Development of Helmet Detection System & Smart Seat Belt

S. Anil Babu [1], Sumathi Ayyalusamy [2], Rejin Ranjit Singh [3], Sreejin Dharmarijan [4], Jason James [5], Mohamed Anas [6]

1&2, Assistant Professor, School of Engineering & IT, Manipal University Dubai campus, International Academic City, Dubai, UAE.
3,4,5,6,Undergraduate Student, School of Engineering & IT, Manipal University Dubai campus, International Academic City, Dubai, UAE .

Abstract: *UAE Road accidents have increased significantly with an average of two people killed on the roads every day [1]. The impact of accidents are further more in dune buggy ,specifically when the driver involves in a high speed accident without wearing a helmet and seat belt. It is highly dangerous and can cause death. Wearing a seat belt and helmet can reduce shock from the impact and may save a life. The aim of this research work is to development of smart helmet detection system and seat belt detection system for dune buggy to avoid or reduce the accident fatigue on drivers during accident. Driver will be unable to start vehicle without wearing seat belt and helmet. An ultrasonic sensor HC/SR04 was used for detecting the driver helmet, ATmega328 microcontroller to control the entire safety system. The technology connects the drivers and the co passenger seat belts with the Ignition system such that without fastening the seat belts, the dune buggy will not start. If the driver unfastens their seat belt or helmet is removed after starting off vehicle, the control unit will disengage the power input to the ignition switch after 30 seconds resulting in halt position.*

Keywords : *Road safety, Helmet Detection system, smart seatbelt. Ultrasonic sensing.*

I. Introduction

Driving without fastening the seat belt was one of the most common traffic offences in Sharjah, UAE. With 6,175 charges laid in the first six months, Young drivers were the least likely to buckle up seat belt. In the year 2011 a survey conducted, it was found that 55% university students did not consistently wear a seat belt [2].Research work on investigation of helmet act implemented in Thailand also figures the increase in helmet wearers to five fold with reduction in head injuries and death to 41.4% and 20 % respectively.[6]

Smart Helmet using Global System for Mobile Communications (GSM) & Global Positioning System (GPS) Technology for Accident Detection and Reporting system proposed by Manjesh et al. [3] vibration sensors are place in different places of helmet where the probability of hitting is more than predetermined value during accident driver crashes and the helmet hit the ground, GSM technology will sent an text message to nearby hospital ambulance service.

Numerous incidents occur irrespective of any functional criteria excluding the factor of safety while travelling on roads. The vice president of Ajman University of Science and Technology has died after a dune-buggy accident in Al Ain. The accident happened on Friday, while Mr. Salman was enjoying a weekend in Al Ain with friends. He hit a quad bike, Mr. Al Gergawi said. He banged his head and he also hit his rib on the steering wheel. Friends gave him first aid while they waited for a helicopter to take him to hospital, but they were unable to save him [4].

Smart-Tec helmet proposed by R prudhiv raj et al. [5] found that most of the 2 wheeler drivers avoid using helmet due the excess heat inside helmet. To overcome this issue peltier module was developed to maintain constant temperature inside the helmet. The (GPS) tracking system aids to track out the location where the incident has happened, upon which the emergency vehicle can be reached. The two sensors incorporated in this system are LM35D temperature sensor and ADXL3 tilt sensor. In case of sudden shocks Peltier module activates thermo electric system preventing blood coagulation meanwhile accelerometer sensing sudden shocks sends information through GSM and GPS modules. Inspite of all these measures the effect of accident is felt but with reduced impact. Our research aims to prevent the major cause of accidents by implementing the simple and positive measures such as to increase the safety factor. This paper presents the Development of Helmet Detection System and Smart Seat Belt (DOHDSSSB) as an integrated system approach with automotives.

II. Experimental Setup of Dohdsssb

A MWG70, 150CC oil cooled dune buggy has been considered for development of DOHDSSSB. The conventional seat belt socket was modified with seat belt detection switch. Fig.1. shows the Photo of The helmet detection sensor was assembled on Dune buggy roof rail.

Fig. 1.Photo of Helmet Detection System

Fig.2. Shows the Block diagram of DOHDSSSB system, initially the transmitter in the ultrasonic sensor sends ultrasonic waves, which gets reflected from the helmet and is received at the receiver. Time of flight is calculated and is used to measure the distance between the helmet and the sensor module. Data from sensing module is sent for processing to the processing module. With reference to distance between the sensor and helmet, the decision making algorithm is executed at the control module. The processing module takes **Yes** or **No** decision based on sensor signals. If the condition is **No** then warning light emitting diode (LED) will glow and engine will not start. If the condition is **Yes** then LED will be turned off and actuation takes place in the ignition switch will be ready for starting the engine.
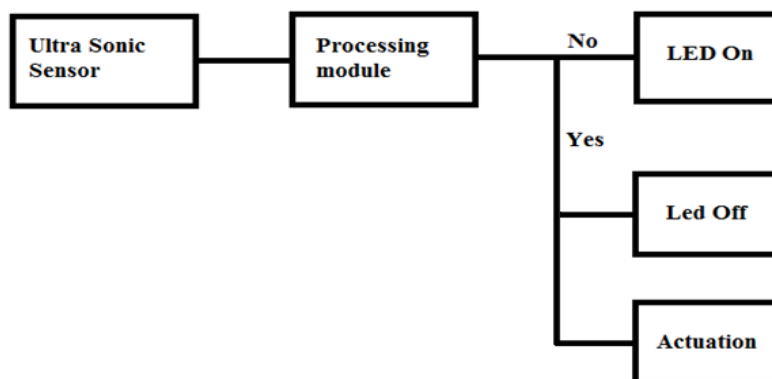

Fig.2. Block diagram of DOHDSSSB system

Fig.3. & Fig.4. Representing the warning sign for fasten the seat belt and helmet on instrumental panel.

Fig.3. Schematic symbol of Seat Belt Warning sign ON

Fig.4. Schematic symbol of Helmet Warning Sign ON

Fig.5. shows the circuit diagram of DOHDSSSB. The 9V battery is connected to the Arduino board (ATmega32) through relay. Ultrasonic sensor is connected to the processing module, in this case ATMega32. From the ultrasonic sensor trigger is connected to one pin and the echo is connected to the other pin of the arduino uno board. The output pin is connected to the base pin of transistor. The collector supply of the transistor is taken from the arduino board, and then from emitter pin of transistor relay are connected.
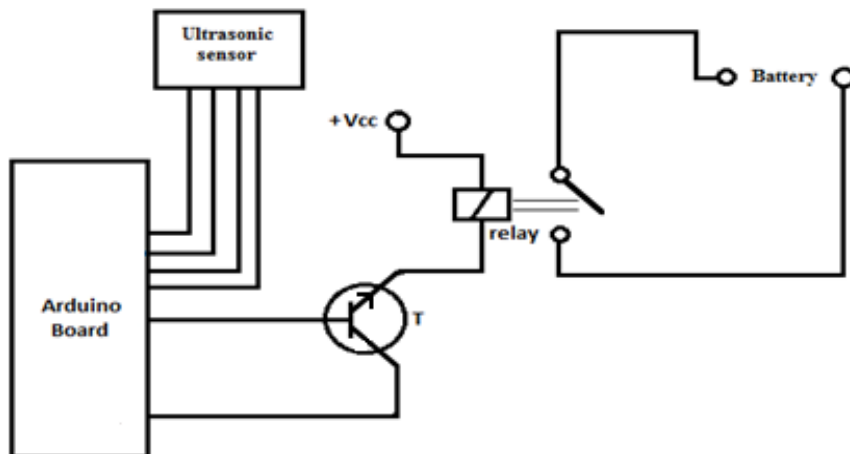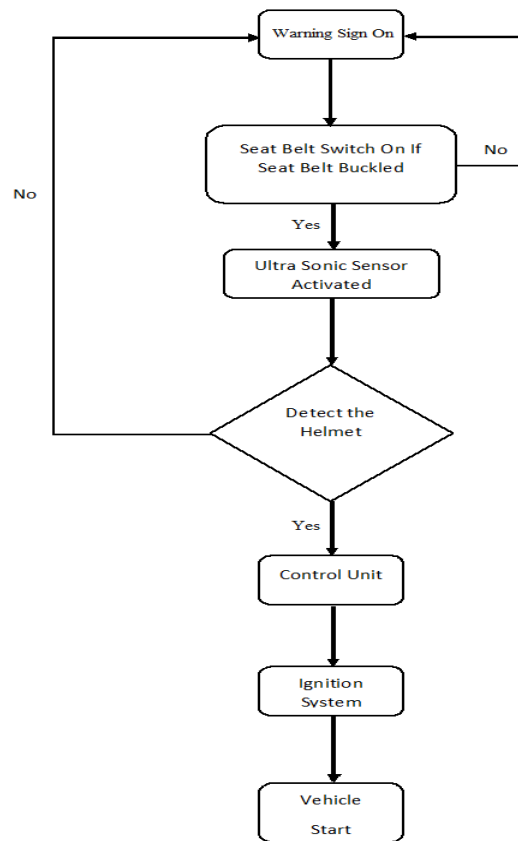

Fig.5. Circuit Diagram of DOHDSSSB

Fig.6. Flow Chart of DOHDSSSB

If ignition key is turned **ON**, then seat belt switch checks whether the seat belt has been fastened or not. If it receives positive feedback from seat belt switch then Helmet detection sensor will be actuated. The helmet sensor checks the presence of helmet with in the range. Both these signals goes to the control unit, and it check wheather both the sensor and the swithch is giving a positive feedback.Now the control unit give the power to the ignition key for starting the vehicle only if it recives positive feedback. If any of the sensors gives the negative feedback the control unit disengages the power supply to the ignition switch. Hence the vehicle will not start until the control unit receive a positive feedback from the helmet and seat belt sensor. Working principle as shown in the Fig.6.Flow chart of DOHDSSSB.

Fig.7. Photograph of DOHDSSSB Testing

Fig.7. shows the photograph of DOHDSSSB testing with wearing helmet and seat belt.

III. Results and Discussion

Most of the cases of Dune buggy accidents, the severities of the accidents are increased because of the absence of helmet or seat belt. The various tests were conducted on DOHDSSSB system, by implementing this system in dune buggy which would decrease the head injuries and prevent driver and co-driver colliding with the interior parts of the vehicle such as steering wheel, instrumental panel and windshield and avoid the ejecting out of passenger from the vehicle during the high speed crash accidents.

IV. Conclusions

The DOHDSSB system was designed for person of height 160 to 165 cm, repeated test was conducted for different persons with in designated heights with helmet where ultrasonic sensor detects the presence of helmet and ignition system turns on but in case without wearing helmet or helmet is been removed after engine starts, the control module automatically disengaging the ignition system thus leads the engine to stop, the total cost of DOHDSSSB system is 150 AED, so this can be implemented in as retrofitted in commercially available vehicles. Thus it can be concluded that DOHDSSSB system when incorporated into the Dune buggy will effectively increase the safety of the driver and co-driver.

References
[1]. UAE road accidents [online] March 11 2015. http://7days.ae/two-killed-day-uae-road-accidents.
[2]. Seat belt is the new ignition switch [online] February 21, 2012.
[3]. http://www.thenational.ae/news/uae-news/seat-belt-is-the-new-ignition-switch-in-sharjah-tests
[4]. Manjesh, Prof.Sudarshan Raj, Smart Helmet sing GSM & GPS technology for Accident Detection
[5]. And Reporting System, International Journal of Electric and Electronic Research, ISSN 2348-6988, Vol.2 Issue 4, Pages 122-127.
[6]. Road accident happened in UAE [online] February 10, 2013.
[7]. http://www.thenational.ae/news/uae-news/golden-boy-of-ajman-killed-in-dune-buggy-accident
[8]. R.Prudhiv Raj, Ch. Krishna Kanth, A.Bhargav Aditya and K.Bharath, Smart-Tec Helmet,
[9]. Advance in Electronic and Electric Engineering, ISSN 2231-1297, Volume 4, Number 5(2014), Pages 493-498.
[10]. M. Ichikawa, W. Chadbunchachai, and E. Marui, "Effect of the helmet act for motorcyclists in Thailand," Accid. Anal. Prev., vol. 35, no. 2, pp. 183–189, 2003.