An Ultrasonic Sensor Distance Induced Automatic Braking Automobile Collision Avoidance System

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Abstract— **Collisions in automobiles have become a major safety concern; cases of damage and death due to automobile collisions are frequently reported. The number of pedestrians knocked to death by automobiles is also on the rise in cities and highways. Further into the game reserves, wild animals are also frequently knocked to death by automobiles. The cost of a life cannot be estimated, the cost of damages to the automobiles also impacts negatively on investment. In most cases drivers fail to notice the presence of obstacles ahead and brakes need a driver's response to operate thus increasing the response time, hence reducing their reliability. Many approaches to automobile crash avoidance systems have been proposed in recent time, however, such approaches mainly concentrate on steering maneuvering control. In addition, these approaches do not take into consideration the safety distance to stoppage of the automobile, more so, many approaches only provide a warning signal to the driver for activating the automatic braking. This always provides a room for human error. This paper presents the development of an automatic microcontroller based crash avoidance system that employs obstacle detection and distance measurement using ultrasonic sensors to detect obstacles and their distances. Once the obstacle has been detected and safe separation distance is reached, the automobile performs safety distance induced braking at that distance to bring the automobile to a stoppage. From the results obtained after tests, the system has an average response time of 0.86s to the activation of the brakes and a 12.8 percentage error with respect to the obstacle real distance.**

Keywords—Ultrasonic, Collision, Sensor, braking system, Automobile

I. INTRODUCTION

The problem of vehicle accident is a part of an endless list of disaster that could occur anywhere anytime. About 1.2 million people die on the world's roads annually, making it a leading cause of death globally [1]. Low and middle income countries are where most of these deaths occur. Rapid economic growth has increased motorization and road traffic injuries. There are very few road safety measures in developing countries, thus leading to more road disasters. This poses a major challenge as developing ountries lose approximately 3% of gross development profit as an outcome of road crashes [2]. Road traffic accident is a leading cause of death for many years, most accident are both preventable and predictable. There are many proofs on ways to help achieve safety on the roads. Some countries that have successfully implemented these solutions have experienced appreciable reductions in road accident deaths. Adopting this mediation globally suggests the huge potential to avoid future harm and save lives at a universal level [3]. This system is recommended where common faults by drivers are eradicated, with many of the intelligent vehicles have monitoring systems only, such as speed sensors, anti-lock brakes, and other automatic systems present, especially in luxury cars [4, 5], but these cars are not cheap to everyone and thus, a cost effective but efficient system is required for the safety of every car user.

Collision avoidance system is a system made of sensors placed inside a car to caution its driver of any obstruction that could possibly lie ahead on the road [6]. Some of the dangers detected by these sensors include the proximity of the car to other cars around it, and its exact distance from the cars. The ultrasonic sensor is modified to measure the proximity with reference to the previous car for the rear end. Most obtainable ultrasonic sensors for vehicles are approved for approaching cars with comparatively low speed. Whereas the rough reading of proximity data cannot be applied directly, an intelligent method is projected to process the distance read out of sensors to yield suitable cautioning signals and counter measures [7].

Approaches to automobile crash avoidance systems have been based on controlling the steering maneuvering system and on car warning systems that interferes with the vehicle drivers to activate braking systems. Many of those systems are very costly and make it very expensive for middle income earners to own such vehicles. In addition, these approaches do not take into consideration the safety distance to stoppage of the automobile. This always provides a room for human error [8]. Thus, this paper presents the development of an automatic micro controller based crash avoidance system that employ obstacle detection and distance measurement using ultrasonic sensors to detect obstacles and their distances for automatic safety braking of the car without the driver's consent and within the safest distance between the vehicle and the obstacle.

The rest of this paper is structured as follows: Previous related work is presented in section 2, while, section 3 presents the design and implementation of the system. Results obtained from simulation and testing are discussed in section 4 and conclusion drawn from the study is lastly presented in section 5.