AUTOMATIC BRAKING SYSTEM

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***Abstract*- LC Engines have been advanced a lot such that its speed is becoming a major catastrophe. Advanced automatic braking system improves braking techniques in vehicles. It changes complete braking systems in an automotive and deals with the concept Of Automatic Braking System giving the solution.**

This project is designed with ultrasonic transmitter, ultrasonic receiver, Arduino UNO R3 board With PIC microcontroller, DC gear motor, Servomotor and mechanical braking arrangement. The Ultrasonic Sensor generates (0.020-20)KHZ frequency signal. It is transmitted through ultrasonic transmitter. The ultrasonic receiver is used to receive the reflected wave present in front Of the vehicle, then the reflected waves is given to the ultrasonic wave generator unit in which the incoming wave is amplified and compared With reference signals to maintain a constant ratio and this signal is given to microcontroller and through which the working of DC gear motor and Servomotor may takes place, which results in application of brakes.

The prototype has been prepared depicting the technology and tested as per the simulated conditions. In future the actual model may be developed depending on its feasibility.

Chapter -1
Introduction

1.1 BACKGROUND

Driving is a common activity for most of the people. The number of vehicles is increasing day by day. Now a days, the technology has got vast changes which leads increase in speed. The speed plays a vital role to maintain time for longer distances. But, this speed also getting a major problem for causes of road accidents. The common braking is not sufficient for avoidance of accidents when driver is not active. Further improvement has to done in braking system in order to brake a vehicle when driver is not able to brake i.e., it may needs automatic braking system. This automatic braking system allows the vehicle to brake without support of the drive

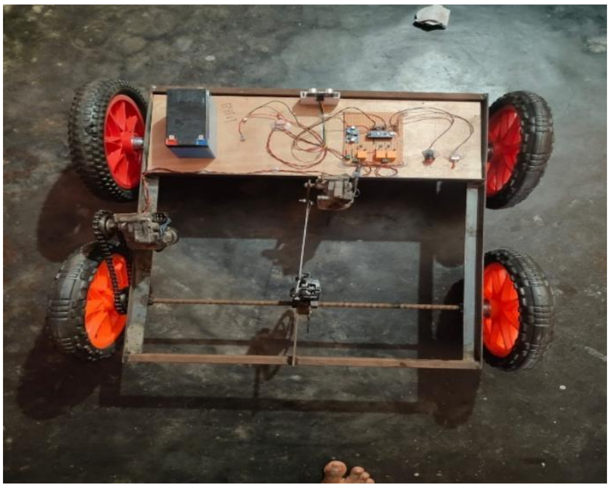

Fig 1 – Automatic Breaking System

The main target of the ultrasonic braking system is that, vehicles should automatically brake when the sensors sense the obstacle. is a technology for automobiles to sense an imminent forward collision with another vehicle or an obstacle, and to brake the vehicle accordingly, which is done by the braking circuit. This system includes two ultrasonic sensors viz. ultrasonic wave emitter and ultrasonic wave receiver. The ultrasonic wave emitter provided in front portion Of an automatic braking system vehicle, producing and emitting ultrasonic waves in a predetermined distance in front Of the vehicle. Ultrasonic wave receiver is also provided in front portion of the vehicle, receiving the reflected ultrasonic wave signal from the obstacle. The reflected wave (detection pulse) is measured to get the distance between vehicle and the obstacle. The DC gear motor is connected to the wheels of vehicle and power input is given to it from Arduino board. Then PIC microcontroller is used to control the servo motor based on detection pulse information and the servo motor in turn automatically controls the braking of the vehicle. Thus, this new system is designed to solve the problem where drivers may not be able to brake manually exactly at the required time, but the vehicle can Stop automatically by sensing the obstacles to avoid an accident.

In order to reduce the emission, more work is going on for the modification of engine work functions and all. There are several kinds Of braking mechanism systems that would only can be applicable mechanically, to move the ideology more deep and brief the automatic braking system will be more sufficient and satisfactory in addition to mechanical braking system.
In present generation, number of vehicles are coming into existence with newer technologies for implementation of human comfort and other conditioning. To extend the ideology in more brief manner and to take the Step in different way, may automatic braking system would fulfill the methods of extension of technical existences.

1.2 OBJECTIVE
The objective of this project is to design the automatic braking system in order to avoid the accident. TO develop a safety vehicle braking system using ultrasonic sensor and to design a vehicle with less human attention to the driving.
This project is necessary to be attached to every vehicle. Mainly it is used when drive the vehicles in night time. Mostly the accident occurred in the night time due to long travel the driver may get tired. So the driver may hit the front side vehicle or road side trees. By using this project the vehicle is stopped by automatic braking system. So we can avoid the accident.

1.3 SCOPE OF PROJECT
The scope of this project is to develop an ultrasonic sensor to detect the obstacle and to process the output from the ultrasonic sensor to drive the servomotor as an actuator.
Vehicles can automatically brake due to obstacles when the sensor senses the obstacles. The focus of this project is designing an automatically braking system that can help us control the braking system of a vehicle. The automatically braking system also needs to work with an ultrasonic sensor, which produce sound pulse by a buzzer. The ultrasonic wave is generated from a transmitter and sends to a receiver.

1.3 METHODOLOGY

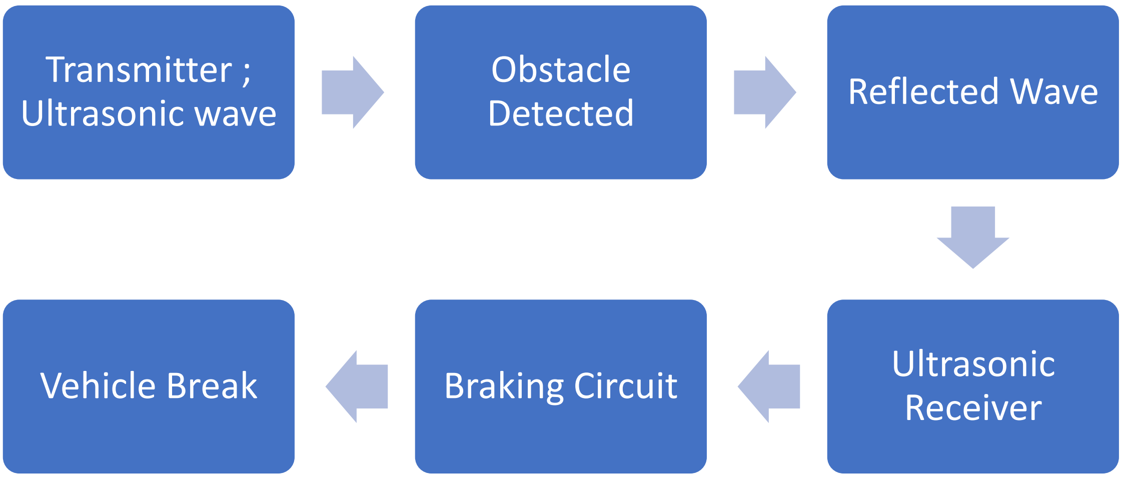

Figure 1.1 Block Diagram of the Automatic Braking system

Ultrasonic Sensor signals	Range
Maximum	I metre
Minimum	2 centimetres

1.5 PRINCIPAL COMPONENTS OF AUTOMATIC BRAKING SYSTEM
- SENSOR
- TRANSDUCER
- ULTRASONIC SENSOR
- OPERATIONAL AMPLIFIER AND ADC
- BRAKING CIRCUIT
- DC GEAR MOTOR
- SERVOMOTOR

1.5. SENSOR

A sensor is an electrical device that maps an environmental attribute to a quantitative measurement. Each sensor is based on transduction principle which is conversion Of energy from one form to another form. There are two important terms related to any sensor —

- Target Angle — This term refers to the 'tilt response' limitations Of a given sensor. Since the ultrasonic waves reflect off the target object. target angles indicate acceptable amounts Of tilt for a given sensor.
- Beam Spread — This term refers to the maximum angular spread Of the ultrasonic waves as they leave the transducer.

1.5.2 TRANSDUCER

A transducer is an energy conversion device which converts one form Of energy into another. In the ultrasonic sensors they are used to convert electrical energy into ultrasonic energy and vice-versa. In this system piezoelectric transducers are used, which create ultrasonic vibration through use of piezoelectric materials such as certain forms Of crystals or ceramic polymers. Their working is based on the piezoelectric effect. This effect refers to the voltage produced between surfaces of a solid, (non-conducting substance) When a mechanical Stress is applied to it. Conversely, When a voltage is applied across surfaces Of a solid that exhibits piezoelectric effect, the solid undergoes mechanical distortion.

1.5 ULTRASONIC SENSOR

Ultrasonic ranging and detecting devices use high frequency sound waves called ultrasonic waves to detect presence of an object and its range. Normal frequency range Of human ear is roughly 2011z to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of human ear, and thus have frequency above 20,000Hz. An ultrasonic sensor necessarily consists Of a transducer for conversion of one form of energy to another. a housing enclosing the ultrasonic transducer and an electrical connection. These sensors are Of two types:

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

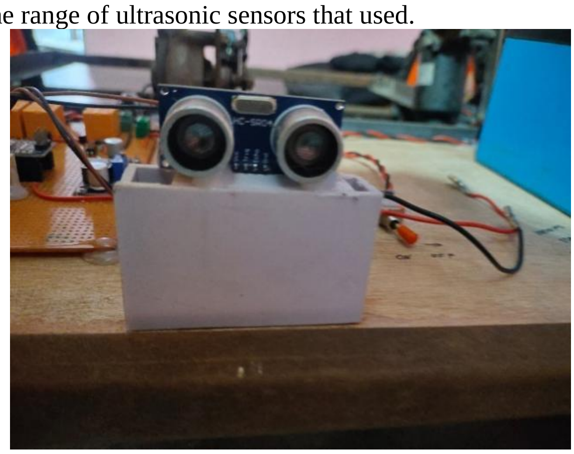

Fig 2 Ultrasonic Transmitter

- 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. •ntere is ultrasonic transducer that Will transform back the sound wave to electrical energy. This signal amplified by an amplifier. The amplified signal is compared With 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 Ultrasonic Receiver

1.5.4 OPERATIONAL AMPLIFIER AND ADC

An operational amplifier, usually referred to as op-amp, is a high gain voltage amplifier with differential inputs and a single output. The amplifier's differential inputs consist Of an inverting input and a non-inverting input. The op•amp amplifies only the difference

in the voltage between the two inputs called the •differential input voltage'. The output voltage of the op-amp is controlled by feeding a fraction of output signal back to the inverting input. This is known as negative feedback. Due to the amplifier's high gain. the output voltage for any given input is only controlled by the negative feedback.
The amplified signal is a square pulse which is given to the ADC. ADC (Analog to Digital Converter) converts input analog signal to corresponding digital signal. The digital signal is given to the microcontroller.

BRAKING CIRCUIT
The processed i.e. the amplified digital signal is sent to the braking circuit. PIC (Peripheral Interface Controller (or) programmable Interface Controller) — The microcontroller used is PIC 16FS4 which is 8-bit microcontroller. PIC microcontrollers are made by microchip technology. PICS are used in this system due to their IOW cost and Wide availability. The numbers Of instructions to perform a variety Of operations vary from 35 instructions in low-end PICS to about 70 instructions in high-end PICS. It is programmed by using C language.
The signal from the ADC is processed by the PIC microcontroller, and it gives an instruction as an output, based on the condition Of the signal, to the servo motor. The signal received from the ADC can also be displayed on the LCD display (which gives an audio-visual warning on the windshield in the driver's field of view), and it gives the distance between the front Of the vehicle and the obstacle.

Fig 4 – Braking System

The distance value at which automatic braking should start is already stored in the microcontroller. When the measured distance reaches this value, the PIC automatically sends the signal to the servo motor which in turn controls braking through mechanical arrangements.

1.5.6 DC GEAR MOTOR

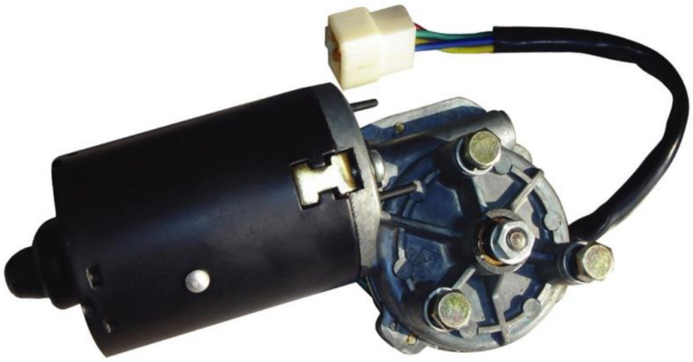

Fig 5 – DC gear (Wiper) Motor

DC gear motor is a fairly simple electric gear motor that uses electricity, gear box and magnetic field to produce torque, which turns the motor. At its most simple, DC gear motor requires two magnets of opposite polarity and an electric coil,which acts as an electric magnet. The repellent and attractive electromagnetic forces Of the magnets provide the torque and causes the DC gear motor to turn. A gear box is present just after the DC motor and a rotary shaft is connected to it, with the help of this DC gear motor setup the vehicle wheels can be rotated in this project.

1.5.7 SERVO MOTOR

The Output of the PIC is the input of the servo motor. The servo motor allows for precise control of angular position, velocity and acceleration. It consists of a motor coupled to a sensor for position feedback. Thus, it is a closed loop mechanism that uses position feedback to control its motion and final position. The input is a signal, either analog or digital, representing the position commanded for the output shaft. The measured position of the output shaft is compared to the command position (the external input to the motor). If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction as needed, to bring the output shaft to the appropriate position. As the required position approaches, the error signal reduces to zero and the motor stops.

FIG 5- Servo motor

The output shaft Of servo motor is capable Of travelling somewhere around 180 degrees. A normal servo motor is used to control an angular motion between O and 180 degrees, and it is mechanically not capable Of turning any farther due to a mechanical stop built on to the main output gear. The angle through which the output shaft Of the servo motor need to travel is determined according to the nature Of the signal given to the motor as input from the PIC.

The servo motor controls the braking through mechanical arrangements. This is done by using a pair of crossed helical gears and a grooved cylindrical component. The larger gear is mounted on the output Shan of the servo motor and the smaller is mounted on the master cylinder piston rod. Thus, when the output shaft of the servomotor gets signals and hence the larger gear rotates in say anticlockwise direction. the smaller gear and hence the master cylinder piston rod rotates in clockwise direction. Due to the groove on the cylindrical component translatory motion is also produced. This is due to a pin, one end of which is inserted in the groove and the other end is fixed rigidly to a Support. Thus, a combination Of translatory as well as rotary motion is produced.

Hence, the fluid pressure is applied due to stretching out Of the master cylinder piston thus resulting in braking of the vehicle. The piston returns to the original position When the servo motor output shaft rotates in clockwise direction.

Thus, the speed of the vehicle reduces for clockwise rotation Of the smaller gear (i.e. anticlockwise rotation of larger gear and hence the servo motor output shaft). Thus, the servo motor is used to control the brakes, when the PIC gives the signal to the servo motor, based upon the distance measured by means of sensors.

This constitutes the braking circuit.

1.6 Advantages of Automatic Braking System

- Discrete distances to moving objects can be detected and measured. ▪ Resistance to external disturbances such as vibration, infrared radiation, ambient noise, and EMI (Electro Magnetic Interference) radiation.
- Measures and detects distances to moving objects.
- Impervious to target materials, surface and colour.
- Solid-state units have virtually unlimited, maintenance free lifespan.
- Detects small Objects over long operating distance.
- Ultrasonic sensors are not affected by dust, dirt or high moisture.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Fundamentals of Sensors

In the broadest definition, a sensor is an object whose purpose is to detect events or changes in its environment, and then provide a corresponding output. A sensor is a of transducer; sensors may provide various types of output, but typically use electrical or optical signals. For example, a thermocouple generates a known voltage (the output) in response to its temperature (the environment). A mercury-in-glass thermometer, similarly, converts measured temperature into expansion and contraction Of a liquid, which can be read on a calibrated glass

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micro-machinery and easy-to-use micro controller platforms, the uses Of sensors have expanded beyond the most traditional fields of temperature, pressure or now measurement, for example into MARG (Magnetic, Angular Rate, and Gravity) sensors. Moreover, Analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine, and robotics. It is also included in our day-to-day life.

2.1. Ultrasonic Sensor

Ultrasonic ranging and detecting devices use high-frequency sound waves to detect the presence Of an Object and its range. The systems either measure the echo reflection of the sound from objects or detect the interruption of the sound beam as the Objects pass between the transmitter and receiver.

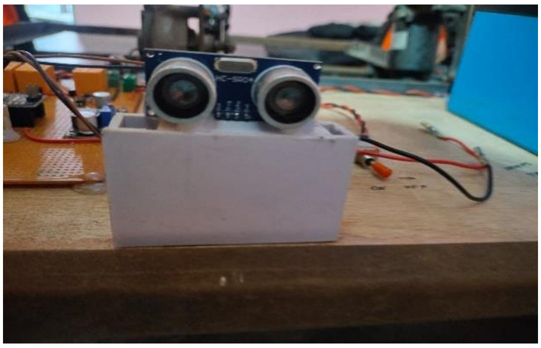

Fig 6-Ultrasonic Sensor

An ultrasonic sensor typically utilizes a transducer that produces an electrical output in response to received ultrasonic energy. The normal frequency range for human hearing is roughly 20 to 20,000 hertz. Ultrasonic sound waves are sound waves that are above the range Of human hearing and thus, have a frequency above about 20,000 hertz. Any frequency above hertz may be considered ultrasonic. Most industrial processes, including almost all source Of friction, create some ultrasonic noise.

The ultrasonic transducer produces ultrasonic signals. These signals are propagated through a sensing medium and the same transducer can be used to detect returning signals. Ultrasonic sensors typically have a piezoelectric ceramic transducer that converts an excitation electrical signal into ultrasonic energy bursts. The energy bursts travel from the ultrasonic sensor, bounce off objects, and are returned toward the sensor as echoes. Transducers are devices that convert electrical energy to mechanical energy, or vice versa. The transducer converts received echoes into Analog electrical signals that are Output from the transducer.

The piezoelectric effect refers to the voltage produced between surfaces of a solid dielectric (non-conducting substance) when a mechanical stress is applied to it. Conversely When a voltage is applied across certain surfaces Of a solid that exhibits the piezoelectric effect, the solid undergoes a mechanical distortion. Such solids typically resonate within narrow frequency ranges. Piezoelectric materials are used in transducers e.g., phonograph cartridges, microphones, and strain gauges that produce an electrical Output from a mechanical input. They are also used in earphones and ultrasonic transmitters that produce a mechanical output from an electrical input. Ultrasonic transducers operate to radiate ultrasonic Waves through a medium such as air. Transducers generally create ultrasonic vibrations through the use of piezoelectric materials such as certain forms of crystal or ceramic polymers.

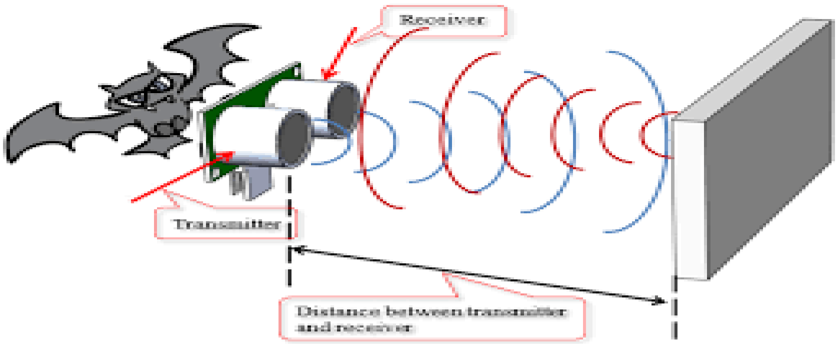

Fig 7-trasonic ranging

2.1.2 Ultrasonic sensing and control

Ultrasonic signals are like audible sound waves, except the frequencies are much higher. Our ultrasonic transducers have piezoelectric crystals which resonate to a desired frequency and convert electric energy into acoustic energy and vice versa. The illustration shows how sound waves, transmitted in the shape of a cone, are reflected from a target back to the transducer. An Output signal is produced to perform some kind Of indicating or control function. A minimum distance from the sensor is required to provide a time delay so that the "echoes" can be interpreted. Variables which can affect the operation Of ultrasonic sensing include, target surface angle, reflective surface roughness or changes in temperature or humidity. The targets can have any kind of reflective form - even round objects.

2.2 Measurement principle and effective use Of Ultra Sonic Sensor

Ultrasonic Sensor transmits ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an Object. Basically, in our project ultrasonic sensor ranges of about 2 centimetres to I metre. By measuring the length of time from the transmission to rec•eption Of the sonic wave, it detects the position Of the object. The ultrasonic transducer produces ultrasonic signal. These signals are propagated through a sensing medium and the same transducer can be used to detect returning signals. In most applications, the sensing medium is simply air, An ultrasonic sensor typically comprises at least one ultrasonic transducer

Which transforms electrical energy into sound and in reverse sound into electrical energy, a housing enclosing the ultrasonic transducer, an electrical connection and optionally, an electronic unit for signal processing also enclosed in the housing.

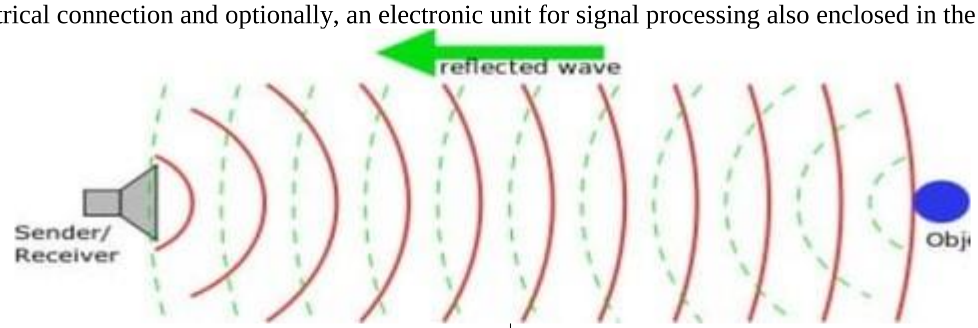

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Figure 8- Basic Ultrasonic operation

2.3 Advantages or Ultrasonic Sensors

Ultrasonic have a lot of advantages for using in real application. The advantages Ofultrasonic sensor are:

- Discrete distances to moving Objects can be detected and measured. Less affected by target materials and surfaces, and not affected by colour. Solid-state units have virtually unlimited, maintenance free life. Ultrasonic can detect small Objects over long operating distances.
- Resistance to external disturbances such as vibration, infrared radiation, ambient noise, and EMI (Electro Magnetic Interference) radiation.
- Measures and detects distances to moving objects.
- Impervious to target materials, surface and colour.
- Solid-state units have virtually unlimited, maintenance free lifespan.
- Detects small Objects over long operating distance.
- Ultrasonic sensors are not affected by dust, dirt or high moisture environments.

2.4 Disadvantages of Ultrasonic Sensors

Some disadvantages of ultrasonic sensor are:

- Overheating of a wave emitter precludes the energy of ultrasonic waves emitted there from being enhanced to a practical level.
- Interference between the projected waves and the reflected waves takes place, and development Of standing waves provides adverse effects.
- It is impossible to discern between reflected waves from the road surface and reflected waves from other places or objects.

2.5 **Target Angle and Beam Spread**

This term refers to the "tilt response" limitations of a given sensor. Since ultrasonic sound waves reflect off the target Object, target angles indicate acceptable amounts of tilt for a given sensor.

This term is defined as the area in Which a round wand Will be sensed if passed through the target area, This is the maximum spreading of the ultrasonic sound as it leaves the transducer.

2.6 **Effect Of Environmental factors on Ultrasonic sensor**

There are many factors present in the environment which can affect the working Of ultrasonic sensor. They are:

2.6.1 **Temperature**

The velocity Of sound in air is 13,044 inches's at O ºc, it is directly proportional to air temperature. As the ambient air temperature increases. the speed of sound also increases. Therefore if a fixed target produces an echo after a certain time delay, and if the temperature drops, the measured time for the echo to return increases, even though the target has not moved. This happens because the speed of sound decreases, returning an echo more slowly than at the previous, warmer temperature. If varying ambient temperatures are expected in a specific application, compensation in the system for the change in sound speed is recommended.

2.6.2 **Air Turbulence and Convection current**

A particular temperature problem is posed by convection Currents that contain many bands of varying temperature. If these bands pass between the sensor and the target, they will abruptly change the speed Of sound while present. NO type Of temperature compensation (either temperature measurement or reference target) Will provide complete high-resolution correction at all times under these circumstances. In some applications it may be desirable to install shielding around the sound beam to reduce or eliminate variations due to convection currents. Averaging the return times from a number ofechoes will also help to reduce the random effect ofconvection.

2.6.**3 Atmospheric pressure**

Normal changes in atmospheric pressure will have little effect on measurement accuracy. Reliable operation Will deteriorates however, in areas Of unusually low air pressure, approaching a vacuum.

2.6.4 Humidity
Humidity does not significantly affect the operation of an ultrasonic measuring system. Changes in humidity do have a slight effect, however, on the absorption of sound. If the humidity produces condensation, sensors designed to operate when "ret must be used.
2.6.S Acoustic Interference
Special consideration must be given to environments that contain background noise in the ultrasonic frequency spectrum. For example, air forced through a nozzle, such as air jets used for cleaning machines, generates a whistling sound with harmonies in the ultrasonic range. When in close proximity to a sensor, whether directed at the sensor or not, ultrasonic noise at or around the sensor's frequency may affect system operation. Typically, the level of background noise is lower at higher frequencies, and narrower beam angles work best in areas with a high ultrasonic background noise level. Often a bame around the noise Source Will eliminate the problem. Because each application differs, testing for interference is suggested.
2.7 Sensor's Target Considerations
For detecting a target, the ultrasonic sensor takes into consideration the various properties ofthe target. •ntey are:
2.7.1 Composition
Nearly all targets reflect ultrasonic sound and therefore produce an echo that can bc detected. Some textured materials produce a weaker echo, reducing the maximum effective sensing range. The reflectivity Of an Object is Often a function Of frequency. Lower frequencies can have reduced reflections from some porous targets, While higher frequencies reflect well from most target materials. Precise performance specifications can often be determined only through experimentation.
2.7.2 Shape
A target of virtually any shape can be detected ultrasonically if sufficient echo returns to the sensor. Targets that are smooth, fiat, and perpendicular to the sensor's beam produce stronger echoes than irregularly shaped targets. A larger target relative to sound wavelength Will produce a stronger echo than a smalle•r target until the target is larger than approximately 10 wavelengths across. Therefore, smaller targets are better detected With higher frequency sound. In Some applications a specific target shape such as a sphere, cylinder, or internal cube corner can solve alignment problems between the sensor and the target.
2.73 Target Orientation
To produce the strongest echoes. the sensors beam should be pointed toward the target. If a smooth, flat target is inclined Off perpendicular, some Of the echo is deflected away from the sensor and the strength of the echo is reduced. Targets that arc smaller than the spot diameter of the transducer beam can usually be inclined more than larger targets. Sensors With larger beam angles Will generally produce stronger echoes from nat targets that are not perpendicular to the axis of the sound beam. Sound waves striking a target With a coarse, irregular surface Will diffuse and reflect in many directions. Some of the reflected energy may return to the sensor as a weak but measurable echo. As always, target suitability must be evaluated for each application.
2.8 DC gear motor
Geared DC motors can be defined as an extension Of DC motor which already had its insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed Of motor is counted in terms Of rotations Of the Shan per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination Of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed ofthe vehicle but increase its torque is known as gear reduction. This insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.
DC Gear motor is also called DC Geared Motor, Geared Dc Motor and gear head motor or gearbox motor. It consists of a electric DC motor and a gearbox or gear head: these gear heads are used to reduce the DC motor speed. While increase the DC motor torque. Therefore user can get lower speed and higher torque from gear motor.
2.8.1 Applications
l) Home Appliance
2) OtT1ce Automation
3) Robotics: Robotics arm, ears, Robotic toy, Teaching Robotics, etc
4)Sanitary Automations: Pap-errrowcl Dispensers, Soap dispenser, Air Freshener Dispenser, Toilet Lid opener, Seat-Changer, Sensor Sanitary Bin, Feminine Hygiene...
5) Safe and Security: electronic lock, door lock, safe, door locker. latch closer
6) Coffee Machine and Coffee Make, Coffee Bean grinder
7) Vending Machine: Beverage vending, hot and cold drink dispenser. Juicer Maker 8) Bank Automation: ATM, Coin Counter, Coin Selector, Coin Validator, Bank notc counter
9) Automotive
10) Electric Valve, Gas Meter, Water Meter
I l) Electric Curtain and Blinds, etc.

2.9 **Servo Operation**
The servo motor has some control circuits and a potentiometer (a variable resistor) that is connected to the output shaft. In the picture above, the pot can be seen on the right side of the circuit board. This pot allows the control circuitry to monitor the current angle Of the servo motor. If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor to the Correct prototype direction until the angle is correct. The output shaft Of the servo is capable Of travelling somewhere around 180 degrees. Usually, it is somewhere in the 210 degree range, but it varies by manufacturer. A normal servo is used to control an angular motion Of between O and 180 degrees. A normal servo is mechanically not capable of turning any farther due to a mechanical stop built on to the main output

The amount of power applied to the motor is proportional to the distance it needs to travel. So, if the shaft needs to turn a large distance, the motor will run at full speed. If it needs to turn only a small amount, the motor Will run at a slower speed.
This is called proportional control.
The control Wire is used to communicate the angle. The angle is determined by the duration of a pulse that is applied to the control wire. This is called pulse Coded Modulation. The seno expects to see a pulse every 20 milliseconds (0.02 seconds). The length Of the pulse Will determine how far the motor turns. A 1.5 millisecond pulse, for example, will make the motor turn to the 90 degree position (Often called the neutral position). If the pulse is shorter than 1.5 millisecond, then the motor will tum the shaft to closer to O degrees. If the pulse is longer than 1.5ms, the shaft turns closer to 180 degrees.

From the figure above, the duration Of the pulse dictates the angle Of the output shaft (shown as the blue circle With the arrow). Note that the times here are illustrative and the actual timings depend on the motor manufacturer. The principle, however, is the same.
2.10 Arduino UNO R3
Arduino is a software company, project, and user community that designs and manufactures computer open-source hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

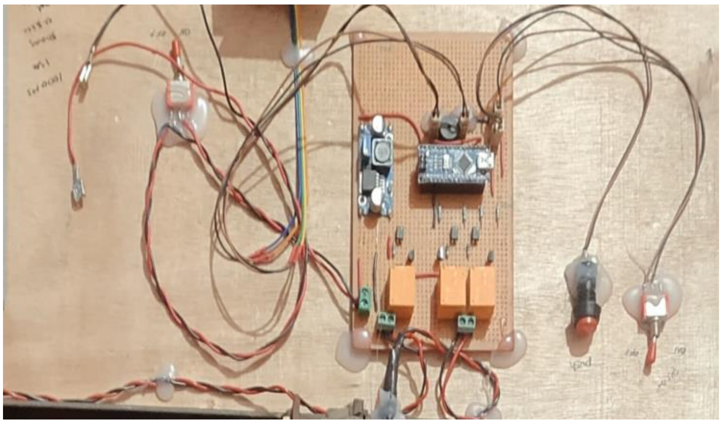
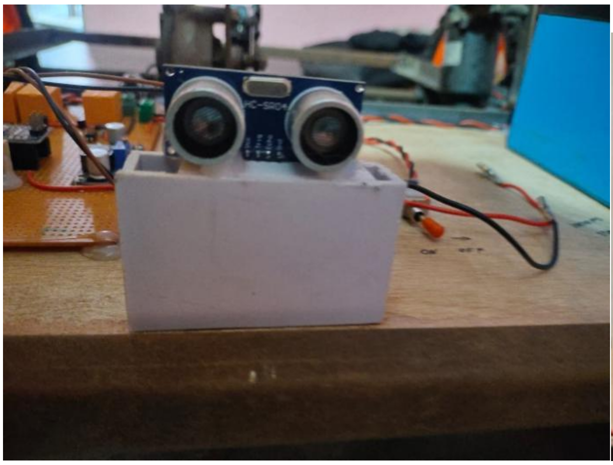


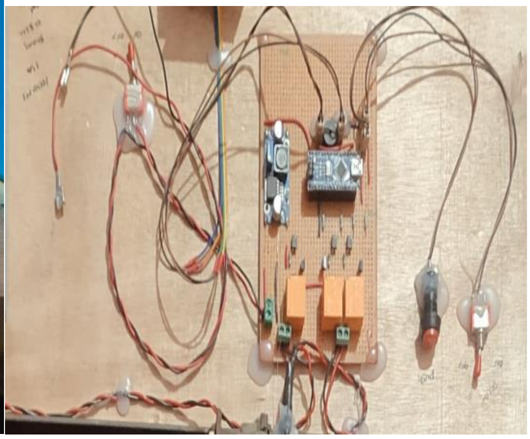
Fig 8- Arduino UNO R3

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets Of digital and Analog I/O pins that can interface to various expansion boards (termed shields) and
Other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named processing, which also supports the languages C and C++.
The first Arduino was introduced in 2005, aiming to provide a IOW cost, easy way for novices and professionals to create devices that interact with their environment using sensor and actuators. Common examples Of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors. Arduino UNO R3 boards are available commercially in preassembled form, or as do-it-yourself kits. The hardware design specifications are openly available, allowing the Arduino boards to be produced by anyone.
Arduino is a tool for making computers that can sense and control more Of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.
Massimo Banzi helped invent the Arduino, a tiny, easy-to-use open-source microcontroller that's inspired thousands of people around the world to make the coolest things they can imagine. Because, as he says, "You don't need anyone's permission to make something great".
A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. The Arduino Uno R3 is a microcontroller board which has 14 digital input/output pins (Of which 6 can be used as PWM outputs and 6 Can be used as analog inputs).
In fact, the Arduino language is merely a set ofC/C++ functions that can be called from your code. The microcontroller shield is using as L293d Motor Drive Shield is a circuit board that uses a set Of pins to connect directly to some of the pins on the microcontroller. A shield is an easy way to connect all of your external components together. You can use shields to control motors, relays, LEDs, or anything

Chapter 3
Experimental Procedure
Buying the apparatus
Firstly we have bought the required items from the nearby electronic and hardware shops. The materials we bought from the electronic shops are Ultrasonic sensor, Arduino nano, DC Motor, 12v 7ah Battery, wires two meters , gum, switches two. Later we have bought the hardware components required for our project from the nearby areas. The items we bought are 12 inch bicycle

wheel four in quantity, 18 teeth free wheel two, bicycle chain one, 12 mm Thread rod two meters, four nuts of twenty in size, brake lever one, brake wire one feet, two meters iron rods





Ultrasonic sensor

Arudino Unio Board

DC motor 12v 7ah Battery

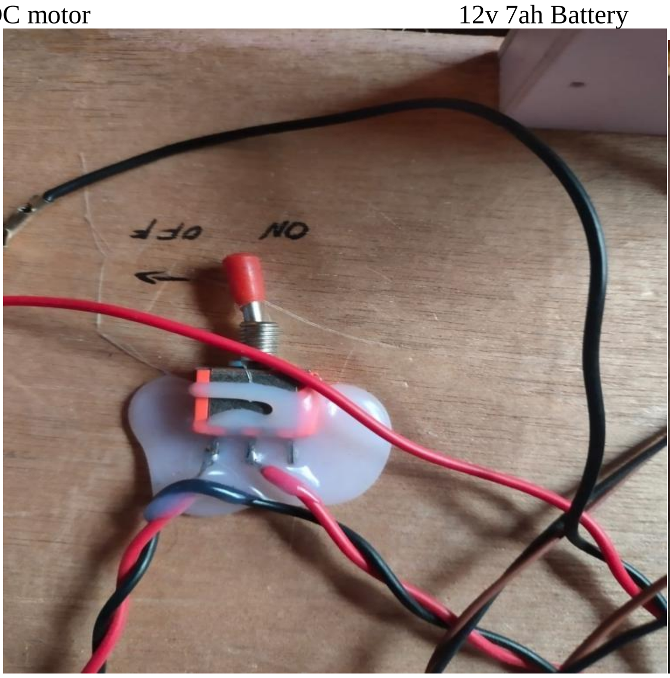


Fig 9- switch fig10-12mm bicycle wheel

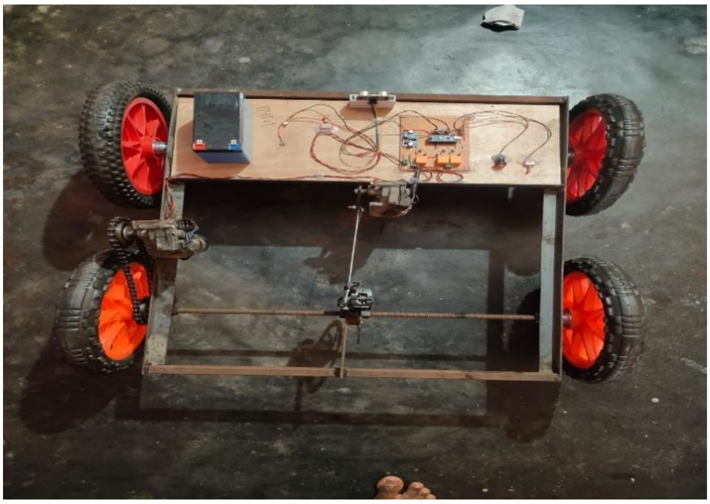
Fig11 -18 teeth free wheel fig12-12 mm Thread rod

Hardware works

After buying all the materials from the nearby shops then we went to the hardware shops and started to cut, grind and weld the metal rods into our required size. We have cut the metal into two pieces of 2 feet dimensions and 2 pieces of 3 feet dimensions. After that now we have welded the metal pieces into the rectangle shape by welding the 4 pieces where the length is 3 feet and the breadth is 2 feet. Now we have bought a thread rod and connected the two thread rods in the rear and front such that the two wheels of the rear and the front are connected to each other. For the rear thread rod the bearings have been fit on both the sides and to the bearings we have fit the two wheels on the rear end. Now the procedure has been followed to the front wheels as well. We have taken the DC motor and welded a 18 teeth free wheel to the motor, another 18 teeth free wheel has been welded to the rear wheel. These two 18 teeth free wheels have been connected through the bicycle chain such that while the motor rotates then along with it the rear wheels also rotate. To the rear thread rod we have fit an 160 mm disk break set, The break disk is in connection with the another dc motor which acts as a connection such that the electrical response gets converted into the braking push. In the front side we have set up an wood board to set up the circuit on it.

Circuits Connection

Now the circuits work has started, as we have bought the required equipments, then we first started to program the required code to the Arduino and then the ultrasonic sensor has been connected to the Arduino with the wires and then the Arduino has been fixed with the gum steadily to the support, two switches have been connected to the Arduino. Now these two switches have been connected such that one is connected to
the battery for the power on/off and the other switch for the start and stop of the vehicle. Now after that we have connected the break lever to the Arduino and from Arduino to the dc motor, as soon as the dc motor receives the signal from the Arduino the dc motor applies the breaks.



over all circuit

CHAPTER 4
SENSING AND CONTROLLING

The Sensing and Controlling unit, is that part Of this system which senses the object or obstruction in front of the car, measures the distance and the approaching velocity and then sends necessary signals to the servo motor and hence to the Automatic Braking Unit. Its components consist of Arduino as a microcontroller, Servo motor, Ultrasonic Transducer and a power source to keep the system running. The Arduino is coded by a software called Arduino 1.6, a language promoted by the Company of the same name, which acts as a free source coding, just like Android.

4.1 Components Of Sensing and Controlling Unit (SCU)
4.1.1 Arduino Uno R3
The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 Analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable Or power it with a *NC-to-DC adapter or battery to get started. You can tinker With your UNO Without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and Start o ver again.
"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.(). The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions Of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.
The structure of Arduino is its disadvantage as well. During building a project you have to make its size as small as possible. But With the big structures Of Arduino we have to stick With big sized PCB's, If you are working on a small micro-controller like ATmegaS you can easily make your PCB as small as possible.

Brand name	Arduino
Height	25 Millimetres
Width	5.5 Centimetres
Weight	91 Grams
	8 x 5.5 x 2.5 Centimetres
RAM Siae	
Voltage	5 Volts
Digital Pins	14

Table 3.1 Technical Specification of Arduino Uno

The Arduino Uno can he powered via the USB connection or With an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-tO-DC adapter (walÄvart) or battery. The adapter can be connected by plugging a 2. I mm centre-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and VIN pin headers Of the POWER connector.
The board can operate On an external supply Of 6 to 20 volts. Ifsupplied With less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board, The recommended range is 7 to 12 volts.
The power pins are as follows:
- VIN: The input voltage to the Arduino board When it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the powerjack, access it through this pin.
- 5'v': The regulated power supply used to power the microcontroller and Other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- 3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND: Ground pins.

Each ofthe 14 digital pins on the Uno can be used as an input or output. They operate at S volts. Each pin can provide or receive a maximum Of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 In addition, some pins have specialized functions:
- Serial: O (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TH. serial data. These pins arc connected to the corresponding pins of the ATmegaSU2 USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a IOW value, a rising or falling edge, or a change in value. See the attachlnterrupt( ) function for details.
- PWM: 3, 5, 6, 9, 10, and J I. Provide 8•bit PWM output with the analogWrite( ) function.
- SPI•. 10 (SS), 1 1 (MOS'), 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.
4.1.2 Transducer Ultrasonic

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.

Fig 13-ransducer Ultrasonic

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.

Ultrasonic probes and ultrasonic baths are used to apply sound energy to agitate particles in a wide range of laboratory applications. An ultrasonic transducer is a device that converts AC into ultrasound, as w'ell as the reverse, sound into AC. In ultrasonic, the term typically refers to piezoelectric transducers or capacitive transducers. Piezoelectric crystals change size and shape When a voltage is applied; AC voltage makes them oscillate at the same frequency and produce ultrasonic sound. Capacitive transducers use electrostatic fields between a conductive diaphragm and a backing plate.

The beam pattern of a transducer can be determined by the active transducer area and shape, the ultrasound wavelength, and the sound velocity of the propagation medium. The diagrams show the sound fields of an unfocused and a focusing ultrasonic transducer in water, plainly at differing energy levels.

Since piezoelectric materials generate a voltage When force is applied to them, they can also work as ultrasonic detectors. Some systems use separate transmitters and receivers, While others combine both functions into a single piezoelectric transceiver.

Ultrasound transmitters can also use non-piezoelectric principles such as magneto-striction. Materials With this property change size slightly When exposed to a magnetic field, and make practical transducers.

A capacitor ("condenser") microphone has a thin diaphragm that responds to ultrasound waves. Changes in the electric field between the diaphragm and a closely spaced backing plate convert sound signals to electric currents, Which can be amplified.

Ultrasonic sensors are Widely used in cars as parking sensors to aid the driver in reversing into parking spaces. They are being tested for a number of other automotive uses including ultrasonic people detection and assisting in autonomous UAV navigation.

(a)

Fig 14- Ultrasonic Transducer HC-SR04 (Front and Back view)

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

The basic principle Ofwork:

- Using 10 trigger for at least Ous high level signal,
- The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- IF the signal back, through high level , time Of high output 10 duration is the time from sending ultrasonic to returning. Test distance (high level time • velocity ofsound (340MfS) / 2.

Wire connecting direct as following:

- SV Supply
- Trigger Pulse Input
- Echo Pulse Output
- OV Ground

Working Voltage	
Working Current	15mA
Working Frequency	40Hz
Max Range	
Min Range	
Measuring Angle	15 degree
Trigger Input Signal	Ious pulse
Echo Output Signal	Input TTL lever signal and the range in proportion
Dimension	45 x 20 x

Table 3.2 Specification of Ultrasonic Transducer

Timing Diagram

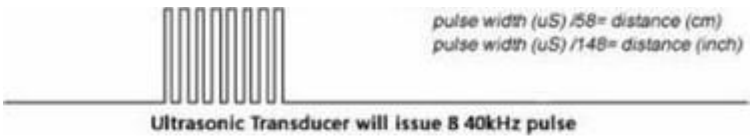
The Timing diagram is shown below. You only need to supply a short I OuS
pulse to the trigger input to start the ranging, and then the module will send out an 8
cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse Width and the range in proportion
Nou can calculate the range through the time interval between sending trigger signal and receiving echo signal.
Formula:
µS/ 58 centimetres or "S / 148 •inch;
Or
The range — high level time • velocity (340M/S) / 2

It is always cycle, in order signal to the suggested to use over 60ms measurement to prcwent trigger echo signal.

pulse width corre (about iSOuS•2Sms. no obstad•)

Initiate Echo back

Signal



Internal

Fig 15- Ultrasonic Transducer HC-SR04 (Front and Back view)

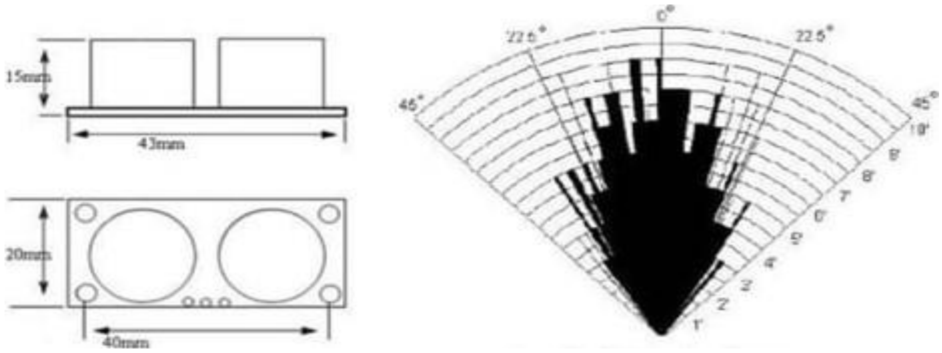


Fig 16- Best in 30 degree angle practical test Of performance

4.1.3 DC gear motor

DC geared motors are essentially a DC shunt motor which has been specially designed for IOW inertia, symmetrical rotation and smooth low-speed characteristics. Geared motor is a motor with a closed feedback system in which the position of the motor Will be communicated back to the control circuit in the motors. Geared motors are formed from four ditTerent elements: a DC motor, a position-sensing device (a potentiometer), a gear reducing part and a control unit. All Of these :omponents work together to make the motor to accept control signals that represent the desired output of the motor shaft and power the DC motor until its shaft is turned to the right position. The shaft in geared motors doesn't rotate as freely as those in regular DC motors; it is only able to rotate around 200 degrees in both directions. The position sensing device in a geared motor determines the rotation Of the Shan and thus the way the motor needs to turn in order to arrive at the desired position. The sliding mode control is robust to plant uncertainties and insensitive to external disturbances. It is commonly used to get good dynamic performance of controllable systems. Even then, the chattering phenomena due to the finite speed of the switching devices can affect the system behaviour significantly. Besides, the sliding control needs the knowledge of mathematical model of the system with bounded uncertainties. Reduced chattering may be achieved without sacrificing robust performance by combining the attractive features of fuzzy control with SMC.

Length	8Omm
Volts	
Stall Torque	12kg-cm
Speed	1200rpm
Shaft Diameter	6mm
Weight	281g

Table 33 Specifications Of DC gear motor

4.1.4 Servo Motor

A servo system mainly consists Of three basic components - a controlled device, a output sensor, a feedback system. This is an automatic closed loop control system. Here instead Of controlling a dewiee by applying the variable input signal, the device is controlled by a feedback signal generated by comparing output signal and reference input signal. When reference input signal or command signal is applied to the system, it is compared with output reference signal of the system produced by output sensor, and a third signal produced by a feedback system.

This third signal acts as an input signal Of controlled device. This input signal to the device presents as long as there is a logical difference between reference input signal and the output signal Of the system. After the device achieves its desired output, there will be no longer the logical difference between reference input signal and reference output signal Of the system. Then, the third signal produced by comparing theses above said signals will not remain enough to operate the device further and to produce a further output Of the system until the next reference input signal or command signal is applied to the system. Hence, the primary task Of a servomechanism is to maintain the output of a system at the desired value in the presence Of disturbances.

A servo motor is basically a DC motor (in some special cases it is AC motor) along with some Other special purpose comm3nents that make a DC motor a servo. In a servo unit, you will find a small DC motor, a potentiometer. gear arrangement and an intelligent circuitry. The intelligent circuitry along with the potentiometer makes the servo to rotate according to our wishes. As we know, a small DC motor Will rotate with high speed but the torque generated by its rotation will not be enough to move even a light load. This is where the gear system inside a servomechanism comes into the picture. The gear mechanism will take high input speed of the motor (fast) and at the output, we will get an output speed Which is slower than original input speed but more practical and Widely applicable.

The output shaft of servomotor SG 90 is capable of travelling some.vhcrc around 180 degrees. A normal servomotor is used to control an angular motion between O and 180 degrees, and it is mechanically not capable of turning any farther due to a mechanical Stop built on to the main output gear. The angle through Which the output shaft of the servomotor need to travel is determined according to the nature Of the signal given to the motor as input from the PIC microcontroller. Due to rotation of servomotor in 180 degrees, the brakes can be applied and released through given brakes mechanism.

Fig Servomotor

Weight	9 gram
Gear Type	Plastic
Operating speed	O. 12second/ 60degree
Operating voltage	(3.0-7.2)V
Angle of rotation	(O- 180) degrees

Table 3.4 Specifications of servomotor

4.IS Arduino 1.6 software

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mae OS X, and Linux. The environment is written in Java and based on processing and other open-source software.

This software can be used With any Arduino board.

The developed program for success of our project as follows:

```
:Servo.h> // I  *include // Includes servo library.
                #include // Includes SR-04 Sensor Library.
:Ultrasonic.h>  Ultrasonic   ıltrasonic(A0,A1);I // (Trig PIN,EchO PIN)
Servo servo l;   // Creating Servo object.
// declaring Motor Shield int dataPin 8; int latchPin 12; int clockPin 4; int en = 7;
D Variable to store distance int left d 20; int right_d O; int front d O; int max_d 50; // Max distance to obstacle void setup()
// setting    up shield.
     pinMode(dataPin, OUTPUT); pinMode(latchPin, OUTPUT); pinMode(c10ckPin, OUTPUT); pinMode(en,
     OUTPUT); digitalWrite(cn, LOW);
     servo_1.attach(10);// Attaching ser,'o to Pin No-IO servo_ I.write(90); // Initial position delay(350);
void     loop()
front_d  ultrasonic.Ranging(CM); // measuring fornt distance if (front_d < max_d)
halt().,
iflright_d >   max_d)
delay(400);
forward();

}

else if ( left

{        left_d > max_d)
delay(400); forward();
else backward(); delay (500); halt();
else t forward()•,
void orward(void){ // function for forward movement.
digitalWritc(IatchPin, LOW); shiftOut(dataPin, clockPin, LSBFIRST, 3); digitalW'rite(latchPin, HIGH);
void ackward(void){ // function for backward movement.
```

digitalWrite(latchPin, LOW); shiftOut(dataPin, clockPin, LSBFIRST, 164); digitalWrite(IatchPin, HIGH)•,
void halt(void) // function for stopping robot.
digitalWrite(latchPin, LOW); shifiOut(dataPin, clockPin, LSBFIRST, 32); digitalWrite(latchPin, HIGH);
void !et_d(void) // ruction to get distances.
servo_l.write(180); // Right Position delay(3000)•, right_d ultrasonic.Ranging(CM); servo_ I .wTite(O); // Front positon delay(500); front_d ultrasonic.Ranging(CM); servo_l .write(O); // Left position ofservo delay(500); left_d = ultrasonic.Ranging(CM); servo_l. // back to front
d」 ay(250);

CHAPTER 5

5.1 **Result**

As a result of this automatic braking system, the function of each part is working well and the Whole system is successfully accomplished. The safety distance is determined then the vehicle system is braked when the obstacle is detected. The ranging accuracy of ultrasonic sensor in this prototype is about 2cm to 1m and works effectively within the prescribed limit.

4.2 Final Overview of Project

In this project, we have cheeked the working Of our project, we connected it with a batteries and whose braking system is controlled by a DC gear motor and servomotor. This technique is eco-friendly and 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. Also the system stopped automatically in restricted areas. It gave very accurate measurement according to limit of values interpreted.

CONCLUSION

We have successfully completed the fabrication of automatic braking system model prototype and this project presents the implementation Of an Automatic Braking System for Forward Collision Avoidance, intended to use in vehicles where the drivers may not brake manually, but the speed Of the vehicle can be reduced automatically due to the sensing of the obstacles.

It reduces the accident levels and tends to save the lives Of so many people. By doing this project practically we gained the knowledge about working Of automatic braking system and With this future study and research, we hope to develop the system into an even more advanced speed control system for automobile safety, While realizing that this certainly requires tons of work and learning, like the programming and operation of microcontrollers and the automobile structure.

Hence we believe that the incorporation Of all components in Automatic Braking System will maximize safety and also give such system a bigger market space and a competitive edge in the market.

FUTURE SCOPE

The future scope is to design and develop a control system based on an automotive braking system is called "Automatic Braking System". The Automatic Braking System With ultrasonic sensor would alert the driver When the distance between vehicle and obstacle is in within the sensing range zone then the brakes are applied. This is the new function in this prototype design that could be possibly used for all the vehicles. By making it safer, this system Will provide better guarantee for vehicle's safety and avoid losses. Therefore, the safety system of vehicles will be developed and may have more market demands.

It can be further used for large type Of heavy vehicles like buses, trucks, cranes, tractors, etc. We can surely get the information about the obstacle detection sense zone according to vehicle condition. It is verily useful to public sector and users. It is also avoids the accidents in large or metropolitan cities. so we feel it is a better idea for automatically braking of vehicle with moderate cost.

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