

Smart Alert System for Automotive Door Opening

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Abstract: A vehicle door opening warning system for a car includes a sensor for sensing the approaching of another car from behind when a person is opening the car door, a car door-opening control unit alerts the passenger while opening the car door when the sensor senses the approaching of the other car from behind, and a warning light and a buzzer are activated to give a visual warning signal and an audio warning signal when the car door is being opened.

Key Words- Ultrasonic sensor, Arduino, Dooring, buzzer.

INTRODUCTION

To avoid accidents due to unusual opening of the vehicles door a sensor-based system is being developed, which will alert the passenger about approaching vehicle. Dooring is the act of opening a motor vehicle door into the path of another vehicle. The key elements will be an ultrasonic sensor with inbuilt sender and receiver, microcontroller to be programmed for processing of the input given by sensor, a door switch, single tone buzzer and a battery. During the operational phase of the system the ultrasonic sensor located outside the car body, will come into action when vehicles door is partially opened and further it will detect for any approaching vehicle and further sending the input signal to the microcontroller. The microcontroller will further process the input given by the sensor and give a buzzer when a vehicle is detected before opening of the door.

PROBLEM IDENTIFICATION

In today's busy world safety should be the first priority, but many a times safety is omitted due to human errors or even lack of knowledge. Dooring is the act of opening a motor vehicle door into the path of another road user may it be a car, motorcycle, truck, cycle or even a pedestrian. Everyone cannot keep up with the protocols while opening the vehicle door as it is psychologically, physically, environmentally and ergonomically difficult at times.

But there is a need to overcome this problem to prevent loss of life, loss of property, loss of capital and loss of time. In a populated and busy country as ours the chances of an individual meeting with an accident due to dooring are quite high. A 2015 study of the city Vancouver¹, British Columbia found that dooring accounted for 15.2% of collisions. In New York City, 3% (7 out of 225) of bicyclist fatalities in the ten-year period between 1996 and 2005² were from striking an open door. An analysis of Chicago bike crashes found that there were 344 reported dooring crashes reported in 2011³, for a rate of 0.94 doorings per day. Doorings made up 19.7% of all reported bike crashes. The number of additional doorings that occurred without being reported is unknown.

Hence, a system is developed to eliminate the accidents caused by dooring which should be reliable, cheap and user friendly.

SCOPE OF PROJECT

1. Prevention of fatal accidents from careless car door opening using a processing module is the aim of the project.
2. Maximum safety is ensured by the proposed system which operates automatically and eliminates the need for human intervention.
3. Significant reduction of accident rates and property damages is achieved by the system.
4. Passenger safety technology in the automobile industry could be enhanced by car door technology.
5. Various applications can be adapted for by the versatile proposed system.
6. A promising future with the potential for cost-effective computerized production is offered by the system.

PRESENT THEORY**[1] Existing Accessibility Solution**a) The Dutch Reach technique⁴

The Dutch Reach technique⁴ is a technique for opening car doors that can help prevent accidents involving cyclists or pedestrians. The technique involves the use of the opposite hand to open the door. This automatically causes the body to turn and look back, reducing the risk of hitting a passing cyclist or pedestrian with the car door. The technique is especially important in urban areas where there are many cyclists and pedestrians sharing the road with cars.



Safer roads for everyone can be promoted by drivers using the Dutch Reach technique. Accidents with cyclists who may be riding in the bike lane or alongside the car can be avoided by passengers and drivers who use this technique. However, the technique may not be intuitive for all drivers, especially those who have been driving for a long time and are accustomed to opening the car door with their dominant hand.

b) Bird eye system⁵

A 360-degree camera system" or "bird's eye view", also known as "Eagle view" in a car, is a technology that provides a complete view of the vehicle's surroundings. Images of the area around the car are captured by multiple cameras placed around the car, and then these images are processed to create a 360-degree bird's-eye view of the car and its surroundings. The technology is particularly useful for parking and manoeuvring in tight spaces as any obstacles that may be in the vehicle's path can be clearly viewed. Additionally, it can be used to provide additional safety features such as object detection and warning systems, which can alert the driver to



potential hazards in their blind spots. Eagle view is included as a standard or optional feature on some vehicles by car manufacturers.

Need for an improved Solution-

Dutch Reach technique relies on driver and passenger behaviour, but at certain times it may be inconvenient to follow the technique. Many people are accustomed to using their nearest hand to open the car door, and may not be aware of the

potential danger to approaching vehicle. Dutch Reach technique may not be effective in all situations. Dutch Reach technique may not be implemented significantly due to a lack of awareness and education.

While a 360° camera system can provide drivers with a comprehensive view of their surroundings, it is not specifically designed to prevent accidents caused by sudden opening of car doors. However, it can still be a useful technology for improving overall safety on the road. Not all cars come equipped with a 360°. This feature is typically offered as an optional extra on higher-end models or included as standard on luxury vehicles.

However, to specifically address the issue of accidents caused by sudden opening of car doors, other technologies like smart alert systems can help to reduce the risk of collisions and improve overall road safety.

Concept of Smart Alert System for Automotive door opening-

A smart alert system for automotive door opening is being developed. It will detect approaching vehicles from the rear of the car and give a buzzer as a signal to the passenger or driver. This will help avoid accidents caused by sudden opening of doors and contribute significantly to road safety.

Advantages of System-

A smart alert system for automotive doors can provide a range of benefits that improve safety on the road. By alerting drivers and passengers to the presence of approaching vehicles, cyclists, and pedestrians, it can significantly reduce the risk of accidents caused by sudden opening of car doors. In addition, the system can increase awareness of the driver's or passenger's surroundings, which can help to prevent accidents in other situations. Implementing a smart alert system is also relatively cost-effective, and it can improve the public perception of car manufacturers that prioritize safety and innovation.

WORKING PRINCIPLE

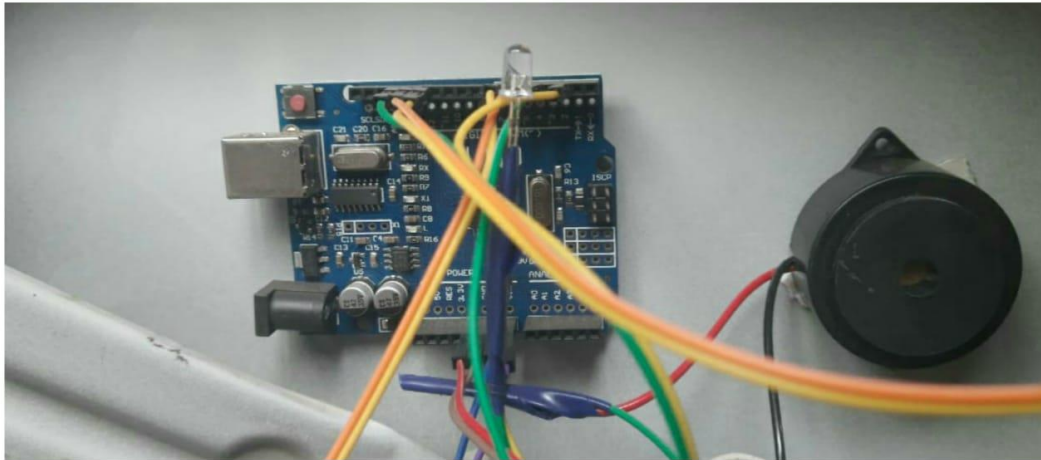
The working system is divided into input, processing, and output. Input is given by the ultrasonic sensor⁸ to the Arduino when an approaching vehicle is detected. Further, the input is processed by the Arduino, and the output is produced accordingly. The output to buzzer and LED¹⁰ is calculated on threshold values programmed in arduino.

As soon as the door is about to be completely opened, two ultrasonic sensors located at the rear end of the vehicle come into action. The sensors are powered by 5v pinout connected to 5v on arduino and ground pinout is connected to ground pinout on arduino. The Trigger pin, which is an input pin, sends the ultrasonic sound wave from the ultrasonic sensor, and the Echo pin is the output pin, which will give input to the Arduino. The Trig pin in the sensor is kept 10us in the beginning to start the measurement method. So, this sensor module generates sound waves by the 40,000 Hz frequency around every second from the source.

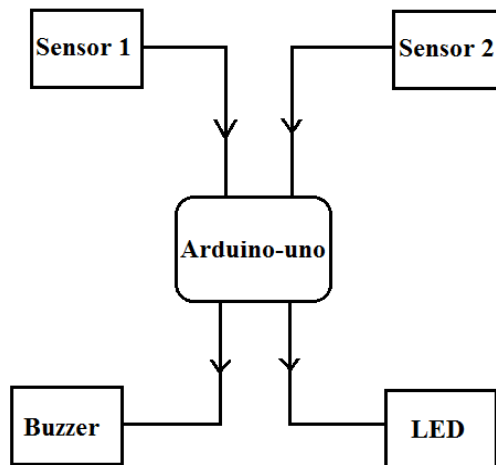
When the sound waves return back, the Echo pin will activate until these waves are obtained by the receiver. The time will be measured with the help of an Arduino board. The pulse processed by the Arduino will give output according to programmed thresholds to the buzzer and LED¹⁰. The Arduino will process the pulse and activate a delay of 150 when the vehicle is detected by the ultrasonic sensor in the proximity of 182-243 cm. This will result in a delayed time between each buzzer sound and LED¹⁰ blink. When the vehicle is in the proximity distance of 120-180 cm, it will result in a lesser delay time of 100, resulting in a medium gap in buzzer sound pulse as well as LED.

Further, when the vehicle has approached too close in the proximity of the sensor of distance 60-120 cm, the delay time is reduced to 50, and a continuous buzzer and LED will be turned on to notify the passenger about the approaching vehicle. The input from the ultrasonic sensor⁸, which senses the approaching vehicle, is processed by the Arduino.

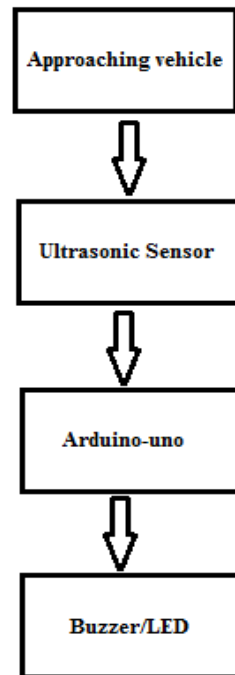
The Arduino compares the input with the set thresholds and selects an appropriate delay time accordingly. The buzzer and the LED are then activated, and the passenger is notified about the approaching vehicle before the complete opening of the door⁷.



Block Diagram



Flowchart



CONCLUSION

The approaching vehicles from the rear are effectively detected and an audible warning signal is provided to the driver by the developed smart alert system for automotive doors. It is indicated by the results that an approaching vehicle is detected when it is within 8 feet of the rear of the vehicle, and the frequency of the warning signal increases as the vehicle gets closer. Overall, it is suggested by these findings that safety can be improved and the risk of accidents caused by drivers opening doors when it is not safe to do so can be reduced by the system. Overall, a promising approach to improving vehicle safety is represented by the smart alert system, which could potentially have significant benefits for drivers and passengers.

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