International Journal of Advanced Research Methodology in Engineering & Technology, ISSN 2456 6446
Volume 1, Issue 3, May 2017

Collision Avoidance System In Vehicles

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Abstract

Nowadays, vehicle accidents in India have increased tremendously. To minimize the accident rate, we have designed and developed a technology called "collision avoidance system in vehicles". The main objective of the project is to avoid the accident of vehicles. It consists of IR sensors, control unit and pneumatic systems. IR sensors are used to detect any obstacle closer to the vehicles. Control unit controls the pneumatic system and the signal is given to pneumatic system when there is an obstacle near the vehicle. Compressor provides the power to the pneumatic system. The pneumatic system actuates the brake of the vehicle automatically to reduce the speed of vehicle. The bumper will be expanded to minimize the severity of the accident. The accident can be reduced by installing this apparatus in vehicles and severity of accident can be minimized.

Keywords—collision avoidance; IR sensor; control unit; pnuematic system; brake and bumper actuation.

I. INTRODUCTION

India is a developing country. Vehicles have become a vital part of Indian people. Peoples in cities like Delhi preferably using four wheelers rather than two wheelers. In present scenario, accidents became a severe problem in our world because of lack of quality of road and lack of protection technologies in cars. Number of peoples dying because of accidents is more than peoples dying of other causes. Even though there are many causes for accidents, proper braking can reduce the accidents. So, we developed and designed a project called "collision avoidance system in vehicles".

A. Bumper

Bumper is an accessory which is connected to the front and rear of the vehicle. It is made up of soft materials. It is used to protect the car from damages and pedestrians due to accidents. It actually protects the vehicle by absorbing the kinetic energy generated by impact.

$$E_k = \frac{1}{2}mv^2$$

Where,

m=mass of the vehicle

v=velocity of the vehicle

s = slow down distance

B. Brake

Brake is a device used to reduce the speed or to stop a moving vehicle. Nowadays, we use friction brakes mostly. Friction brakes uses friction to reduce the speed by converting the kinetic energy into heat.

C. Pneumatics

Pneumatics are commonly used in automation powered by compressed air or any inert gases. It can be controlled through manual or automatic solenoid valves. Advantages of pneumatics is their simplicity in design and their control, reliability and safety.

II. PROBLEMS IN CURRENT TECHNOLOGIES

A. Airbag

- High cost.
- Complex design
- Cannot be installed in small vehicles.
- Resetting is impossible.
- Causes minor injuries to the persons.

B. Camera collision avoidance systems

- Inefficient during night conditions and foggy weather.
- Response will be lower than other sensor systems.
- Flashing problems.
- Dusts in atmosphere will reduce the performance of camera during driving.

C. Radar collision avoidance systems

- Inefficient in high traffic areas.
- Inefficient at higher speeds.
- Performance of radar is easily affected by dusts in atmosphere.

D. Other systems

- Response is low
- Inefficient in traffic.
- Performance is low at higher speeds.

III. OBJECTIVES

- To prevent the accidents due to human errors.
- To minimize the severity of the accidents.

- To protect the vehicle and persons inside the car.
- To improve the safety of the vehicle.
- To eliminate other costly requirements like airbags.
- To provide a safety before the collision occurs.
- To improve the braking system in the time of need.
- To improve the external safety of the vehicle from damages.

IV. COMPONENTS

A. IR Sensor

IR sensor is used to detect the distance between any two objects. It consists of a LED which transmits IR ray of specific wavelength. If any object is near the sensor, the ray will be reflected back. The receiver receives the IR ray and detect the distance between them using it.

Fig. 1. IR Sensor

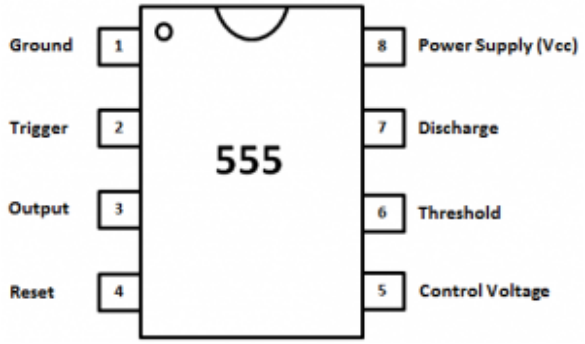
TABLE I
IR SENSOR SPECIFICATIONS

Range	10-150 cm
Voltage	10-30V DC
Current	200 mA

B. IC 555 Timer

The 555 timer IC is an integrated circuit used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide two or four timing circuits in one package.

Fig. 2. IC 555 Timer



PIN NO:1 It is ground terminal.
PIN NO:2 The trigger voltage to the lower comparator is applied. It has constant voltage that is at least one third of the supply voltage, when trigger voltage falls below this level the flip-flop changes its state and output becomes high.
PIN NO:3 It is the output terminal, in low state output is equal to zero and when at higher state output is equal to Vcc.
PIN NO:4 It controls the flip flop directly. It turns the device to its original position when reset pin is connected to ground the output is approximately equal to zero. When reset is not used, it is connected to V_{cc}.
PIN NO:5 It is the control voltage terminal. It is connected to ground through a capacitor of 0.01 μF. Any external voltage at pin: 5 will change both the threshold voltage and the trigger voltage reference level.
PIN NO:6 Threshold voltage of upper comparator is applied from this terminal. The resistor Rt connected to Vcc and pin: 6 is grounded by an external capacitor. The output is high capacitor charges by resistor Rt. When the capacitor changes to the threshold level, the output becomes low.
PIN NO:7 It is the discharge pin for external capacitor. Usually pin: 7 is connected with pin: 6 directly to by a resistor. When the output becomes low then the external capacitor discharges by internal discharge transistor remains at cut-off and the external capacitor charges to Vcc.
PIN NO:8 It is the positive supply terminal. A dc voltage from +5 to + 15 can be applied. The important features of IC555 can be summarized as follows.

1. Timing range from microseconds to hours.
2. Monostable and Actable operations are possible through IC555.
3. The duty cycle can be adjusted according to our necessity.
4. It has the ability to operate from a wide range of supply Voltage.
5. The output of 555 is compatible with CMOS, DTL and TTL, logic.
6. Output can be operated as normal ON and normal OFF.
7. RC timers, 555 provide a time intervals that is virtually independence of Supply voltage Vcc.

This because that, the charge rate of CT and the reference Voltage to the threshold comparator are all directly proportional to the supply Voltage.

C. Air Supply Tank

An air storage tank is a container designed to hold gases or liquids at a pressure substantially different from the ambient pressure. The compressed air is stored in air storage tank, usually a large cylindrical steel container. From the air tank, the compressed air is supplied to various systems for use. A pressure gauge is provided on the air tank to monitor the pressure of air.

Fig. 3. Air Supply Tank

D. Solenoid Valve

The directional valve is one of the important parts of a pneumatic system. A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid. In the case of a two-port valve the flow is switched on or off, in the case of a three-port valve, the outflow is switched between the two outlet ports.

Fig. 4. 3/2 DC Solenoid Valve

TABLE II
3/2 SOLENOID VALVE SPECIFICATIONS

Type	3/2
Voltage	220V AC
Power	6VA
Working pressure	2-10 bar
Current	23A AC

E. Hose And Hose Collar

Hose is used to supply air from air supply tank to the pneumatic cylinders and other required parts, hose collar is used to connect the hose to the output of the air supply tank.

Fig. 5. Hose and Hose Collar

F. Pneumatic Cylinder

Single-acting cylinders use the pressure imparted by compressed air to create a driving force in one direction (usually out), and a spring to return to the "home" position. More often than not, this type of cylinder has limited extension due to the space the compressed spring takes up. Another downside to SACs is that part of the force produced by the cylinder is lost as it tries to push against the spring.

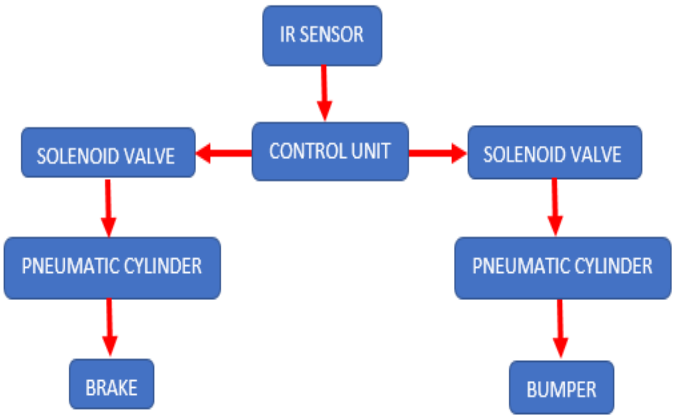
TABLE I
SINGLE ACTING CYLINDER SPECIFICATIONS

Description	**Cylinder 1**	**Cylinder 2**
Pressure	0-10 bar	0-10 bar
Stroke length	100 mm	50 mm

Fig. 6. Single Acting Spring Return Valve

V. PROJECT SETUP

Fig. 7. Schematic diagram of project



VI. WORKING PROCEDURE

The system will be activated when the speed of the vehicle reaches 50 kmph. A proximity sensor is mounted on the wheel of the vehicle which monitors the speed of the vehicle. IR sensor will be detecting the obstacle and distance between the obstacle and vehicle frequently. When there is an obstacle is detected within 5 feet of the vehicle, the control unit will send a signal to actuate the solenoid valve. The solenoid valve will be actuated and air will be supplied to the pneumatic cylinders. The pneumatic cylinders will apply the full brake automatically to reduce the speed of the vehicle and another cylinder will expand the bumper in the front of the vehicle to minimize the damage of the vehicle.

VII. ADVANTAGES AND DISADVANTAGES

A. *Advantages*

- Simple construction.
- Compact in size.
- Low cost.
- Provides more safety to vehicle.
- Reduces the severity of accident.
- High response.

B. *Disadvantages*

- Frequent maintenance.
- Inefficient in traffic.
- Proximity sensors working can be easily affected due to dusts.

VIII. APPLICATIONS

- It can be installed in any vehicles irrespective of heavy and light vehicles.

  Heavy vehicles – lorry, bus etc.
  Light vehicles – car, tempo etc.

IX. CONCLUSION

Behind the designing of this system, our main aim is to improve the technique of prevention of accidents and also reducing the hazard from accidents like damage of vehicle, injury of humans, etc. The application of pneumatics produces smooth operation.

By using more techniques, they can be modified and developed according to the applications. By implementing this project, we can reduce cost of high end cars by giving similar kind of safety. This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We have gained practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. Towards the end of completion of the project, we felt that the project has helped us to bridge the gates between institution and industries.

In conclusion remarks of our project work, we have developed an “COLLISION AVOIDANCE SYSTEM IN VEHICLES” which helps to achieve low cost automation. We are proud that we have completed the work with the limited time successfully. We have done the project to our ability and skill making maximum use of available facilities and we are able to understand the difficulties in maintaining the tolerances and also quality. We also observed that the

prototype manufactured is working with satisfactory conditions and our work is able to achieve all the objectives which are necessary.

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