4.1: Our Final System (Front View)

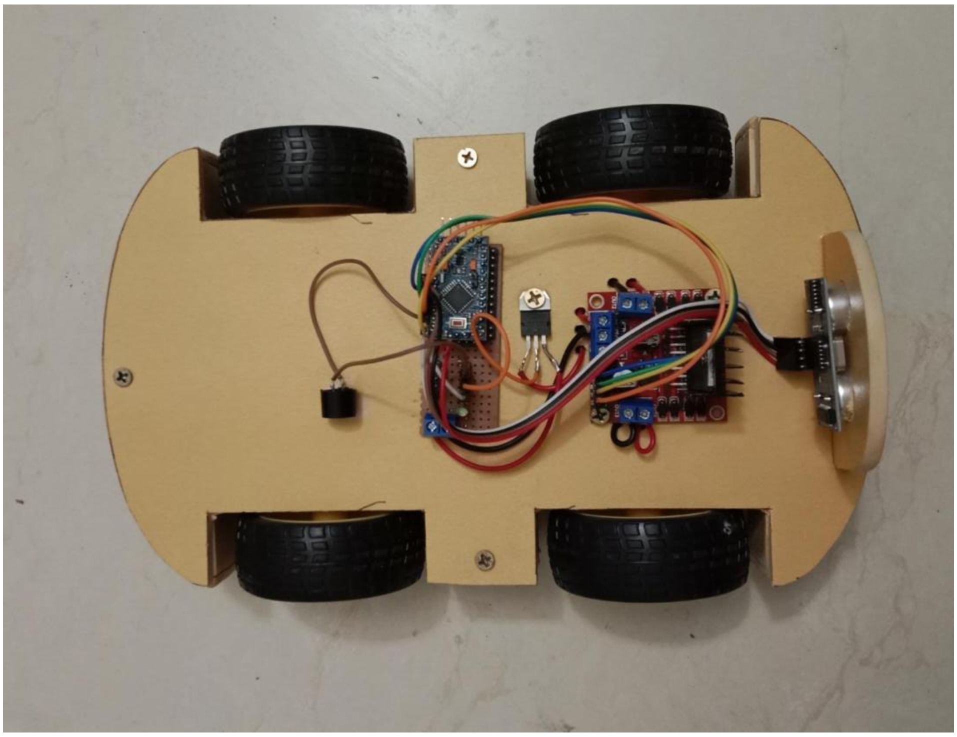

Figure 4.2: Our Final System (Top View)

Chapter 5

Result and Discussion

5.1 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

5.2 Result

After making our project we observe it very careful. It works as we desire. Our project give output perfectly and all equipment are work perfectly. We check how much it works and we get perfect output from this project.

- Finally, we have completed our project successfully & check our project its run accurately according to our objective.
- When the vehicle detect the object at less than 70cm, buzzer will be ring and alert to user.
- The vehicle was moved and when find some obstacle towards of this robot. And reduce its speed 50cm to 30cm.
- If the obstacle don't move then our system will fully stop before being hit.

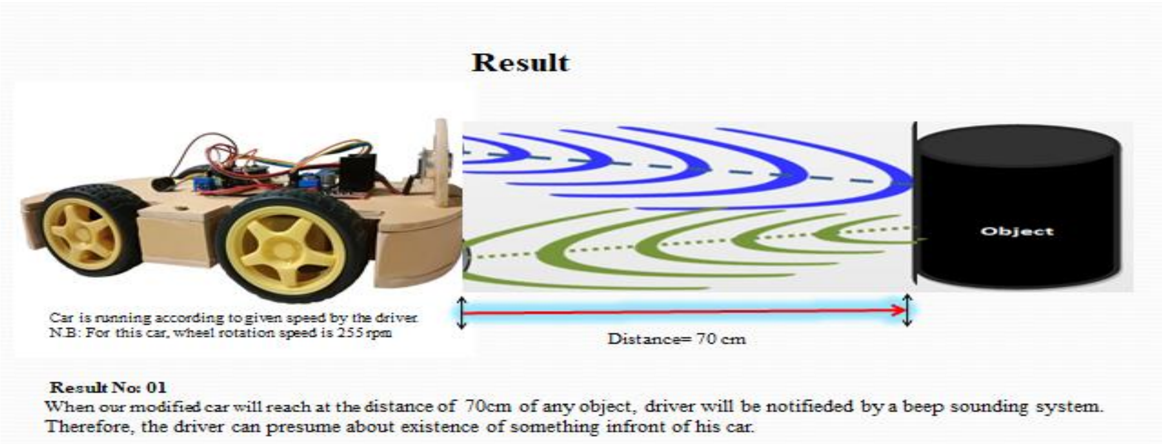

Figure no 5.1: 1st Result Outcome

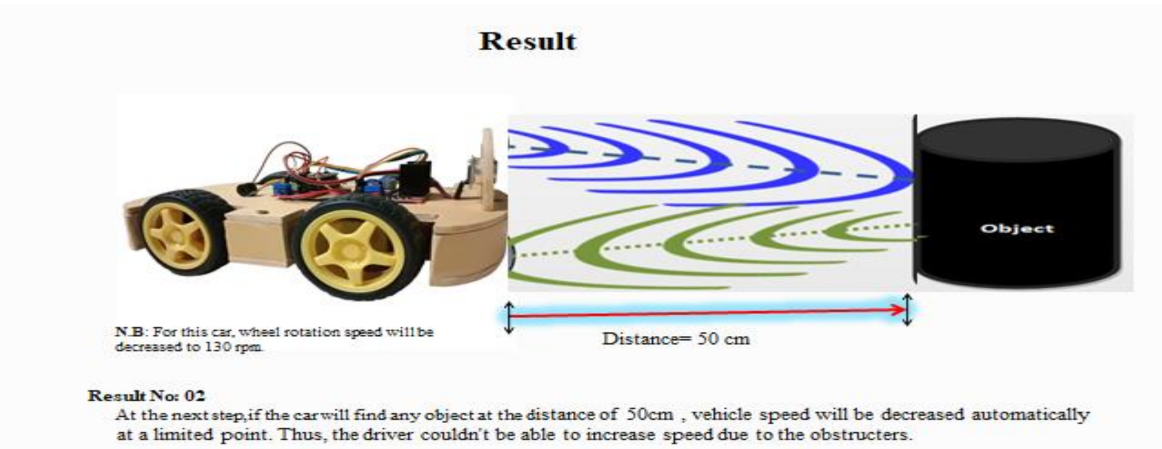

Figure no 5.2: 2nd Result Outcome

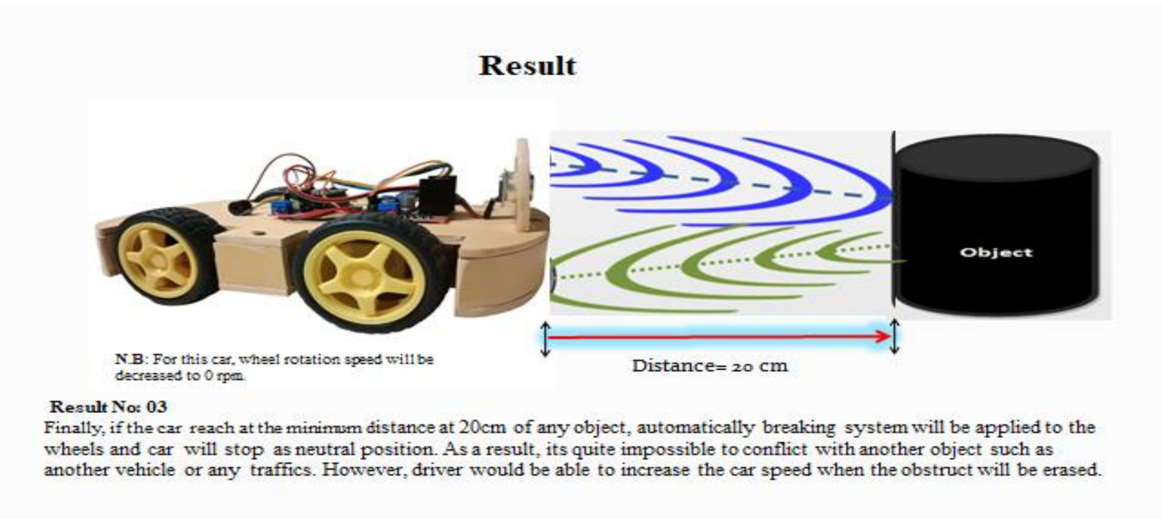

Figure no 5.3: 3rd Result Outcome

5.3 Advantage

There are certainly many advantages of our project and some of the major ones have been given below:

- Able to measure the distance obstacle from car.
- The whole system is automatic system.
- The system is user friendly.
- Able to detect object / obstacle.

5.4 Application

The application areas for this project in this modern and practical world are huge and some of these are given below:

- To use in various vehicle like privet car, truck, bus etc.

Chapter 6

Conclusion

6.1 Conclusion

This automatic vehicles accident avoidance system can be an important aid in constructing smart transport systems in Bangladesh in near future. The main goal of this system is to reduce the accidents by controlling vehicle speed. This smart system will make vehicles more secure, trustworthy, and effective to owners and passengers. It will contribute to saving people's lives.

6.2 Future Scope

We are thinking about adding many features to our project in the future to get more desirable out comes. Some of the steps that we are thinking about taking are given below:

- In future, we are thinking about adding a camera feature for show the obstacle image on screen.
- In future we will improve avoidance feature.
- In future we are thinking about adding more feature to detect various data from unnecessary incident.

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