Sensor Operated Intelligent Parking System

Pratik Gite
Department of Mechanical Engineering
Sandip Institute of Engineering and Management, Nasik, India

Abstract— The purpose of this project is to provide a braking system that provides safety for vehicles in parking area. Many times, the driver is unable to judge the obstacle at the rear side of vehicle during parking of vehicle. The project "Intelligent braking system" is planning to introduce new advanced system of automatic and semi-automatic control to avoid fatigue to driver and damage to vehicle during parking. In present work, a prototype of an Infrared distance measuring technique is used to measure distance between vehicle and stationary object. Controlling speed of vehicle with respect to the predetermined distance is done through electronic control unit. The aim is to design and develop a control system with pneumatic braking system by an intelligent electronic control using iterative technologies. The system uses IR sensors, which measure relative distance between the vehicle and stationary object after that the system actuates accordingly to restrict vehicle movement.

Keywords: Intelligent braking system, IR sensor, prototype, infrared

I. INTRODUCTION

Braking systems of commercial vehicles had always given the highest importance to the concerning safety issues. Due to different parameters like load characteristics, design of these vehicles, adhesion between tire and road and behavior of vehicle in different conditions is the reason that vehicle-braking system should be constantly monitored. Inappropriate braking of these vehicles can cause accidents, which can cause damage to vehicle and injury to someone. The ever-increasing demand for quick response and control of braking action by automatically can be fulfilled by modern electronic abilities integrating with the commercial braking system.

The main objective of this project is to provide comfort to the driver while parking the vehicle without damage to the vehicle by collision.

Since the control system does not use the absolute speed to calculate the safety distance as done by already existing methods, the interaction with automotive electronics is limited to actions on accelerator and brake. This matter coupled with the fact of lower cost of ultrasonic sensors compared with other type of sensors, could facilitate the application and mounting and application of system in many low end vehicles, helping to improve comfort, safety and hassle free driving at low cost. Integration of mechanical components and electric devices is used for the optimum results.

II. SYSTEM MODELING

Main components such as 5/2 DC valve, pneumatic cylinder, connecting wires, tubes, connectors are required along with electronic equipment like IR sensors, control circuit for valve are used. F

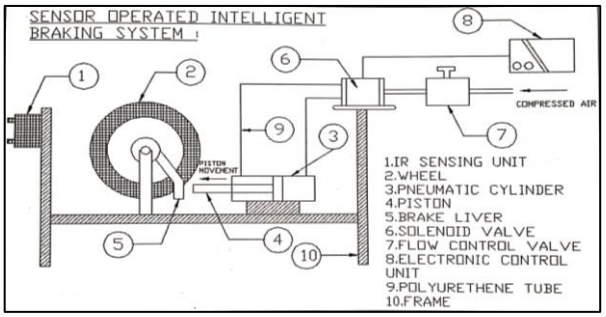

Fig. 1: Sensor Operated Intelligent braking System

III. SPECIFICATIONS OF PARTS

A. *Pneumatic Cylinder*

Pneumatic cylinder is used for breaking purpose and is mounted on rectangular bar.
Cylinder type – Double acting
Bore – 16 mm
Stroke – 100 mm
Piston rod diameter – 6 mm
Maximum working pressure – 0.1 to 0.9 MPA

Fig. 2: Pneumatic cylinder

B. *Solenoid Valve*

One solenoid 5/2 DC valve is used for controlling of pneumatic cylinder. Valve is mounted on frame and valve ports are connected to cylinder by polyurethane tube.

Fig. 3: 5/2 DC valve

C. *D.C. Motor*

One D.C. motor is mounted inside the wheel to provide free rotation to the wheel.

1) Voltage – 12 V
2) Output power – 1.1 W
3) Rated speed – 200 rpm

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4) Rated torque – 7.84 N*cm
5) Rated current – 0.41 A
6) Encoder resolution – 60 counts per revolution
7) Weight – 160 g
8) Diameter – 37 mm
9) Shaft diameter – 5.5 mm

D. IR Transmitting Circuit

IR sensor is a transducer used for measurement of a physical variable. IR sensor unit is mounted on the back side of the frame. External power supply is given to the sensor unit. Control unit is mounted on the backside of the valve. IR sensor is used along with the IC555 timer.

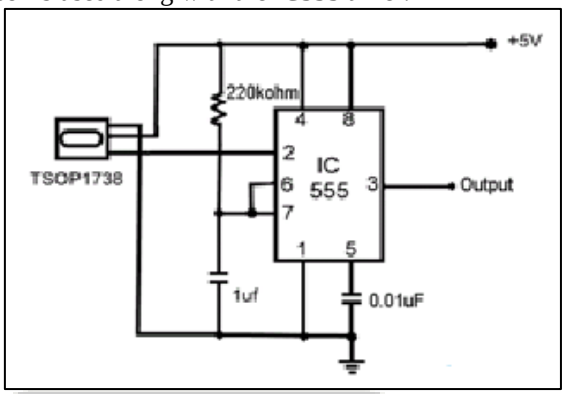

Fig. 4: IR infrared receiving circuit using IC 555

E. Working wheel

Two working wheels of free rotation are provided on both end of metal shaft. Two ball bearings are provided for smooth rotation of both wheels and all bearings are mounted on rectangular bar.

F. Bearings

Bearings are deep groove radial of standard 6000 are selected
Bore diameter – 10 mm
Outer diameter – 26 mm
Width – 8 mm

Fig. 5: Deep groove ball bearing

G. Polyurethane Tube

The polyurethane tube features excellent flexibility and it can be used for compact piping requirements having small radius.

1) Pressure range – Less than 0.7 Mpa
2) Temperature range – 5 to 140 °C

IV. WORKING OF MODEL

Cast iron is used for making the frame. It is used to support all components over it. Two rectangular bars used to support wheel shaft, cylinder and bearings. Both bars are made of cast iron and welded in vertical direction. Each bar has one hole in it to support the bearings.

The wheels are continuously rotating as the motor is connected to the wheel.

IR circuit consists of one transmitter "IR transmitter" and one receiver "IR receiver". IR transmitter continuously transmits the Infra-Red rays. If any object comes in the path rays get reflected. These reflected rays are received by the IR receiver. The IR Receiving circuit gives the control to the solenoid valve. As the solenoid valve activated it allows passing of air from compressor to cylinder through the connecting tube. After that
High pressure of air move the piston to outside of the cylinder and the shaft of the piston come in contact with the wheel and thus brake applies and wheel stops rotating.

The compressed air form the compressor at pressure of 5 to 7 bar is passed through the pipe connected to the solenoid valve with one input. The solenoid valve is actuated with control timing unit. The air enters in one input and leaves by one of the two outputs.

When the solenoid is activated, the compressed air activates the pneumatic cylinder and moves the piston rod so the breaking mechanism is activated. The braking speed can be varied by the flow control valve.

V. CALCULATIONS

Pneumatic Cylinder specifications
Thrust in forward stroke

$$\boldsymbol{F = (\pi/4) * D^2 * P} \quad (3.1)$$

$$\boldsymbol{F = (\pi/4) * 16^2 * (0.1\ to\ 0.9)}$$

F = 20.11 – 181 Kg

Thrust in return stroke

$$\boldsymbol{F = (\pi/4) * (D^2 - d^2) * P} \quad (3.2)$$

$$\boldsymbol{F = (\pi/4) * (16^2 - 6^2) * (0.1 to\ 0.9)}$$

$$\boldsymbol{F = 17.28 - 155.5\ Kg}$$

Theoretical air consumption in forward stroke

$$\boldsymbol{C = [(\pi/4) * D^2 * (P + 1) * L]/1000} \quad (3.3)$$

$$\boldsymbol{C = [(\pi/4) * 16^2 * (0.1 + 1) * 100]/1000}$$

$$\boldsymbol{C = 22.11\ liters}$$

Theoretical air consumption in return stroke

$$\boldsymbol{C = [(\pi/4) * (D^2 - d^2) * (P + 1) * L]/1000} \quad (3.4)$$

$$\boldsymbol{C = [(\pi/4) * (10^2 - 6^2) * (0.1 + 1) * L]/1000}$$

$$\boldsymbol{C = 19\ liters}$$

Braking distance (Db)

$$Db = [v^2/ (2 \times \mu \times g)]\ \text{meter} \quad (3.5)$$

Where,
v = Velocity before applying brakes
μ = coefficient of friction = 0.7 (for dry surfaces)
g = acceleration due to gravity (9.81 m/$\boldsymbol{sec^2}$)
Braking distance,

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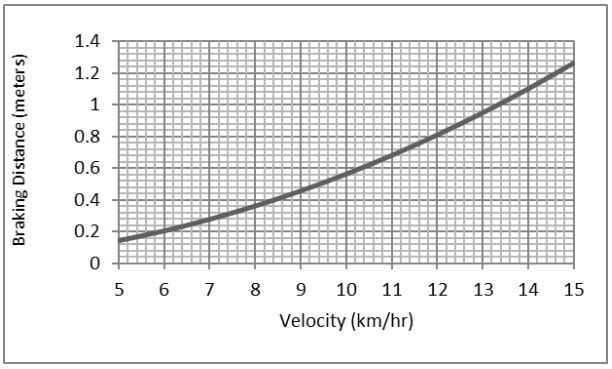

Fig. 6: Braking distance as a function of velocity

VI. CONCLUSION

Behind the designing of this system, our main objective was to implement the preventive technique of accidents and also reduce the hazard from accidents like damage of vehicle, injury of driver and passengers, etc. We observed that our work is able to achieve all the mandatory objectives. The solution provided is cheap, reliable and easy to implement. It can be implemented in the low end as well as high end cars. The sensor operated intelligent braking system provides ease of parking, comfort and avoids fatigue to driver. The system can actuates the pneumatic braking mechanism to bring the vehicle to the rest within few millimetres when the IR sensors sense any obstacle in the path of vehicle.

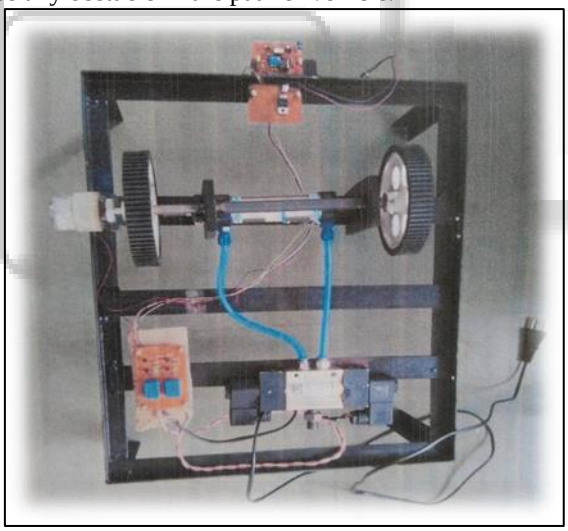

Fig. 6: Model of the sensor operated intelligent braking system

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