

AUTOMATIC BRAKING SYSTEM USING ULTRASONIC WAVES

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Abstract - Currently, vehicles are often equipped with active safety systems to reduce the risk of accidents, many of which occur in the urban environments. The most popular include Antilock Braking Systems (ABS), Traction Control and Stability Control. All these systems employ different types of sensors to constantly monitor the conditions of the vehicle, and respond in an emergency situation. In this paper the use of ultrasonic sensors in safety systems for controlling the speed of a vehicle is proposed. An intelligent system includes an ultrasonic wave emitter provided on the front portion of a car producing and emitting ultrasonic waves frontward in a predetermined distance. An ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective ultrasonic wave signal. The reflected wave (detected pulse) gives the distance between the obstacle and the vehicle. Then a microcontroller is used to control the speed of the vehicle based on the detection pulse information to push the brake pedal and apply brake to the car stupendously for safety purpose.

Key Words: Antilock Braking Systems, Traction Control, Stability Control, ultrasonic waves, Microcontroller.

1. INTRODUCTION

Driving is a compulsory activity for most people. People use cars to move from one place to another. The number of vehicles is increasing day by day. It is produced tacked tightly and risk to accident. Nowadays, the numbers of accident is so high and uncertainly. Accidents occur frequently and cause worst damage, serious injury and death. These accidents are mostly caused by delay of the driver to hit the brake. This project is designed to develop a new system that can solve this problem where drivers may not brake manually but the vehicles can stop automatically due to obstacles.

The main target for this project is, cars can run automatic braking due to obstacles when the sensor senses the obstacles. The braking circuit function is to brake the car automatically after received signal from the sensor. In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

NEED FOR AUTOMATION:

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production. For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate.

2. AUTOMATIC BRAKING

Automatic braking system is designed for preventing lots of accidents. It operates automatically not manually so chances of failure of this system is less due to this the chances of accidents is also reduces. It is a combination of electronics and mechanical engineering. It is a electro-mechanical device which is designed to prevent accidents and loss of human lives. This system contains Ultrasonic sensor, Relay switch, Micro Controller Unit, Actuator and brakes.

3. COMPONENTS AND WORKING

FRAME

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

PULLEY

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt along its circumference.^[1] Pulleys are used in a variety of ways to lift loads, apply forces, and to transmit power. In nautical contexts, the assembly of wheel, axle, and supporting shell is referred to as a "block."

A pulley may also be called a sheave or drum and may have a groove or grooves between two flanges around its circumference. The drive element of a pulley system can be a rope, cable, belt, or chain that runs over the pulley inside the groove or grooves.

BELT DRIVE

A **belt** is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel. In a two pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts). As a source of motion, a conveyor belt is one application where the belt is adapted to carry a load continuously between two points.

Belts are the cheapest utility for power transmission between shafts that may not be axially aligned. Power transmission is achieved by specially designed belts and pulleys. The demands on a belt-drive transmission system are large, and this has led to many variations on the theme. They run smoothly and with little noise, and cushion motor and bearings against load changes, albeit with less strength than gears or chains. However, improvements in belt engineering allow use of belts in systems that only formerly allowed chains or gears.

AC MOTOR

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

Less commonly, linear AC motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.

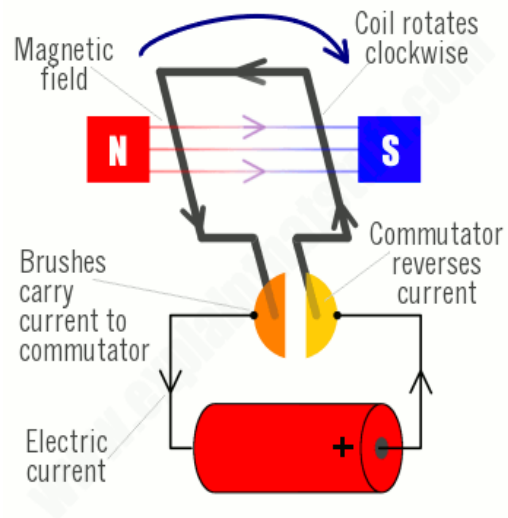


FIGURE 1 : AC MOTOR

PNEUMATIC CYLINDER

Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.

Like pneumatic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage.

Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tiki Room, pneumatics are used to prevent fluid from dripping onto people below the puppets.

Cylinder is a device which converts fluid power into linear mechanical force. They are widely used in industrial pneumatic systems. These cylinders are also called as linear motors and reciprocating motors and are designed for variety of services.

Pneumatic cylinders are designed for a variety of services. Pneumatic cylinders transform the flow of pressured fluid into a push or pull of the piston rod since our system uses double acting cylinders we shall see some details about them.

Double acting cylinders are in one in which fluid force can be applied to the movable element in two directories. The force exerted by the compressed air moves the piston in two directories in a double acting cylinder. They are used particularly. The piston is required to perform work not only on the advance movement but also on the return.

In principle, the stroke length is unlimited, although bucking and bending must be considered before we select a particular size of piston diameter, rod length and stroke length.

The main component of any pneumatic system is the cylinder, which receives air under pressure and the pressurized air helps to move the piston to and fro. The force acting on the piston will be equal to the product of the pressure of air and the area of the cylinder.

SOLENOID VALVE

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV, this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts.

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 in which the plunger is pulled when the solenoid is energized.

The solenoid valve has 5 openings. This ensure easy exhausting of 5/2 valve. The spool of the 5/2 valve slide inside the main bore according to spool position; the ports get connected and disconnected.

BALL BEARING

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is mild steel.

Ball and roller bearings are used widely in instruments and machines in order to minimize friction and power loss.

This technology was brought to its present state of perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type.

However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. Design engineers have usually two possible sources for obtaining information which they can use to select a bearing for their particular application

SENSOR

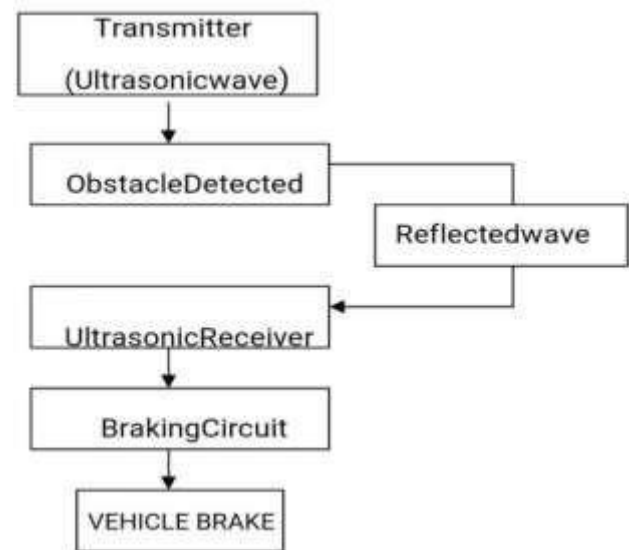
A sensor is an electrical device that maps an environmental attribute to a quantitative measurement. Each sensor is based on transduction principle which is conversion of energy from one form to another form. There are two important terms related to any sensor –

- Target Angle – This term refers to the tilt response ‘limitations of a given sensor. Since the ultrasonic waves reflect off the target object, target angles indicate acceptable amounts of tilt for a given sensor.
- Beam

Spread – This term refers to the maximum angular spread of the ultrasonic waves as they leave the transducer.

4. OPERATIONAL PROCEDURE

In this system, we are using ultrasonic sensor which have range of .2m to 4m. This sensor is fitted over the front portion of the body which emits waves to analyses the speed motion of the vehicle and distance of obstacle (vehicle) in front of them. These sensors give real time inputs to the microcontroller coding. Here solenoid valve are included to activate the actuator to pull drag wire to operate brakes. Brakes are operated with the help of pneumatic cylinder. Relay switch are electro-mechanical switch which operates when electric current passes through them. Electric current passes due to sensors. When sensor senses the obstacle send the signal to MCU Unit it sends current to Switch on the Switch. When relay Switch is ON then actuator is activated. Overall this system operates automatically. Aware of safety in terms of avoiding accidents like in the first place and then protecting occupants when a crash is unavoidable, we can avoid more accidents, save more lives, and reduce insurance and medical costs to society by implementing this system. This system is also necessary implemented like wearing seat belts, helmets etc., in vehicle by government authority to reduce lots of accidents.



5. PROBLEM IDENTIFICATION

The initial requirement for a project work is to identify and understand the nature of the problem. The problem is related to the installment of braking system. Braking system tools and equipment’s play a vital role in making and installation of the system on the vehicle. The main target of the ultrasonic braking system is that, vehicles should automatically brake when the sensors sense the obstacle. This is a technology for automobiles to sense an imminent forward collision with another vehicle or an obstacle, and to brake the vehicle accordingly, which is done by the braking circuit.



FIGURE 2: ULTRASONIC SENSOR



FIGURE 3: PROTOTYPE

6. CONCLUSION

The Braking system, if implemented can reduce number of accidents and can save invaluable human lives and property. The whole system is widely open and can work with various brakes, various sensors and actuator solutions. It must be mentioned that the different subsystem such as sensors, actuators etc. have found other applications since they were designed. Now, this system is designed as a project work at small level but we can adopted this system at industry level so that we can prevent lots of accidents and human lives. The future of automotive safety is more than just developing new technology for preventing accidents.

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