A Novel Approach Using Sensor Technologies For Enhancing Accident Safety Assistance System In Different Environments

Mr. D. Selvakarthi, Dr. D. Sivabalaselvamani, Ms. V. Nivetha, Mr. S. Pratheep, Mr. S. Pravin, Mr. S. R. Thiyaneshwaran

Abstract: The accidents are becoming a common occurrence on the roads due to negligence. According to recent survey 70 % of the accidents occur due to driver's carelessness. This proposed method "smart assist system" ensures the human safety. The main reasons for accidents are fire accidents in the vehicle, sudden lane changing, and fall asleep while driving, drunk and drive. The proposed system mainly focuses on the areas of blind spot, drowsiness, and flame and alcohol detection. These problems can be rectified using various sensors with the help of a controller. The indicators are used to alert and ensure the safety of the driver and also the passengers. The signal received from the sensors are fed to the controller and the actions are taken by the controller accordingly. These safety features are added to the vehicles which helps to avoid accidents by alerting the driver, implementing safeguards and take over the control.

Index Terms: Accident, Alcohol, Blind spot, Drowsiness, Drunk & Drive, Flame, Safety, Sensors

1. INTRODUCTION

Vehicle accidents are considered as one of the major issues. According to recent survey for every minute a major accident occurs in India and around 17 people die every hour 1214 road crashes occur every day in India.Road accidents are happening more frequently and causes many damage to the government and the people.70% of the road accidents occurs due to drivers careless mistake. Most of the road users are quite aware of the all general rules and safety measures while driving in roads but it is only their negligence, which causes the road accidents and crashes. Every year, millions of people die because of road accidents, many of them suffer from non-fatal injuries and become physically disabled. Road accidents costs nearly51800 crore across the board costing. The challenge is to reduce the number of accidents occurs due to driver's carelessness. For which, it's better to take action before an error occurs.

- *D. Selvakarthi is an Assistant Professor in the Department of Electronics and Instrumentation Engineering in Kongu Engineering College, India, PH-9789951541. E-mail: selvakarthi.eie@kongu.edu*
- *D. Sivabalaselvamani is an Assistant Professor in the Department of Computer application in Kongu Engineering College, India, PH-9940049001. E-mail: sivabalaselvamani@gmail.com*
- *V. Nivetha is currently pursuing a bachelor's degree program in Electronics and Instrumentation Engineering in Kongu Engineering College, India.*
- *S. Pratheep is currently pursuing a bachelor's degree program in Electronics and Instrumentation Engineering in Kongu Engineering College, India.*
- *S. Pravin is currently pursuing a bachelor's degree program in Electronics and Instrumentation Engineering in Kongu Engineering College, India.*
- *S.R. Thiyaneshwaran is currently pursuing a bachelor's degree program in Electronics and Instrumentation Engineering in Kongu Engineering College, India.*

But sometimes it's not in our hands for example vehicle malfunction, components failure and many injured lose their lives for not getting informed beforehand. An automated smart system would be the best solution considering the circumstances. The main causes of accidents include drunken driving, use of mobile phones, fatigue, collision of vehicle with obstacles, over speeding etc... This proposed system is add safety features to the vehicle that will tend to avoid accidents by alerting the driver, implementing safeguards and taking over control of the vehicle. We had find a solution for this problem statements which will minimize happenings of the error.

2 OBJECTIVE

The objective of this proposed system is to ensure safe transport for all by detecting human errors. The human errors include drunken and drive, fall asleep while driving, sudden lane changes and sudden fire in the engine bonnet. The proposed system mainly focuses on the areas of blind spot, drowsiness, flame and alcohol detection. These problems can be rectified using various sensors with the help of a controller. The indicators are used to alert the driver to ensure the safety of the driver and also the passengers. The signal received from the sensors is fed to the controller and the actions are taken by the controller accordingly.

3 METHODOLOGY

The proposed methodology is to develop a smart system that can alert a driver to avoid the road accidents and ensure the safety of driver and passengers. This smart system includes the features of blind spot identification, alcohol detection, fire detection and drowsiness detection. This can be achieved by integrating the sensor with controller and the indicators .The sensors used are eye blink sensor, alcohol sensor, ultrasonic sensors and the fire sensor. The controller controls the indicators. Indicators used here are two LED, buzzer alarm and LCD display.Firstly, the blind spot identification is done by placing the ultrasonic sensors at left and right back end of the vehicle. Ultrasonic sensor detects the object and the obstacles in the blind spot area and indicates the driver by two LED's that are placed in left and right side of the driver dash board. The blind spot identification is used to avoid accidents due to lane changing and careless driving of adjacent vehicle driver.

Secondly, the drowsiness of the driver is detected by the eye blink sensor and for this purpose the driver has to wear an eye blink sensor attached with glass frame which gives high output to the controller when the driver close the eye for more than two seconds and gives an alert to the driver and passengers through buzzer and also displayed in back side of vehicles that driver is drowsy. Thirdly, we have to monitor the alcohol level of the driver for safe and focused driving. The alcohol level is measured by placing the alcohol sensor. The alcohol sensor is placed near the steering wheel which detects driver alcohol level not the passengers. When the levels go beyond it stops the vehicle by locking the motor drive and displays that the driver is drunken in LCD display. When the alcohol levels become normal then it allows the driver to start the vehicle. Finally, we have to monitor any fire or flame in the vehicle engine bonnet and in the back side of the vehicle for those using gas fuels. The small flames lead to huge fire accident so it should be identified immediately and the vehicle has to be stopped. For this purpose a flame sensor is used for identifying the flame. When it detects any flame the buzzer will on and the motor drive stops the vehicle and ensures the safety of the passengers. By using these sensors and safety indicators we can avoid most of the accident and ensure the safety of drivers. The main advantages of our proposed method are low cost and can be interfaced with all kind of vehicles.

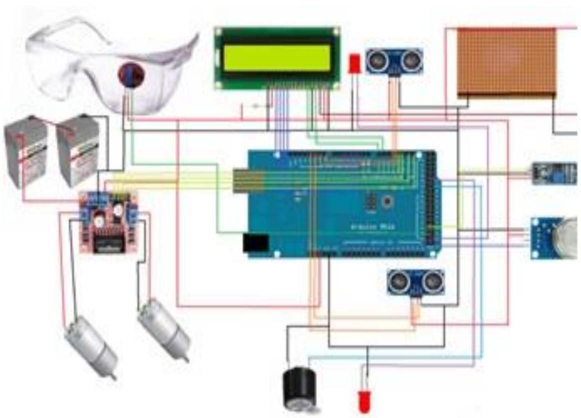

Fig. 1. *Diagrammatic representation of the model*

4 BLIND SPOT DETECTION

For the purpose of blind spot identification two ultrasonic sensors which are placed in left, and right side of the vehicle. The figure 2 shows the collision report of the accidents happened in Tamil Nadu in the year of 2018-2019. The majority of the accidents are happened due to frontal collision nowadays many automobile industries working on that to reduce the problem. Here we have to find the solution for the side collision of vehicles by detecting the objects in the blind spot and avoid the collision by prior intimation. That is done by placing the ultrasonic sensors in the vehicle. Table 1 shows the range of the two ultrasonic sensors fixed in the back end of the car. The range for the blind spot is fixed as 20 .when any objects present in the region of blind spot it detected by the ultrasonic sensor and indicated to the driver.

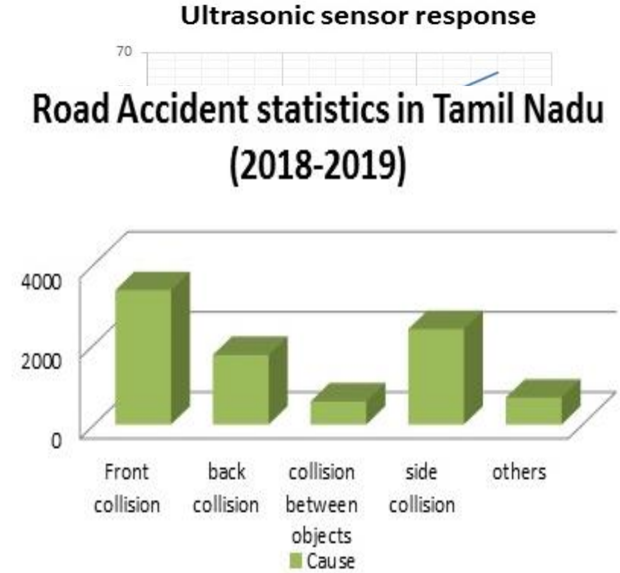

Fig. 2. *Road Accident Statistics*

TABLE 1

RANGE OF THE TWO ULTRASONIC SENSORS

Condition	Ultrasonic sensor 1 values	Ultrasonic sensor 2 values
No vehicle in blind spot	1560-500	1560-500
Objects in blind spot	0-20	0-20

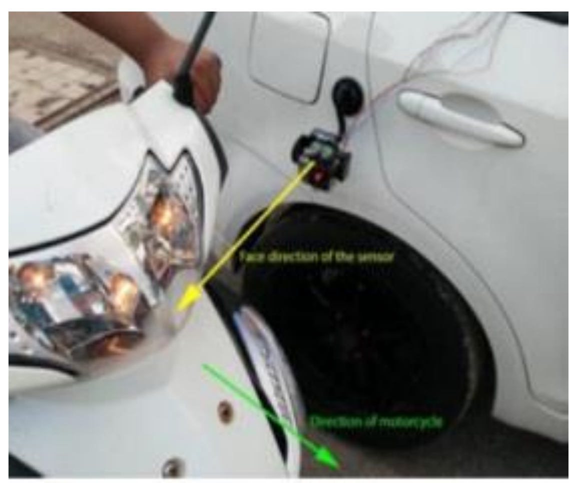

Fig. 3. *Direction of detection*

The Figure 3 shows the direction of detection of vehicle in the blind spot. The direction of detection and the direction of motorcycle is perpendicular to each other. The Figure 4 shows the sensor is mounted at 0.71m above the ground level at the back side of the car, that's where the sensor is more accurate than other places. The sensor converts the reflected wave to a digital data. With the help of this data, distance of a vehicle/object can be calculated using the formula Distance = (duration/2) / 29.1

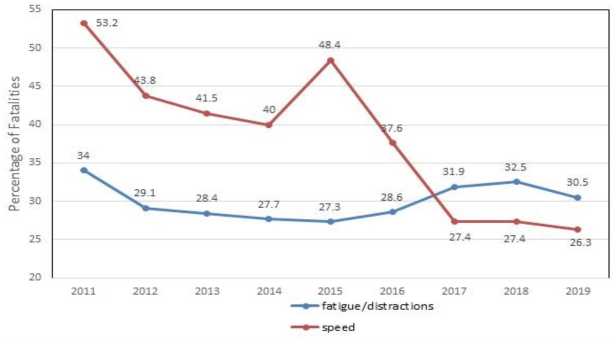

***FIG. 4**. ULTRASONIC SENSOR RESPONSE*

The figure 4 shows the ultrasonic sensor time reaction for the different distance during running condition. The ultrasound reflection time increase as the distance increases.

5 EXPERIMENTAL RESULT

This experiment is conducted by placing the sensors in the car. The experiment is performed under the following conditions.

5.1. Static Test. The first test is conducted to test the ability of the model to distinguish between static objects and vehicle. The model gives only a warning signal while encountering a static vehicle and does not provide any signal for Beauregard present on the road.

5.2 Vehicle speed at 60 km/h and 100 km/h. The second test is conducted at 60 km/h and 100 km/h. The model was successfully able to detect the vehicles in the blind spot detection.

5.3. Overtake Test. The third test is conducted while overtaking a vehicle. It is used to whether the car will collide with the other vehicle. The experiment is conducted during both day and night. This model shows very promising result. The table 2 shows the results of the sensor in different conditions below in the following table. When it fails in any one of the condition the sensor position is adjusted to correct position and the test was conducted and finally the perfect position for the sensor is finalized based on the experimental results

TABLE 2

THE RESULT OF THE SENSORS

Test	Daytime	Night	Raining
Statics	Pass	Pass	Pass
60 km/h	Pass	Pass	Pass
100 km/h	Pass	Pass	Pass
Overtake	Pass	Pass	Pass

5.4. Drowsiness detection

Eye blink sensor monitors the drowsiness of the driver half sleepy while driving causes more accidents

The figure 5 shows the recent survey on road accidents due to distractions the surveys proves that the accident due to the over speeding is reduced now a days by incorporating new technologies and advanced braking system, but the crashes due to the distractions and fatigue are increasing and higher than the accidents due to the over speeding.

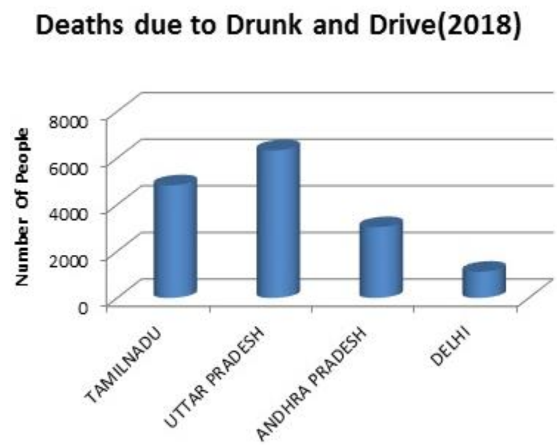

***Fig. 5**. Survey on Road Accidents*

From this we can infer that we should reduce the road accidents caused by the drowsiness for the eye blink sensor is used to detect the drowsiness of the driver so we can avoid the accidents by giving an alert to the driver 'eye blink sensor illuminates the eye around area and detects the drowsiness from the reflected rays.

5.5. Alcohol Detection

The alcohol sensor MQ 3 used to detect the driver's alcohol level. Alcohol measured as parts per million (ppm) in the surrounding air. The figure 6 shows the number of people die due to drink and drive in different states in the year 2018.this survey shows that many accidents are occurs because of drunk and drive and it also affects the people who are not drunken .four states accidents statistics are shown

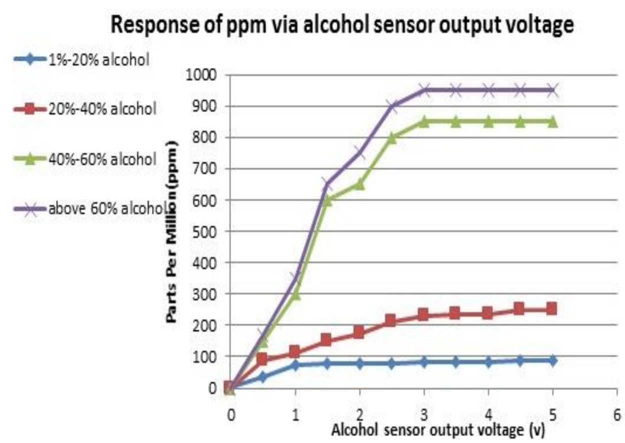

***Fig. 6**. Death Ratio*

The figure 7 shows the response of alcohol sensor output with different amount of alcohol concentration surrounding the sensor. It is that the alcohol sensor value greatly depends on the alcohol concentration.

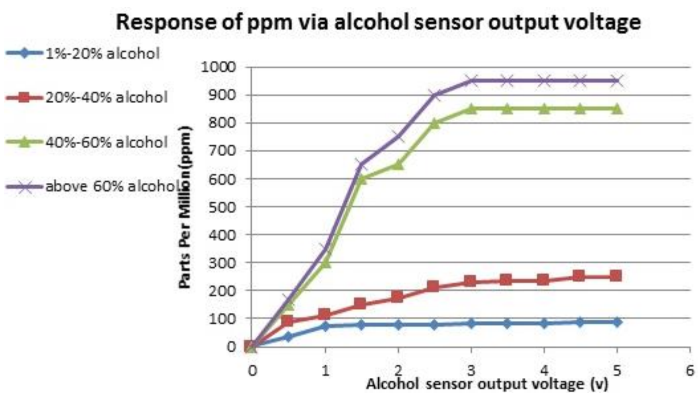

***Fig. 7**. Alcohol Sensor Output*

TABLE 3

OUTPUT VALUE OF THE ALCOHOL SENSORS

VOLATGE (V)	PPM	PERCENTAGE (%)
0	0	0
0.5	100	10
1	200	20
1.5	300	30
2	400	40
2.5	500	50
3	600	60
3.5	700	70
4	800	80
4.5	900	90
5	1000	100

TABLE 4

ACTION TAKEN FOR THE DIFFERENT ALCOHOL CONCENTRATION

Voltage Output	200 - 300ppm 1 – 1.5V 20 – 30%	300 – 400ppm 1.5 – 2V 30 – 40%	400 – 500ppm 2– 2.5V 40 – 50%
LCD Display	Intoxicated	Slightly Drunk	Drunkenness
Alarm	Off	Off	On
Ignition System	On	On	Off
Indicator	Led Green On	Led Green On	Led Red On

Actions taken for the three different conditions

5. 5. 1 Intoxicated: First the experiment was conducted with persons who didn't consume alcohol. The LCD displayed "Intoxicated". The driver have control over the vehicle.

5. 5. 2 Slightly drunk: The experiment was repeated with persons who consumed alcohol moderately (30-40%). The LCD displayed "Slightly Drunk". The engine will remains on and driver can control the vehicle

5. 5. 3 Drunkenness: The experiment was repeated with person who consumed alcohol 40 to 50%.The LCD displayed "Drunkenness" and engine system will lock

5.6. Alcohol Sensor Accuracy

Accuracy is the measurement of an instrument to give equivalent value to the true value or the quantity being measured. The accuracy can be calculated from the percentage error

Sensor Error = Theoretical value – Actual value

Sensor Error = 47-45

Percentage error = Sensor Error / Actual value × 100%

Percentage error = 2/45 x 100

Percentage error = 4.4 %

The average accuracy of the alcohol sensor used is obtained as Ave % accuracy = 100 – 4.4% = 95.6 %. Thus, our calculation above shows that the alcohol sensor is 95.6% accurate.

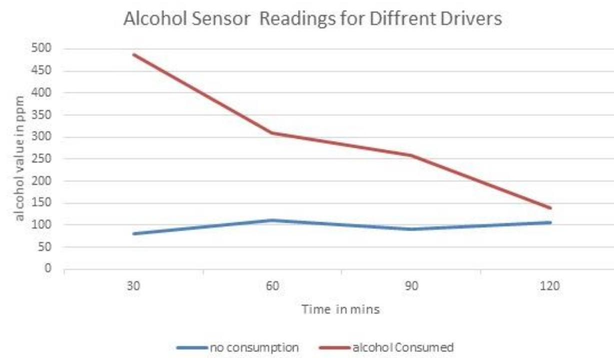

***Fig. 8**. Response of Alcohol Sensor on two Different Occasions.*

5.7. Fire Detection

The fire detection is carried out with the help of an IR receiver. The IR receiver absorbs the infrared rays emitted from the fire. The absorbed IR ray is converted to a digital value. The value may vary based on the intensity of the IR ray. An experiment is conducted by varying the distance between the IR sensor and fire. The figure 9 shows the analysis of this experiment.

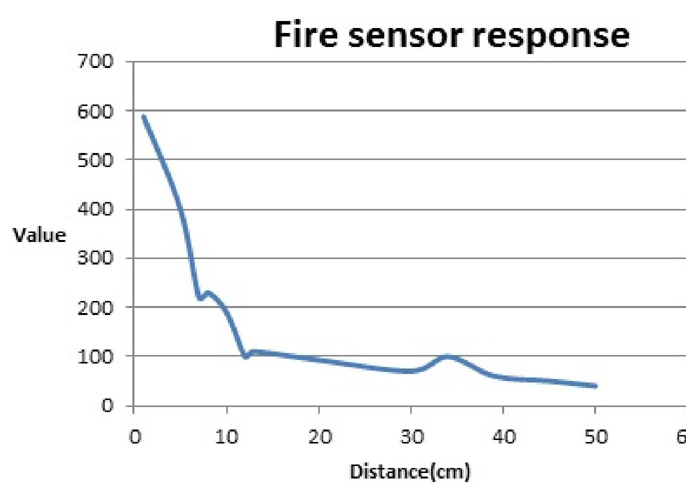

***Fig. 9**. Fire Sensor Response*

From the figure 9 it is evident flame sensor output and distance are inversely proportional to each other. When the distance increases the sensor value decreases and when the distance decreases the sensor value increases.

5.8. Process flow

The process flow chart for the smart assist system is shown in the figure 10. The various sensor outputs are given to the controller conditions are programmed in the controller based on the conditions the indicators are actuated. The motor is controlled to stop the vehicle when the values exceeds the preset limit.

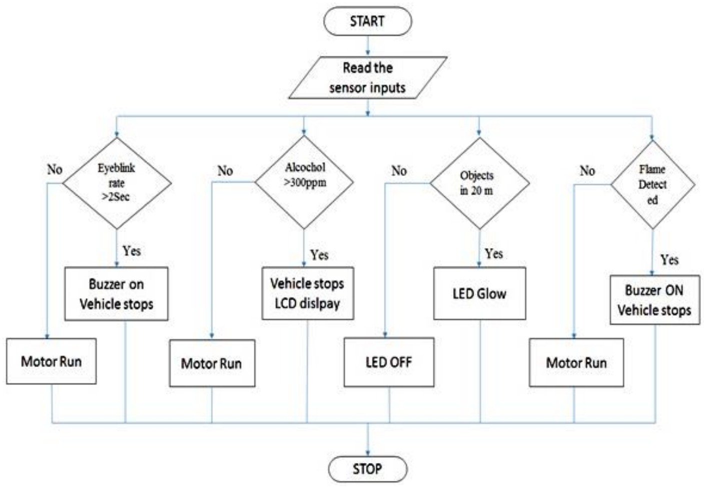

Fig.10. *Process Flow Chart*

6 Conclusion

The proposed smart assist system is helpful to avoid vehicle accidents because of driver's careless mistake and negligence. The developed prototype using Arduino has been analyzed in various conditions like obstacles, flame, alcohol and drowsiness. This model can be minimize the accidents occurred during drivers negligence. In future, this smart assist system can be implemented and developed as an Autonomous Vehicle System (AVS). A self-driving car, known as an autonomous vehicle. Autonomous vehicle is capable of sensing its environment and moving safely with little or without human inputs. Human mistakes can be eradicated by incorporating a computational intelligence like Artificial Intelligence, Machine Learning, RADAR and LIDAR in the autonomous vehicles.

References

[1] Mahapatra, Rajedra Prasad, and K. Vimal Kumar. "Panoramic Sensor Based Blind Spot Accident Prevention System." World Academy of Science, Engineering and Technology 25 (2009).

[2] Sivabalaselvamani, D., A. Tamilarasi, and L. Rahunathan. "Supporting Trust-based Design for Efficient Transportation using Intelligent Transportation System (ITS) in VANET." Asian Journal of Research in Social Sciences and Humanities 6.7 (2016): 634-647.

[3] Hetrick, Shannon. Examination of driver lane change behavior and the potential effectiveness of warning onset rules for lane change or" side" crash avoidance systems. Diss. Virginia Tech, 1997.

[4] Racine, David P., Nicholas B. Cramer, and Mehrdad Hosseini Zadeh. "Active blind spot crash avoidance system: A haptic solution to blind spot collisions." 2010 IEEE International Symposium on Haptic Audio Visual Environments and Games. IEEE, 2010.

[5] Sivabalaselvamani, D., et al. "Accident Identification Using Fuzzy Cognitive Maps with Adaptive Non-Linear Hebbian Learning Algorithm." Proceedings of the International Conference on Intelligent Computing Systems (ICICS 2017–Dec 15th-16th 2017) organized by Sona College of Technology, Salem, Tamilnadu, India. 2017.

[6] Opeyemi, Ajibuwa Emmanuel. "Alcohol Detection of Drunk Drivers with Automatic Car Engine Locking System Dada Emmanuel Gbenga, Hamit Isseini Hamed, Adebimpe Adekunle Lateef 2." Nova 6.1 (2017): 1-15.

[7] Hassan, Muhammad Zahir, Zainal Ariffin, and Haziq Irfan. "Development of Vehicle Blind Spot System for Passenger Car." Applied Mechanics and Materials. Vol. 393. Trans Tech Publications, 2013.

[8] Forkenbrock, Garrick, et al. Blind Spot Monitoring in Light Vehicles—System Performance. No. DOT HS 812 045. United States. National Highway Traffic Safety Administration, 2014.

[9] Jeong, Sungmoon, Sang-Woo Ban, and Minho Lee. "Autonomous detector using saliency map model and modified mean-shift tracking for a blind spot monitor in a car." 2008 seventh international conference on machine learning and applications. IEEE, 2008.

[10] Rahunathan, L., A. Tamilarasi, and D. Sivabalaselvamani. "Efficient and Secure Interoperable Healthcare Information System Using Keyword Searchable and Role-Based Access Control in Cloud Environment." Journal of Computational and Theoretical Nanoscience 15.4 (2018): 1176-1181.

[11] Ogazi, Chidi, and Ema Edison. "The drink driving situation in Nigeria." Traffic injury prevention 13.2 (2012): 115-119.