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Arduino Based Automated Anti-Collision Braking System

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ABSTRACT-

This paper introduces novel approach to automotive technology about how to avoid accidents occurring due to over speeding of vehicles and clashing of vehicles opposite to each other due to over-speeding.The suggested technology incorporates the concept of vehicle safety and detects any object. and slowdowns the vehicle if the seems to crash with Barricade or with other vehicle within the following distance. This system provides the implementation of the prototype of designed ARDUINO based automated car anti-collision system. It also highlights the challenges associated with the implementation of the automatic braking system and provides recommendations for future research. Overall, this paper emphasizes the importance of vehicular safety in enhancing vehicle safety and reducing the number of road accidents and vehicle reversing process.

Keywords: automobile, anti-collision, braking system, vehicular safety.

1. INTRODUCTION

The human race is reaching new heights on a daily basis as a result of the gradual advancement of technology. Since human needs have dramatically expanded at every level of society over the past two decades, safety has become the top priority [1]. One of the most serious safety concerns is traffic accidents. The tenth-biggest cause of mortality worldwide and the main cause of death by injury is a road accident. Road accidents claim the lives of an estimated 1.25 million people each year, and they also cause up to 50 million injuries, filling 30 to 70 percent of the orthopaedic beds in hospitals in developing nations.

Accidents happen in this quick-paced, unstable environment; thus, one must take care of their personal safety. The number of accidents is rising daily as a result of the behaviour of the drivers behind the wheel, including drunk driving, driving when fatigued, driving through interruptions, or driving while oversleeping the car [2]. Technologies for detecting obstacles and preventing collisions currently exist. Some of them have been previously mentioned. Each one of them approaches the obstruction in a similar manner; the only differences are in the sensor's method for identifying the impediment and the actions taken when it is detected. The following are the various strategies that were used in earlier attempts to solve the obstacle problems T. Sanjana et al[1] Implements a prototype designed with microcontroller based automated car anti-collision system which specializes in detecting obstacles by sharp distance sensor and alerts within close distance of collision and hereafter brakes automatically by actuator in critical distance without the help of driving person followed by the proposal of Liang Li et al[3] about the rear-end collision which is one of the main types of accident, and it brings unnecessary casualties and property losses. Aiming at reducing the rear-end collision, the work focus on the front collision avoidance system. With the development of vehicle-to-vehicle communication (V2V), a new way to develop the rear-end collision avoidance system is put forward. Another method known as collision avoidance system (CAS) for self-driving cars that focuses on preventing collisions with pedestrians came into form [4] which is a stereo-vision-based pedestrian detection system that delivers accurate estimates of the time to collision makes up the detection component. Fuzzy controllers for the actuators, which simulate human behaviour and responses, are used in the collision avoidance maneuver, together with a highly accurate Global Positioning System (GPS), which provides the data required for the autonomous navigation. The suggested system has been evaluated in two steps. First, manual driving trials are used to study driver behaviour and sensor accuracy. This study will be utilised to establish the parameters for the second step, which involves autonomous pedestrian collision avoidance at up to 30 km/hr speeds.

Sumit Garethiya[5] et al, advanced collision avoidance system detects the presence of obstacle in front as well as in blind spot of vehicle and alert the driver accordingly. This system implants ultra sonic sensor for detection purpose of real time moving and stationary object under all-weather environment with the help of raspberry-pi, but it too have some difficulties in processing stage. Ren He [6] investigated the performance of AEB systems in different driving scenarios, including highway, urban, and rural environments. The study found that AEB systems were effective in reducing the severity of rear-end collisions in all scenarios, but their performance was affected by factors such as vehicle speed, traffic density, and weather conditions. Arduino-based car collision detection utilising the CAN protocol was proposed by Shanmathi.S et al. [7]. It is suggested to measure the separation between the vehicles using an ultrasonic sensor. Through data acquired from an alcohol sensor, the vehicle will immediately stop if the driver looks to be intoxicated. The location of an accident is sent by SMS to the hospitals and police station by a bump sensor, which also detects accidents. ECUs can interact with one another using the CAN protocol. Collision Avoidance System (CAS) has been found by T.U. Anand Santhosh Kumar et al. [8] to effectively avert automotive vehicle collisions and to offer the maximum protection to the users in challenging or inclement weather. It provides a methodical architecture to preventThe remaining sections are organised as follows. Second Section, will discuss about the proposed model. In third Section, simulation of the work and performance analysis is done followed by the future scope and conclusion.

2. PROPOSED WORK

Anti-collision braking system (ACBS) is a safety system that can identify when a possible collision is about to occur and responds by autonomously activating the brakes to slow a vehicle prior to impact or bring it to a stop to avoid a collision. The technology commonly uses radar, cameras, or ultrasonic sensors to identify threatening situations. The slower the vehicle is traveling, the more likely, it is that the automatic emergency braking system can bring it to a stop to Prevent a collision shown in fig 1.1 Here, the main concept behind the braking system is the transmission and reception of Ultrasonic frequency using ultrasonic sensor is calculated according to the reflected wave. If, the transmitted frequency of wave hits to a moving car or an object, the reflected wave reaches the receiver module and the distance is calculated accordingly, if the distance gets minimalized to the given extent, then the braking mechanism gets turned on.

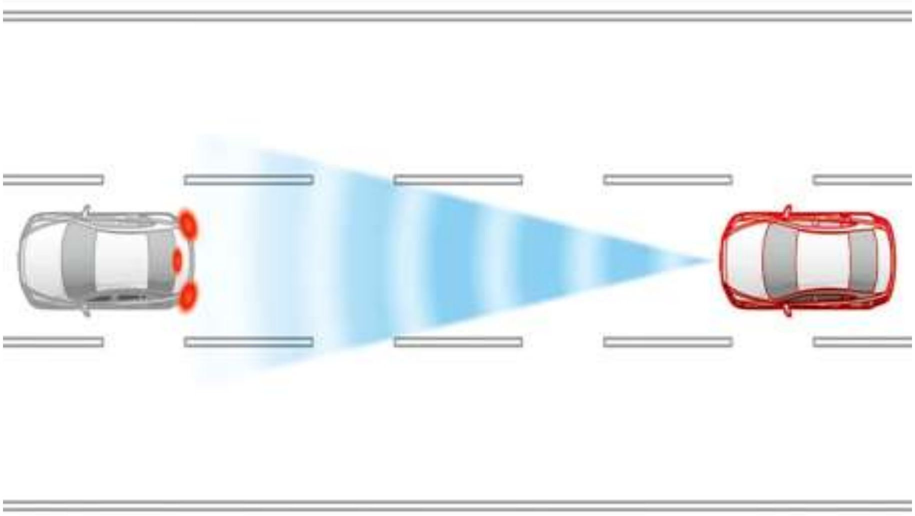

Fig 2.1 Concept of Anti-Collision Braking System

The working principle of an Anti-Collision Braking System is to continuously monitor the vehicle's surroundings using sensors such as radar, lidar, or cameras. The ACB system then uses this information to detect potential collisions with objects such as other vehicles, pedestrians, or obstacles. Once a potential collision is detected, the ACB system activates a collision detection algorithm that determines the likelihood and severity of the collision. If the collision is deemed imminent, the ACB system activates a brake control algorithm that calculates the amount of braking force required to prevent or mitigate the collision. It then applies the appropriate amount of braking force to the vehicle's brakes to prevent or mitigate the collision. The braking force applied can vary depending on the severity of the collision, the speed of the vehicle, and the distance to the obstacle. The steps followed during the process is depicted in the block diagram fig 2.2.

First step is the connection of the ultrasonic sensors to the Arduino using jumper wires. The sensors should be connected to the appropriate pins on the Arduino board as per their specifications. The code for the ACB system using the Arduino Integrated Development Environment (IDE) is written. The code includes a collision detection algorithm that uses the sensor inputs to detect potential collisions and a brake control algorithm that calculates the appropriate amount of braking force required to prevent or mitigate the collision. Then the code is uploaded to the Arduino and testing is done. It is tested with various phase of testing until the intended result is observed. Testing is done by the system by placing obstacles in the vehicle's path and observing how the system responds. The response of the system is recorded for various phases and used for performance analysis.

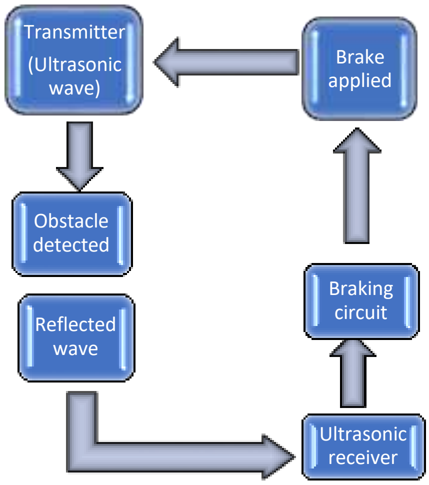

Fig 2.2 Block diagram

3. SIMULATION AND PERFORMANCE ANALYSIS

The simulation software used in the proposed work is proteus. Proteus is a simulation software that is widely used for designing and testing electronic circuits. It allows users to design circuits and simulate their behaviour before they are implemented in hardware, which can help to reduce costs and save time. The main reason for simulating the software is to test designs under different scenarios or conditions that may be difficult or impossible to replicate in a physical prototype. This can help to identify potential issues or performance limitations.

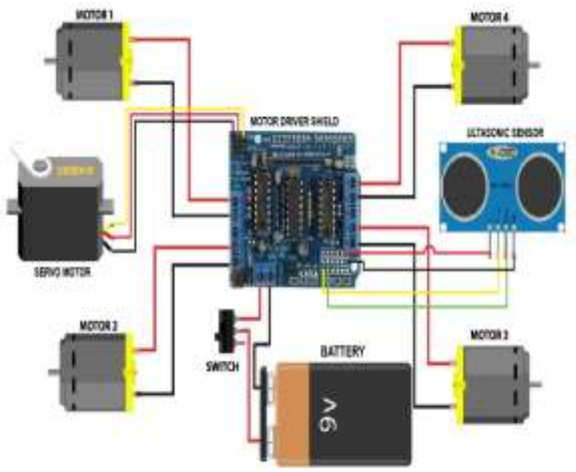

Fig 3.1 Circuit connections.

At first coding part is done using Arduino IDE and uploaded in the system. The connections are given as per the circuit diagram mentioned in the figure 3.1 these connections are given to the corresponding pin of the Arduino-UNO kit for further functioning.

The next step is to check the circuit connections, power supply and the testing processes will be started. During this process various test phases are done by keeping the obstacles at different positions and measuring the accuracy level of detection and position of the braking level is observed and recorded for further analysis. The simulation window with connections is given in the figure 3.2.

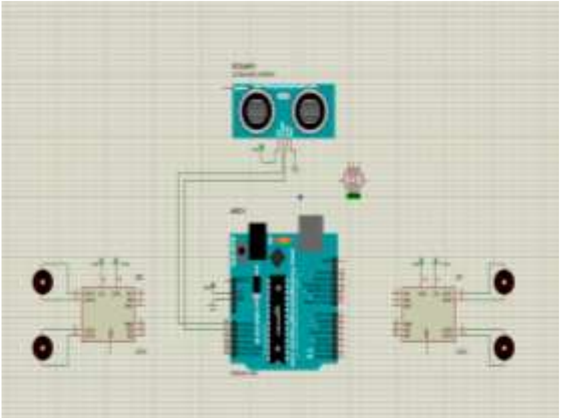

Fig 3.2 Simulation

Performance analysis:

It is possible to assess the effectiveness of an anti-collision braking system using Arduino by looking at a number of important metrics, including response time, precision, and reliability.

Response time is the amount of time it takes for the system to identify an obstruction and apply the brakes to stop the vehicle from colliding. A quicker response time is preferred since it reduces how far the car must go before the brakes are applied. A stopwatch or other comparable timing tool can be employed to measure the system's response time. Accuracy is a term used to describe how successfully a system can identify obstacles and distinguish between them. A precise system can distinguish between small and large obstacles and can find obstacles under varied illumination conditions. By positioning several obstacles of various forms and sizes in front of the sensors and observing how well the system recognizes them, the accuracy of the system can be evaluated. The ability of the system to perform correctly and consistently throughout time is referred to as reliability. A reliable system should work properly in a variety of situations and not give rise to false positives or false negatives. By exposing the system to various environmental conditions, such as variations in humidity, temperature, or illumination, it can be evaluated to see how reliable it is.

The comparison table is made to compare the performance analysis with the previous survey papers which is mentioned in the table 3.1 which is calculated on the basis if the vehicle is travelling 60 km/h (37 mph).

Table 3.1 Comparison table of performance analysis

Distance	Results of [1]	Proposed result
Safe distance	26m	35m
Too close distance	21m	25m
Critical distance	9m	12m

Thus, the overall experimental and performance analysis is done with the accuracy rate approximately equal to 89%. By evaluating the system's performance in these key areas, any issues or areas for improvement can be identified and addressed, which can help to improve the overall performance and safety of the system. The hardware implantation of the proposed model is shown in figure 3.3.

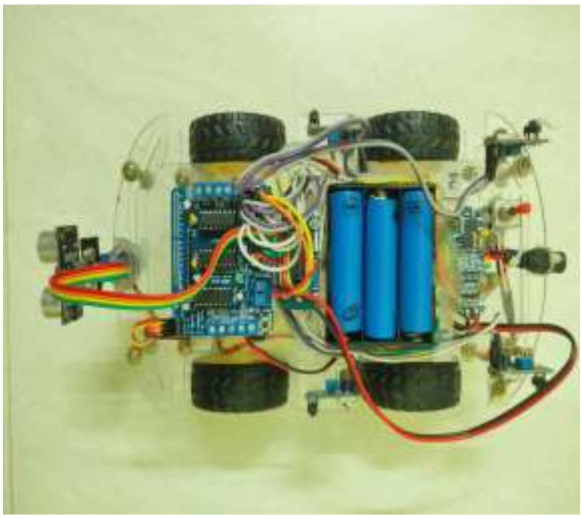

Fig 3.3 Hardware implementation

4.CONCLUSION

Every person has the potential to have experienced a little mishap. As time goes on, technology advances very quickly, as does security technology to reduce car accidents that could potentially save lives. The major objective of this initiative is to make anti-collision braking systems standard equipment in all cars in an effort to reduce accident effects and causes. The proposed system uses ultrasonic sensors to detect any vehicle on both the front and back sides of our vehicle with the goal of providing safety while driving. It detects any object and slows down the vehicle if it appears to collide with a barricade or with another vehicle within the following distance. The huge crane that is primarily utilised in construction uses this technique as well.

5. REFERENCE

[1] T. Sanjana, K. A. A. Fuad, M. M. Habib and A. A. Rumel, "Automated anti-collision system for automobiles," 2017 International Conference on Electrical, Computer and Communication Engineering (ECCE), Cox's Bazar, Bangladesh, 2017.

[2] Vidya S A, Basavaraj G. Kudamble, “Implementation of Car Black-Box using ARM”, International Journal of Engineering Research & Technology (IJERT) NCRTS – 2015 (Volume 3 – Issue 27)

[3] Li, Liang, Guangquan Lu, Yunpeng Wang and Daxin Tian. “A rear-end collision avoidance system of connected vehicles”, 17th International IEEE Conference on Intelligent Transportation Systems (ITSC) (2014): 63-68.

[4] David Fernández Llorca, Vicente Milanés, Ignacio Parra Alonso, Miguel Gavilán, Iván García Daza, Joshué Pérez, and Miguel Ángel Sotelo, “Autonomous Pedestrian Collision Avoidance Using a Fuzzy Steering Controller”, IEEE transactions on intelligent transportation systems, vol. 12, no. 2, June 2011.

[5] Sumit Garethiya, Lohit Ujjainiya and Vaidehi Dudhwadkar. “Predictive vehicle collision avoidance system using raspberry – pi”, Asian Research Publishing Network (ARPN), VOL. 10, NO. 8, MAY 2015.

[6] He, R. and Zhang, D., "Research on AEB Collision Avoidance Strategy Based on Characteristics of Driver-Vehicle-Road," SAE Technical Paper 2020-01-1213, 2020.

[7] Shanmathi, S., & Kamalanathan P., “ARDUINO BASED VEHICLE COLLISION DETECTION USING CAN PROTOCOL”, IJRDO - Journal of Electrical and Electronics Engineering,2015.

[8] T.U.Anand Santhosh Kumar, J. Mrudula, “Advanced Accident Avoidance System for Automobiles” International Journal of Computer Trends and Technology (IJCTT) – volume 6 number 2– Dec 2013.

[9] L. M. Bergasa, J. Nuevo, M. A. Sotelo, R. Barea, and M. E. López, “Real- time system for monitoring driver vigilance,” IEEE Trans. Intell. Transp. Syst., vol. 7, no. 1, pp. 63–77, Mar. 2006

[10] A. Eidehall, J. Pohl, F. Gustafsson, and J. Ekmark, “Toward autonomous collision avoidance by steering,” IEEE Trans. Intell. Transp. Syst., vol.8, no. 1, pp. 84–94, Mar. 2007.

[11] Zutao Zhang, Jiashu Zhang, “A Novel Vehicle Safety Model: Vehicle speed Controller under Driver Fatigue”, IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.1, January 2009.

[12] Ramesh, S., Ravi Ranjan, R. Mukherjee and Swarnali Chaudhuri. “Vehicle Collision Avoidance System Using Wireless Sensor Networks.” (2012).

[13] Essam Dabbour and Said Easa, “Proposed collision warning system for right-turning vehicles at two-way stop-controlled rural intersections”, Transportation Research Part C, Volume 42, pp. 121-131 ELSEVIER 2014.

[14] Jaehyun Han, Dongchul Kim, Minchae Lee and Myoungho Sunwoo, “Enhanced Road Boundary and Obstacle detection using a Downward Looking LiDAR Sensor”, IEEE March 2012.

[15] Abdelrahman Zaroug, M.K. A Ahmed Khan, Niranjan Debnath and I.Elamvaruti “Automatic head-on anti-collision system for vehicles using wireless communication”,Robotics & Manufacturing Automation (ROMA), IEEE,December 2014