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AUTOMATIC REVERSE BRAKING WITH BLINDSPOT DETECTION

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ABSTRACT

In this world of automation, various systems have been developed just to reduce the time and human error. The paper is about a system for assisting a car driver while parking in reverse direction and to reduce blind spots area around a vehicle that cannot be seen while looking either forward or through side or rear view mirror. The automatic reverse braking system with blind spot reduction technology will process the sensor data and control the vehicle to prevent accidents caused by careless driving or difficulty in detecting objects in reverse path and on the road while driving. This is an integrated circuit based setup which is useful in automobiles as an intelligent vehicle assistant for safe driving.

KEYWORDS: Reverse braking, blind spot, automatic, automobile safety.

I. INTRODUCTION

Driving is a compulsory activity for most people. People use their car to move from one place to another place. The numbers of vehicles are increasing day by day. Proportionally, the numbers of accidents are also increasing. Accidents cause worse damage, serious injury and death. They are mostly caused by the delay of the driver to hit the brake. The use of electronic components in automobiles is set to accelerate and with ongoing efforts to improve safety and comfort. Cars makers in many countries have contributed to automobiles technology by developing systems such as rear view camera system, road-to-vehicle and inter vehicle communication system, auto-parking system and new car technology for intelligent cars such as intelligent transport system, hybrid car, electric car and hydrogen fueled car. Around 250 electronic components are presently being used in a car. Therefore, a system is proposed which will help in enhancing the performance of vehicles and thus contributing to the upcoming automobiles technology. [1]

To develop safety, when car gets too close to an obstacle, an alarm is triggered which may warn the driver. In this process, human error is also included. The actual time to stop the car is response time taken by the driver plus the time required by the braking system to brake the car and time of response of driver is much of a greater influence. Hence, it is required to make an automatic reverse braking system. Pneumatically operated reverse braking which is activated when ultrasonic sensors sense an obstacle. [3]

A problem that often concerned by the driver is the areas which cannot be seen by side view and rear view mirrors, which is called as blind spot region of vehicle. Vehicles in the adjacent lanes of the road may fall into these blind spots, and a driver may be unable to see adjacent vehicle using only the car's mirrors. Other areas that are sometimes called blind spots are those that are too low to see behind and in front of a vehicle. Also, in cases where side vision is hindered, areas to the left or right can become blind spots as well. [2] In several accident cases, it has happened because of driver's inability to monitor the blind spot region well. The main objective for this project is that the car can automatically brake when driving in reverse due to obstacles when sensor senses the obstacles. And also to eliminate the blind spot regions by sensing the vehicle in sideways by the sensors and reducing the accidents and the driver could safely change the lane on roads.

This system is mainly divided into two categories according to operation. Electronic operation for the detection of obstacle behind the car, the ultrasonic sensor transmitter and receiver circuit is required. The output from this circuit is sent to the solenoid valve which helps in pneumatic braking. Mechanical operation, when ultrasonic

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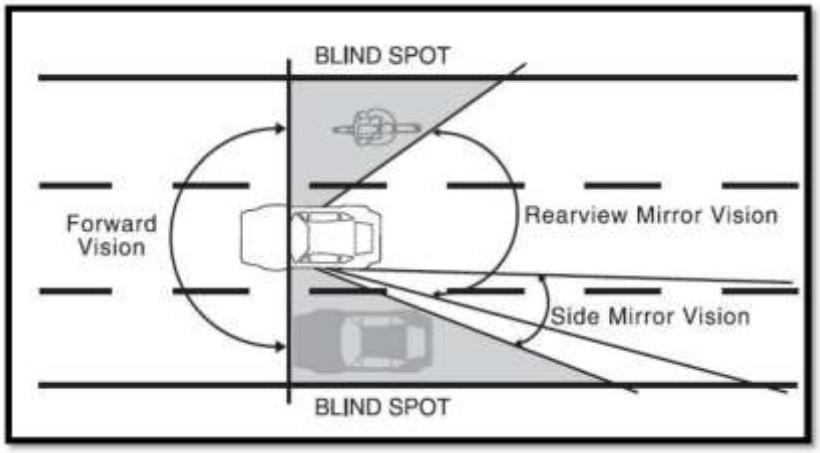
sensor gives input to solenoid valve via circuit board, then pneumatic brake is applied to the car. For this operation, pneumatic force is used to apply the brake.



Blind spot definition

II. COMPONENTS AND CONSTRUCTION

Pneumatic single acting cylinder

The cylinder is a single acting cylinder, which means that the air pressure operates forward and spring returns backward. The air from the compressor is passed through the regulator which controls the pressure to required amount by adjusting its knob. A JELPC SU32X50 pneumatic cylinder with MS steel piston has been used to brake two wheels along with the shaft. Technical details of component is shown in table 1.

Pneumatic single acting cylinder [4], and Solenoid valve [5]

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. This solenoid cut off valve is controlled by the emergency push button. The 3/2 single acting solenoid valve is having one inlet port, one outlet port, and one exhaust port. The solenoid valve consists of electromagnetic coil, stem, and spring. The air enters to the pneumatic single acting solenoid valve when the push button is in ON position. It will control the only signal for reverse braking. Technical details of component is shown in table 1.

Air tank, Ultrasonic sensor, and Motor

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Air tank
Air tank is for storing compressed air to operate to pneumatic cylinder. It provides potential for the braking system.

Ultrasonic sensor
Active ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. A set of four ultrasonic sensors has been used to cover the blind spot regions.

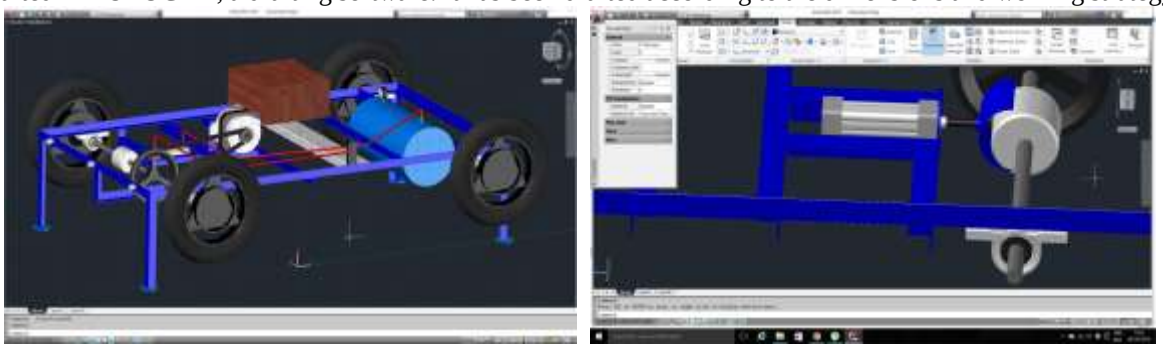
Table 1. Technical details of components

Pneumatic single acting cylinder	Solenoid valve	Motor
Model: JELPC SU32X50, Piston rod: MS hard chrome plated, Seals: Nit rile (Buna-N), Piston: Aluminium, Bore: 35 mm, Stroke: 65 mm, Media: Compressed air, Temperature: 20° to 80° C.	Model: Mozy Pneumatic 4V10-08, Pressure: 0.15~0.8 MPa, Media: Compressed air, Type: 3/2, Applied voltage: 12 V DC, Frequency: 50/60 Hz.	Phase: Single phase, Voltage: 240 Volt Rotation: 1200 rpm, Horse power: 0.25 hp, Maximum current: 2.8 Amp.

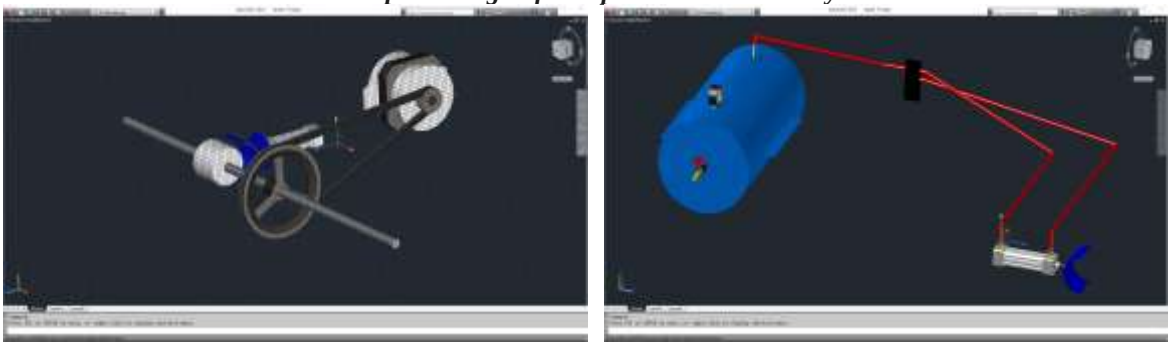
Motor
Motor is a machine powered by electricity or internal combustion that supplies motive power for vehicle or another device with rotating parts. In the given setup, an AC motor is used to give motive power or propulsion to the shaft & wheels of the system with the help of pulley arrangement. A 0.25 hp motor is used to provide rotation to the shaft. The entire frame has been constructed from mild steel and joined using arc welding. The shafts are metal and lathe processed. Hard metal bearings support the shaft and entire electronic system is operated by a circuit board. Technical details of component is shown in table 1.

DESIGN

Before making mechanical components, it should be designed or drafted in any designing or drafting software with its specific dimensions and parameters. By doing so, any kind of failures can be identified before manufacturing it. Also, it can be visualized how it will look and work. All the components in figure has been drafted in AUTOCAD, a drafting software. It has been drafted according to the dimensions and working strategy.



Complete design of set up and brake assembly



Motor with belt-drive and pneumatic brake system

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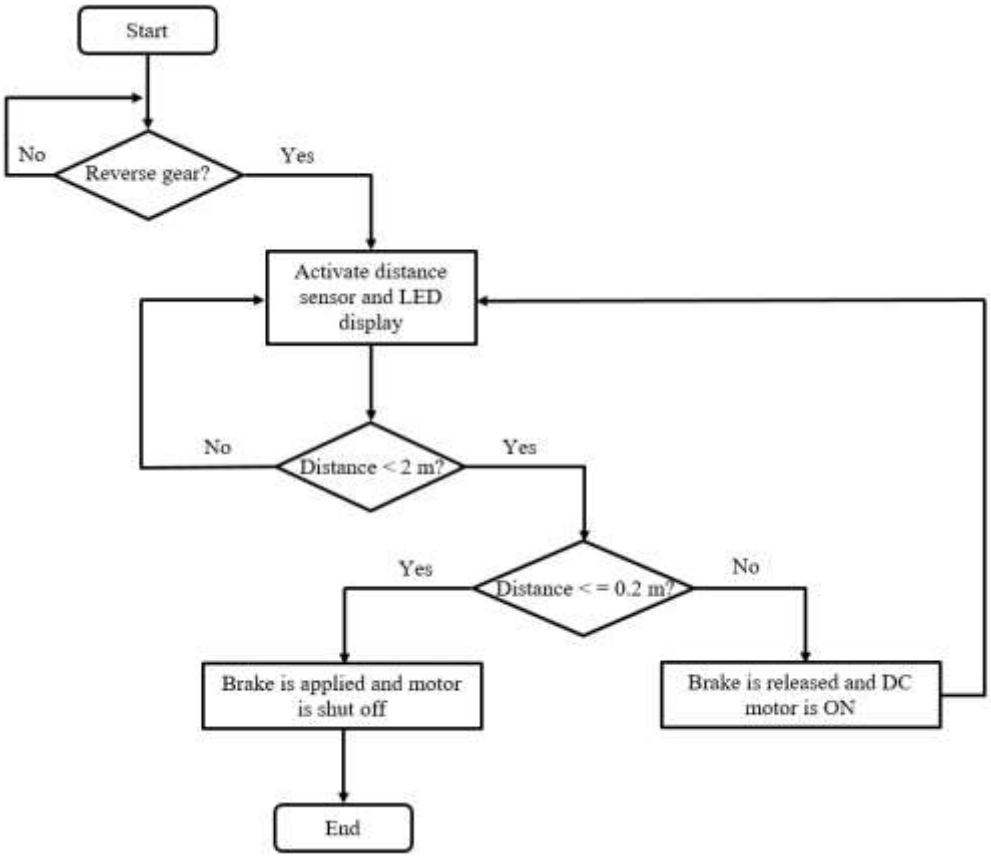
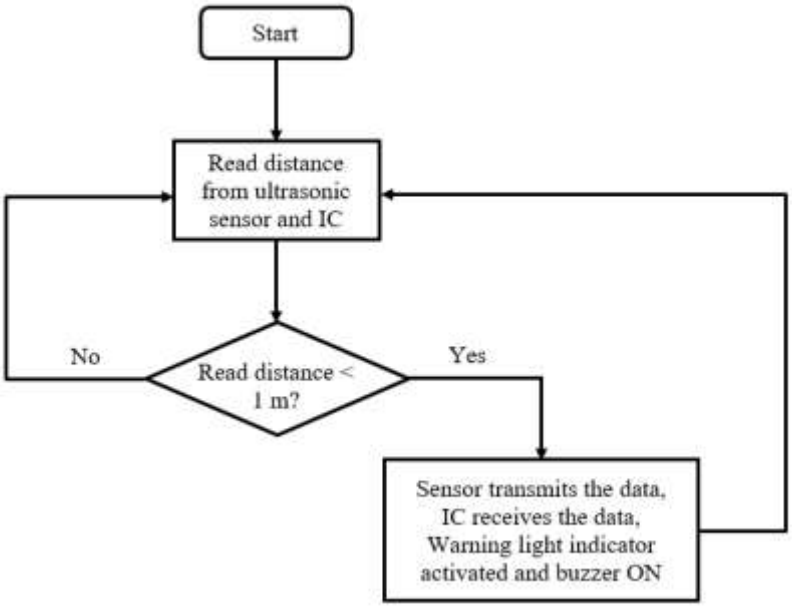
III. WORKING

The whole system operates only when the car is moving in reverse direction. When vehicle is the reverse gear, power supply is given to the sensor unit. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object as shown in figure. [3]



Operating principle of automatic reverse braking system



Operating principle of blind spot reduction system

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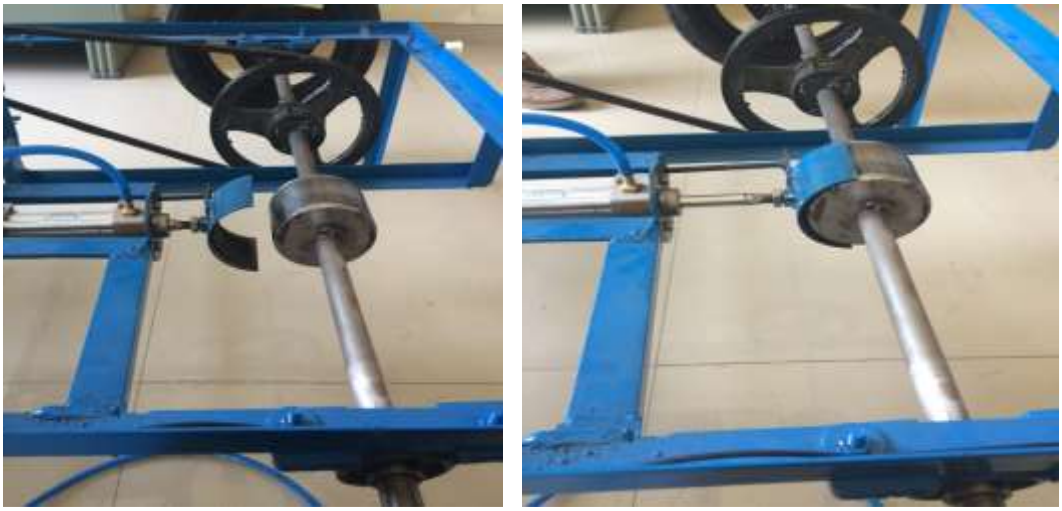
This reflected echo is received by the control circuit. If there is no obstacle in a path, the receiver circuit will not receive any signal and the whole signal remain as it is. Ultrasonic sensor receives the reflected echo and giving the control signal to the control circuit. The control circuit is used to activate the solenoid valve. If the solenoid valve is activated, the compressed air passes to the double acting pneumatic cylinder. [6]

The compressed air activates the pneumatic cylinder and moves the piston road. If the piston moves forward, then the braking arrangement is activated. The braking arrangement will used to stop the wheels gradually or suddenly due to the piston movement. [7]

For the blind spot reduction, shown in figure, two ultrasonic sensors are used which are attached at the side A pillars. LEDs are used to indicate driver during changing the lane or at the corner. When the sensor detects any vehicle in the range, it will send signal to the same IC circuit used in reverse braking system and indicate on the LED screen.



Initial position of brake, and after brake applied

The figure shows an initial position of the brake assembly. When no obstacles are found by sensors, then there is no data given to the control circuit so the pneumatic system is not activated hence there is no movement of the single acting cylinder towards the rotating hub which is attached at the shaft.

The figure shows a brake applied after sensing any obstacle. When any obstacle enters in range of the sensor, the sensor sends the data to the control circuit. After receiving the data from the sensor the control circuit activates the pneumatic system and by the compressed air the pneumatic cylinder moves forward and coming in contact with the rotating hub and because of the friction between them the brake will be applied.

IV. RESULT AND DISCUSSION

Results of automatic reverse braking are shown in table 2. The system stays off until the reverse gear has been pulled. After, it has been pulled at a distance of 1.2 m from obstacle, the brakes start slow fluctuations. As the obstacle comes close, the fluctuations keep speeding up. Finally, at a distance of 0.2 m, the brake is fully applied. The motor shuts off at this point and shutting down any movement to the wheels.

Table 2. Results of automatic reverse braking system

Reverse gear applied	Distance (meter)	LED	Buzzer	Brake applied	Motor
No	-	Off	Off	Off	Off
Yes	1.2	On	Low	Slow fluctuate	On
Yes	0.9	On	Medium	Medium fluctuate	On
Yes	0.6	On	High	Rapid	On
Yes	0.2	On	High, Constant	Fully applied	Off

Results of blind spot reduction technology are shown in table 3. The digital LEDs show distance from any obstacle in its blind spot region, along with warning lights and buzzer activation. At a distance of 1 m, LED shows green light along with a low buzzer warning. If distance decreases to 0.6 m, LED shows yellow light with a medium

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buzzer sound. Further on at a distance of 0.3 m from obstacle, LED shows red lights and a high buzzer sound is emitted warning the driver about closer distance.

Table 3. Results of blind spot reduction technology

Distance (meter)	LED	Buzzer
1	Green	Low
0.6	Yellow	Medium
0.3	Red	High and constant

V. CONCLUSION

The laboratory set-up demonstrating blind spot detection and reverse braking system was successfully developed as per the design. This system is flexible to be used in any commercial vehicle. Use of multiple alert devices such as buzzers, LEDs and ultrasonic sensors makes the system more secure to prevent any accidental situations. Cost is low and can be implemented along with the current vehicle system. Tests have been carried out to check the proper working of set-up as per the design. The result for reverse braking system shows that complete braking is done at 0.2 m if any obstacle is sensed at that distance to avoid collision. Similarly, tests were also conducted for blind spot detection and the result shows that if any obstacle is entering the blind spot area, then LED will blink green with slow buzzer at 1m. Further LED will blink yellow with medium buzzer at 0.6 m and lastly LED will blink red with constant buzzer at 0.3 m.

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VII. REFERENCES

[1] Nilima G. Maraskolhe, Shubham S. Lokhande, Nayna P. Lokhande, Bhushan S. Rakhonde, “International Research Journal of Engineering and Technology”, Volume 4 Issue 1 e-ISSN 23950056, pp. 1748-1751, 2017.
[2] Mohd Ridhuan Bin Selamat, Dr. Herman Bin Wahid, “A blind spot detection system based on ultrasonic sensing”, Bachlor’s thesis, Universiti Teknologi Malaysia, 2014.
[3] Sonali Sachin Sankpal, Ajita A. Patil, Madhukar S. Chavan, “Intelligent Vehicle Assistance System. International Journal of Emerging Technology and Advanced Engineering”, Volume 4, Issue 11, pp. 73-75, November 2014.
[4] JELPC (Ningbo Jiaerling Pneumatic Machinery Co. Ltd.), http://www.jelpc.com/sc-su-series/sc-su-series.html, accessed February 11, 2017.
[5] Solenoid (Solenoid-Valve-Info.com), http://www.solenoid-valve-info.com/solenoid-valve-definition.html, accessed February 11, 2017.
[6] P. Balashanmugam, K. Balasubramaniyan, G. Balasubramaniyan, S. Vinoth, “Fabrication of high speed indication and automatic pneumatic braking system”, International Journal of Engineering Trends and Technology, ISSN: 2231-5381, Volume 5 Number 1, pp. 40-46, 2013.
[7] Divya Thakur, A P Thakare, “Implementation of Automatic Reverse Braking System on FPGA”, IETE 46th Mid Term Symposium “Impact of Technology on Skill Development” MTS – 2015, Special Issue of International Journal of Electronics, Communication & Soft Computing Science and Engineering, ISSN: 2277-9477, pp. 133-136, 2015.

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