DESIGN AND DEVELOPMENT OF AN AUTO BRAKING SYSTEM UTILIZING ULTRASONIC SENSOR

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A Thesis

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Declaration

We hereby declare that the work presented in this project is the outcome of the investigation and research work performed under the supervision of **Md. Navid Inan, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU).** We also declare that no part of this project has been or is being submitted elsewhere for the award of any degree.

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ABSTRACT

The increase in car purchases has unfortunately correlated with a rise in accidents and fatalities, with last year seeing a significant spike according to the Road Safety Organization. A leading cause of accidents is drivers failing to brake in time. To address this, engineers have developed Autonomous Emergency Braking systems (AEBS). These systems utilize ultrasonic sensors to detect obstacles and trigger the vehicle's braking mechanism automatically. Rigorous testing ensures the reliability and effectiveness of these systems, displaying how technology can enhance road safety by preventing collisions.

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CHAPTER 01

INTRODUCTION

1.1 Introduction:

Vehicle braking systems are crucial for safety, especially as the number of drivers on the road increases and traffic jams become more common worldwide. Traditional brake systems using compressed air are being replaced by modern electronic systems, like Autonomous Emergency Braking Systems (AEBS), found in commercial vehicles. These AEBS systems respond quickly and precisely, ensuring safety by controlling the brakes for each wheel individually.

Automatic braking technology is another safety feature gaining popularity. It kicks in when needed, either pre-charging the brakes or even stopping the vehicle entirely to prevent collisions. Drivers should understand their car's specific automatic braking capabilities and always stay alert and in control.

The Insurance Institute for Highway Safety emphasizes that automatic braking is a crucial part of crash avoidance technology, along with features like front crash prevention and cross-traffic alert systems. These systems help minimize accidents by assisting drivers in emergencies.

To further improve braking systems, there is a focus on intelligent control of braking forces. This means the system continuously monitors the distance between vehicles and activates the brakes if they get too close, ultimately stopping the vehicle to prevent accidents. Intelligent braking systems have many potential applications, especially in developing countries where research into smart vehicles and intelligent transportation is advancing rapidly.

The system when integrated with other subsystems like an automatic traction control system, intelligent throttle system, automatic cruise control system, etc. will result in smart vehicle maneuver. At the end of the day, a driver is a passenger. Safety accorded the highest priority the journey will be optimized in terms of time duration, cost, efficiency, and comfortability. The impact of such design and development will fill the need of contemporary society that aspires to quality drive as well as to accommodate the advancement of technology, especially in the area of smart sensors and actuators. The emergence of digital signal processors enhances the capacity and features of universal microcontrollers. The overall system is designed so that the value of the inter-vehicle distance from the infrared laser sensor and the speed of the follower car from the speedometer are in the DSP for processing, resulting in the DSP issuing commands to the actuator to function appropriately. The most popular systems like Antilock Braking Systems (ABS), and Traction Control, Stability Control employ different types of sensors to constantly monitor the conditions of the vehicle, and respond in an emergency.

An intelligent mechatronic system includes an ultrasonic wave emitter provided on the front portion of a car producing and emitting ultrasonic waves frontward in a predetermined distance. An ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective ultrasonic wave signal. The reflected wave gives the distance between the obstacle and the vehicle. Then a microcontroller is used to control the speed of the vehicle based on the detection pulse information to push the brake pedal and apply brake to the car stupendously for safety purposes.

1.2 Objective of the Project:

As the requirements of human beings for comfort and safe driving increase. The auto braking system is an addition to the regular safety system and increases the demand for vehicles in the market view. Mainly it is used when driving the vehicles during day and nighttime. Most accidents occur in the nighttime due to long travel, and the driver may get tired. Therefore, the driver may hit the front side of the vehicle or roadside trees.

- To study or learn more about automatic braking systems.
- To design the automatic braking system to avoid the accident.
- To develop a safe Vehicle braking system using ultrasonic sensors and to design a vehicle weightless you get attention to the driving.
- To avert critical damage to the vehicle during driving. Most of the time, the driver is unable to judge the proper distance between a car and an obstacle, so this system will be helpful as well as important in car safety.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature Review:

Visiting several workshops like Auto Xpress, Multiband Workshop Ltd, DHS Motors, and Navana Ltd going through a detailed study of the ABS from various sources such as books, internet and carefully understanding the mounting of each component of ABS such as ECM, Hydraulic control module warning system got a clear idea about the existing advance braking technologies. Workshop technicians got mixed feedback from owners of vehicles with ABS. Drivers reported that they find stopping distance for regular conditions is lengthened ABS either because there may be errors in the system or because of clinking or noise of ABS may contribute to drivers not braking at the same rate.

Hence concluded that the braking systems present in vehicles are either so advanced that they take the braking control away from the driver and increase the risk factor or some of them are not that advanced to perform precisely, so we decided to make such a system that can allow the driver brakes manually at the same time system also controlling the brakes to reduce risk factors in a panic situation. An ABS can be expensive to maintain. Expensive sensors on each wheel can cost hundreds of dollars to fix if they are out of calibration or develop other problems.

For some, this is a big reason to decline ABS in a vehicle. Moreover, many commuter vehicles in India do not have the option of ABS because it's very expensive. It is easy to cause a problem in an ABS by messing around with the brakes. Problems include disorientation of the ABS, where a compensating brake sensor causes the vehicle to shudder, make a loud noise, or generally brake worse.

ABS can only help if the rider applies it at the right time manually and maintains the distance calculations. ABS has its braking distance. Volvo's laser-assisted braking could work effectively in rainfall and snowfall season and laser is easily affected by atmospheric conditions.

In our project, we are using Ultrasonic sensors and a Microcontroller with which the speed of the vehicle is automatically reduced and voice alarms are given to the user when it approaches an object by automatically sensing the position of the object vehicle.

CHAPTER 3

WORKING PRINCIPLE

3.1 Block Diagram:

This is the main block diagram of the automatic braking system project. The Power supply is a very important part of the project. This unit provides sufficient current and voltage to other units Reset switch is connected to the microcontroller RESET pin when the microcontroller faces any occurred situation this time if you press the RESET button then the microcontroller will be reset.

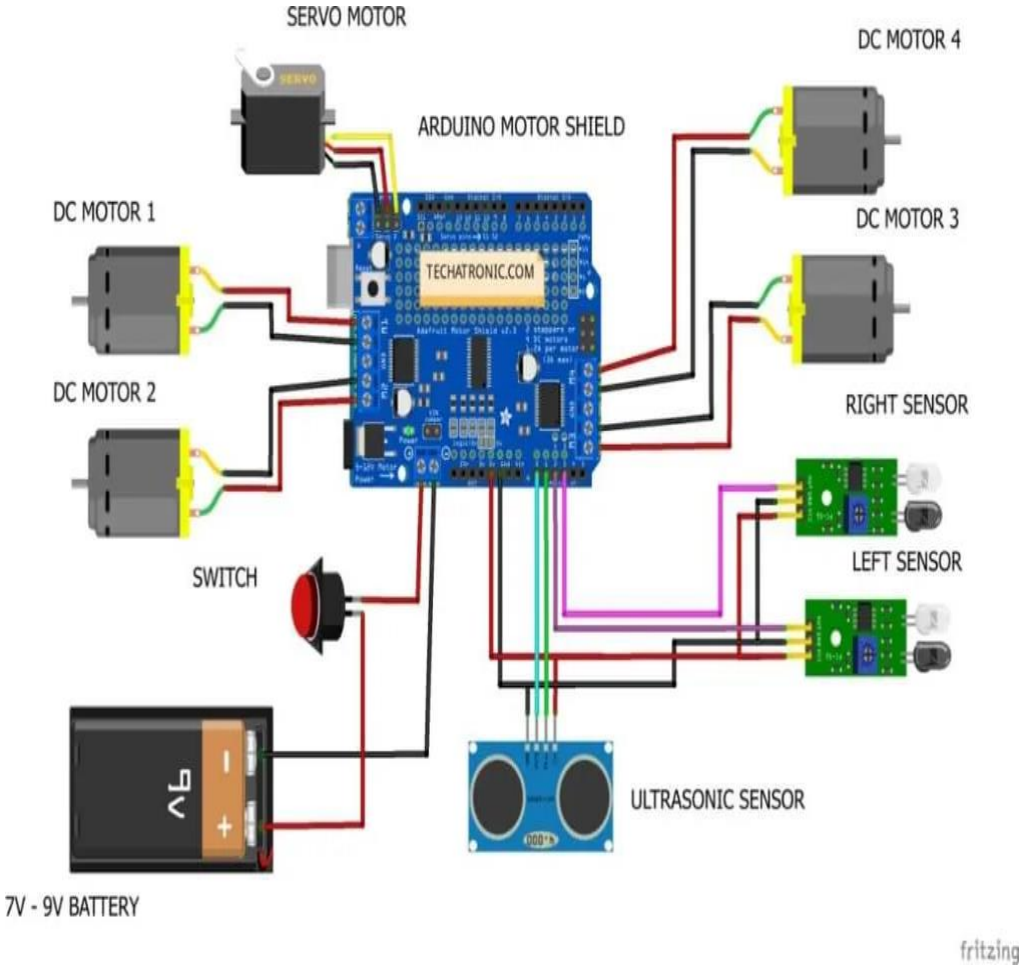


Fig 3.1.1: Block Diagram-1

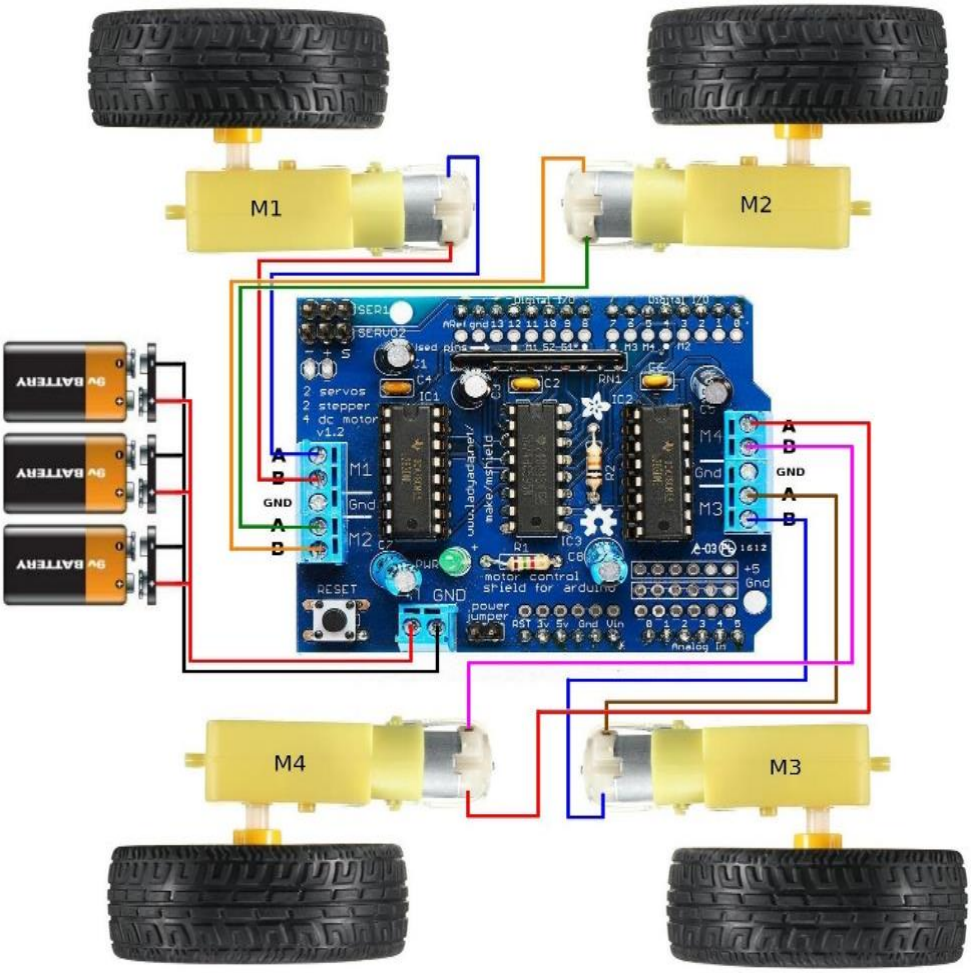


Fig 3.1.2: Block Diagram-2

Highway switch you can select the highway mode and for the jam mode switch you can select the jam mode. L293d driver module drives the 4-gear motor. The buzzer sounder generates a warning sound for the driver.

3.2 Circuit Diagram:

To ensure proper vehicle control during braking and reduce stopping distance, most vehicles have ABS on board to increase the safety of passengers. Based on different sensor input signals, the precise control of the hydraulic modulator ensures that each wheel has the right braking force at the right time. The fault statuses are monitored by the control unit and displayed to the driver. The electric park brake option further enhances vehicle safety and driver comfort.

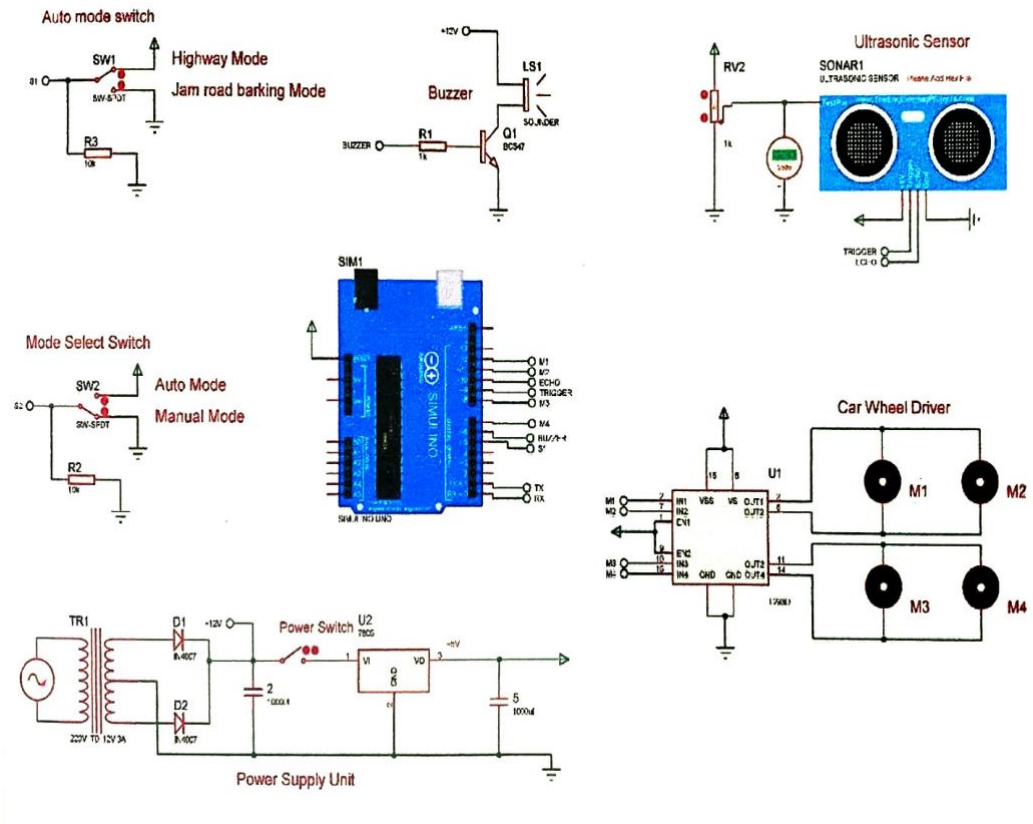


Fig 3.2.1: Circuit Diagram

3.3 Working Principle:

To power up our system, we have made a different power circuit. At first, we used a 220V to 15V transformer to step down the voltage into the 15V. Then a rectifier and capacitor convert AC voltage into the DC voltage and filter the signal. Then we used a buck converter to supply fix 15V DC in our system. If we used a direct 15V battery to supply power then we don't need these extra arrangements in the system. Now we will go to our control circuit and into our main system. First to start the system we need to press the push button as the start switch. When the button is pressed once all the sensors, buzzers, and LED will start to operate.

An ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective ultrasonic wave signal. The reflected wave (detected pulse) gives the distance between the obstacle and the vehicle speed control of the vehicle. The microcontroller is used to control the braking of the vehicle based on the detection pulse information to push the brake pedal and apply the brake to the car stupendously for safety purposes. It has two functional switches one is select the option manual and auto and another switch is jam mode or HI way mode.

This car has two speeds hi-speed and low speed or stop position. Vehicle speed depends on ultrasonic sensors. In our sensors have added 2 sensors. One is an eye blink sensor and the other is an ultrasonic sensor. The eye blink sensor is a digital sensor. It will generate a digital signal and will give input to our controller. When eyes are open, the sensor will continuously send a low signal that means "0" to our microcontroller and the eyes are open.

When the eyes are closed, the signals are set to high or send "1" signals to our microcontroller. When the microcontroller receives a high signal, it will turn the RED LED and the buzzer automatically and stop the operation of L293D.

3.4 Using Device List:

- Full Bridge Rectifier
- Arduino Nano
- 1000uF Capacitor
- Buck Converter L293D
- LM7805
- Crystal
- Resistor
- Diode IN 4007
- 15V Battery
- Buzzer
- Motor 3.5A
- Ultrasonic Sensor
- LED

3.4.1 Arduino Nano:

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Adriano boards can read inputs - a light on a sensor, a finger on a button, or a Twitter message and turn it into an output activating a motor, turning an LED, and publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use Arduino programming language and the Arduino Software (IDE) based on Processing.

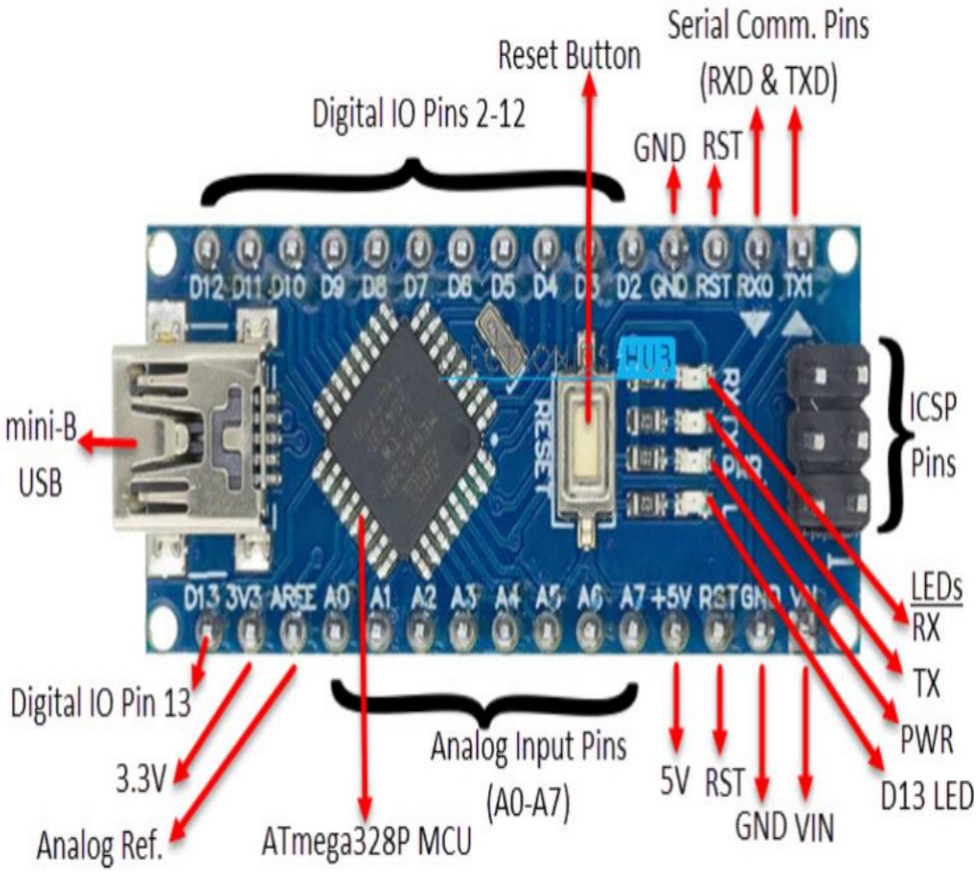


Fig 3.4.1.1: Arduino Nano Pin Diagram

3.4.2 Technical specifications:

Microcontroller	Atmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (Atmega328P) Of which 0.5 KB is used by the bootloader
SRAM	2 KB (Atmega328P)
EEPROM	1 KB (Atmega328P)

The Atmega328 is a single-chip microcontroller created by Atmel and belongs to the mega AVR series. Today the Atmega328 is commonly used in many projects and autonomous stems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Nano and Arduino Nano models.

The key features of this device are as below.

- 28-pin AVR Microcontroller
- Flash Program Memory: 32 k bytes
- EEPROM Data Memory: 1 k bytes
- SRAM Data Memory: 2 k bytes
- I/O Pins: 23
- Timers: Two 8-bit/One 16-bit
- A/D Converter: 10-bit Six Channel
- PWM: Six Channels
- RTC: Yes, with a Separate Oscillator
- MSSP: SPI and I^2C Master and Slave Support
- USART: Yes
- External Oscillator: up to 20MHz



Fig: 3.4.2.1: ATMEGA328P-PU Chip to Arduino Pin Mapping

3.4.3 Motor Driver (L293D)

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

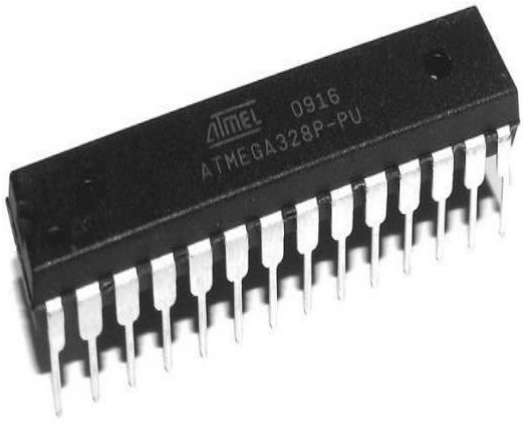


Fig: 3.4.3.1: L293D Motor Driver

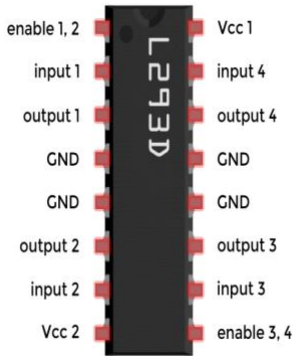


Fig: 3.4.3.2: L293D Pin Diagram

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver is enabled. As a result, the outputs become active and work in phase with their inputs.

3.4.4 DC Geared Motor (wheel motor):

This is a DC motor and wheel set for making robots. These motors are lightweight and have high torque and low RPM. They can climb hills and have excellent traction, and you can mount the wheel on either side of the motor with its double-sided output shaft



Fig: 3.4.4.1: DC Geared Motor with wheel

3.4.5 Specifications:

- Motor Voltage: 3-12 V
- Motor Current: 70 mA (typical) - 250 mA (max)
- Speed: up to 170 RPM
- Torque: up to 0.8 Kg
- Gear Ration: 1:48
- Wheel Diameter: 66 mm
- Wheel Width: 27 mm

3.4.6 Transformer:

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Commonly, transformers are used to increase or decrease the voltages of alternating current in electric power applications.

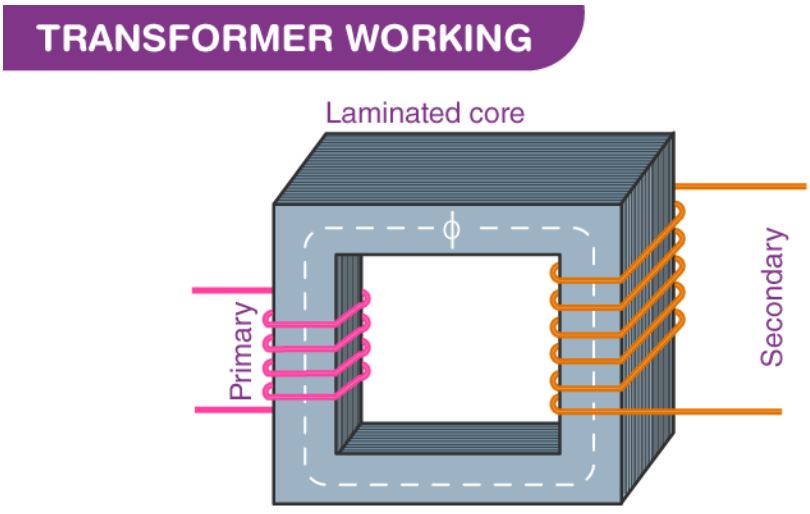


Fig. 3.4.6.1: Transformer

According to Faraday's law of induction, since the same magnetic flux passes through both the primary and secondary windings in an ideal transformer, a voltage is induced in each winding.

3.4.7 LM7805 (Voltage Regulator IC):

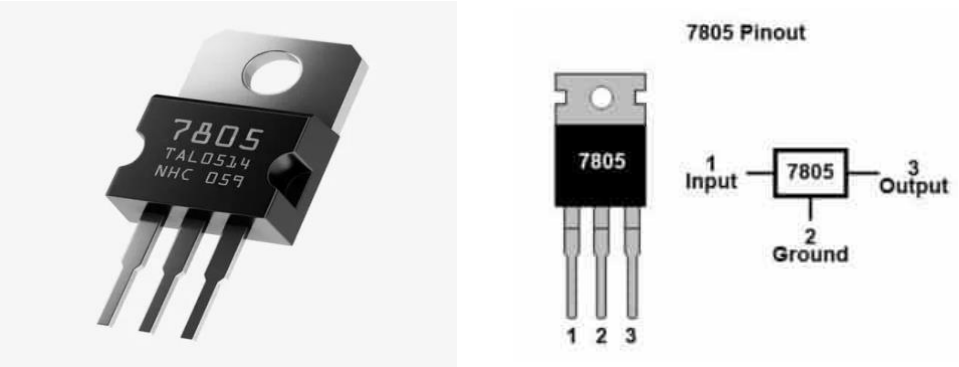


Fig: 3.4.7.1: 7805 (Voltage Regulator IC)

7805 is a voltage regulator integrated circuit. It is a member of the 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V a regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

Pin No	Function	Name
1	Input Voltage (SV-18V)	Input
2	Ground (0V)	Ground
3	Regulated Output: 5V (4.8V-5.2V)	Output

3.4.8 Crystal:

A crystal or crystalline solid is a solid material whose constituent atoms, molecules, or ions are arranged in an ordered pattern extending in all three spatial dimensions. In addition to their microscopic structure, large crystals are usually identifiable by their macroscopic geometrical shape, consisting of flat faces with specific, characteristic orientations.



Fig: 3.4.8.1: Crystal

The scientific definition of a "crystal" is based on the microscopic arrangement of atoms inside it, called the crystal structure. A crystal is a solid where the atoms form a periodic arrangement.

3.4.9 Resistor:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. The current through a resistor is in direct proportion to the voltage across the resistor's terminals.

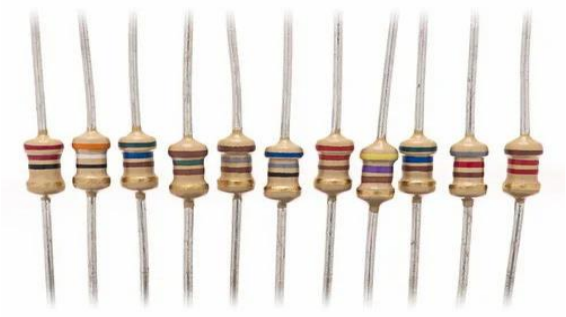


Fig: 3.4.9.1: Resistor

The ratio of the voltage applied across a resistor's terminals to the intensity of current in the circuit is called resistance, and this can be assumed to be a constant (independent of the voltage) for ordinary resistors working within their ratings.

3.4.10 Diode (IN 4007):

In electronics, a diode is a two-terminal electronic component with asymmetric conductance, it has low (ideally zero) resistance to current flow in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p-n junction connected to two electrical terminals. A vacuum tube diode has two electrodes, a plate (anode), and a heated one.



Fig: 3.4.10.1: Diode (IN 4007)

The most common function of a diode is to allow an electric current to pass one direction (called the diode's forward direction), while blocking current in the opposite direction (the reverse direction). Thus, the diode can be viewed as an electronic version of a check valve. This unidirectional behavior is called rectification and is used to convert alternating current to direct current, including extraction of modulation from radio signals in radio receivers these diodes are forms of rectifiers.

We used IN 4007 which is a simple, very common rectifier diode. Often used for reverse voltage protection, the IN4007 is a staple for many powers, DC-to-DC step-up, and breadboard projects. 1N4007 is rated for up to 1A/1000V.

3.5.1 Vero Board:

Strip Board is a widely used type of electronics prototyping board characterized by a 0.1-inch (2. 54 mm) regular (rectangular) grid of holes, with wide parallel strips of copper cladding running in one direction across one side of the board. It is commonly known by the name Vero Board. With the car, it is possible to break between holes to allow for components that have two-pin rows only one position apart such as twin-row headers.

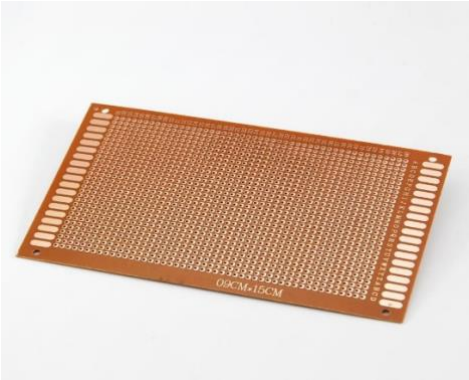


Fig. 3.5.1.1: Vero Board

3.5.2 Wire:

A wire is a single, usually cylindrical, flexible strand. Wires are used to carry electricity and telecommunications signals. Standard sizes are determined by various wire gauges. The term wire is also used more loosely to refer to a bundle of such strands, as in 'multi-stranded wire', which is more correctly termed a wire rope in mechanics, or a cable in electricity.



Fig: 3.5.2.1: Connecting Wire

Although usually circular in cross-section, the wire can be made in square, hexagonal, flattened rectangular, or other cross-sections, either for decorative purposes or for technical purposes such as high-efficiency voice coils in loudspeakers. Edge-wound coil springs, such as the Slinky toy, are made of special flattened wire.

3.5.3 LED:

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p-n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons can recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

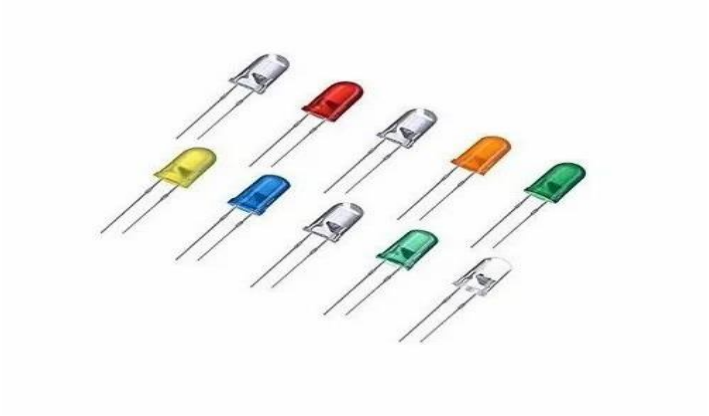


Fig: 3.5.3.1: Indicator LED

3.4.4 Ultrasonic Sensor:

Ultrasonic ranging and detecting devices use high-frequency sound waves called ultrasonic waves to detect the presence of an object and its range. The normal frequency range of the human ear is roughly 20Hz to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of a human car and thus have a frequency above 20,000Hz. An ultrasonic sensor necessarily consists of a transducer for the conversion of one form of energy to another, a housing enclosing the ultrasonic transducer, and an electrical connection.

3.5.5 Ultrasonic Transmitter:

Before transmitting the ultrasonic wave, there is a part which is the ultrasonic wave generator that functions to generate the ultrasonic wave. In that part, there is timing instruction means for generating an instruction signal for intermittently providing ultrasonic waves. This signal will be sent to an ultrasonic wave generator for generating ultrasonic waves based on the instruction signal from said timing instruction means (transform electrical energy into a sound wave). After the ultrasonic wave is produced, the ultrasonic transmitter transmits the ultrasonic waves toward a road surface to find out the obstacle. The range of that obstacle detected depends on the range of ultrasonic sensors that are used.



Fig: 3.5.5.1: Ultrasonic Transmitter

3.5.6 Ultrasonic Receiver:

If the ultrasonic wave detects the obstacle, it will produce a reflected wave. An ultrasonic receiver is used for receiving the ultrasonic waves reflected from the road surface to generate a reception signal. There is an ultrasonic transducer that will transform back the sound wave to electrical energy. This signal is amplified by an amplifier.

The amplified signal is compared with a reference signal to detect components in the amplified signal due to obstacles on the road surface. The magnitude of the reference signal or the amplification factor of the amplifier is controlled to maintain a constant ratio between the average of the reference signal and the average of the amplified signal.



Fig: 3.5.6.1: Ultrasonic Receiver

3.5.7 Battery Case:

This is a 4 x AA Battery Holder Box, without a cover. The case box can keep batteries organized and a protector. The holder case is designed with leads for ease of soldering and connection. This Battery holder case is perfect for devices that need a 12V external battery.



Fig: 3.5.7.1: Battery Case

3.5.8 Buzzer:

An audio signaling device like a beeper or buzzer may be electromechanical piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarms, music, bells & sirens.



Fig: 3.5.8.1: Buzzer

3.5.9 Programming:

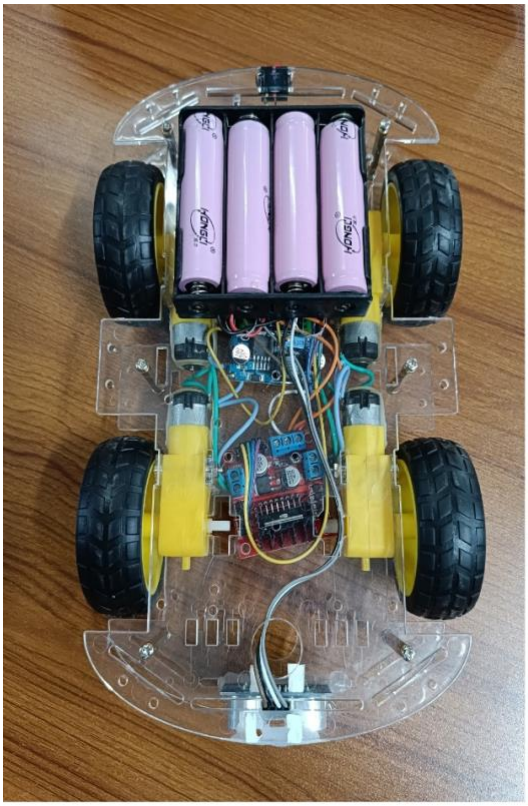
Arduino is the world's lead and offers a range of software to the world's leading open-source hardware and software ecosystem. The Company's software tools, hardware platforms, and documentation enable almost anybody to be creative with technology. To unpopular tool for a lot of product development as well as one of the most successful SEM/STEAM educations. Hundreds of thousands of designers, engineers, students, and makers around the world are using Arduino to innovate in music, games, toys, smart homes, farming, autonomous vehicles, and more. To do so use the Arduino programming language based on wiring and the Adriano software (IDE) based on processing.

CHAPTER 4

VIEW OF PROJECT

4.1 Full view of the project:

This is our full view of the project. This study developed a prototype of modern braking system.



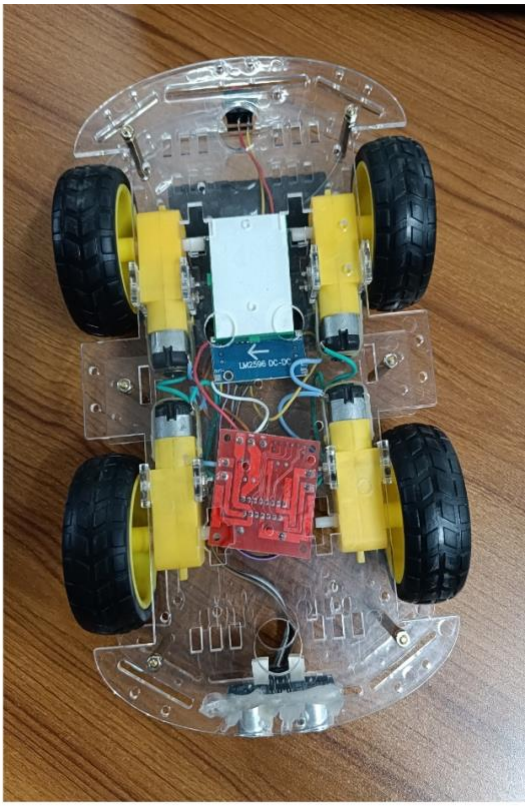




Fig: 4.1.1: Project Overview

Well, the whole system is accomplished. The safety distance is determined then the vehicle system is braked when the obstacle is detected. The ranging accuracy of the ultrasonic sensor in this prototype is about 40cm and works effectively within the prescribed limit. There are two manual switches on the top of the car. Number one is the Auto and manual switch another one is the traffic jam and highway mode switch.

The driver can select any mode depending on the situation. SV piezo buzzer sounder can generate a warning sound for the driver in an emergency all electronics component is connected to the Arduino microcontroller board. When this car will be auto mode selected and its jam mode. This car will always maintain a certain distance from the car in front. So, it will be very helpful for car drivers. Similarly, when the car is be highway mode then our device will alert the driver if the car in front is within 4 feet. If the driver is not alert and the car in front moves within 2 feet, our car will brake automatically. There is a 15V battery for the control circuit this circuit is operated by the powerful microcontroller. The ultrasonic sensor module can measure the distance of obstacles. LM7805 Voltage regulator IC converts the voltage 15V to 5V. This 5V power provided the perfect voltage to ultrasonic sound and other modules. The L293D DC motor driver module controls the 4-wheel DC gear motor. The motor driver module moves the motor clockwise and anticlockwise and also stops the command.

4.2 Costing of this Project:

Ingredients	Price
Arduino Nano	1 × 400 = 400
Battery	100 × 4 = 400
Charger	1 × 300 = 300
Vero Board	1 × 100 = 100
Wheel	4 × 50 = 200
Motor	4 × 80 = 320
Chassis	2 × 300 = 600
Ultrasonic Sensor	1 × 300 = 300
Controller	1 × 300 = 300
Cable	1 × 30 = 30
Switch	1 × 20 = 20
Capacitor	1 × 100 = 100
Battery Case	1 × 50 = 50
Supportive Pillar	6 × 20 = 120
Wheel Case	4 × 30 = 120
Buzzer	1 × 30 = 40
Total Cost	**3400**

CHAPTER 5

RESULT AND DISCUSSION

5.1 Data Table:

Calculation: We get,

For *distance, s = 100cm = 1m, time t = 4.7s*

We know,

Normal Speed, $\vartheta = \frac{s}{t}$

$$\therefore \vartheta = \frac{1}{4.7}\, ms^{-1}$$

$$= 0.213\, ms^{-1}$$

Table 5.1.1: Mean or Average Velocity

SL No.	Distance s (cm)	Time t (s)	Velocity $\vartheta\ (cms^1)$	Mean/ Average Velocity $(cms^{-1)})$
01	50	2.6	19.23	20.98
02	100	4.7	21.28	
03	150	7.1	21.13	
04	200	9.3	21.51	
05	250	5	21.74	

Table 5.1.2: Safe Distance on Traffic Jam Mode

SL No.	Total Distance x_t (cm)	Distance Covered Before Braking X_e (cm)	Safe Distance $X_s = (x_t - x_e)$ (cm)	Mean/ Average Safe Distance X_m (cm)
01	50	19.2	30.8	30.78
02	100	69.3	30.7	
03	150	119.3	30.7	
04	200	169.2	30.8	
05	250	219.1	30.9	

5.2 Final Overview of the Project:

In this project, we have checked the working of our project, we connected it with a battery whose braking system is controlled by a DC gear motor and Servomotor. This technique is eco-friendly at list this work is an attempt to reduce Accidents while in critical driving conditions. We have tested the working of the System by placing various objects ahead as obstacles. The system responded by reducing the speed of the vehicle when the obstacle is placed at various distances.

From it. In addition, the system stopped automatically in restricted areas. It gave very accurate measurements according to the limit of values interpreted.

5. 3 Device Systems Test:

It is any type of automatic safety mechanism that is incorporated into the vehicle to control its operation during start-up or run time. One such method commonly used is to activate or deactivate the vehicle ignition system. The ignition interlock consists of a 5V DC L293D motor driver that is interfaced to a microcontroller to control the vehicle ignition during vehicle start-up based upon the short distance of the car. When the car moves on the road in the jam this time the car moves forward. The ultrasonic sensor detects the distance in front of the next car.

5.4 Ultrasonic Sensor:

In this stage, when the car is switched on the system measures the level of distance. When the car will be jam mode if the car distance is 1.5' then car movement will be stopped. When the car is jammed de and a distance of 15' then car movement will be forward.

When the car is be highway mode if the car distance is <2' then the car speed will be half. When the car is be HI way mode and distance < 1.5' then car movement will be full brake.

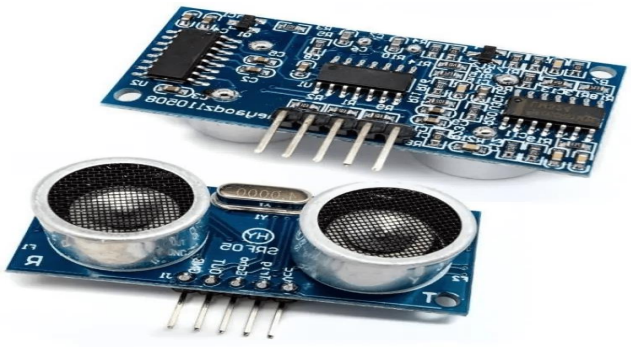


Fig: 5.4.1: Ultrasonic Sensor

5.5 Advantages of this Project:

The expert, who is a member of the Road Safety Management Council, said that the automatic braking system recognizes the threat of an imminent collision and warns the driver so that he can either brake or maneuver. Should the driver fail to take action, the system causes the car to brake automatically.

He added that the system helps prevent, or at least mitigate, between 20 and 40 percent of motor vehicle accidents in which injuries are caused.

The system causes the car to reduce its speed, meaning that even if the accident is not avoided in full, the risk of injury is at least reduced.

The cost of the entire project was about 4000 taka. The materials for this project are purchased from retail stores so the cost is a little higher. The cost will be lower if manufactured commercially. It can be spread widely among people for awareness. By doing this, accidents can be prevented.

5.6 Limitations:

- It cannot ditect transparent object.
- Sometimes it can’t ditect thiny object.

CHAPTER 6

CONCLUSION

6.1 Conclusion:

Enhancing Au Safety through Advanced Ultrasonic Auto Braking Systems.

The integration of ultrasonic sensors in auto braking systems marks a significant leap forward in automotive safety, promising long-term benefits and accident prevention. By leveraging cutting-edge technology, these systems not only protect occupants but also safeguard the vehicle itself.

The execution of such advanced systems could potentially be mandated, like wearing safety belts, to mitigate accidents to a considerable extent. Ultrasonic braking represents an example shift from traditional safety measures, offering substantial advantages in accident prevention and vehicle protection.

In summary, the adoption of ultrasonic auto braking systems heralds a new era in automotive safety, offering comprehensive protection and accident-avoidance capabilities. By embracing this technology, we pave the way for safer roads and reduced collision rates, ultimately saving lives and preserving vehicles.

6.2 Future Recommendation:

Our future course of action is to assemble a system on a vehicle & perform various experimentations by varying different

Parameters. Those parameters are as follows:

- Vehicle Speed
- Left right back side obstacle distance
- Sensor Position
- Varying deceleration rate.

6.3 Advantages and Disadvantages of Ultrasonic Sensor:

Advantages:

- Ultrasonic proximity sensors are not affected by atmospheric dust, snow, rain, etc.
- Can work in adverse conditions.
- The sensing distance is more compared to inductive or capacitive proximity sensors.

Disadvantages:

- Ultrasonic sensors have more Difficulties Reading Reflections from Soft, Transparent, Curved, Thin, or Small Objects.

6.4 Advantages and Disadvantages of Microcontrollers:

Advantages	Disadvantages
• Small	• Limited by ADC
• Portable	• Limited Processing Power
• No Computer Required	• No data storage
• Programmable	
• Vast Range of Applications	
• Cheap	

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APPENDIX

Programming of This Project:

```
/*
 * Project: Auto Breaking System
 */
#include <Servo.h>

#define TRIG 3
#define ECHO 2

#define IN_11  4    // L298N #1 in 1 motor Right Ahead
#define IN_12  5    // L298N #1 in 2 motor Right Ahead
#define IN_13  7    // L298N #1 in 3 motor Right Back
#define IN_14  6    // L298N #1 in 4 motor Right Back

int timeEcho;
int lookAhead;

void setup() {

   pinMode(TRIG, OUTPUT);
   pinMode(ECHO, INPUT);

   pinMode(IN_11, OUTPUT);
   pinMode(IN_12, OUTPUT);
   pinMode(IN_13, OUTPUT);
   pinMode(IN_14, OUTPUT);
   Serial.begin(9600);
}
```

```
void goAhead(){
      digitalWrite(IN_11, HIGH);
      digitalWrite(IN_12, LOW);

      digitalWrite(IN_13, LOW);
      digitalWrite(IN_14, HIGH);
  }

void goBack(){
      digitalWrite(IN_11, LOW);
      digitalWrite(IN_12, HIGH);


      digitalWrite(IN_13, HIGH);
      digitalWrite(IN_14, LOW);
  }

void goLeft(){
      digitalWrite(IN_11, LOW);
      digitalWrite(IN_12, HIGH);

      digitalWrite(IN_13, LOW);
      digitalWrite(IN_14, HIGH);
  }

void goRight(){
      digitalWrite(IN_11, HIGH);
      digitalWrite(IN_12, LOW);

      digitalWrite(IN_13, HIGH);
      digitalWrite(IN_14, LOW);
  }
```

```
void stopRobot(){

      digitalWrite(IN_11, LOW);
      digitalWrite(IN_12, LOW);

      digitalWrite(IN_13, LOW);
      digitalWrite(IN_14, LOW);

  }

void distanceAhead(){

  digitalWrite(TRIG, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG, LOW);
  timeEcho = pulseIn(ECHO, HIGH);
  lookAhead = timeEcho/58;

  }

void loop(){
  distanceAhead();
  Serial.println(lookAhead);
  if(lookAhead == 0){
    lookAhead = 50;

  }
```

```
  if(lookAhead < 40){
    stopRobot();
  }
  else{
    go ahead();
  }
}
```