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Vehicle to Vehicle Communication for Autonomous Vehicles

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Abstract:

Nowadays, Accidents occur far too frequently and with such uncertainty. Accidents can result in severe injury, death, or other catastrophic harm. The delay in the driver applying the brakes is the primary cause of these collisions. In order to reduce the possibility of getting into an accident, preventive measures as enhanced visibility, auto headlights, windscreen wipers, tyre traction, etc. were used. We are now in the phase of actively preventing collisions and offering the highest level of protection to the passengers of the vehicles, including pedestrians. So, we attempt to offer a new automated vehicle collision avoidance system in this study. The goal of this project is to create a new system that can address the issue of vehicles stopping automatically due to obstructions rather than drivers having to manually apply the brakes. Consequently, the development of a sensor-based embedded system is the main emphasis of this study in order to help drivers avoid road collisions in order to save lives and save financial loss.

Keywords—collision avoidance, embedded system, and ultrasonic sensor.

I. INTRODUCTION

Collision avoidance systems focuses on advanced techniques like pre-crash sensing, in which an ultrasonic sensor is used to sense the obstacle in front of the vehicle and send the signal to the microcontroller unit. The microcontroller unit delivers a signal to the braking unit for automatic brake application based on the signal from the ultrasonic sensor. A collision avoidance system, often referred to as a pre-crash system, forward collision warning system, or collision mitigating system, is a type of auto safety device made to help avoid collisions or minimize their impact. When an accident is imminent, it uses radar (all-weather), occasionally laser (LIDAR), and camera (using image recognition). With a geolocation database, GPS sensors can identify fixed risks like approaching stop signs. When an impending collision is detected, these systems sends an alert to the driver. Without any driver input, they function independently when an accident is about to occur (by braking or steering or both). At low vehicle speeds, such as below 50 km/h (31 mph), collision avoidance by braking is appropriate; but, if lanes are clear, collision avoidance by steering may be more appropriate at higher vehicle speeds. The same forward-looking sensors that are used in adaptive cruise control may also be included within vehicles with collision avoidance.

- The field of intelligent transportation systems is diverse and developing.
- The use of connected cars to communicate between machines and the Internet of Things can be seen as a part of the smart cities agenda and machine-to-machine (M2M) connections.
- The development of V2V communications typically occurs as part of intelligent transportation systems.
- By using vehicle-to-vehicle communication, the amount of transmitted information between vehicles and roadside devices can be reduced, which lowers the high operating costs associated with broadcasting through a mobile operator's network.
- For the development of automobiles that can drive themselves, much research is being done.
- Autonomous vehicles offer greatly improved traffic safety, fuel efficiency, better use of the infrastructure, and the release of drivers to perform other activities.
- A paradigm shift in how people and things are moved could result from autonomous driving.

II. LITERATURE REVIEW

[1] Predictive vehicle collision avoidance system using raspberry-bi it seemed like to avoid accidents in the blind spot area using ultrasonic sensor using raspberry-bi module. The ultrasonic sensor works like radar system to detect the obstacles in the blind spot that can Cause the accidence but it is cheaper than it. In addition to that the ultrasonic sensor is used to measure the distance between the vehicle and the obstacles and saved the distance safe before fatalities happened and alerting the driver before the accidence using two ways visualization using light emitting diode (LED) and make a sound using buzzer and the driver alone apply the brake or steering to controlling on the speed. The main advantage of ultrasonic sensor is that it provides highest reliability in getting proximity and has lesser absorption

than RF and IR frequencies.

[2] Advanced Accident Avoidance System for Automobiles. This paper discussed the most important factors of accident due to the intersection accident and the bad weather and this whether to some extent either the heavy rain, huge ice or high darkness. Indeed, this bad weather conditions the driver feel very harsh to drive the vehicle and can't controlling the car. In this paper there are for types of sensors such as lm35 temperature sensor and humidity sensor and those sensors are used to check the weather states and alert the driver if any thinks happen in the weather. And there are a substation number of ultrasonic sensors to detect the near car and infrared sensors used to detect the forward cars by using burst of light to measure the cars speed, distance and position those sensors were fixed in the both car sides and in the forward of the vehicle to avoid all the cars and any barrier and alert the driver. This system was provided by Global System for Mobile communications (GSM) and Global Positioning System (GPS) module. If the accidence were happened, then the system automatically takes position of the car and sends it to the police office and the driver family to save the driver and passenger's health.

[3] Internet of Car: Accident Sensing, Indication and Safety with Alert system. In this paper we are discussing how to use ultrasonic sensor and radar system and laser to detect the obstacles such as humans, animals or vehicles and send the car and driver information to the police and their siblings and controlling of the brake system, the steering system and doors. And determine the accidence coordinates and send the data via GSM module in addition to that the data can send the data via Wi-Fi to the twitter. Actually, the main technology used is Obstacle detection & indication sensor in this method we use the photoelectric sensor it mainly consists of transmitter and receiver. In the two side of cars there are two sensors to detect the obstacles. The indicator used the red light emitting diode (LED) when it finds obstacles. Subsequently the second method is used is passive infrared (PIR) sensor or we can say human detection sensors. The importance of this sensor to detect the human near the car and give the car order to avoid this human. To detect the accidence here they used complex three axis accelerometer. This sensor mainly detects the accidence when the car deviate by angle from the road in addition to that the system were provided by relay circuit to protect the car from battery ignition when the accidence occurs and this system uses GUS designed by android platform to monitor and tracking the vehicle.

[4] Vehicle collision avoidance system prototype that will alert drivers to their surroundings and potentially hazardous driving situations. This system is needed to reduce the number of vehicle accidents on the road. Such a system would lead to improved efficiency of the road usage and limit human as well as economic losses. The proposed system will use ultrasonic sensors to provide blind spot coverage, while utilizing long-range radar to detect possible frontal collisions. The system will be implementable on a variety of standard cars with easy installation. While the system will not provide any autonomous action to avoid collisions, it will warn the driver through both audible and visual warnings. The system will be evaluated through rigorous testing in order to develop an algorithm that encompasses most of the countless circumstances encountered on the road. Once the system is implemented, the system will accurately detect the presence of surrounding vehicles with minimal false positives and the driver will be alerted to any possible accident, giving him or her adequate time to respond.

III. SYSTEM DESIGN

A. Block Diagram

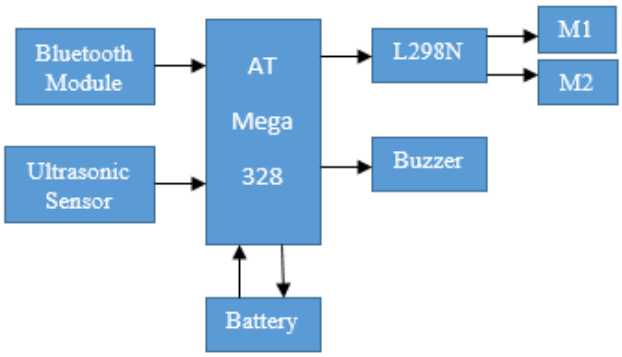

Fig-1: Block Diagram

B. Working

For vehicle-to-vehicle communication for autonomous vehicles, hardware and software part is required. The proposed circuit is built in the hardware part, which deals with hardware assembly, and the proposed system is programmed in the software part.

The block diagram is composed of an atmega 328 smd controller, a Bluetooth module, an ultrasonic sensor, an L298N driver, a buzzer, and a battery.

- The system receives 12V 1.5A power supply from a battery.
- With an app connected via a Bluetooth module, the vehicle may go left, right, forward, and reverse.
- To find the obstruction, an ultrasonic sensor is employed.
- Buzzer will sound if it discovers any obstructions.
- So that the driver can be informed.

IV. CIRCUIT DIAGRAM

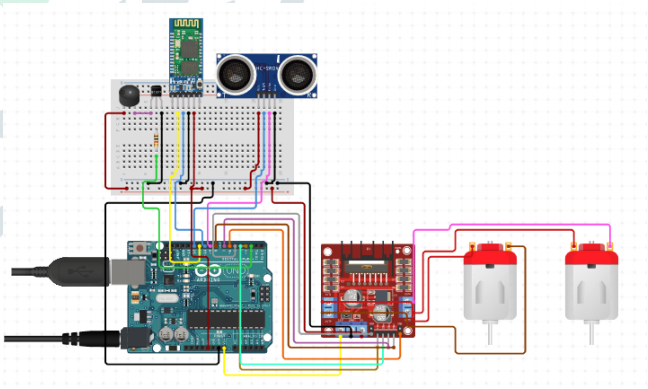

Fig-2: Circuit Diagram

V. RESULTS

The Arduino will get parameter value from the sensor as long as the system is powered. The Arduino will process, examine, and determine the next course of action in accordance with the software. A closed loop system is used in the provided algorithm.

Hardware end: Hardware is divided into

- Sensing unit
- Control unit
- Actuating unit

Sensing unit - The ultrasonic sensor and Bluetooth module that

make up the sensing unit deliver the desired results.

Control unit - The Control Unit (Atmega 328 smd) will deliver the required output by processing the sensor data to achieve real-time regulation of the vehicle-required parameter.

Actuating unit - The Actuating Unit is made up of a Bluetooth module and a sensor that periodically give the Controller the necessary amount of data.

VI. CONCLUSION

The V2V Communications for Autonomous Vehicles system was built, mounted on a very simple and comprehensible model, and it was tested for effectiveness. Shorter-range distances could be accurately read by the sensor. Ultrasonic sensor that detects objects at long distances is needed to apply on a real vehicle. So, if the appropriate materials are gathered, it may be able to improve its properties so that it may be utilised in automobiles. This model serves as an asset for research towards anti-collision warning systems as well.

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