ISSN 2395-1621

Design and Fabrication of Automatic Braking System in Automobile using Ratchet and Pawl Mechanism in Sloppy Areas

#1Harsh Vardhan Agnihotri, #2Subodh Kumar, #3Akant Jaiswal, #4Pankaj Rai
#5Mr. Swapnil Ghogardare

1harshvardhanagnihotri@gmail.com

#12345B.E Mechanical Engineering,
D.Y.Patil College of Engineering, Akurdi.

ABSTRACT

This paper presents an ultrasonic automatic braking system for collision avoidance. This system consists of ultrasonic sensors namely ultrasonic wave emitter and ultrasonic wave receiver. The ultrasonic wave emitter is provided in front portion of the car, producing and emitting ultrasonic waves in a predetermined distance in front of the car. The reflected wave (detection pulse) is measured to get the distance between vehicle and the obstacle. In this work the mechanism has been developed to stop the vehicle from rolling backwards when the vehicle is moving in the hill roads. Ratchet and Pawl mechanism has been identified to arrest the motion to the front axle. Anti-Roll Back mechanism has been fabricated and tested on the front axle assembly. The mechanism works well.

Keywords :- Automatic braking system, Ultrasonic sensors, Detection pulse, Arduino uno, Relay, Solenoid Valve, Ratchet & Pawl Mechanism.

ARTICLE INFO

Article History

Received: 25th May 2017

Received in revised form :

25th May 2017

Accepted: 27th May 2017

Published online :

28th May 2017

I. INTRODUCTION

As more than 50,000 fatal accidents in the country take place due to over speeding, government is also planning to make speed warning beep audio warning mandatory in vehicles on similar lines of seat belt wearing sign.

Ratchet and pawl mechanism is used in many applications effectively where the one side power transmission is required for example in (i) Giant wheel- It is the large wheel used in the amusement parks to rotate along the horizontal axis to rotate in one direction while carrying the number of passengers. (ii)Clocks- where the hands rotate in clockwise directions only.(iii) Baffle gates- in the entrances of many buildings which rotates about vertical axis in one direction.(iv) Shaping Machines – in the crank and slotted arm. In the hill station, the most common problem to the drivers isto park their cars in the slope and to start up the car. While waiting in the traffic , the cars have to move on step by step very slowly, this situation is a difficult one for the drivers to make their car not to roll back in the slope. So the mechanism has to be developed to stop the vehicle from rolling back and it should not stop the vehicle in accelerating forwards. This function can be achieved by using the ratchet and pawl mechanism

II. OUTLINE OF THE PAPER

This paper is outlined as follows: Section 3 describes the principal components of the ultrasonic automatic braking system. Section 4 describes the methodology. Section 5 describes construction and working of the system. Finally, the conclusion is presented in Sections 6.

III. PRINCIPAL COMPONENTS OF AUTOMATIC BRAKING SYSTEM

ULTRASONIC SENSOR

Ultrasonic ranging and detecting devices use high frequency sound waves called ultrasonic waves to detect presence of an object and its range. Normal frequency range of human ear is roughly 20Hz to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of human ear, and thus have frequency above 20,000Hz. An ultrasonic sensor necessarily consists of a transducer for conversion of one form of energy to another, a housing enclosing the ultrasonic transducer and an electrical connection. These sensors are of two types:

• Ultrasonic Transmitter – Before transmitting the ultrasonic wave, transducer is used to generate the ultrasonic waves. The transducer is given a signal to intermittently produce

ultrasonic waves. After that the ultrasonic transmitter sends the waves at a predetermined distance frontward. The maximum range for which obstacle can be detected depends on the range of ultrasonic sensors used.

• Ultrasonic Receiver:
If the ultrasonic wave detects the obstacle, it will produce a reflected wave. An ultrasonic receiver is used for receiving the ultrasonic waves reflected from the obstacle. The received ultrasonic wave is converted into a reception signal with the help of a transducer. The signal is amplified by an amplifier (operational amplifier). The amplified signal is compared with the reference signal, to detect components in amplified signal due to obstacles on the road.

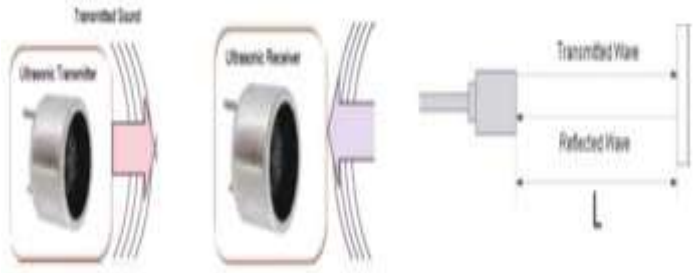
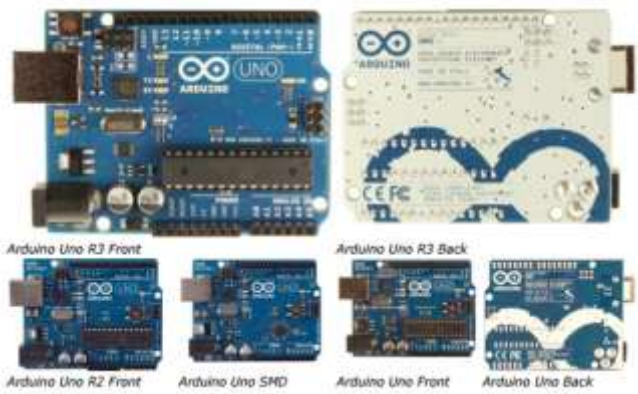


Fig. 1 Ultrasonic transmitter Fig. 2 Ultrasonic receiver Fig. 3 Operation of an ultrasonic sensor

Arduino Uno :-
The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features:

• 1.0 pinout:
Added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V.

•Atmega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.



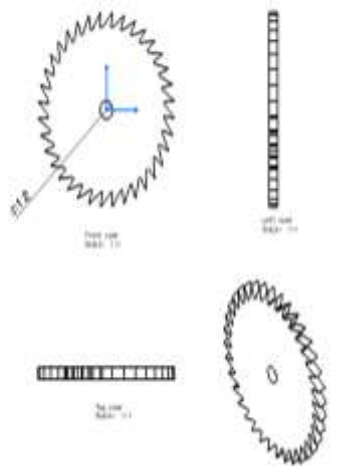
SOLENOID VALVE:
This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoids may be push type or pull type. The push type solenoid is one in which the plunger is pushed when the solenoid is energized electrically. The pull type solenoid is one is which the plunger is pulled when the solenoid is energized. Parts of a Solenoid Valve :

1. Coil
2. Frame
3. Solenoid Plunger

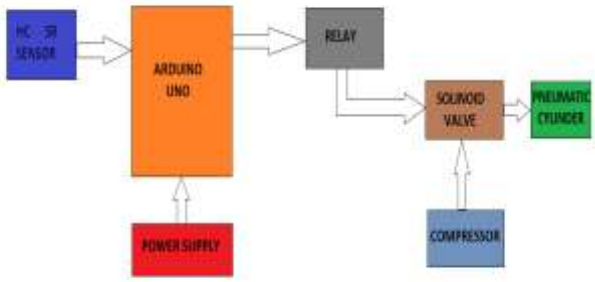
PNEUMATICS:
The word ‘pneuma’ comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure.

RACHET:
The number of teeth on ratchet wheel is assumed as 36. The following parameters are considered for the design of the mechanism. The three dimensional model of the mechanism is shown in figure,



IV. METHODOLOGY



There are two cases which occur in real situations:

(1) When the behind car is less than a distance of 15cm (as programmed in our system) from our car the ultrasonic sensors gets activated turning ON the whole system which turns the rachet and pawl which is subsidiary in blocking the backward motion.

(2) In case, we require more safety the sensors can be established in front which will be helpful in detecting any unwanted objects in front of the car which will finally reduce the velocity and finally stops the car.

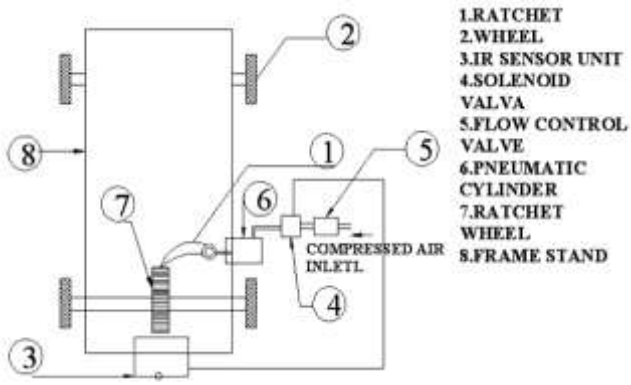
V. WORKING

The ULTRASONIC TRANSMITTER circuit is to transmits the Infra-Red rays. If any obstacle is there in a path, the Infra-Red rays reflected. This reflected Infra-Red rays are received by the receiver circuit is called "ULTRASONIC RECEIVER".

The Ultrasonic receiver circuit receives the reflected Ultrasonic waves 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 Single Acting Pneumatic Cylinder. The compressed air activates the pneumatic cylinder and moves the piston rod.

If the piston moves forward, then the breaking arrangement activated. The breaking arrangement is used to break the wheel gradually or suddenly due to the piston movement. The breaking speed is varied by adjusting the valve is called "FLOW CONTROL VALVE".



IV. CONCLUSION

This paper presents the implementation of an Ultrasonic Automatic Braking System for backward Collision along with forward collision(if needed). The ultrasonic sensors are cheaper and the system comprises of a less demanding hardware. The relative speed of the vehicle with respect to the obstacle is estimated using consecutive samples of the distance calculated. Our programmed microcontroller detects the object in the distance range of 15cm.

REFERENCES

[1] A.Arunkuma , T. Muthumani , V. Balasubramani "DESIGN AND FABRICATION OF ANTI ROLL BACK SYSTEM IN VEHICLES USING RATCHET AND PAWL MECHANISM" ISSN: 0976-1353 Volume 12 Issue 3 – JANUARY 2015.

[2]Knorr-Bremse systems for Commercial Vehicle systems India Pvt. Ltd. (KBI-CVs)" ANTI-ROLL BACK SYSTEM FOR COMMERCIAL VEHICLES"

[3] V. P. Bondaletov, "Pawl Motion in Free-Running Ratchet Gear at High Ratchet Speeds", ISSN 1068-798X, Russian Engineering Research, 2008, Vol. 28, No. 9, pp. 845–848.

[4] J. A. Kennedy, L. L. Howell, "The Ratchet and Pawl Ring (RaPR) Mechanism", 12th IFToMM World Congress, Besançon (France), June18-21, 2007.

