# Ultrasonic Collision Prevention System for Vehicles

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**Abstract-** Vehicle technology has increased rapidly in recent years, particularly in relation to braking system and sensing system. In parallel to the development of braking technologies, sensors have been developed that are capable of detecting physical obstacles, other vehicles or pedestrians around the vehicle. This development prevents accidents of vehicles using Stereo Multi-Purpose cameras, Automated Emergency Braking Systems and Ultrasonic Sensors. The stereo multi-purpose camera provides spatial intelligence of up to 50 metres in front of the vehicle and there is an environment recognition of 500 metres. Cars can automatically brake due to obstacles or any hindrance when the sensor senses the obstacles. The braking circuit function is to brake the car automatically after receiving signal from the sensors. All cars are competent in applying brakes automatically to a maximum extent of deceleration of 0.4g. Integrated safety systems are based on three principles. They are: collision avoidance, collision mitigation braking systems and forwardcollision warning

*Keywords*: Stereo Multipurpose Cameras, Emergency Braking System, Collision Avoidance

## I. INTRODUCTION

Driving is a compulsory activity for most people. People use their car to move from one place to other place. The number of vehicle is increasing day by day. It is produced tacked tightly and risk to accident. Nowadays, the numbers of accident is so high and uncertainly. Accident will occurs every time and everywhere and cause worst damage, serious injury and dead. Accidents are caused mostly due to the delay in applying of brakes. This work 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. This work is about a system that can control braking system for safety. Using ultrasonic as a ranging sensor, its function based on ultrasonic wave. After transmit by transmitter, the wave can reflect when obstacle detected and receive by receiver. The main target for this project is, car can automatically 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. To prevent these accidents of vehicles from taking place we are using Ultrasonic Sensors. The main target for this project is, car cans automatically braking due to obstacles when the sensor senses the obstacles.

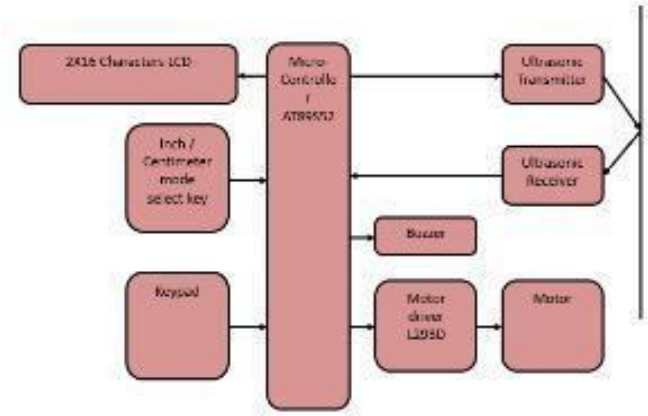


Fig.1

## II. EXPERIMENTAL SETUP

Here an ultrasonic sensor provides spatial intelligence of up to 50 metres in front of the vehicle and there is an environment recognition of 500 metres. This sensor provides spatial intelligence of up to 50 metres in front of the vehicle and there is an environment recognition of 500 metres. Vehicles driving ahead and pedestrians also have a variety of traffic signals and on-road markings that are detected and have been assigned a spatial grouping. The data from short-range ultrasonic sensors that are positioned all around the vehicle as well as from a long-range ultrasonic sensors with an approximate-range detection capabilities provides data on the distance from detected objects. The ultrasonic sensor helps in detection of objects, pedestrians, vehicles or people. This detection is very reliable. It produces a framework to detect objects that are in motion on road. This system detects moving features based mainly related to feature points projection i.e an error on the image which minimizes false detection from a far distance. There is a transmitter which is kind of like an ultrasonic wave which is used to detect any kind of physical obstacle. The ultrasonic transmitter has a piezoelectric crystal that resonates up to a required frequency. This also converts the electrical energy into acoustic energy and vice versa. While transmitting the ultrasonic wave, there is a part



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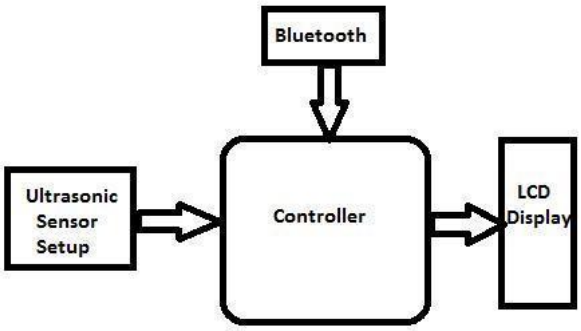
which is ultrasonic wave generator that functions to generate ultrasonic wave.
The figure the block diagram to the simplest:




After ultrasonic waves were produced, ultrasonic transmitter transmits the ultrasonic waves toward a road surface to find out the obstacle. The range that obstacle detected is depends on the range of ultrasonic sensors that used. The ultrasonic wave detects any kind of physical obstacle, hence it will produce a reflected wave.

Once the obstacle is detected there is a reflector which reflects the ultrasonic waves. An ultrasonic receiver is used for this which does the receiving of the ultrasonic waves, reflected from the road surface to generate a reception signal. There is ultrasonic transducer that will transform back the sound wave to electrical energy. This signal amplified by an amplifier. The amplified signal is compared with reference signal to detect components in the amplified signal due to obstacles on the road surface. The magnitude of the reference signal or the amplification factor of the amplifier is controlled to maintain a constant ratio between the average of the reference signal and the average of the amplified signal. This allows the ultrasonic sensor to examine the existence of vehicles. Once this is complete the sensors give an alarm as to an obstacle detected. The processed signal will be send to the braking circuit. The braking circuit here is also known as the Emergency Braking System. The Emergency Braking System is known as an independent road safety system designed for vehicles. This is able to detect incidents where the speed relative to this and the distance between the target and the host suggests here that a collision is impending. At the braking circuit, brake pressures are applied here automatically. This provides maximum brake boost instantly as soon as the driver engages the brakes. After this if the driver's steering actions or the brake that he applies is not sufficient to avoid a collision then the Emergency Braking System with the maximum pressure given by the brakes will be to support mitigation of the impact. This system is recognized as Emergency Braking System and it ensures full reduction in speed. The emergency braking system plays a major role in this and it is the highest escalation step for a very safety system to immediately respond to a critical incident.

The Bluetooth is being used to control the vehicle in the emergency situation.

**Emergency Braking System:**

The entirely new purpose all depend on the existing sensor system that comprises a new Emergency Braking System and an ultrasonic sensor. This behaves as eyes for the entire vehicle. Initially imagine a moving object on the ground which is accelerating at a speed which is about to collide with another moving object. During the point of collision, the distance sensor which had already been installed in the vehicle gives an input to the alarm, which gives an alert to the person who is controlling the vehicle. This will then automatically activate the automatic brake system. In the automatic brake system the vehicle will come to a complete stop gradually when applying brakes automatically to a maximum extent of deceleration, when it is about to collide.

## MICROCONTROLLER

Microcontrollers as the name suggests are small controllers. They are like single chip computers that are often embedded into other systems to function as processing/controlling unit. For example the remote control you are using probably has microcontrollers inside that do decoding and other controlling functions. They are also used in automobiles, washing machines, microwave ovens, toys etc, where automation is needed.

Micro-controllers are useful to the extent that they communicate with other devices, such as sensors,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motors, switches, keypads, displays, memory and even other micro-controllers. Many interface methods have been developed over the years to solve the complex problem of balancing circuit design criteria such as features, cost, size, weight, power consumption, reliability, availability, manufacturability. Many microcontroller designs typically mix multiple interfacing methods. In a very simplistic form, a micro-controller system can be viewed as a system that reads from (monitors) inputs, performs processing and writes to (controls) outputs. Embedded system means the processor is embedded into the required application. An embedded product uses a microprocessor or microcontroller to do one task only. In an embedded system, there is only one application software that is typically burned into ROM. Example: printer, keyboard, video game player.

Microprocessor - A single chip that contains the CPU or most of the computer

Microcontroller - A single chip used to control other devices

Microcontroller differs from a microprocessor in many ways. First and the most important is its functionality. In order for a microprocessor to be used, other components such as memory, or components for receiving and sending data must be added to it. In short that means that microprocessor is the very heart of the computer. On the other hand, microcontroller is designed to be all of that in one.

**Ultrasonic Sensor**

There are ultrasonic signals which are similar to audible sound waves, except its frequencies are much higher. Ultrasonic sensor (US) can provide the initial information on distance to obtain the parameters for further methods to perform task. They are signals that are almost like audible sound waves, except those frequencies are higher. The ultrasonic transmitter has a piezoelectric crystal that resonates up to a required frequency. We have ultrasonic transducers that have piezoelectric crystals which reverberate to a desired frequency. This converts the electric energy into acoustic energy and also vice versa. The sound waves, which are transmitted in the shape of a cone, are reflected back from a target to the transducer. Here an output signal is fabricated to perform some kind of designating or control function. Minimum distance from the sensor is necessary to issue a delay in time so that the echoes can be elucidated. There are few variables that can affect the operation of ultrasonic sensing. Some of them are reflective surface roughness, target surface angle or changes in temperature or humidity. These targets could have any kind of reflective form such as round objects. Ultrasonic transducer produces an ultrasonic signal. These signals are generated through a sensing medium. The very same transducer is used to detect receiving signals. In many cases, the sensing medium is mostly and always air. One ultrasonic transducer is typically present in an ultrasonic sensor which does the transformation of an electrical energy into sound and vice versa a sound into an electrical energy. A housing enclosing the ultrasonic transducer. Optionally an electronic circuit for signal for signal processing and an electrical connection also enclosed in the housing. The ultrasonic sensor measures the distance from the selected point of the ground to the vehicle. The measurement of the ultrasonic sensor is based on the time of fight of an ultrasonic pulse to its reflected wave from the ground. The optimization technique with constraints is used to get the reflected pulse, which are been detected by the usage of threshold comparator. The sub-wavelength is detected with the technique of taking the frequency response into consideration. Low cost components are only compressed in this sensor. This sensor is adaptable for any kind of weather condition.

**Bluetooth**

Bluetooth technology can be found in many devices ranging from smartphones and home entertainment products to watches and medical devices. One popular use is using your phone to connect to the car to listen to music for example. Bluetooth technology is a short-range communication technology which has a low cost and uses low energy. When two devices connect to each other they can “pair” with each other, as long as they are within each other’s proximity. Afterwards a link is maintained, even if there is no data flow. A feature of Bluetooth wireless


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technology is the ability to handle data and voice transmissions simultaneously. It also operates in the unlicensed industrial, scientific and medical (ISM) band at 2.4 to 2.485 GHz, using spread spectrum frequency hopping full duplex signal. Frequency hopping spread spectrum is a transmission technique where the frequency used is changed or switched at random time intervals. This causes the transmission to be more secure; since it is hard to intercept and has minimal interference with other transmissions.

Bluetooth 4.0 is the newest iteration of the Bluetooth wireless technology and is already implemented in some smartphones such as the Samsung Galaxy S3 and the Iphone 5. It will also be implemented in many more smartphones in the coming year. The most significant characteristic of Bluetooth 4.0 is energy efficiency, thus providing a much better battery life for devices. Therefore, a new protocol was added to the Bluetooth Core Specification which is the Bluetooth low energy (BLE). BLE was designed for devices that collect small chunks of information frequently, therefore it is not optimized for file transfer or streaming even though it has a data rate of 1Mbps]. This design allows a device to be on a button-cell battery and last for many months. A new feature that was added to Bluetooth v3.0 and 4.0 is the compatibility with NFC, thus allowing devices to "pair" through tapping these devices together.

BLE is also known as Bluetooth Smart, and the devices that implement Bluetooth 4.0 have two distinct variations. They are divided into Bluetooth smart ready devices which are devices that uses the full range of Bluetooth 4.0, and Bluetooth smart devices, which are devices that gather specific information and sends it to Bluetooth smart ready devices. There are also two different wireless radios, the dual mode radios which are in the Bluetooth smart ready devices. These radios support both classic connections and BLE connections. The Bluetooth smart devices have a single mode radio which allows them to only make Bluetooth low energy connections.

## III. ADVANTAGES

- Eas y to u nd ers ta nd a nd d es i g n
- Eas y to co n tro l sp eed
- Red u ced n u mb er o f a cc i d en t s .
- Sa v i n g o f ma n y l i ve s .

## IV. APPLICATIONS

- Embedded controllers may be found in many different kinds of system and are used for many different applications. Such as:
- Manufacturing and process control
- Construction industry
- Transport
- Domestic service
- By putting a camera on it
- As a fire fighting robot
- Medical diagnostics,monitoring and life support
- Testing ,monitoring and diagnostic system

## V. CONCLUSION

- The framework of the proposed system is developed for a safety car braking system using ultrasonic sensor and to design a vehicle with less human attention to the driving. This technology could be further enhanced. The same can be implemented in aircrafts, submarines. But automatic brakes cannot be used always. So it can be replaced by action of automatic diversion with the help of various sensors such as radar sensors, distance sensors, etc. The stereo multiple camera has a kind of approach which also enables an assist to further 424 develop the system to be able to detect slowly moving object in a very disturbed environment. There are experiments which are being conducted with challenging on-road datasets. The results displayed are that of a combined approach which outperforms than a feature-based approach in a disturbed environment.


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