INFRARED (IR) BASED BRAKING SYSTEM

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ABSTRACT

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 bumper activation system called "Intelligent Braking with Pneumatic Bumper ". This system consists of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system and braking unit. This output is given to logic circuit to indicate the final output i.e. alarm and the control signal is given to the bumper activation system braking unit. The pneumatic bumper system is used to provide safety to the man and vehicle

INTRODUCTION:

Over the years, automotive safety has gained an increasing amount of interest from the general public, governments, and the car industry. Traffic accident statistics more than justify this focus, as each year around 1.2 million people dies due to road traffic accidents.

An automobile has been used to move human beings or something since the automobile was invented and the automobile technology has been developed within the last few years. Recently, the automobile is thought as daily necessaries because we spend much time in an automobile and enjoyed the entertainment such as game, e-mail, DVD, mp3, and internet etc. in the car. Car makers in Europe and Japan are developing for safety such as both collision safety and preventive safety and new car technology for intelligent car such as intelligent transport system (ITS), rear view camera system, Road-to-vehicle and Inter-vehicle Communication Systems, auto-parking system, hybrid car, electric car, and hydrogen fuel car. Car makers are beginning to develop equipment for high-end vehicles with systems to sense roadway conditions using cameras, radar, sensors and such in an effort to avoid accidents. The traffic accident is increasing as automobile production has been increasing. It is important to prevent accidents and to protect the driver and pedestrian when accidents were occurred. Therefore, pre-crashing system will be demanded. The pre-crash system is to prevent front-end, rear-end, right-turn and left-turn accidents on roads with poor visibility by using sensor network to find invisible vehicles, which are to be detected by autonomous on-vehicle sensors. The pre-crashing system is processing the sensor data and controlling the vehicle to prevent front-end, rear-end accidents and accidents caused by careless driving. The development of such systems to automatically control vehicles and avoid accidents will accelerate in the future.

The important thing in auto-braking system is detect the distance and speed of front vehicle to prevent a traffic accident.

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PROPOSED SYSTEM:

We have pleasure in introducing our new project "IR sensor braking system", which is fully equipped by IR sensors circuit, automatic braking and Pneumatic bumper activation circuit when the driver is not applying the brakes manually in case of emergency. It is a genuine project which is fully equipped and designed for Automobile vehicles. This forms an integral part of best quality. This product underwent strenuous test in our Automobile vehicles and it is good.

The important components of our project are,

- IR transmitter
- IR receiver
- Control Unit with Power supply
- Solenoid Valve
- Flow control Valve
- Braking system
- Pneumatic bumper
- Air Tank (Compressor)

COMPONENTS USED:

Main components of our project are:

1) Double acting pneumatic cylinders
2) 5/2 Solenoid valve
3) Axles
4) Wheels
5) Bearings
6) Motor

DESIGN AND IMPLEMENTATION:

The fabricated auto-braking system has the sensor part and signal processing part to prevent an accident as shown in Figure 1. It performed monitoring the environment and sensor signal processing. The sensor embedded in vehicle will detect the road environment, such as self-velocity, distance from front vehicle, and surroundings vehicles, using infrared sensor and ultrasonic sensor. These sensors were operated all the time during driving. The processing part accepted the signal from sensors and processed the signals and generated the instructions and transferred the generated instruction to control unit of transmission and brake of vehicle. There are three cases occurred in real situations. One case is that the distance between the front car and driver's car is far enough to defend crashing and self-velocity is the same velocity of front car or slower than that of front car. In this case, the driver's car is continuously running without changing its velocity. Another case is that the distance between the front car and driver's car is near and self-velocity is slower than that of front car. In this case, the driver's car is also continuously running without changing its velocity. Another case is that the distance between the front car and

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driver's car is near and self-velocity is faster than that of front car. In this case, the driver's car is continuously running only when the   driver reduce speed. But if the driver does not reduce speed, the auto-braking system may forcibly reduce the speed of driver's car to protect an accident. The reason is that if the driver does not reduce speed, the accident will be occurred and the driver will be hurt.
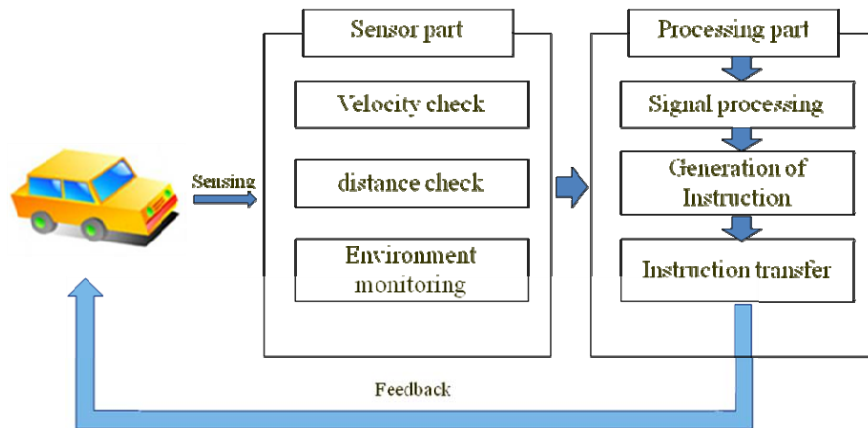

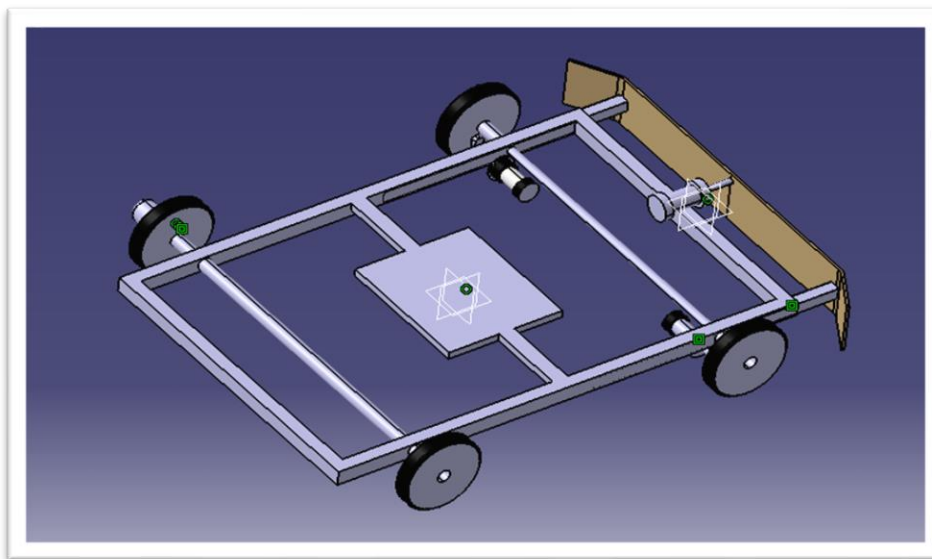Figure. The operation principle of the fabricated auto-braking system.

Fig. CATIA MODEL

BASIC DESIGN CALCULATION:

Frame design

Material used –mild steel, square pipe

Area=1*1inch=25.4*25.4=645.16mm^2

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Length of link=20 inch=508 mm

Weight of project=15 kg= 15*9.81 =147.15 N

Solution

1. Effective length

Effective length, when both ends fixed,

$$L_e = \frac{L}{2} = \frac{508}{2} = 254 \text{ mm}$$

2. Internal Area

Internal width and depth, which have 3 mm thickness,

d=b=38.1-2*3 =32.1 mm

3.Moment of inertia

$$I = \frac{BD^3 - bd^3}{12} = \frac{25.4 * 25.4^3 - 19.4 * 19.4^3}{12} = 22882.048 \text{ mm}^4$$

4. Crippling load by Euler's formula

$$P_c = \frac{\pi^2 EI}{Le^2} = \frac{\pi^2 * 210 * 10^3 * 22882.048}{254^2} =$$

$$=735.1 \text{ kN}$$

Frame design

Material used –mild steel, square pipe

Area=1*1inch=25.4*25.4=645.6mm^2

Length of link=30 inch=762 mm

Weight of project=15 kg= 15*9.81 =147.15 N

Solution

1. Effective length

Effective length, when both ends fixed,

$$L_e = \frac{L}{2} = \frac{762}{2} = 381 \text{ mm}$$

2. Internal Area

Internal width and depth, which have 3 mm thickness,

d=b=38.1-2*3 =32.1 mm

3.Moment of inertia

$$I=\frac{BD^3-bd^3}{12}=\frac{25.4*25.4^3-19.4*19.4^3}{12}=22882.048\text{mm}^4$$

4. Crippling load by Euler's formula

$$P_c=\frac{\pi^2 EI}{Le^2}=\frac{\pi^2*210*10^3*22882.048}{381^2}=$$

=384.945 kN

SCOPE:

The project is combination of the mechanical and Electronics, which is fairly known as the Mechatronics. The upcoming world is full of Automation so we need to develop 'a system which is fully automatic. Now a day vehicle accident is the major problem. This braking system used an innovative project for the purpose of preventing accidents happens in the restricted roadways. To overcome this problem, we are going to develop a system which is helpful for the reduction of road accidents. It is the project which has been fully equipped and designed for auto vehicles. The technology of pneumatics plays a major role in the field of automation and modern machine shops and space robot.

ADVANTAGES:

- It able to Increase the sureness in braking system.
- Braking system able to give fast response.
- System able to increase the pre-crash safety.
- System able to provide more safety to the passengers.
- System plays an important role to save human Life in road accidents

LIMITATIONS:

- Additional cost is required to use the system.
- Vehicle speed above 40-50 km/hr.
- System have few limitations in densely traffic road.
- System has no provision to prevent accidents from rear side of vehicle.

APPLICATIONS:

- For Automobile applications.
- For Industrial applications.
- Passenger car vehicles.

- This system also successfully installed in cars, Rickshaws, Tempos & heavy vehicles like buses, trucks, trailers, etc.

CONCLUSION:

Our main aim behind the designing of this system is to improve the prevention technique of accidents and also reducing the hazard from accidents like damage of vehicle, injury of human etc. We observed that our system is able to achieve all the objectives which we have determined.

REFERENCES:

1. Apeksha S. Chavan1, Dipali D. Pansare, Swapnil P. Kadam, Naval K. Mayekar, Kavita V.Jha, Poonam R. Bhagwat "Design of Accident Prevention System Using QRD 1114 and CNY70 Sensors"
2. B.Praveen kumar, K.Mahendrakan "Prevention of Accident Due To Drowsy" by Using Eye Blink
3. Srinivasa chari.v, dr. Venkatesh p. R, dr.prasanna rao n.s, adil ahmed s "automatic pneumatic bumper and break actuation before collision", 2015, international research journal of engineering and technology (irjet) volume: 02 issue: 04, pp1015-1023

4. Dr. P. Poongodi. Mr. P. Dineshkumar, "Automatic Safety System for Automobiles"
5. Dr.eung soo kim,"fabrication of auto braking system using sensor", international journal of control and automation, vol-2, and no1.
6. Takahiro Wada, "A Deceleration control method of automobile for collision avoidance based on driver perceptual risk"
   IEEE international Conference on Intelligent Robots and Systems, Oct 4881-4886.
7. Lee,"A Theory of Visual Control of Braking Based on Information About Time to Collision", Perception, Vol 5, pp 437-459
8. Erik Coelingh, LottaJakobsson, Henrik Lind, Magdalena Lindman, "Collision Warning with Auto Brake - A Real-Life Safety Perspective", Volvo Car Corporation Sweden Paper Number 07-0450
9. J. T. Wang, "An Extendable and Retractable Bumper"