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AUTOMATIC TRAIN BRAKING SYSTEM TO AVOID ACCIDENTS USING, ULTRASONIC SENSORS

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ABSTRACT –

The railway is generally the most welcoming and extensively used mode of transportation in cities across the world. Train travel is a popular mode of transportation due to its affordability, comfort, and safety. It is something that people in a variety of professions can work at. Every year, more than 5 billion people travel by rail throughout the globe, carrying almost 10,000 billion tone-kilometers of freight. The train transport system is essential in today's world for business travel as well as for safety and comfort. But due to missed signals, incorrect track switching, dangerous level crossings, etc., the train runs into unanticipated situations at every turn, which have led to crashes. The economic sector has been severely harmed as a result. But by using ultrasonic sound in combination with a specialized embedded system to create a collision detection technology that can identify obstacles and gradually reduce speed by activating the air brake to stop the train before the collision occurs, we can prevent this unexpected collision and take proactive measures to prevent the accident.

INTRODUCTION –

The world's most popular and friendly form of transportation is the train. On the other hand, rail transportation faces numerous difficulties on a daily basis. With the countless advancement that occurred between 1820 and 2016, rail transport systems—which began in England in the 1820s—have become one of the most popular forms of transportation in the globe. Over 5 billion people and 10,000 billion freight ton-kilometers are transported each year, according to a Railway Statistical Report. According to economists, having a contemporary rail system is a key sign of a country's economic development. However, train transit systems are not safe at the moment.

Numerous crashes occur frequently in several nations when trains are traveling. However, if railroads are equipped with anti-accident technology (ACT), all accidents can be prevented. This state-of-the-art technology detects collision objects at a specific distance from the train and employs ultrasonic and embedded systems to prevent collisions dynamically and effectively. The train disaster is one of the riskiest incidents in history. Faulty lights or signals, faulty machinery, absent safety gates, dangerous crossings, train conductor negligence, and low public awareness are the most common causes of train collisions.

LITERATURE REVIEW-

In the automation sector, designers have proposed several enhancements. A precise short-range radar system was developed for anti-collision applications where automated braking is performed in response to collision risk detection and where there is a very high detection probability combined with a very low false alarm rate. To ensure a smooth and steady parking experience, the recommended brake controller for an automated parking system in a car works in concert with the system. The autonomous antilock braking system (ABS), designed for four-wheel drive vehicles, can override the vehicle's traction control.

Through the prevention of wheel lock-up, ABS serves to maintain the vehicle's directional stability when braking in an emergency or on icy roads. Modern car braking systems have advanced significantly in recent years.

COMPONENTS -

The proposed system offers an enhanced approach to object monitoring by utilizing an Arduino microcontroller, an ultrasonic sensor, and a radar module. The radar will determine the object's distance from the train, and the ultrasonic sensor will ensure that no accidents are caused by the train colliding with objects. The generation of sound waves at a frequency inaudible to humans is how ultrasonic sensors work. They then wait for the sound to be reflected back, timed the amount of time it takes to determine the distance. This is similar to how radar determines the duration of a radio signal's reflection off an item.

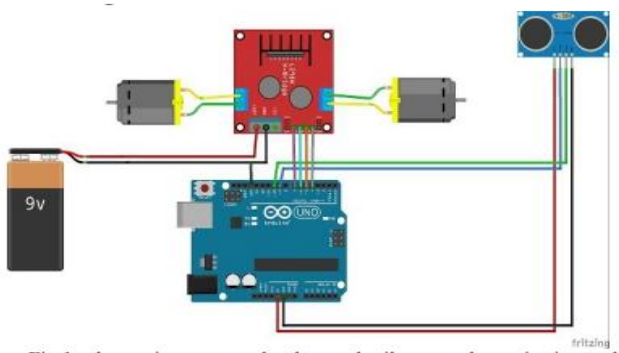


Fig 1: ultrasonic sensor and radar used railway track monitoring and accident avoidance system

COMPONENTS USED IN THE ULTRASONIC BRAKING SYSTEM:

- Arduino UNO
- radar screen
- Electric motor (DC gear motor)
- Ultrasonic Sensor (transmitter and receiver)
- Servomotor
- Mechanical Braking system

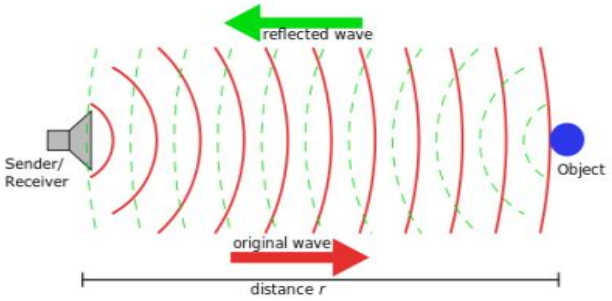
ARDUINO MICROCONTROLLER –

A micro controller is made up of an incredible CPU that is closely coupled to memory, multiple clock or counter, intrusion controller, information procurement interfaces, analogue to digital converter, and digital to analogue converter) all coordinated on a single silicon chip. When developing a framework on a chip, the developer needs to consider peripherals and external memory, including RAM, ROM, and EPROM. All of these offices are given to the controller on a single chip, though. The PCB becomes smaller and less expensive with the introduction of a microcontroller. I/O interfaces (including a sequential port, parallel port

ARDUINO MICROCONTROLLER

RADAR SCREEN -

This Adriano Radar Project is completed with the use of a processing programmed. Radar is a long-range object detection technology that uses radio waves to measure an object's location, speed, and range. Radar is used in automobiles, aero planes, missiles, maritime boats, and weather forecasting. Even though the project is named the Adriano Radar Project, it is actually based on sonar technology since I will be using an ultrasonic sensor to detect the presence of any item within a certain range.



DC GEAR MOTOR -

A DC gear motor is a rudimentary electric gear motor that is powered by magnetic flux, electricity, and a gearbox to produce torque. A DC gear motor requires two magnets with opposing polarity and an electric coil that functions as an electric magnet in its most basic configuration. The electromagnetic forces of attraction and repulsion between the magnets generate the torque needed to move the DC gear motor. In this project, the wheels of the car may revolve because of the DC gear motor layout. It may be found just after the rotary shaft and DC motor are connected to it.

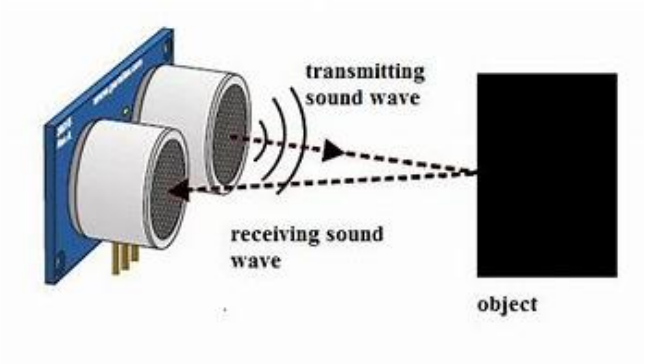
ULTRASONIC SENSOR

Transmitting ultrasonic waves into the atmosphere, an ultrasonic sensor detects signals reflected off of things. There are several applications for ultrasonic sensors, such

as automotive backup sensors, automated door openers, and intrusion alarm systems. Rapid advancements in information processing technology have given rise to new application areas, such as industrial automation equipment and automobile electronics. After years of research and development, Murata has developed a special method for producing piezoelectric ceramics, which has enabled it to produce a range of minuscule yet incredibly powerful ultrasonic sensors.

As the name implies, ultrasonic sensors measure distance using ultrasonic waves. The sensor head emits an ultrasonic wave, which the target reflects back. Ultrasonic sensors determine the target's distance by measuring the time elapsed between emission and reception. Unlike an optical sensor, which contains a transmitter and receiver, an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflecting type ultrasonic sensor, ultrasonic waves are alternately emitted and received by a single oscillator. The sensor head might shrink as a result of this.

ULTRASONIC SENSOR



MECHANICAL BRAKING SYSTEM –

Making use of the auto-braking system A sensor was proposed as a means of preventing collisions involving a vehicle's left, right, and rear ends. This module may employ a sensor to determine how far ahead the driver's automobile is from the other vehicle and then use that information to apply the brakes. Each of the previously stated proposed design approaches raised the bar for both vehicle and pedestrian safety. Not only did it prevent rear-end crashes, but it also supplied ABS for slippery roads and sharp turns.

However, they are all limited to autos travelling in regular directions. Therefore, we need to develop systems that enhance vehicle performance and safety when reversing. One vehicle reversal-focused technology employed binocular cameras to manage speed and recognize obstacles. One kind had obstacle detection and speed control based on binocular cameras and was designed for vehicle reversing.

Therefore, in this work, we propose a "Automatic Reverse Braking system" that employs sensors to recognize obstacles in order to prevent crashes. The "Automatic Reverse Braking system" guides the vehicle and evaluates sensor data to prevent crashes. It is predicted that the proposed work would integrate the vehicle speed control and automated format braking system. There are three main phases in the process: 1. Find the handle (item) inside the car. 2. Control the car's speed. 3. An automatic braking system. The recommended method makes use of a number of sensors to automatically alert the driver to any obstructions on the road via the display. Ultrasonic sensors installed in the vehicle identify the handle and provide data to the controller. The controller responds to these signals in a number of ways to give the driver a safe environment. Once the obstacle in front of the car has been identified, we can see the distance between it and the vehicle right away on the LED display. The automatic braking system is activated when an infrared sensor detects conditions similar to an accident, or when there is very little space between two cars or between cars and an impediment.

Distance Calculation -

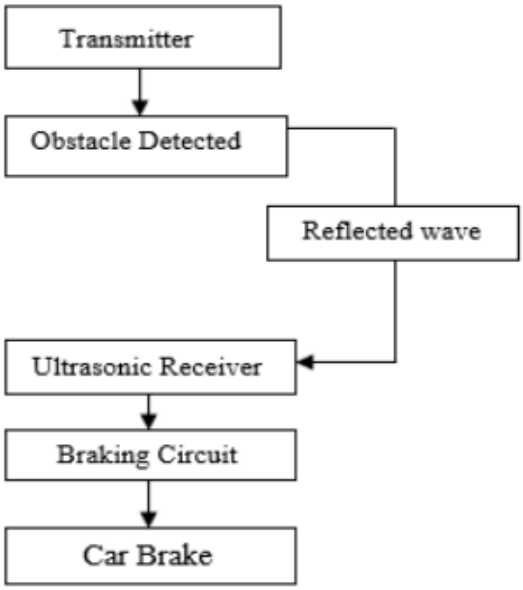
In terms of time intervals between emission and reception (T), sonic speed (C), and distance (L), the formula is 1/2 × T × C. (The money is twice by half since the time it takes to go and return is T.)

WORKING PRINCIPLE

All automakers employ some form of sensor input, even if their autonomous braking systems use various technologies. Transmitter and receiver modules make up the ultrasonic sensor. To detect impediments, the ultrasonic transmitter emits signals and the ultrasonic receiver unit reflects them back. The ultrasonic sensor information is then used to determine if there are any objects in the vehicle's path. If an item is observed ahead of the vehicle, the Automatic Breaking System Using Ultrasonic Sensors Page system may then determine if the car's speed is higher than that of the object.

The PIC microcontroller will do calculations depending on the given maximum distance and the distance between the

obstacle and the autonomous system using an Adriano written C programmed. The DC gear motor rotates steadily at a fixed rpm and gradually decreases speed, using the phenomenon of the servomotor braking mechanism to automatically break the system. A significant speed differential may indicate that a collision is imminent, in which case the system can engage the brakes right away.



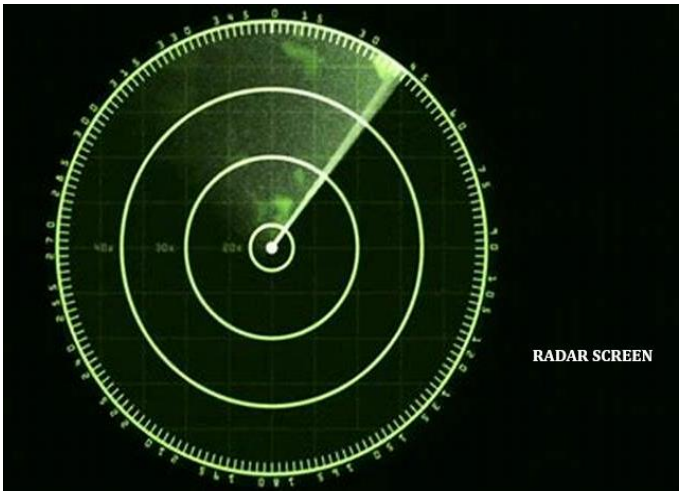
Ultrasonic Braking system block diagram

RESULTS -

The recommended solution makes use of an ultrasonic sensor. The sensor on the receiver's side is fixed along the train route. The signals are converted into electrical energy by the sensor on the transmitter side. Ultrasonic sensors, also known as transceivers, work in a manner akin to sonar or radar, which determine a target's attributes by interpreting radio waves or sound waves, respectively. Ultrasonic sensors generate high frequency sound waves and then examine the reflected sound they receive.

Motor drivers act as current amplifiers because they increase the current signal from a low current control signal. This higher current signal is used to power the motors. L293D has two integrated H-bridge driver circuits. In its usual mode of operation, two DC motors can be operated simultaneously in both forward and backward directions. This is a thorough description of the collision avoidance system's functionality. Every component of the system is linked to the control unit. The power source provides electricity to the control unit. With the help of this project, we may develop an automated method to avoid rail accidents. The obstacles in the train route are located by use of ultrasonic sensors. Ultrasonic sensors function similarly to sonar, which measures a target's distance by listening for the echoes of ultrasonic sound waves. This ultrasonic module's accurate measurement range is 0 to 400 cm, with a gross error of 3 cm. It is a helpful sensor for mapping and measuring distances because of its smaller size, longer range, and ease of use.

Two pins are utilized for triggering and measurement in micro controllers, making it simple to link the module with them. The sensor transmits the ultrasonic wave, and in the time it takes for the burst echo to return to the sensor, it produces an output pulse. The target's distance and any obstructions in the path may be ascertained by measuring the echo pulse width. If obstacles are found during the train's journey, a notification will be transmitted to the monitoring unit.



CONCLUSION -

The project's main objectives are accident prevention and railway track surveillance. The established model was utilized for testing, while Proteus was used for simulation. Ongoing predictions state that if the technology is used on railroads, trains on the International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 1, January 2015 71 ISSN: 2278 – 909X may inadvertently crash. 2015. All Rights Reserved. Copyright IJARECE track fault warnings will instantly stop trains if this idea is implemented, averting crashes and maybe saving lives.

Automatic railway gate controllers can be used at unmanned level crossings to reduce the possibility of coincidences. Because the programmed is fully autonomous, it may thus be used in remote villages without the need for a station master or queue man. In addition, it saves a tone of time because it is automated. It takes time for the lineman to tell the station master when to close and open the gate when using manual procedures. Moreover, because everything is automated, there are less chances for error. This design has several railway applications as a consequence.

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