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ANTI-COLLISION SYSTEM WITH SAFETY IMPACT REDUCTION SYSTEM

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Abstract - *This paper gives a study on anti-collision system especially for four-wheeler vehicles. The System is based on an electronic control system. This system activates brakes or the drive motor as well as extends the bumpers from its initial position to a farther outward position to reduce the damage caused during collision. The IR sensors are used to sense the colliding object (Obstacles / Human / Any vehicle in specified range of distance) which is responsible for accident. Then sensor sends feedback signal to the control unit, Thereby activating the solenoid valve for an activation of the pneumatic system and the motor in case of rear-end detection. During the working of Automatic braking system simultaneously the driver can also try to stop the vehicle by pressing brake or throttle pedal. Extended bumpers with the help of pneumatic pressure reduces the damage to vehicle in case of an occurrence of collision. This system provide pre-crash safety and crash-time safety to the vehicle. It also improves the response time of vehicle braking to keep safe distance between the vehicles.*

***Key Words*: Anti-collision, Pneumatic system, Impact reduction, Infra-Red sensors, Solenoid valve, extending bumpers, ECU, Brakes, Drive motor**.

1. INTRODUCTION

The recent advances in the sensor rich field of automation of vehicles has had a great impact on the design of modern Autonomous vehicles. In particular, the Maneuverability of these vehicles and the safety of the passengers have a great scope of development as the necessity is high, when the human intelligence is taken out of the picture.

Various Anti-collision automatic braking systems are being developed, tested and implemented on a regular basis in the development of the Autonomous vehicles. These systems are also being incorporated in the conventional driver vehicles to assist and increase the level of safety of road travel.

Despite the Automatic braking systems existing in vehicles, many collisions occur due to failure in systems or other unfortunate situations. Many automatic braking systems in use do not help in the prevention of rear-end collisions. The referral of various other papers contributed in the ideology of the system, few of which are

Automatic collision warning and Electro-Mechanical braking system by Raj Reddy published in the International Journal of Emerging Technologies.

Intelligent Braking system using IR sensor by Cyril Anthony published in the International journal of advances in science, research and Engineering.

These papers depict a broad information on the Automatic Braking system in frontal collision avoidance and crash safety systems.

This is an innovative system in which the Automatic braking system along with impact reduction system is present. This system also features a rear-end collision avoidance assist system with impact reduction system at the rear end as well.

The following sections depict the system construction, working, advantages and scope of implementation.

2. EXPERIMENTAL SETUP

Table -1: COMPONENTS

COMPONENT	*QUANTITY*	*SPECIFICATIONS*
Mild Steel bars	4-5 meters	2cm*2cm
Wheels	4	10 inches with brake
Pneumatic cylinders	3	Double acting Max. pressure 9.9kgf/cm2
Solenoid valve	2	3/2 port type
IR sensors	2	Optical Infrasonic IR
Motor	1	12v DC spur gear motor
Battery	1	12v battery

2.1 Construction of the experimental setup

The square Mild Steel tubes are measured and cut for the required dimensions and welded to form a frame which act as a chassis for our system and resides pneumatic and electronic drives on it. Four wheels are mounted at the bottom side of chassis and on its opposite side. Two bumpers are equipped at front and rear end of the frame. These are connected to the pneumatic cylinders which are present on the frame. Each bumper has its own separate

Pneumatic cylinder. Another pneumatic cylinder is connected to a brake lever of a wheel. These three Pneumatic cylinders are directly coupled to a 3/2 solenoid valve. A DC spur gear motor is coupled with one of the wheels which is powered by a battery equipped on the frame. Two Optical Infra-Red sensors are placed on the system one at the front and the other at the rear end to detect objects that could collide with the vehicle.

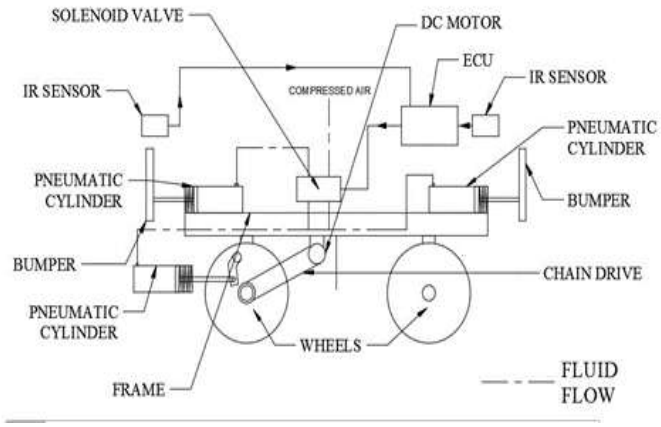

Fig1. The 2D layout of the experimental setup of Anti-collision system with safety impact reduction system.

3. WORKING METHODOLOGY OF THE EXPERIMENTAL SETUP

3.1 Frontal collision safety

The Optical Infra-Red sensor of the setup consists of a transmitter and a receiver. Infra-Red light is emitted from the emitter and when there is an object at a dangerously close distance the receiver receives the reflected Infra-Red signal and sends the signal to the control unit.

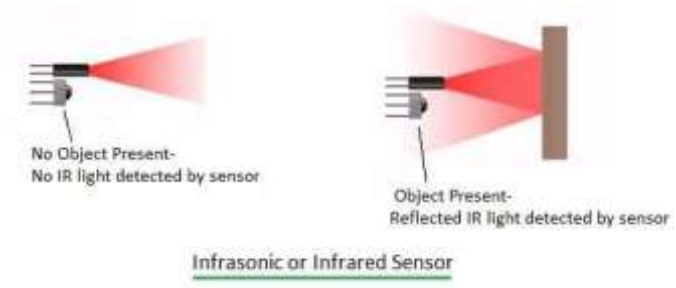

Fig 2. The working principle of Optical IR sensor.

The control unit then activates the Front-end Solenoid valve that releases the air to two Pneumatic cylinders. One of which is the Pneumatic cylinder connected to the brake lever at the wheel, which when activated applies brakes to stop the motion of the vehicle and prevent collision. The other Pneumatic cylinder extends or protrudes the front bumper further away from the frame body to absorb the impact and reduce the impact effects on the frame directly.

3.2 Rear collision safety

The same kind of Infra-red sensor as mentioned the previous sub-section is placed at the rear end of the setup. When an object is identified by this IR sensor at the rear, the signal is sent to the control unit which activates two separate systems. One of which is the DC spur gear motor connected to the rear wheel which propels the vehicle system forward to avoid the collision from the on-coming object from the behind. The driver can then steer the vehicle away to avoid rear-end collision.

The other system is the rear Solenoid valve which sends compressed air to the rear Pneumatic cylinder used to protrude the rear bumper backwards from the frame of the system to prevent direct impact from rear to the frame of the system and reduce the impact effects as well.

4. APPLICATIONS AND ADVANTAGES

4.1 Applications

- This system can be implemented in any four or more wheeled vehicles.
- When implemented in cars, an Air compressor needs to be installed along with the system.
- In heavy vehicles with Pneumatic brakes can use the same compressor for this system as well.
- This system can help brake the vehicle automatically to avoid frontal collisions in case of high proximity of an object at the front.
- This system can accelerate or propel the vehicle forward using the DC motor in case of high proximity of an object from the rear.
- In unfortunate situations such as poor brake pads, worn out tires or slippery road conditions or failure of ABS activation, the protruding bumper system introduced can help prevent direct collision with the frame and reduce the impact on it.
- The protruding bumpers are present both at the front end and rear end and both act in the same way and absorb most of the impact.

4.2 Advantages

- The most important advantage of the system is its ability to avoid collisions both from the front and the rear, not just only the front as is found in some vehicles on the road.
- The ability to reduce impact on the main vehicle body in case of occurrence of collision either due

to poor brakes, worn out tires, slippery roads or failure of the activation of Anti-Lock Braking system (ABS).

- This impact reduction is done by using Pneumatically activated Protruding or Extending bumpers both in the front and the rear.
- This system acts like a backup safety system in case the other preliminary safety systems fail to act proficiently.

5. CONCLUSION

Despite the presence of Automatic braking system in some vehicles, it may not be successful in avoiding collision in few unfortunate situations such as rear-end collisions, poor brakes, worn out tires, slippery road conditions and failure of Anti-Lock Braking systems. The Anti-collision system with Safety Impact reduction system depicted in this paper helps avoid the damage to the vehicle body directly by using motors that accelerate the body, in case of rear end collisions and Pneumatic protruding or extending bumpers both on the front and rear to absorb the impact and reduce the impact effect on the main vehicle body.

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