In-Vehicle Traffic Accident Detection and Alerting System Using Distance-Time Based Parameters and Radar Range Algorithm

Lukman Adewale Ajao
Blessing Olatunde Abisoye
Ibrahim Zakariyawu Jibril
Udeme Monday Jonah
Department of Computer Engineering
Federal University of Technology
Minna, Nigeria
ajao.wale@futminna.edu.ng, ORCID: 0000-0003-1255-752X

Jonathan Gana Kolo
Department of Electrical and Electronics Engineering
Federal University of Technology
Minna, Nigeria
jgkolo@futminna.edu.ng, ORCID: 0000-0003-3687-5960

Abstract — **The high proportion number of citizen death rates with little or severe sustained injury is commonly recorded from road-traffic accidents (RTA). The effect of a road traffic accident is brutal, and it usually leads to mortality and deformity in human physiological anatomy. This work aims to develop an embedded in-vehicle automatic accident detection and barrier detection notification system. A radar range algorithm (RRA) is proposed for the barrier detection on the road before collision occurrence. Also, distance-time based parameters (DTBP) algorithm was developed for the detection of accident geo-location coordinates using the Haversine formula. An Internet of Things (IoT) approach was adopted by integrating the wireless communication devices and sensors embedded into a single chip for the design purposes. This developed system alerts the driver before collision occurrence and eliminates the delay time between accident occurrence and emergency personnel arrival. The use of this system will save more lives from road hazards and decrease mortality.**

Index Terms—**Accelerometer, Emergency unit, Internet of things, Road traffic, Wireless sensors.**

I. INTRODUCTION

The recent global records from the World Health Organization (WHO) analysis affirm that road traffic accident is number eight leading misfortune of sudden death and injuries in the world [1], [2]. The strong TIE insurance service incorporation statistics also prove that hundreds of road-traffic accidents occur across the country every day [3], for instance Nigeria as a case study. It is documented that more than 10 cars accident-related to deaths casualty happened in California daily, and many other passengers sustaining severe injuries and deformity in physiological anatomy [4], [5]. The misfortune of road traffic accidents in African countries is at a very high side and disastrous due to poor road design, lack of driver cautions, bad roads, distractions in driving, over speeding and reckless driving.

Several efforts were made to develop systems that can discover accident location and fall of the vehicle in real-time, to give high accuracy and consistency, but the concern is time waste in locating car accident points. The Global Positioning System (GPS) and Global System for Mobile Communication (GSM) has been widely adopted with embedded wireless sensors, microchips, and mobile apps for the purpose of remote tracking and monitoring [6]. Such works include road and car traffic accident detection [7], automobile crude oil conveyance tracking [8], security tenacities [9], [10], home automation system, and many others.

Programmable vehicle accident detection assistance was proposed using vehicle-to-vehicle (V2V) and vehicle-to-roadside infrastructure (V2I) technology [11]. This system was developed to achieve remote information transmission in real-time through the On-Board Units (OBUs) component integrated within the vehicle. It includes an external information control unit that can precisely calculate the rate or extent of damages during the vehicle crash. A notification message was sent to the emergency rescue unit for their awareness. The major drawback of this mechanism is the lack of detailed information about the accident when the accident involves passer-by and the longer time it takes before the information gets to the appropriate authorities. A smart vehicle alert system aimed at detecting the location of the accident and transmitting the message remotely was developed in [12]. The system utilized Atmega 2560 microcontroller for the processing of geolocation information gathering from GPS and sent through the GSM modules to the remote location. The application of the system is limited to the location detection and message forwarding without consideration for fire occurrence and many others.

Watthanawisuth et al. proposed a wireless black box using Micro-Electro-Mechanical System (MEMS) accelerometer and GPS for monitoring vehicle accidents [13]. The work has the capability of monitoring the occurrence of an accident