International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-9 Issue-1, May 2020

Smart Traffic Accident Monitoring System

Anurag Sharma, Puneet Panchal, Saurav Suman

Abstract- A system which detects the occurrence of accidents and informs the respective units responsible is designed. When a vehicle meets an accident then the sensors installed in the vehicle detect the accident and inform the medical unit, police control as well as family members by sending an alert message to the fire station (in case if the vehicle catches fire during the accident). To avoid accidents due to collision in winters because of FOG, ultrasonic sensors to detect the nearby objects and produce sound if it gets too close are used. Vibration sensor installed will detect the changes in vibration and if it is above threshold which means an accident occurred and it will notify the respective units. The alert message contains accident location coordinates obtained by the GPS module which was sent to respective units through the GSM module. Designed system is fully automated therefore it would get the exact location coordinates of the accident spot.

Keywords- GPS module, GSM module, sensors, ultrasonic sensor, Fog, Vibration sensor

I. INTRODUCTION

The numbers of vehicles on road are increasing day by day, they are increasing at a faster rate than the population growth of any country [1]. The reason behind its growth is the need of transportation. Therefore, the number of accidents on road are increasing at a fatal rate. The people injured in those road accidents are in abundant; they were injured or dead due to this. Most of the deaths caused by road accidents are because of not getting any medical assistance on-site. The numbers are more in rural areas where emergency vehicle cannot reach on time. This can be overcome if the victim gets the treatment within an hour of accident which is known as "golden hour" for the victim. Rank of India is worst in case of road accidents; every year around 150,000 people die in road accident in India which is the highest in the world in accidents. Around 80% of the accident victims in India do not receive any emergency medical care within this golden hour. According to World Health Organization India has the highest number of death in road accident in the world in year 2012 [2]. In the past years; due to fog, accidents were also increasing.

Manuscript received on April 02, 2020.
Revised Manuscript received on April 15, 2020.
Manuscript published on May 30, 2020.
* Correspondence Author
Anurag Sharma, Student of B. Tech majoring in Electronics and Communication Engineering from Galgotias University, Greater Noida, Uttar Pradesh.
Puneet Panchal , Assistant Professor at the Galgotias University, Greater Noida, Uttar Pradesh.
Saurav Suman, Student of B. Tech majoring in Electronics and Communication Engineering from Galgotias University, Greater Noida, Uttar Pradesh.

A vehicle has various types of flammable materials like engine oil, gasoline and solid combustibles and when the accident occurs and because of any flammable materials, vehicle catches fire which is also termed as auto fire or car fire.

In this modern era every person has smartphone and they carry it with them every time wherever they go [3]. This is the most important object in this system as smart phone will notify the responsible emergency units as well as relatives of the victim.

II. LITERATURE SURVEY

In this paper [3], the system consists of a GPS module, GSM module and shock sensor which could be activated by vibration or triggered by a highly effective safety system airbag. In this, Bluetooth technology is used to activate the GPS by the sensor. This system works when the vehicle registration is done and the information such as (a) Full name of the passenger (b) blood type of the passenger (c) Phone number of the passenger (d) E-mail (e) Medical history (f) Date of birth (g) Reference Phone number, uploaded in the database of PSO headquarter. When the accident occurs, the system installed in the vehicle is activated due to activation of a shock sensor and sends the notification to the pre-installed phone numbers of the family member, police station, ambulance and the nearest hospital with the vehicle location coordinates. In [4] various previous designed accident detection systems were studied and based on that a new system is proposed. The system is in two phase (a) Accident detection system phase (b) Notification phase. Accident detection phase contains three sensors to detect the accident. (a) Speed sensor to detect the change in speed of the car, (b) Vibration sensor to detect the variation in vibrations produced, (c) collision detection sensor to identify collision between two solid bodies. Whenever a vehicle collides, it detects changes and notifies the accident to the smartphone. After the accident is detected by the sensor, the GSM module sends the location coordinates provided by GPS module to the nearest hospital through an application in mobile phone. When the accident occur, a notification is displayed on the smartphone of the victim for 10 sec. if he does not need any immediate treatment then he can press NO button and the alert message will be discarded. If he does not press any button in 10 sec then after 10 sec the application considers it as an emergency and sends a message to get help. The system designed in [5], consist of microcontroller unit, GPS, GSM module, CAN transceiver and an alcohol sensor. GPS receiver provides the information regarding the location of the vehicle at every half a minute.

The L10 receiver supports National Marine Electronics Association (NMEA) standard 3.01. L10 sends information to microcontroller unit and then the microcontroller sends all this information to a server every half a minute via GPRS through the GSM module. The data received in the MCU unit is updated every 0.5 seconds. Devices connected to each other communicate through TCP/IP protocol.

The information stored in the server is used to show the location of the vehicle on the google map so that the vehicle can be tracked down continuously. MCU also evaluates the status of fence violation continuously, if the vehicle violates the fence limit then the CAN messages are send to other ECUs in the vehicle to lock the vehicle doors and vehicle speed can also be controlled. At the same time alcohol sensor sense the alcohol level and if found above threshold then an SMS alert along with the location details is send to the registered phone numbers and ignition of vehicle would be turn OFF. System [6], consist of temperature sensor, microcontroller (ARM), GPS and GSM module. When a vehicle met an accident then the vibration sensor sends a signal to the microcontroller from which an accident is detected or if a vehicle rolls over, a micro-electromechanical (MEMS) sensor will detect the specific signal and send it to the microcontroller. Microcontroller then immediately send the signal to GPS module to get the exact location coordinates and after getting , it send the alert message through GSM module including coordinates to medical rescue team and police control room. After that the medical team will confirm the coordinates on a map and inform the nearest rescue team for treatment. The main advantage of the system is that if driver is not severely injured and is conscious then he can turn OFF the alarm through a switch manually and the rescue tram or police does not have to waste their time.

III. COMPONENTS USED

a) Raspberry pi 3 B+ [7]
b) Arduino NANO [8]
c) GPS Module NEO 6M [9]
d) GSM Module SIM 900 [10]
e) Ultrasonic Sensor HC-SR04 [11]
f) Fire Sensor YG1006 [12]
g) Vibration SensorSW-420 [13]
h) Alcohol Sensor MQ-3 [14]

A. Raspberry pi 3 B+

Specifications:

- Processor- Cortex A53 64 bit SoC @ 1.4 GHz
- RAM- 1GB LPDDR2
- USB 2.0 for Gigabit Ethernet
- GPIO header is of 40 pins which is extended
- HDMI port is of Full size
- For connecting camera, CSI port is given
- For connecting display, DSI port is given

Fig. 1. Raspberry pi 3 B+

B. Arduino NANO

Arduino NANO is based on Atmega328 microcontroller and it is a small, complete and breadboard friendly board. The functionality of this board is very similar to other Arduino boards but in a different way. The main disadvantage of this board is that it has a mini USB port instead of DC power jack.

Specification:

- Reset automatic when the program is being downloaded
- Blue LED for power
- Green- transmitter(TX), Red- Receiver(RX)
- Switching of input power is automatic
- Manual reset switch

Fig. 2. Arduino NANO

C. GPS NEO 6N

Specifications:

- It has high precision output in binary form
- Very sensitive for indoor application
- Configurable power management with anti-jamming technology
- Supported antennas are active and passive
- 5Hz is position update rate

Fig. 3. GPS Neo 6N module

Micro-controller	Atmel ATmega328
Operating Voltage	5 VOLTS
Input Voltage	7-12 VOLTS
Digital I/O Pins	14 in which 6 are for PWM
Analog Input Pins	8
DC Current per I/O Pin	40 milliAmpere
Flash Memory	32 KB (2 kilobytes are used for bootloader
SRAM	2 Kilobytes
EEPROM	1Kilobytes
Clock Speed	16MHz
Dimensions	0.70”x1.70”

D. GSM SIM 900

Specifications:

- Supports Quad band (GSM 850, EGSM 900, DCS 1800, PCS 1900)
- With 2G SIM, It can connect any GSM network globally.
- With an external earphone, it can make voice calls and can receive them
- Can send and receive messages(SMS)
- Can send and receive internet data packets i.e., GPRS data
- Serial based AT command set Chip support baud rate from 1200 bps to 11520 bps with auto band detection.

Fig. 4. GSM SIM 900 Module

E. Alcohol Sensor

Specifications:

- Low cost semiconductor sensor
- Detect alcohol gases conc. from 0.05milligram/L to 10milligram/L
- Conductivity of SnO2 is lower in clean air therefore used as a sensitive material
- High sensitivity to alcohol
- It has high sensitivity and high response

F. Vibration Sensor

Specifications:

- SW420 module can work from 3.3Volt to 5Volt
- Gives digital data, logic low or High, or binary 0 or 1
- High sensitivity
- Non directional
- Adjust the sensitivity according to our own need

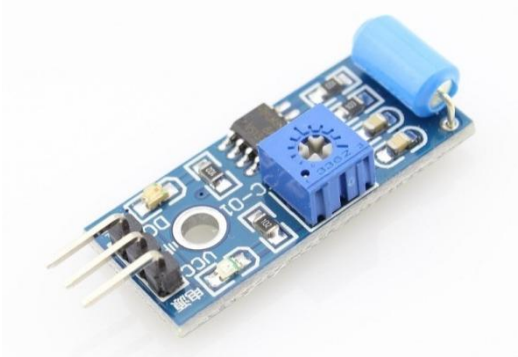

Fig. 5. Vibration Sensor SW-420

G. Ultrasonic Sensor

Specifications:

- Uses SONAR to determine distance to an object
- Effective angle is <15°
- Range of this sensor is 2cm to 400cm
- 30° is a measuring angle
- 10µs is a trigger pulse fir input

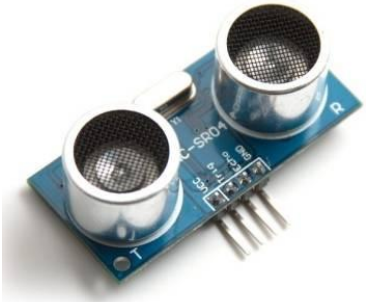

Fig. 6. Ultrasonic Sensor HC-SR04

H. Fire Sensor (IR based flame sensor)

Specifications:

- Can detects a flame or a light source having wavelength between 760nm to 1100nm
- Sensitive to flame spectrum
- Detection angle is about 60°
- Working voltage between 3.3Volt to 5Volt DC
- Can detect infrared light up to a distance of 100cm with in its 60° of detection angle

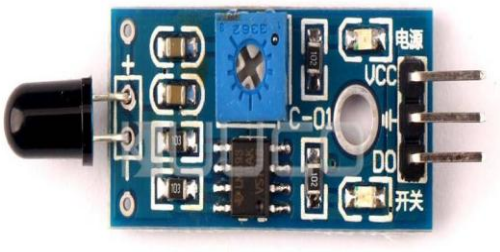

Fig. 7 Fire sensor YG1006

IV. BLOCK DIAGRAM

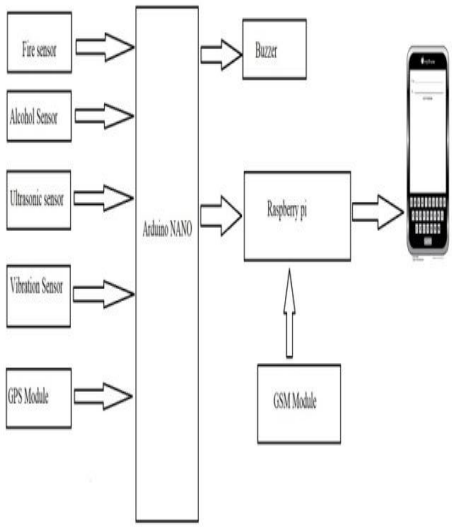

Fig. 8. Block Diagram of Smart traffic accident monitoring system

V. FLOW CHART

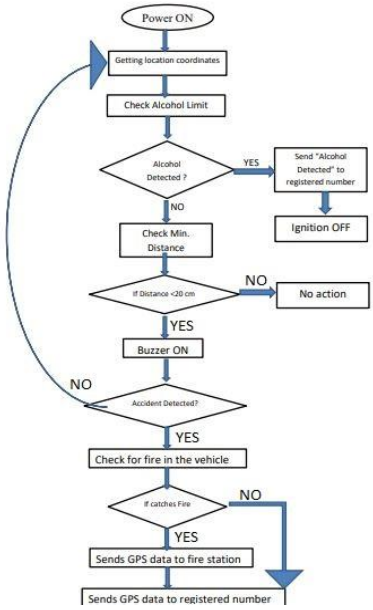

Fig. 9. Flow Chart of Smart traffic accident monitoring system

VI. WORKING

When the system initializes, the GPS module starts getting the coordinates and it updates at a definite time interval, and then the alcohol sensor checks the alcohol present in the surroundings and if it is above threshold then it will send "Alcohol detected" to the registered number and ignition will be OFF. After that ultrasonic sensor checks for the minimum distance for collision and if distance is less than 20cm the system will start producing sound through buzzer so that an accident could be prevented. If by any chance it could not be prevented and an accident occurs then, it will be detected by vibration sensor and if the shock wave or vibrations are above threshold then the location coordinates of the accident spot obtained by the GPS module will be sent to the police, medical unit and to the registered family member. It will send alert message to fire station in case vehicle catches fire, with the help of GSM module.

VII. RESULTS AND DISCUSSION

Table- I: When Alcohol sensor is above threshold

S.NO	STATUS	COMPONENTS	INPUT	OUTPUT
1	ON	GPS MODULE	As system started it takes coordinates	LAT(Latitude): 28.630152 LON(Longitude): 77.370041

2		Alcohol SENSOR	1025(above threshold)	Sends "Alcohol detected" and ignition OFF

Table- II: When Accident detected

S.NO	STATUS	COMPONENTS	INPUT	OUTPUT
1	ON	GPS MODULE	As system started it takes coordinates	LAT(Latitude): 28.630152 LON(Longitude): 77.370041
2		Alcohol SENSOR	1000(below threshold)	No Action
3		Ultrasonic Sensor	Distance<20cm	Buzzer will blow
4		Vibration Sensor	Above Threshold	Accident Detected
5		Fire Sensor	Above Threshold	Fire Detected

Fig. 10(a). GPS coordinates of the vehicle

Fig. 10(b). Distance minimum alert by the system

Fig. 10(c). Accident detected by the system

Fig. 10(d). Fire detected during the accident in the vehicle

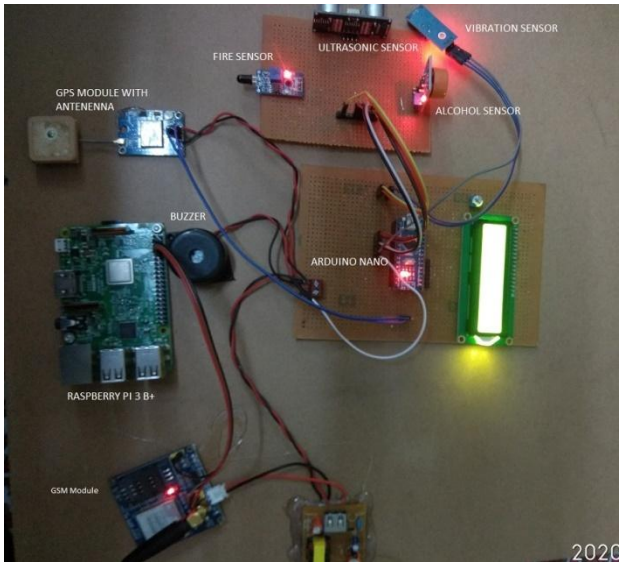

Fig. 10(e). Full system setup

The designed system shown in fig. 10(e) works in various critical situations. If it detects that the driver is having alcohol in his/her system above threshold, then, according to table I, it will send an alert message and ignition will be tuned OFF.

According to table II, when the vehicle approaches other object and distance between them cease to be less than 20 cm, then, it will alert the driver as shown in fig. 10(b). In case of accident, an alert message will be sent to the respective units as shown in fig. 10(c) and to the fire station, in case, if vehicle catches fire as shown fig. 10(d).

VIII. CONCLUSION

The Smart Traffic Accident Monitoring system is designed in such a way that it not only detects the accident but also helps in preventing it. It has a vibration sensor for detecting the possibility of an accident and it has an ultrasonic sensor for the prevention of the accident.

This system will also help in reducing deaths caused by driving under the influence of alcohol as it has an alcohol sensor. The system will also inform the family members of the victim and the fire station through message with the help of GSM module in case of fire in the vehicle.

FUTURE WORK

The system can be monitored from any location and it can check the vehicle properties through IOT and a specified application can be designed which shows the properties as well as notify the owner of the vehicle if any change or accident occurs.

REFERENCES

1. A. George, M. Haridas T.P, N. Kattukkaran,"Intelligent Accident Detection and Alert System for Emergency Medical Assistance", *International Conference on Computer Communication and Informatics*, Jan 05-07, 2017
2. A.K.P Suresh, A. Tony, M.M Joy, Neethu K.R, T. Thomas, "Intelligent Accident Detection System", *National Conference on Emerging Research Trends in Electrical and Electronics Engineering*, March 2018
3. S.M Butt, "A Review paper on accident detection system using intelligent algorithm for VANET", *Journal of information Engineering and Application*, Vol. 06, No.5, 2016
4. Parmar, D. Patel, K. Parmar, M. Darji, M. Sanathra, "Car Accident Detection and Notification: An Analytical Survey", *International Research Journal of Engineering and Technology*, Vol. 06, Issue 8, Aug 2019.
5. Tanushree Dalai, "Emergency Alert and service for Automotives for India", *International journal of Advanced Trends in Computer Science and Engineering*, Vol. 02, No. 05.
6. D. Mahamulkar, L. Somwanshi, S.B. Pawar, "Vehicle Accident Detection System using GSM and GPS", *International Research Journal of Engineering and Technology*, Vol. 06, Issue 4, April 2019
7. Accessed: April 09, 2020. [Online]. Available: https://www.techrepublic.com/pictures/raspberry-pi-3-model-b-see-all-the-new-features-on-the-board/
8. Accessed: April 09, 2020. [Online]. Available: https://www.banggood.in/ATmega328P-Nano-V3-Module-Improved-Version-No-Cable-Development-Board-p-959231.html?cur_warehouse=CN
9. Accessed: April 09, 2020. [Online]. Available: https://afel.cl/producto/gps-ublox-neo-6m-v2-con-memoria-eeprom/
10. Accessed: April 09, 2020. [Online]. Available: https://lastminuteengineers.com/sim900-gsm-shield-arduino-tutorial/
11. Accessed: April 09, 2020. [Online]. Available: https://robu.in/product/vibration-sensor-module-alarm-motion-sensor-module-vibration-switch-sw-420/
12. Accessed: April 09, 2020. [Online]. Available: https://www.flipkart.com/robomart-ultrasonic-sensor-module-hc-sr-04/p/itme2zrvgz2hqznz
13. Accessed: April 09, 2020. [Online]. Available: https://www.flipkart.com/rotobotix-fire-flame-sensor-module/p/itmefvrkaevfwpee
14. A. Anil, R. Rajan, R.Varghese, "Preliminary Medical Monitoring System in Ambulance for Rescue of Accident Victims", *International Research Journal of Engineering and Technology*, Vol. 06, Issue 11, Nov 2019
15. A.V Deshmukh, G.D Deshpande, I. Karande, S. Kumbhar, "Intelligent Anti-theft tracking and Accident detection system for automobiles based on Internet of things", *International Journal of Innovative research in Computer and Communication Engineering*, vol. 04, Issue 3, March 2016
16. A. Kumar M, Anush CN, Karthik BR, P. Bharadwaj, T.L.S Patel, "Drowsiness Detection and Accident avoidance system in Vehicles," *International Journal of Intelligence in Science and Engineering*, Vol. 01,Issue 2, May 2019

AUTHOR'S PROFILE

Anurag Sharma is a 4th year student of B. Tech majoring in Electronics and Communication Engineering from Galgotias University, Greater Noida, Uttar Pradesh. His area of interest is embedded system and wireless technology. He has done certificate course in C, C++ and CCNA and CCNP in networking. He has working knowledge of MATLAB and proteus software.

Puneet Panchal received his M.Tech. degree in Electrical Engineering for his thesis on Model Order Reduction for Some Class of Systems, in 2017, from Indian Institute of Technology, Roorkee, Uttarakhand. In 2014, he received his B.Tech. degree in Electronics and Communication from Jamia Millia Islamia, New Delhi. He is working as an Assistant Professor at the Galgotias University, Greater Noida, Uttar Pradesh, since July 2017. His research interests include Control system, model reduction techniques for linear and nonlinear dynamical systems, optimal control systems and their real time applications.

Saurav Suman is a 4th year student of B. Tech majoring in Electronics and Communication Engineering from Galgotias University, Greater Noida, Uttar Pradesh. He has done industrial training in National Thermoelectric Power Corporation Limited (NTPC) at Dadri in Control and Instrumentation Department. His area of interest is embedded system.