‘AUTOMATIC ACCIDENT AVOIDING SYSTEM FOR FOUR-WHEELERS’

A Project report

Submitted in partial fulfillment for the

Award of the degree of

BACHELOR OF TECHNOLOGY

In

MECHANICAL ENGINEERING

Submitted by

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DECLARATION

We hereby declare that we are **Students of Mechanical Engineering, IIMT, Ghaziabad.** We are working on a project under the guidance of **Mr. M.K. Poddar.** Further, this work has been submitted in partial fulfilment for degree of the Bachelor of Technology that the studies described in this report entitled "**AUTOMATIC ACCIDENT AVOIDING SYSTEM FOR FOUR-WHEELERS (BUMPER CAR)"** in subject Mechanical engineering is carried out by

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ABSTRACT

The aim is to design and develop a control system based intelligent electronically controlled automotive bumper activation and automatic braking system called AUTOMATIC ACCIDENT AVOIDING SYSTEM FOR FOUR-WHEELERS (BUMPER CAR). This project consists of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system and pneumatic braking system. The IR sensor senses the obstacle. There is any obstacle closer to the vehicle, the control signal is given to the bumper activation system and also pneumatic braking system simultaneously. The pneumatic bumper and braking system is used to product the man and vehicle.

Some of the automotive manufacturers already use shock absorption system that consist passive damper located between the bumper and the vehicle chassis. However, by using this system most of the force will be dissipate by transmitting all the impact energy through the compression of the damper and the remaining force will be transferred to the vehicle chassis. This system normally has very high static damping coefficient and cannot dissipate higher speed collision force. In this project, dampers were used to provide dynamic damping coefficient and reduced the crash impact and lowering the transmission of the remaining force to the vehicle body.

The present work is an attempt to develop a concept to make a shock proof accident avoiding system which can meet out the requirement of safe journey. Working principle of this concept is bit different from the available type of machine with a difference of embedded mechanism of the electronic sensor and mechanism of mechanical parts. The objective of bringing down the rate of accidents which are increasing day by day is almost achieved in present work within the limitation of work as mentioned.

NOMENCLATURE

Symbol	Description
D	Dia. of master cylinder
A	Cross-section area of master cylinder
d	Bore of pillar cylinder
a	Cross-section area of pillar cylinder
a_e	Equivalent cross-section area of pillar cylinder
L	Stroke length of master cylinder
l	Stroke length of pillar cylinder
T_{ps}	Torque produced at pinion shaft
T_{in}	Torque produced at gearbox input
F_{in}	Force produced by motor
r_m	Radius of motor gear
d_g	Effective dia. of gear
P_m	Motor power
f	Force exerted on the pillar piston
F	Master cylinder force
W	Work done by master cylinder
d_p	Dia. of pinion
L_e	Effective distance between pinion and motor shaft
Nm	Newton meter
Hp	Horsepower
rpm	Revolution per minute
ΔP	Hydrostatic pressure
ρ	Density of fluid
g	Acceleration due to gravity
Δh	Fluid depth from the surface
IMA	Mechanical advantage

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CHAPTER-1: INTRODUCTION

The population of our country has been increasing rapidly which indirectly increases the vehicle density and leads to many road accidents. The aim of the project in to minimize the road accidents which causes the loss of invaluable human life and other valuable goods. Safety is a necessary part of man's life. It is expected that if such a device is designed and incorporated into our cars as a road safety device, it will reduce the incidence of accidents on our roads and various premises, with subsequent reduction in loss of life and property. Over 1,37,000 people were killed in road accidents in 2013 alone, that is more than the number of people killed in all our wars put together. The obtained results show that high rate of accident is reported each year. One serious road accident in the country occurs every minute and 16 die on Indian roads every hour. 1214 road crashes occur every day in India. A lot of cases reported is as a result of drivers sleeping off while driving, and when he/she eventually woke up, a head-on collision might have taken place. Not many have had the fortune to quickly avert this. It is therefore imperative to consider the advantages of an early warning system where the driver is alerted of a possible collision with some considerable amount of time before it occurs.

The technology of pneumatics has gained tremendous importance in the field of workplace rationalization and automation from old-fashioned timber works and coal mines to modern machine shops and space robots. It is therefore important that technicians and engineers should have a good knowledge of pneumatic system, air operated valves and accessories. The aim is to design and develop a control system based an intelligent electronically controlled automotive "AUTOMATIC PNEUMATIC BUMPER" activation system is called This system consists of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system and braking system. The IR sensor is used to detect the obstacle. There is any obstacle closer to the vehicle, the control signal is given to the bumper activation system. The pneumatic bumper system is used to product the man and vehicle. This bumper activation system is only activated the vehicle speed above 40-50 km per hour. This vehicle speed is sensed by the proximity sensor and this signal is given to the control unit and pneumatic bumper activation system.

1.1 AIM OF OUR PROJECT:

- We have the objective to minimize the road accidents due to above mentioned facts in real time using embedded systems platform in low cost. In our project, we proposed few concepts to minimize the accidents due to violating rules and carelessness.
- The aim of the project is to minimize the road accidents which causes the loss of invaluable human life and other valuable goods.
- A lot of times, it is seen that the car when an accident occurs, the airbags protects the passenger but after that when it comes to the re-activation of airbags system, it becomes uneconomical for the owner, hence we are aiming for a system that can aim for users safety with keeping the users car pocket friendly.
- Our project includes two segments –
  - Automatic car braking system
  - Automatic bumper activation
  - Automatic Car Braking Activation system is first segment which gets activated since our foremost aim is to keep the driver and passengers safe.
  - After that the brakes gets activated, Bumper gets ejected so that minimal or no harm occurs to the car front components such as airbags system and other criticals components like engine, air conditioner, etc.

Fig 1.1: Automatic Accident Avoiding System

1.2 BACKGROUND RESEARCH:

Automotive safety is intentionally to avoid vehicle accident or reducing the effect of accident especially to the human body including the driver, passengers and pedestrians.

Moreover, some of the safety features are also purposely to reduce vehicle damages in order to minimize the repairing cost. Active safety in vehicle system uses the information of vehicle external environment and the system will response accordingly to the situation during the phase of pre-crash or during the crash event. This is will either avoid the crash from happen or increase the safety of the vehicle by reducing the crash effect. Passive safety in the other hand is a system that only works to prevent injury but not change the vehicle action in response to crash scenario. The examples of the passive safety are like airbag, crumple zone, seat belt and passive automotive bumper. A metal or plastic shell that is filled with a foam energy absorbing block of polypropylene or foam normally used in an automotive low-impact absorbing bumper construction, and is mounted to the vehicle on a relatively rigid beam. The kinetic energy from the collision will be absorbed by the foam energy absorbing material through the deformation of the bumper structure. Many researches have been made regarding to the bumper deformation characteristic and absorption capability. Usually the research is concentrating on the selection of the bumper material like aluminum and composites.

1.3 NEED FOR AUTOMATION:

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production.

For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate.

1.4 THEORY

1.4.1 IR SENSOR

A sensor is a transducer used to make a measurement of a physical variable. Any sensor requires calibration in order to be useful as a measuring device. Calibration is

the procedure by which the relationship between the measured variable and the converted output signal is established.

Care should be taken in the choice of sensory devices for particular tasks. The operating characteristics of each device should be closely matched to the task for which it is being utilized.

Different sensors can be used in different ways to sense same conditions and the same sensors can be used in different ways to sense different conditions.

1.4.2 TYPES OF SENSORS:

- **Passive sensors-** They detect the reflected or emitted electro-magnetic radiation from natural sources.
- **Active sensors-** They detect reflected responses from objects which are irradiated from artificially generated energy sources, such as radar.

IR TRANSMITTER:

The IR transmitting circuit is used in many projects. The IR transmitter sends 40 kHz (frequency can be adjusted) carrier under 555 timer control. IR carriers at around 40 kHz carrier frequencies are widely used in TV remote controlling and ICs for receiving these signals are quite easily available.

IR RECEIVER:

The transmitted signal reflected by the obstacle and the IR receiver circuit receives the signal and giving control signal to the control unit. The control unit activates the pneumatic braking system as well as the pneumatic bumper activation.

CHAPTER 2: LITERATURE SURVEY

2.1 LITERATURE REVIEW OF AUTOMATIC ACCIDENT AVOIDING SYSTEM

1. Miss.Katore Koshal P et al (2015) [1] investigated on automatic accident avoiding system and he has been fond that an intelligent vehicle system for accident prevention and making the world a much better and safe place to live. Passive Infra-red sensor is a reliable solution for detecting human or animals and this technique certainly can save lots of life. Pre-crash detection system must be equipped with combination of different sensors. Detecting humans or animals including obstacles will certainly give us a better solution to reduce the death of humans in road crash. We continuously scan for various parameters of car, such as engine temperature, speed, Gas, eyeblink and alcohol sensors. If the driver is found to have alcohol in the breath, it warns and then turns the buzzer is operated and hence possibility of accident is avoided. Also we have designed an eye blink sensor which continuously monitors the number of times the eye blinks, if the eye blinks count decreases that means the driver is sleepy, in that case a buzzer will operateor if in case an accident happenedthen by using impact sensors we are able to found out on which side the impact occurred.

2. T.U.Anand Santhosh Kumar et al (2013) [2] has been found that to efficiently avoid the collision of automobile vehicles and to provide a greatest security to the users in adverse or in bad weather conditions by using Collision Avoidance System (CAS). In bad weather conditions it is very hard to drive automobiles as smooth as in regular conditions. Generally most of the accidents are occurred due to this bad weather conditions only. Therefore in this paper we propose a systematic architecture to avoid the early accidents which are mostly possible due to bad weather conditions and as well as due to asynchronous speed among the vehicles. In our proposed method the relative speed and distance of all the vehicles around a particular vehicle is estimated using IR sensors and Ultrasonic sensors and based on those results the speed of that particular vehicle is controlled to avoid early collisions. Besides this facility we also provide an accident detection system which detects the accidents and by using GPS and GSM we send the information of the location of the accident place to the police station and relatives, which is most useful information to save the persons.

3. Anusha c et al.(2015) [3] proposes an intelligent collision avoidance system as a prototype, which avoids vehicle accidents and to provide a greatest security to the user

in adverse or bad weather condition. Here, Ultrasonic sensor and IR sensors placed in the car, where IR sensor is used to detect the lane and avoids accident in significant manner. The vehicle state information is obtained using Ultrasonic sensor, which will continuously track for any obstacle from front side. If the obstacle is detected then microcontroller will continuously compare the distance given byUltrasonic sensor. If the obstacle is closer to the car then the microcontroller will start applying the brake within the safe limit. The GSM provides warning message when the safety distance is reduced than safety limit. The overall system is controlled by ARM 7 and information is displayed on LCD. Index Terms— Collision Avoidance System, Ultrasonic Sensor, IR Sensor, GSM, ARM 7

2.2 PROJECT OBJECTIVES

The title of project work is **"AUTOMATIC ACCIDENT AVOIDING SYSTEM FOR FOUR-WHEELERS (BUMPER CAR)"**

- We have the objective to minimize the road accidents due to above mentioned facts in real time using embedded systems platform in low cost. In our project, we proposed few concepts to minimize the accidents due to violating rules and carelessness.
- The aim of the project is to minimize the road accidents which cause the loss of invaluable human life and other valuable goods.
- A lot of times, it is seen that the car when an accident occurs, the airbags protects the passenger but after that when it comes to the re-activation of airbags system, it becomes uneconomical for the owner, hence we are aiming for a system that can aim for users safety with keeping the users car pocket friendly.

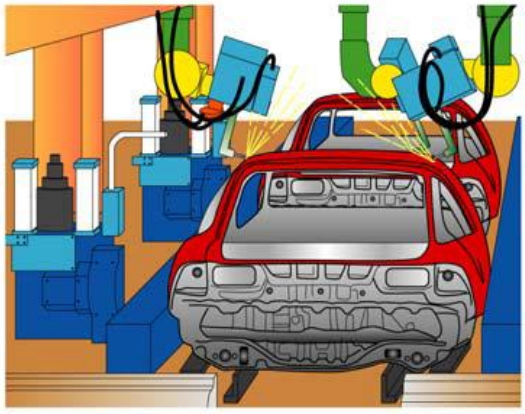
The objectives of the present work are:

- ❖ Study on automatic accident avoiding systems on the basis of safety & performance, economy, and applications.
- ❖ Design and construct a working model of automatic accident avoiding system for four-wheelers (bumper car)
- ❖ Cost analysis of automatic accident avoiding system for four-wheelers (bumper car) model.

CHAPTER- 3: PRINCIPLE OF PROJECT

3.1 PNEUMATIC SYSTEM

Our project works on the pneumatic system. The brakes and the bumper ejection system works on the pneumatic system. Pneumatic system is a system that uses compressed air to transmit and control energy. Pneumatic systems are used in controlling train doors, automatic production lines, mechanical clamps, etc.



(a) Automobile production lines (b) Pneumatic system of an automatic machine

Fig. 3.1 Common Pneumatic Systems Used in the Industrial Sector

3.2 THE ADVANTAGES OF PNEUMATIC SYSTEMS

Pneumatic control systems are widely used in our society, especially in the industrial sectors

for the driving of automatic machines. Pneumatic systems have a lot of advantages.

(I) High Effectiveness

Many factories have equipped their production lines with compressed air supplies and movable compressors. There is an unlimited supply of air in our atmosphere to produce

compressed air. Moreover, the use of compressed air is not restricted by distance, as it can easily be transported through pipes. After use, compressed air can be released directly into the atmosphere without the need of processing.

(II) High Durability and Reliability

Pneumatic components are extremely durable and cannot be damaged easily. Compared to electromotive components, pneumatic components are more durable and reliable.

(III) Simple Design

The designs of pneumatic components are relatively simple. They are thus more suitable for use in simple automatic control systems.

(IV) High Adaptability to Harsh Environment

Compared to the elements of other systems, compressed air is less affected by high temperature, dust, corrosion, etc.

(V) Safety

Pneumatic systems are safer than electromotive systems because they can work in inflammable environment without causing fire or explosion. Apart from that, overloading in pneumatic system will only lead to sliding or cessation of operation. Unlike electromotive components, pneumatic components do not burn or get overheated when overloaded.

(VI) Easy Selection of Speed and Pressure

The speeds of rectilinear and oscillating movement of pneumatic systems are easy to adjust and subject to few limitations. The pressure and the volume of air can easily be adjusted by a pressure regulator.

(VII) Environmental Friendly

The operation of pneumatic systems do not produce pollutants. The air released is also processed in special ways. Therefore, pneumatic systems can work in environments that demand high level of cleanliness. One example is the production lines of integrated circuits.

(VIII) Economical

As pneumatic components are not expensive, the costs of pneumatic systems are quite low. Moreover, as pneumatic systems are very durable, the cost of repair is significantly lower than that of other systems.

CHAPTER-4: COMPONENTS & MATERIAL SELECTION

In this chapter the Components or Hardware required to fabricate our project "AUTOMATIC ACCIDENT AVOIDING SYSTEM FOR FOUR-WHEELERS (BUMPER CAR)" are given. This chapter also tabulated with detailed information of components with their specification, quantity and cost.

4.1 COMPONENTS REQUIREMENT

1. Mild Steel Frame
2. Battery
3. DC Motor
4. Disk Brake
5. PCB
6. Solenoid Valve
7. Compressor
8. Connecting Pipes
9. T-joint
10. Switches
11. Double acting cylinder
12. Wheels
13. Sprocket
14. Bearing
15. Chain
16. Axles
17. Bearings
18. Nut and Bolts
19. IR sensor circuit
20. Sliding channel
21. Relays

S.No.	Component	Specifications	Quantity
1	Structural components		
	(a) Mild Steel Frame	700mmX50mmX20mm; 250mmX50mmX20mm	4;8
	(b) Bumper	45mmX20mm	1
2	Battery	12v, 7.2amp	2
3	DC motor	12v,6amp, 38-53RPM	1
4	Disk Brake	160 mm	1
5	PCB	76.2mmX50.8mm	1
6	Solenoid Valve	12v	1
7	Compressor	12v,15amp,1.02MPa	1
8	Connecting Pipes	6mm	3
9	Switch	16 amp.	1
10	Double acting cylinder		
	(a) For Bumper	16cm, 1.5 to 8 MPa Pressure	1
	(b) For Brakes	12cm, 0.1 to 0.7MPa Pressure	1
11	Wheels	Φ 203.2 mm	4
12	Sprocket	Φ 80 mm	2
13	Bearing	608	1
14	Chain	720mm	1
15	Axle	Φ 12mm	2

16	Bearing	620-Z	4
17	Nut and Bolts	11mm	4
18	IR Sensor	IO Interface: 4-pin Detection range = 1-140mm	1
19	Sliding Channel	L=270mm; W= 40mm	2
20	Relays	12v	2

Table 4.1 Components Required

4.2 COMPONENTS DETAILS

4.2.1 COMPRESSOR

A compressor can compress air to the required pressures. It can convert the mechanical energy from motors and engines into the potential energy in compressed air (Fig.4.1). A single central compressor can supply various pneumatic components with compressed air, which is transported through pipes from the cylinder to the pneumatic components. Compressors can be divided into two classes: reciprocating and rotary.

Fig. 4.1 Compressor

4.2.2 DOUBLE ACTING CYLINDER

In a double acting cylinder, air pressure is applied alternately to the relative surface of the piston, producing a propelling force and a retracting force (Fig. 6). As the effective area of the piston is small, the thrust produced during retraction is relatively weak. The impeccable tubes of double acting cylinders are usually made of steel. The working surfaces are also polished and coated with chromium to reduce friction.

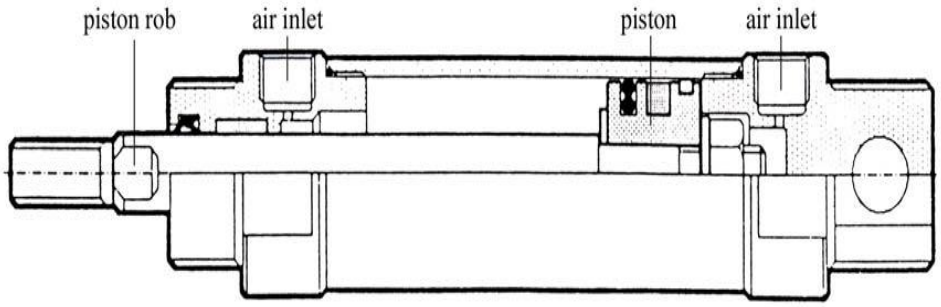


Fig. 4.2 Double Acting Cylinder

4.2.3 MOTOR

The modern DC motor was invented by accident in 1873, when Zénobe Gramm connected a spinning dynamo to a second similar unit, driving it as a motor.The classic DC motor has a rotating armature in the form of an electromagnet. A rotary switch called a commutator reverses the direction of the electric current twice every cycle, to flow through the armature so that the poles of the electromagnet push and pull against the permanent magnets on the outside of the motor. As the poles of the armature electromagnet pass the poles of the permanent magnets, the commutator reverses the polarity of the armature electromagnet. During that instant of switching polarity, inertia

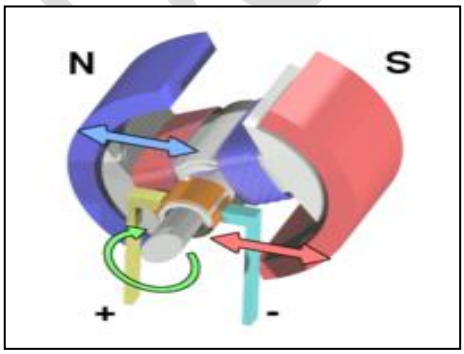


Fig. 4.3a Rotation of Armature w.r.t. Stator

the proper direction.

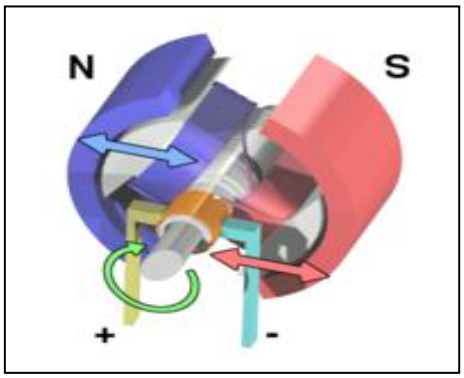


Fig. 4.3b Rotation of Armature w.r.t. Stator

In a simple DC electric motor, When the coil is powered, a magnetic field is generated around the armature. The left side of the armature is pushed away from the left magnet and drawn toward the right, causing rotation.

The armature continues to rotate. When the armature becomes horizontally aligned, the commutator reverses the direction of current through the coil, reversing the magnetic field. The process then repeats.

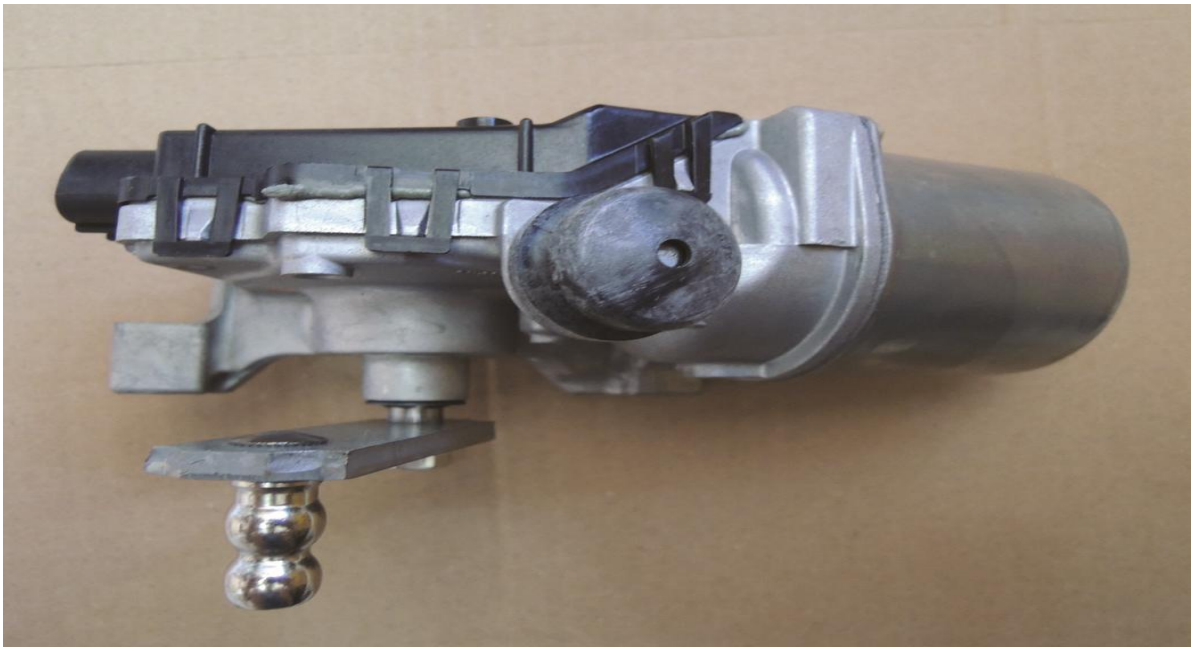


Fig. 4.4 12V DC Motor used in project

Motor specifications:

Related voltage	DC 12V	Test voltage: DC 13.5V
No-load current	Low speed: ≤2.5A	High speed:<3.0A
No-load speed	Low speed:45±5rpm	High speed:<65±5rpm
Related current	Low speed:<3.5A	High speed:<5.5A
Rated speed	Low speed:40±5rpm	High speed:60±5rpm
Noise	Low speed: ≤55 Db	High speed: ≤65 Db
Rated torque	≥5.5 Nm	
Locked-rotor current	≤18A	Locked-rotor torque: ≥20 Nm

Table. 4.2 Specification of Motor

4.2.4 MECHANICAL DISK BRAKE

Mechanical discs use the same cables and housing found on traditional cantilevers and V-brakes. Cables offer certain advantages over hydraulic systems, including simpler installation and adjustment, lighter weight, and less complicated maintenance (cables can be found at any bike shop and are less expensive than hydraulic lines).

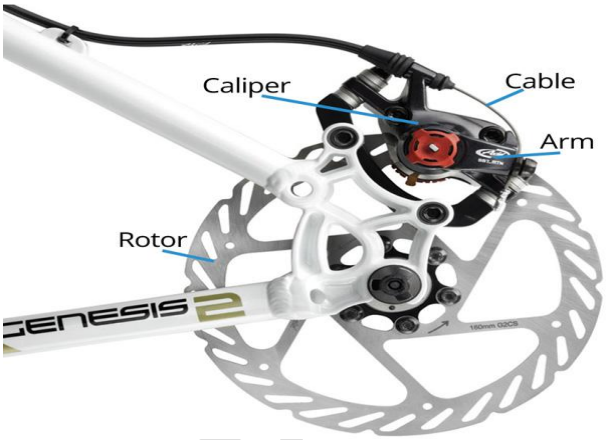


Fig 4.5 Disc Brake

The main drawback to mechanical brakes is cable stretch, which causes a spongy feel, reduces brakin frequent adjustment. Cables and housing are also susceptible to rust, dirt, and debris build-up that can bind the braking system. These problems are completely avoidable though. And the basic maintenance tips that we offer here will keep your mechanical discs strong and reliable.

4.2.5 BATTERY

A lead acid battery is a secondary cell, meaning that it is rechargeable. It is very common in cars and trucks. It contains plates of lead and lead(IV) oxide in a sulfuric acid solution. The lead(IV) oxide oxidizes the lead plate, making an electrical current. Lead-acid batteries are the cheapest rechargeable batteries and can produce much power. They contain toxic lead, though, and should be recycled. They are wet cells, and the dangerous acid can spill out. Sealed lead acid batteries are batteries where the sulfuric acid is in a gel which stays in, even when the battery is turned upside down.

Reactions:

lead(IV) oxide + sulfuric acid + extra hydrogen ions → lead(II) sulphate + water at cathode

lead + extra sulphate ions → lead(II) sulphate at anode

These reactions are reversed when the battery is charged.

Fig. 4.6 Battery

4.2.6 SLIDING CHANNEL

Sliding channel gives the both forward and backward moment to the bumper as shown in fig. 4.6.

Fig 4.7 Sliding Channel

4.2.7: BEARING(6201-Z)

Have you ever wondered how things like inline skate wheels and electric motors spin so smoothly and quietly? The answer can be found in a neat little machine called a bearing. The bearing makes many of the machines we use every day possible. Without bearings, we would be constantly replacing parts that wore out from friction. In this article, we'll learn how bearings work, look at some different kinds of bearings and explain their common uses, and explore some other interesting uses of bearings show as shown in fig. 4.7a and 4.7b.

Fig. 4.8a Bearing 6201-Z

Fig. 4.8b Bearing 327

The concept behind a bearing is very simple: things roll better than they slide. The wheels on your car are like big bearings. If you had something like skis instead of wheels, your car would be a lot more difficult to push down the road.

That is because when things slide, the friction between them causes a force that tends to slow them down. But if the two surfaces can roll over each other, the friction is greatly reduced.

Bearings reduce friction by providing smooth metal balls or rollers, and a smooth inner and outer metal surface for the balls to roll against. These balls or rollers "bear" the load, allowing the device to spin smoothly.

The bearing above is like the one in a barstool. It is loaded purely in thrust, and the entire load comes from the weight of the person sitting on the stool.

The bearing below is like the one in the hub of your car wheel. This bearing has to support both a radial load and a thrust load. The radial load comes from the weight of the car, the thrust load comes from the cornering forces when you go around a turn.

4.2.7.1 Ball Bearing

Ball bearings, as shown as shown in fig. 4.8, are probably the most common type of bearing. They are found in everything from inline skates to hard drives. These bearings can handle both radial and thrust loads, and are usually found in applications where the load is relatively small.

In a ball bearing, the load is transmitted from the outer race to the ball, and from the ball to the inner race. Since the ball is a sphere, it only contacts the inner and outer race at a very small point, which helps it spin very smoothly. But it also means that there is not very much contact area holding that load, so if the bearing is overloaded, the balls can deform or squish, ruining the bearing.

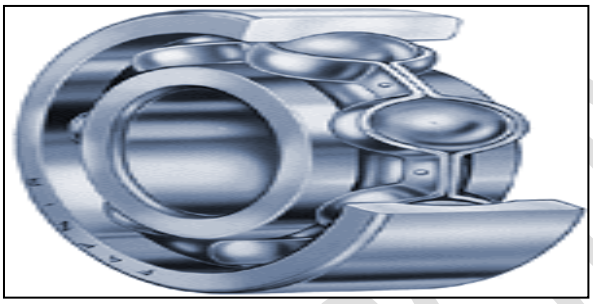


Fig. 4.9 Ball Bearing

4.2.8 SOLENOID VALVE:

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV, this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts.

Fig. 4.10 Solenoid Valve

This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoids may be push type or pull type. The push type solenoid is one in which the plunger is pushed when the solenoid is energized electrically. The pull type solenoid is one is which the plunger is pulled when the solenoid is energized.

4.2.9 T-JUNCTION

Pipe networks are mainly used for transportation and supply of fluids and gases. These networks vary from fewer pipes to thousands of pipes (e.g. water supply network of a large city). In addition to pipes, the network also consists of elbows, T-junctions, bends, contractions, expansions, valves, meters, pumps, turbines and many other components.

Fig. 4.11 T-Junction

4.2.10 I.R. SENSOR

A sensor is a transducer used to make a measurement of a physical variable. Any sensor requires calibration in order to be useful as a measuring device. Calibration is the procedure by which the relationship between the measured variable and the converted output signal is established.

Care should be taken in the choice of sensory devices for particular tasks. The operating characteristics of each device should be closely matched to the task for which it is being utilized.

Different sensors can be used in different ways to sense same conditions and the same sensors can be used in different ways to sense different conditions.

Types of Sensors:

- **Passive sensors-** They detect the reflected or emitted electro-magnetic radiation from natural sources.
- **Active sensors-** They detect reflected responses from objects which are irradiated from artificially generated energy sources, such as radar.

A sensor classified as a combination of passive, non-scanning and non-imaging method is a type of profile recorder, for example a microwave radiometer. A sensor classified as passive, non-scanning and imaging method, is a camera, such as an aerial survey camera or a space camera, for example on board the Russian COSMOS satellite.

Sensors classified as a combination of passive, scanning and imaging are classified further into image plane scanning sensors, such as TV cameras and solid state scanners, and object plane scanning sensors, such as multi-spectral scanners (optical-mechanical scanner) and scanning microwave radiometers.

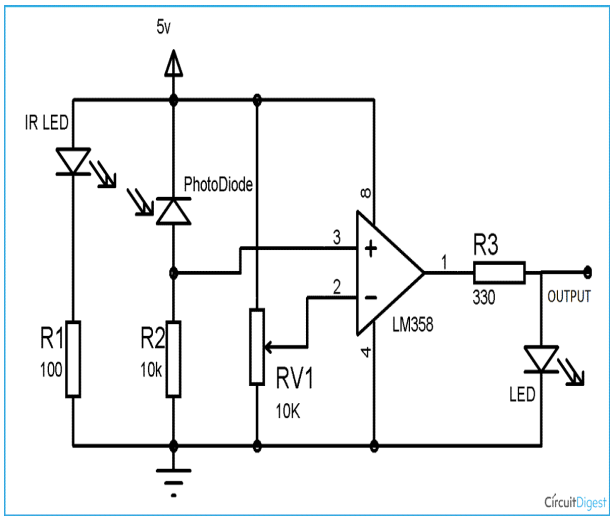
An example of an active, non-scanning and non-imaging sensor is a profile recorder such as a laser spectrometer and laser altimeter. An active, scanning and imaging sensor is radar, for example synthetic aperture radar (SAR), which can produce high resolution, imagery, day or night, even under cloud cover. The most popular sensors used in remote sensing are the camera, solid state scanner, such as the CCD (charge coupled device) images, the multi-spectral scanner and in the future the passive synthetic aperture radar. Laser sensors have recently begun to be used more frequently for monitoring air pollution by laser spectrometers and for measurement of distance by laser altimeters.

IR TRANSMITTER:

The IR transmitting circuit is used in many projects. The IR transmitter sends 40 kHz (frequency can be adjusted) carrier under 555 timer control. IR carriers at around 40 kHz carrier frequencies are widely used in TV remote controlling and ICs for receiving these signals are quite easily available.

IR RECEIVER:

The transmitted signal reflected by the obstacle and the IR receiver circuit receives the signal and giving control signal to the control unit. The control unit activates the



pneumatic braking system as well as the pneumatic bumper activation.

Fig. 4.12(a) IR Sensor Circuit

At Normal Condition:

The IR transmitter sensor is transmitting the infrared rays with the help of 555 IC timer circuit. These infrared rays are received by the IR receiver sensor. The Transistor T1, T2 and T3 are used as an amplifier section. At normal condition Transistor T5 is OFF condition. At that time relay is OFF, so that the vehicle runs continuously.

When There Is Obstacle Nearby:

At Obstacle conditions the IR transmitter and IR receiver, the resistance across the Transmitter and receiver is high due to the non-conductivity of the IR waves. So, the output of transistor T5 goes from OFF condition to ON stage. In that time the relay is ON position. In that time, the solenoid valve is on so that the vehicle stops and bumper gets ejected.

4.2.11 CHAIN DRIVE

Fig. 4.13 Chain Drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing witl the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth.

Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotates once, it causes the gear that drives the wheels to rotate more than one revolution.

4.2.12 SPROCKET

A sprocket or sprocket-wheel is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Fig. 4.14 Sprocket

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

Sprockets are of various designs; a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Some sprockets used with timing belts have flanges to keep the timing belt centred. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chain are so constructed as to be noiseless even at high speed.

4.2.13 SWITCH

A switch is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch removes or restores the conducting path in a circuit when it is operated. It may be operated manually, for example, a light switch or a keyboard button, may be operated by a moving object such as a door, or may be operated by some sensing element for pressure, temperature or flow.

Fig. 4.15 Switch

4.2.14 NUT AND BOLTS

A nut is a type of fastener with a threaded hole. Nuts are almost always used opposite a mating bolt to fasten a stack of parts together. The two partners are kept together by a combination of their threads' friction, a slight stretch of the bolt, and compression of the parts as shown in fig. 4.15.

Fig. 4.16 Nut and Bolts

4.2.15. GLUE GUN

Hot melt adhesive (HMA), also known as hot glue, is a form of thermoplastic adhesive that is commonly supplied in solid cylindrical sticks of various diameters, designed to be melted in an electric hot glue gun. The gun uses a continuous-duty heating element to melt the plastic glue, which the user pushes through the gun either with a mechanical trigger mechanism on the gun, or with direct finger pressure. The glue squeezed out of the heated nozzle is initially hot enough to burn and even blister skin. The glue is tacky when hot, and solidifies in a few seconds to one minute. Hot melt adhesives can also be applied by dipping or spraying.

4.3 COST OF COMPONENT

We have purchase/procure the following component from market which cost is given in the table 3.2.

S. No.	Component	Quantity	Price
1	Structural components		
	(a) Mild Steel Frame	1	500
	(b) Bumper	1	200
2	Battery	2	1500
3	DC motor	1	550

4	Disk Brake	1	800
5	PCB	3	1000
6	Solenoid Valve	1	500
7	Compressor	1	1000
8	Connecting Pipes	3 metres	200
9	Switch	1	50
10	Double Acting Cylinders		
	(a) For Bumper	1	500
	(b) For Brakes	1	400
11	Wheels	4	700
12	Connecting Wires	-	200
13	Sprocket	2	500
14	Bearing(Sprocket)	1	100
15	Chain	1	300
16	Axle	2	300
17	Bearings	4	400
18	Nuts and Bolts	-	100
19	IR Sensor	1	200
20	Sliding Channel	2	400
21	Relays	2	100
22	Miscellaneous	-	500
TOTAL COST			11000

Table 4.3 Cost of Components

CHAPTER-5: PROJECT CONSTRUCTION & FABRICATION

In this chapter, we have explained the fabrication or assembly process step by step with their proper figures. These chapters also include the distribution of power supply to efficiently run the project. This chapter has been included prior to fabrication process of “AUTOMATIC ACCIDENT AVOIDING SYSTEM FOR 4 WHEELERS” to make the fabrication and assembly process easy.

5.1 ABOUT OUR PROJECT

Now we planned to construct our project with the help of concepts of the Pneumatic system. We use one compressor coupled with two double acting cylinders, one for bumper ejection and the for the application of disk brakes on the wheel axle and this mechanism is powered by compressor for supplying atmospheric air at a higher pressure to the cylinders and the vehicle is driven with the help of 12v dc motor.

5.2 PROJECT CONSTRUCTION STEPS

Step-1

First, we make a frame for the mountings and other important elements. For making the frame, we used mild steel pipes (rectangular cross section) for better strength and load taking capacity. The frame is then made by welding pipes together. We used arc welding for this purpose.

Step-2

Then we used arc welding along with the fasteners to join the sliding channel onto the frame in the project and then we connected the bumper (mild steel; rectangular cross section; pipe) to the sliding channel through welding carefully.

Fig .5.1 Bumper is Welded with Sliding Channels

Step-3

Now, we connected the two cylinders (one on the bumper and the other on the upper frame for brake),

Fig. 5.2 Brake Connected with Cylender

Step-4

Now the rear axle is taken and welded with the sprocket being in the proper position so that proper transmission of rotary motion can be done through motor. Also, the rear axle is welded with the disk brake rotor simultaneously so that brake mechanism could be installed.

Fig. 5.3 Rear Axle and Sprocket

Step-5

Now the four bearings are welded on the lower portion of the frame along with the front and rear axles connected to them.

Fig. 5.4 Bearings are Welded on the Frame

After the bearings and axles are placed on their right place, we connect the 4 tyres(2 rear and 2 front) on the axle by the help of bolts and iron flanges to provide hassle free movement of the tyres.

Step-6

Now, we connect the braking calliper installed onto the rotor disk properly and the connect to the lower frame through welding. Now the braking piston is connected to the wire attached to the disk brake through bolt and washer and attaching them through the frame through welds at various points.

Fig. 5.5 Disc Brake Connected with Rear Axle

Step-7

Now the 12V DC Motor is attached to the top section of the frame along with one sprocket attached to its shaft such that the chain could be attached properly in line.

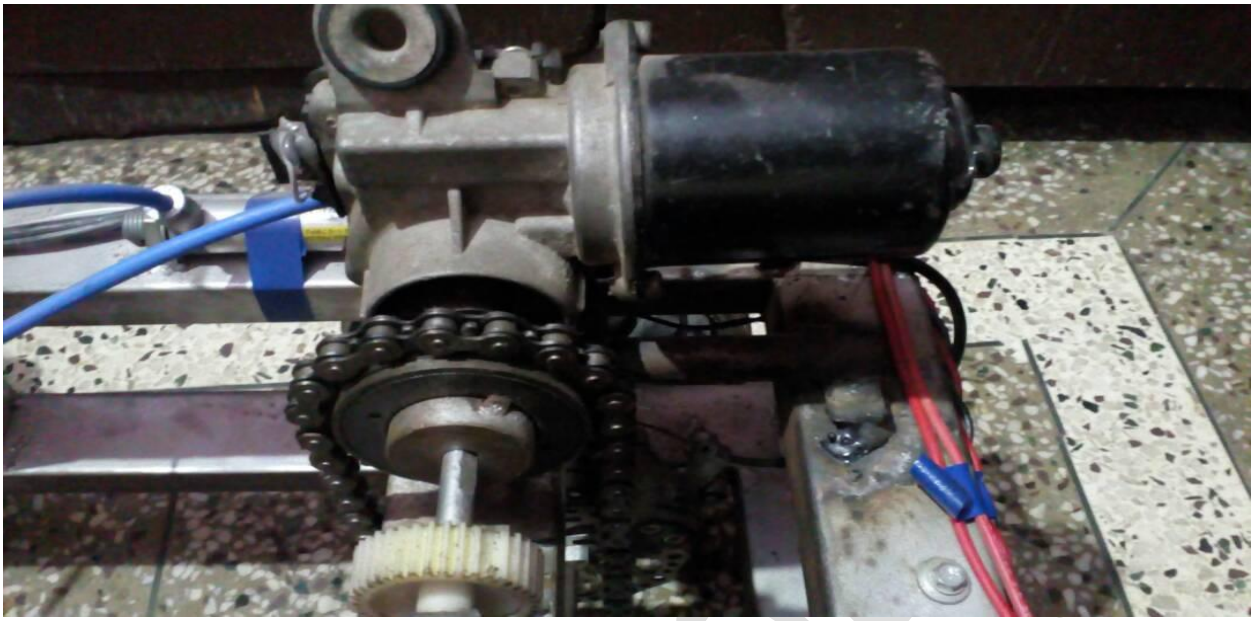


Fig. 5.6 DC Motor Attached with Sprocket

The motor is attached to the frame with the help of support of a hollow pipe welded through the frame. At the same time chain is attached to the two sprockets and removing the unnecessary chain link and ensuring proper connection between end links of the chains.

Fig. 5.7 Supporting Pipe for Motor

Step-8

Now the 12V compressor is attached to the frame rigidly through the help of 2 fasteners so as to dampen the compressor vibrations while it's working. Also at the same time, solenoid valve is installed on the frame with the help of electrical insulation tape.

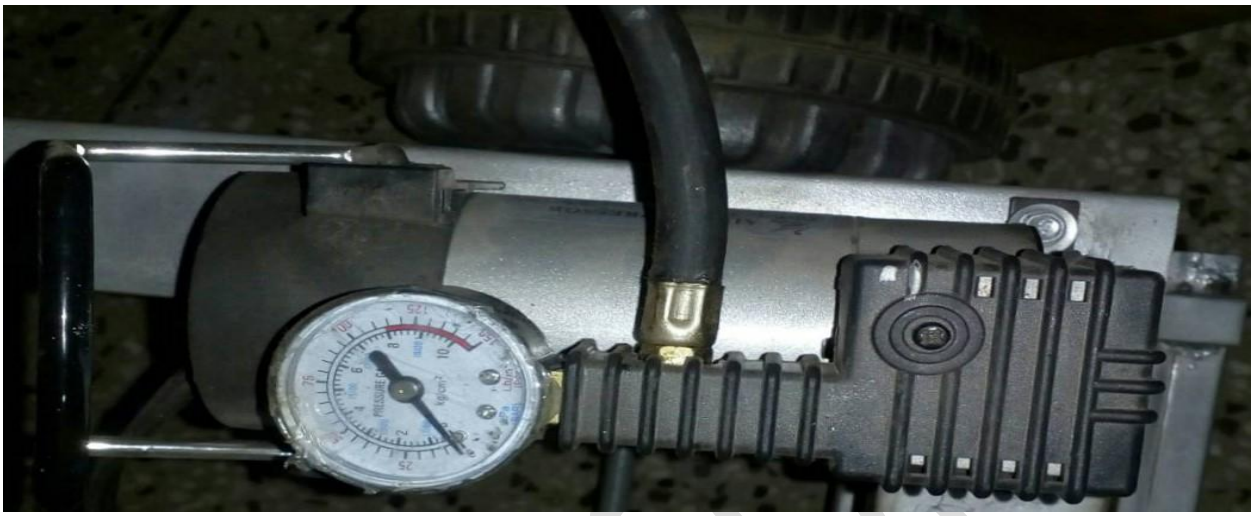


Fig. 5.8 Compressor

Step-8

Now we install two 12V DC Batteries (one for the compressor and circuit and other for relay and DC motor for propelling the model) and support them through a thick cast iron angle and welding onto the mild steel frame of our project.

Fig.5.9 Power House of the System (Battery)

Step-9

Along with all these, we install the IR sensor circuit onto a cardboard sheet and sticking it to the frame through glue gun and nut bolts.

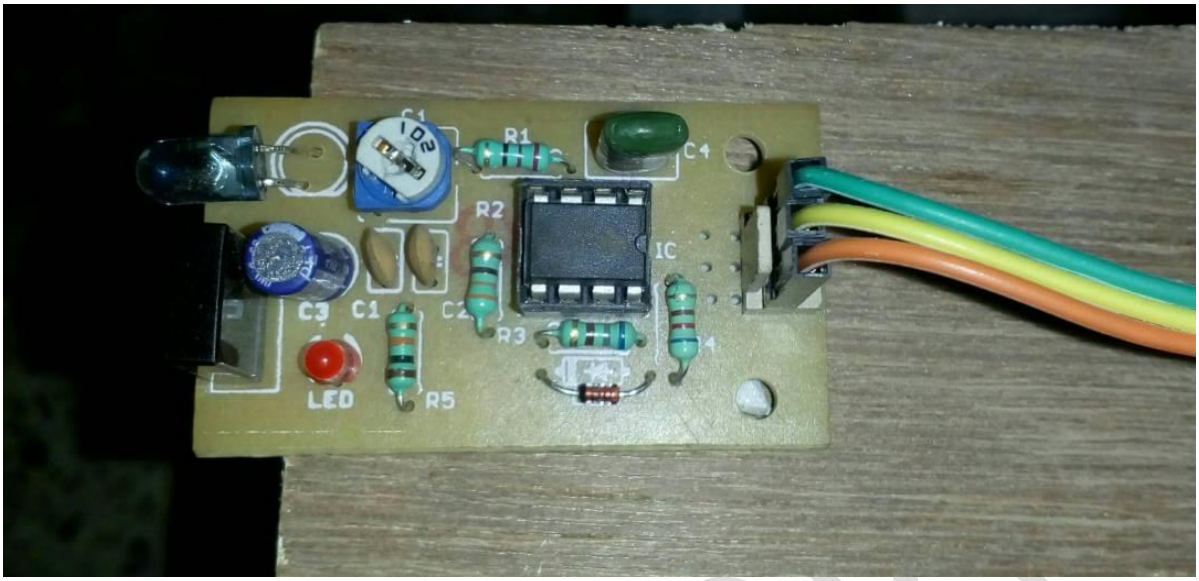


Fig.5.10 Circuit for IR Sensor

Step-10

Simultaneously we stick the electronic circuit box containing all the related circuits onto frame through glue gun.

Step-11

Now after all the elements are arranged on their right places, we make connections so that our model could work properly.

Making the connections of Pneumatic system:

- Firstly, we make connections for the pneumatic system by the help of PVC(6mm) pipes which are connected in proper sequence with the solenoid valve, since the double acting cylinders are supposed to work in both the directions (forward as well as in backward direction) so that after the accident is avoided, the vehicle could do its work properly. We used two T-joints for connecting the inlet and outlet compressed air line.
- Outlet 1 compressed air line is used to actuate brakes and bumper cylinder pistons (in forward direction) and the other Outlet 2 compressed air line is used to evacuate the compressed air in the cylinders (in the backward direction).
- The inlet of the solenoid valve is connected to the outlet of compressor for providing compressed air to the cylinders.

Fig. 5.11 Pneumatic Circuit of the Project

Making the connections of electrical circuits:

- After the pneumatic connections are done, the batteries are connected to the circuit through the help of electrical wires and the terminals are connected to wires through the help of copper clips so that proper electrical transmission could occur.
- One battery drives the electronic circuit present in the circuit box and the other battery drives the solenoid valves and the DC Motor.
- The circuit box contains two relays, one switch and one main power supply PCB. The relays are connected with the IR sensor circuit

Fig. 5.12 Main Circuit of the Project

Step-12

At last all necessary portions of the project are painted through a coat of chrome paint, so that rusting could be prevented.

5.3 WORKING

- Firstly the 4 clips are connected to the battery terminals of all batteries. One of the battery terminals is positive and the other one is negative. For recognition, we have marked the negative terminals of wires with blue tape.
- Then we switch on the compressor button so that is could supply the system with atmospheric air at a high pressure.
- After that we switch on the main switch placed over the circuit box so that the main electronic circuit could receive power. As soon as the switch is turned on, the vehicle starts moving. Now two cases arise:

Case 1: When there is no interruption in vehicle's path

- ✓ At this situation, the vehicle will continue to move to its intended path without any interruption

Case 2: When there is interruption in vehicle's path

- ✓ At this situation, the IR sensor placed over the frame receives a change in resistance due to interruption of the transmitter signals received by the receiver when the distance between the sensor and obstruction is less than 5 inches.
- ✓ IR sensor then directs the relays to do their functions which is to provide command to the solenoid valve so that the compressed air can be transferred to the two cylinders along with cutting off the power supply of the DC motor such that there is no harm to the motor when the brakes are applied.
- ✓ This results in stopping of the device and along with bumper ejection such that the impact by the accident could be decreased.
- ✓ As soon as the obstruction gets removed from the vehicles path, the vehicle starts propelling and this cycle repeats when any obstruction occurs in between vehicle.

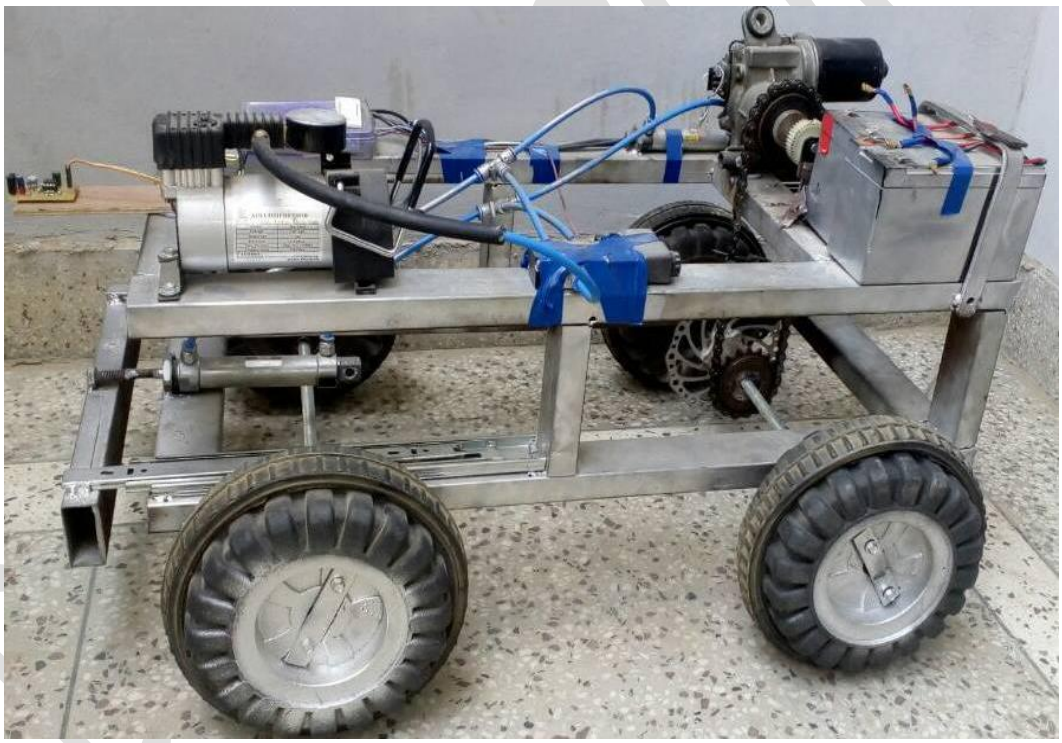


Fig. 5.12 Final view of the Project

5.4 DIFFERENCE BETWEEN MODEL AND COMMERCIAL APPLICATION

When employing this system on the main cars there will be some minor changes in the system functions, they are specified below:

1. The minimum car speed should be 30Km/h else the system won't be working.
2. The Pneumatic bumper system will only work if there will be any major obstructions such as a tree or another vehicle or any other obstruction that could lead to accident.
3. When the obstruction is a human being, the only function that will happen is the immediate braking and not the bumper actuation as the bumper actuation could harm the human being on the road.
4. In actual model, the range at which the brakes and bumper will be activated is calculated by a computer (approximately <40 m at a speed of 80-90Km/h), also the sensor will warn the driver at an appropriate distance (according to speed) at which the driver could act and if not responded, the system would take the handles on its own.

5.5 FUTURE LAYOUT

Commercial application of project in future which is shown in fig. 5.13

Fig.5.13 Automatic Car Braking System

5.5.1 Added features in commercial application

We have given a name to the future project in cars as "PRE-SAFE" along with some added features and advancements for added protection and hassle free rescue when there is any severe accident. This system can be explained briefly as described below:

1. PRE-SAFE offers an anticipatory occupant protection system that activates protective measures for the car's occupants if there is an imminent risk of an accident.
2. The intelligent PRE-SAFE system takes its lead from nature in that it activates protective measures for the car occupants as a precaution, just as living things react instinctively and search for cover when they are in danger.
3. The aim is to prepare the occupants and the car for an imminent collision so that the seat belts and the airbags can deploy with maximum effect in the event of an impact.
4. The PRE-SAFE protective measures are reversible: if the accident is averted, the advance tensioning of the seat belts is halted automatically and the occupants are able to reset the positions of the seats and the sunroof. The anticipatory occupant protection system is then ready for action again straightaway.
5. Early accident detection is possible because PRE-SAFE is an intelligent synergy of active and passive safety.
6. It is linked to Brake Assist and the Electronic Stability Program (ESP), whose sensors detect potentially critical driving situations and send the relevant information to the electronic control units within a matter of milliseconds whose function is to respond by ejecting bumper and application of brakes immediately before any accident occurs.

If Brake Assist PLUS has used the radar system to predict an impending collision and a certain level of deceleration is exceeded when braking, the occupants are prepared automatically for the potential collision by preventive tensioning of the front seat belts and repositioning of the front-passenger seat, enabling the seat belts and airbags to offer the best possible protection.

A multicontour seat ensures that the driver and front passenger are seated even more securely, thereby limiting dangerous whiplash movements by the upper body. If the PRE-SAFE control unit detects a critical driving situation, it instantly activates the air chambers in the seat cushions and backrests. These then envelope the seat occupants and give them support.

PRE-SAFE when braking in an emergency	PRE-SAFE when there is a risk of skidding
Driver and front-passenger seat belts are tensioned	Bolsters in the seat cushions and backrests of the multicontour front seats are inflated
Front-passenger seat is moved backwards or forwards into the optimum position whilst the cushion angle and backrest inclination are also optimized	Side windows at the front and rear are closed

Belt tensioning reduces the forces exerted on the occupants by up to 40 percent. Analyses performed during crash tests show just how important and effective anticipatory occupant protection can be. In the case of belt tensioning, for example, the precautionary measures mean that the driver and front passenger are held in their seats in the best possible position and so do not move forwards as much in the event of an impact, thus reducing the load exerted on the head and neck area. These tests showed that the head was subjected to around 30 per cent less stress. Accident research shows that drivers do not always react as quickly as necessary at critical moments – for example because they are distracted and therefore do not recognize the immediate threat of a head-to-tail crash, or because they fail to heed the warning signals given by an assistance system. In our project, the Brakes intervenes in situations such as these by braking the car automatically and then in fraction of second bumper also gets ejected which decreases the risk of any causalities. It is done in two stages: around 1.6 seconds before the calculated impact point – after three audible warning signals – the system initiates partial braking autonomously and decelerates the car with around 40 percent of the maximum braking power (approx. four m/s^2).

5.6 POWER SUPPLY

Here in our project, we are employing DC supply with the help of two 12V 7.2 Ah lead acid battery. Unlike the use of conventional AC to DC rectifier circuit with 12V transformer we have used batteries so as to provide mobility to our project.

5.6.1 Working of Lead Acid Battery

The storage battery or secondary battery is such battery where electrical energy can be stored as chemical energy and this chemical energy is then converted to electrical energy as when required. The conversion of electrical energy into chemical energy by applying external electrical source is known as charging of battery. Whereas conversion of chemical energy into electrical energy for supplying the external load is known as discharging of secondary battery. During charging of battery, current is passed through it which causes some chemical changes inside the battery. These chemical changes absorb energy during their formation.

When the battery is connected to the external load, the chemical changes take place in reverse direction, during which the absorbed energy is released as electrical energy and supplied to the load. Now we will try to understand principle **working of lead acid battery** and for that we will first discuss about **lead acid battery** which is very commonly used as storage battery or secondary battery.

5.6.2 Materials used for Lead Acid Storage Battery Cells

The main active materials required to construct a lead acid battery are:

- Lead peroxide (PbO_2).
- Sponge lead (Pb)
- Dilute sulfuric acid (H_2SO_4)

Lead Peroxide (PbO_2)

The positive plate is made of lead peroxide. This is dark brown, hard and brittle substance.

Sponge Lead (Pb)

The negative plate is made of pure lead in soft sponge condition.

Dilute Sulfuric Acid (H_2SO_4)

Dilute sulfuric acid used for lead acid battery has ration of water: acid = 3:1.

The **lead acid storage battery** is formed by dipping lead peroxide plate and sponge lead plate in dilute sulfuric acid. A load is connected externally between these plates. In diluted sulfuric acid the molecules of the acid split into hydrogen ions (H^+) and negative sulphate ions (SO_4^-). The hydrogen ions when reach at PbO_2 plate, they receive electrons from it and become hydrogen atom which again attack PbO_2 and form PbO and H_2O (water).

$$PbO_2 + 2H \rightarrow PbO + H_2O$$

$$\frac{PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O}{PbO_2 + H_2SO_4 + 2H \rightarrow PbSO_4 + 2H_2O}$$

This PbO reacts with H_2SO_4 and forms $PbSO_4$ and H_2O (water).SO_4^{--} ions are moving freely in the solution so some of them will reach to pure Pb plate where they give their extra electrons and become radical SO_4. As the radical SO_4cannot exist alone it will attack Pb and will form $PbSO_4$. As H^+ ions take electrons from PbO_2 plate and SO_4^{--} ions give electrons to Pb plate, there would be an inequality of electrons between these two plates. Hence there would be a flow of current through the external load between these plates for balancing this inequality of electrons. This process is called discharging of lead acid battery. The lead sulfate ($PbSO_4$) is whitish in color. During discharging,

- Both of the plates are covered with $PbSO_4$.
- Specific gravity of sulfuric acid solution falls due to formation of water during reaction at PbO_2 plate.
- As a result, the rate of reaction falls which implies the potential difference between the plates decreases during discharging process.

Now we will disconnect the load and connect $PbSO_4$ covered PbO_2 plate with positive terminal of an external DC source and PbO_2 covered Pb plate with negative terminal of that DC source. During discharging, the density of sulfuric acid falls but there still sulfuric acid exists in the solution. This sulfuric acid also remains as H^+ and SO_4^{--}ions in the solution. Hydrogen ions (cation) being positively charged, move to the electrode (cathode) connected with negative terminal of the DC source. Here each H^+ ion takes

one electron from that and becomes hydrogen atom. These hydrogen atoms then attack $PbSO_4$ and form lead and sulfuric acid.

$$PbSO_4 + 2H \rightarrow H_2SO_4 + Pb$$

SO_4^{--} ions (anions) move towards the electrode (anode) connected with positive terminal of DC source where they will give up their extra electrons and become radical SO_4. This radical SO_4 cannot exist alone hence reacts with $PbSO_4$ of anode and forms lead peroxide (PbO_2) and sulfuric acid (H_2SO_4).

$$PbSO_4 + 2H_2 + SO_4 \rightarrow PbO_2 + 2H_2SO_4$$

Hence by charging the lead acid storage battery cell,

- Lead sulfate anode gets converted into lead peroxide.
- Lead sulfate of cathode is converted to pure lead.
- Terminal; potential of the cell increases.
- Specific gravity of sulfuric acid increases.

CHAPTER-6: PROJECT DESIGN AND CALCULATIONS

6.1 DETAILS OF CALCULATIONS

For calculations, V. B. Bhandari and Design Data book were used as reference material. Suitable values in certain cases were taken directly, as per the empirical relations or from standard values and from the internet. Formulas used for calculations are as below:

6.2 Calculation of Pneumatic Cylinder Dimensions

Assumption: Maximum force acting on bumper is assumed to be 90N

Considering factor of safety as 1.25, we design bumper for 90x1.25 =112.5N force

Also, pressure used is 4bars=0.4N/mm2

1) For Applying Brakes

For out-stroke

Fo/s= P x A

112.5 = 0.4 x 0.7854 D

D2 = 358.0978 mm2

So, D =18.92mm

Selecting standard value of 20mm bore diameter, we calculate inner diameter.

Assuming In-stroke force to be equal to outstroke force, we assume instroke force to be 90N.

For factor of safety of 1.25, instroke force is 90x1.25=112.5N.

For in-stroke,

Piston rod area = $\pi/4$ x d2

Effective area = $\pi/4$ x (D2-d2)

= 0.7854 (202-d2)mm2

So,

Fi/s = 0.4 x 0 .7854(202-d2)

112.5 = 0.31416(202-d2)

On solving, we get d= 6.47mm

Hence, selecting from standard values, inner diameter is 7mm.

Keeping stroke of 50mm for applying brakes, we get the cylinder dimensions as

Cylinder bore = 20 mm

Cylinder stroke=50 mm

Similarly, we calculate for Bumper.

2) For Bumper:

For out-stroke

Fo/s = P x A

112.5 = 0.4 x 0.7854 D2

D2 = 358.0978 mm2

So, D =18.92mm

Selecting standard value of 20mm bore diameter, we calculate inner diameter.

Assuming In-stroke force to be equal to outstroke force, we assume in stroke force to be 90N.

For factor of safety of 1.25, instroke force is 90x1.25=112.5N.

For in-stroke,

Piston rod area = $\pi/4$ x d2

Effective area = $\pi/4$ x (D2-d2)

= 0.7854 (202-d2) mm2

So,

Fo/s = 0.4 x 0 .7854(202-d2)

112.5 = 0.31416(202-d2)

On solving, we get d= 6.47mm

Hence, selecting from standard values, inner diameter is 7mm

So, for both the double acting pneumatic cylinders, bore diameter is 20mm.

To increase the crashing distance in case of accidents, we increase the stroke length of cylinder used for extending the bumper.

So, for bumper, cylinder stroke of 100mm is suitable.

6.3 CAD MODEL OF THE PROTOTYPE

The CAD model of the prototype was created using AUTOCAD software. The cad model is used only for visualization of the system design, and hence, dimensions are not the same as used in the actual prototype. The screenshot of created cad model is shown below.

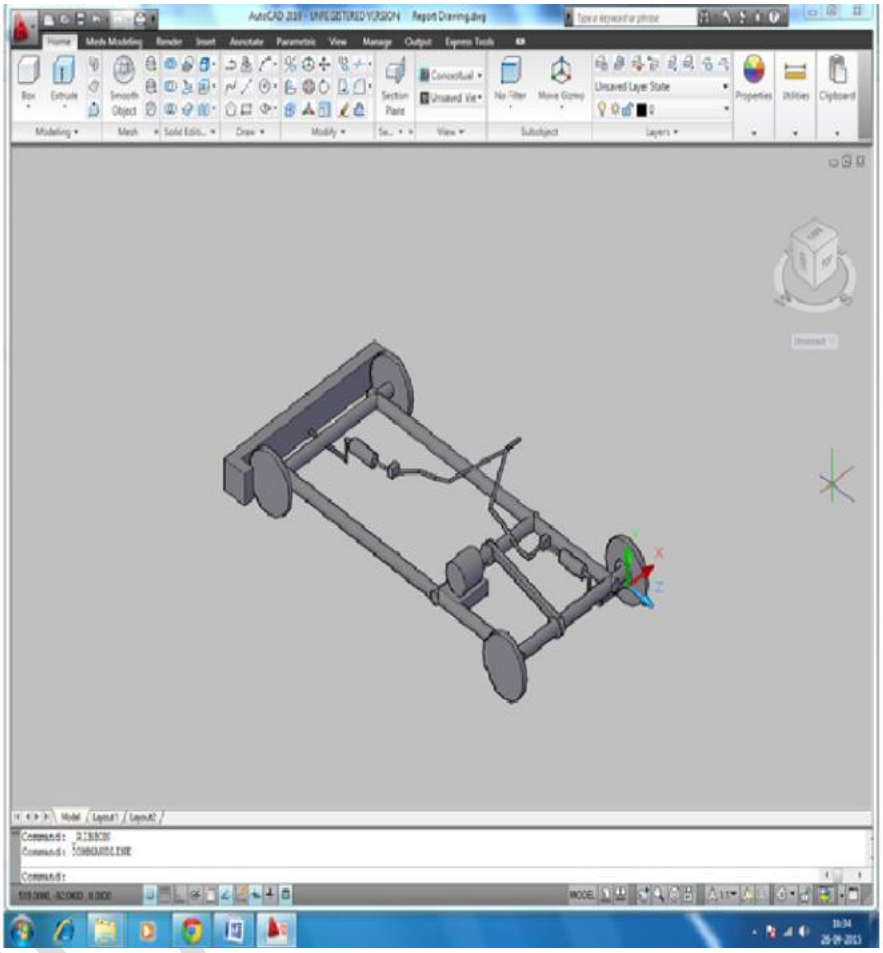


Fig.6.1 A Prototype of Project

COST ANALYSIS

COST ESTIMATION

To ensure sustained and healthy growth of refrigerator production Sector, it is necessary to rationally evaluate the cost of production of refrigerator and to determine a selling rate which should be acceptable to consumers and attractive for investors.

S.NO	COMPONENT NAME	QUANTITY	MATERIAL	PRICE
1	BUMPER	1	Stainless Steel	7000
2	COMPRESSOR	1	Aluminium Alloy	1500
3	SENSOR	2	Semiconductor	1000
4	CIRCUIT CONTROLLER	1	-	1000
5	DAMPNER	3	Aluminium Alloy	1000
6	HOSE PIPES	7	PVC	700
7	COMPRESSED AIR TANK	1	Cast Iron	1500
8	OTHER EXPENDITURE	-	-	300
9	**TOTAL COST**			14000

Table 7.1 Expenditure Table

LABOUR COST: DRILLING, GRINDING, SCREW TIGHTNING, FINISHING:

Cost = Rs. 1000

OVERHEAD CHARGES: The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost = (Material Cost + Labour cost)

= Rs. (14000 + 1000)

= Rs. 15000

Overhead Charges = 10% of the manufacturing cost

= Rs. 1500

TOTAL COST:

Total cost = (Material Cost + Labour cost + Overhead Charges)

= Rs. (14000 + 1000 + 1500)

Total cost for this project = Rs**. 16500**

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CONCLUSION

Our project "Automatic Accident Avoiding System (Bumper Car)" is working in satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work:

1. The application of pneumatics produces smooth operation.
2. By using more techniques, they can be modified and developed according to the user.
3. The project is reliable, hence the passengers can rely upon their safety.
4. The project consists of the various parameters which the consumer of the car seeks during the purchasing of new car which should be under his budget and should provide continuously consistent result and should be reliable as well.
5. The project will not only protect the car from accident but also if the other car during the accident doesn't controls itself from the impact of accident, the bumper of the car will eject automatically to prevent the effects of the accident.
6. Other from the aspect of the use of the project in a specific location of application, it can also be used in many other places. In the industries where there is use of manual labours near the machines such as power plants, manufacturing industries, etc.
7. Also when we will be using our project in the real environment i.e. in the automobiles we have to place a computer such that it could adjust the working range of the sensors according to the real time conditions.
8. The project can be implemented to all the cars for the purpose of safety of each and every car.

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REFERENCES

1. Miss.Katore Koshal P, Prof.Bhambare Rajesh R, 'Vehicle Accident Prevention System using GSM and GPS Technique' International Journal of Computer Trends and Technology (IJCTT) – volume 29 Number 2 – November 2015

2. T.U.Anand Santhosh Kumar, J. Mrudula, "Advanced Accident Avoidance System for Automobiles" International Journal of Computer Trends and Technology (IJCTT) – volume 6 number 2– Dec 2013

3. Anusha c, Dr. P. Venkataratnam, "Collision control and collision avoidance using ultrasonic sensor" International journal of current engineering and scientific research (IJCESR) ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-2, ISSUE-7, 2015

4. G.B.S. Narang, "Automobile Engineering", Khanna Publishers, Delhi, 1991,

5. William H. Crowse, "Automobile Engineering".

6. V. B. Bhandari –"Design Data book"

7. Pneumatic Control System----Stroll & Bernaud, Tata Mc Graw Hill Publications, 1999.

8. S. Ramamrutham & R. Narayan, (1998) "Strength of Material", 12th Edition

9. J.B.K.Das, P.L.Srinivasa Murthy (2011) "Design of Machine Elements-2", Sixth Edition

10. Dr. K. Lingaiah. (2006), "Machine Design Data Handbook Volume-1", Fourth Edition.

11. Collision Control and Collision Avoidance Using Ultrasonic Sensor", Anusha c, Dr. P. Venkataratnam, International Journal of Current Engineering and Scientific Research (IJCESR), Volume-2, Issue-7, 2015

12. "Automatic Hydraulic Bumper and Speed Limiting System",Rohit P. Jain, Dr.V.Singh,IJSRD -International Journal for Scientific Research & Development Vol. 3, Issue 06, 2015.

13. "Automatic Braking With Pneumatic Bumper System",Jadhav N. D, Gulmire S.M, Ghutukade R.S, Gaikwad A.S, Prof.Fegade S.G,IJSART, volume-1 Issue-5, MAY 2015.

14. Dr.Sanjiy.K.Bhatia, Dr.George.M.Lacy, "Infra-Red Sensor Simulation", Missouri,(2009)

15. Dr.Eung Soo Kim,"Fabrication of Auto Braking System Using Sensor", International Journal Of control And Automation, Vol-2

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