

# SSW: Smart Steering Wheel for Real-Time Heart Rate Monitoring of Drivers



Priya J., Reshmi T. S., Gunasekaran M.

**Abstract**— It's very hard to know that Over 467,044 accidents took place specifically on the road in our country in 2018 as per a report revealed by the MoRTH recently. Rapid increasing in numbers of vehicles on the road, stress level of drivers in traffic and even lethargic driving are few reasons for road accidents. Unfortunately, sudden heart attacks of drivers also a reason behind some road accidents; this can be preventable. During driving, monitoring heart rate is not a big deal in today's hi-tech world. Health monitoring while driving is not only important in daily healthcare, also a prevention of bus accidents. Here the proposed work is designing a smart steering wheel based on the technology so-called the Internet of Things (IoT) that monitors the heart rate and foresees the onslaught of fatigue of a driver; also it shares the location to the rescue team. Pulse sensor, GPS and GSM modules are conjoined into the steering wheel. The setup once it gets powered-up, which transmits the data of a driver's health condition and get stored in the cloud environment. By this approach, the steering wheel gives the real-time based monitoring. Therefore this work is aiming for the development of a system which includes multiple sensors incorporated with the steering wheel which is capable to measure the pulse rate and alert the rescue team dynamically about the health related data of a driver, to prevent accidents.

**Keywords**— Internet of Things, Steering wheel, Sensors, Healthcare

## I. INTRODUCTION

Safety is the foremost point to take into consideration in case of driving. There are 'n' numbers of drivers on Indian roads today. The Ministry of Road Transport and Highways (2018) recently revealed a report stated that there were over 467,044 road accidents took place, which might be caused by many reasons. Among that stress level of drivers also plays a role that leads to an accident. Since drivers are being in work for a shift basis of continues 2 days, they may fall ill and become fatigue. By nature, a fatigue or tire driver obviously will lose control and leads to accidents. Pointing out these incidents, many research works are carried out prior by focusing on a driver's health condition in various methods while driving on the road.

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Among all the types of solutions to prevent the road accidents in case of driver dependents, the emerging technology internet of Things (IoT) based solutions plays a very good role in preventing the above mentioned issues.

Literally nowadays, people are getting addicted to technologies that are making their day to day life comfortable. One of the kinds is the Internet of Things, a technology which makes dumb devices to speak with each other. Then these types of devices are too smart to think and work anonymously with no human intervention. Moreover, it makes people work easier and gives an effective and efficient output that cannot be done by a normal human within the given time. Basically IoT is an advanced version of M2M technology, and it gets incorporated with an embedded system leads to smart devices. Hence these were reasons to choose IoT for this project. With the help of smart devices, immediate results can be obtained, which is useful for acting according to the circumstances. Here, pulse measuring sensors, GSM module for communication and location identification modules are getting embedded with a steering wheel which transmits data wherever needed. Therefore, developing an intelligent system for monitoring a driver's health conditions by using IoT is necessary and helpful as well. As I mentioned before that safety is most important, the concern of a driver here shows, it is the aim here. Finally, yet importantly IoT based smart devices not only interacted with themselves, also with interfaces of virtual reality. This paper aims to showcase the works related to the solutions that can overcome the problems stated here, also proposed a smart solution based on the Internet of Things which has been designed to solve the above mentioned issue by that it leads to reduction in accidents on roads. First, Introduction about the statistics of accidents happened so far and the importance of advanced technology, IoT. Second, it's a discussion about the works done still for monitoring the health condition of drivers. Next, it comes about the methodology that has been implemented in the proposed work; Followed by, Experimentation of the concept proposed. At last, the conclusion of this paper comes.

## II. RELATED WORKS

Various techniques have been implemented to monitor the abnormal condition of a driver as well as the vehicle on the road to avoid road accidents. This includes parameters of the position of a vehicle, behavioral pattern of a driver and psychological parameters of driver. Vehicle related measurement includes parameter like deviations in position on lane. Whereas the behavioral pattern of a driver detects facial expression and head positions. And the physiological measurement includes changes in heart and brain activities [1].



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Number of IR sensors are get embedded to monitor a driver's health condition [2-3].

Fatigue condition of a driver has been detected by analyzing the grip force on steering wheel produced by the driver [4] which is not firm as required.

Another work named PSYCAR which reports the feasibility of a control system analysis by evaluating the correlations among physical parameters [5].

A non-invasive technique based ECG, in which the pulse wave of heartbeat measures the variation of blood volume in tissues with the help of the light source and a detector [6, 7]. By capturing a driver's face expression and with that video images and force given on the grip of steering wheel by the driver were determined to find the health condition of a person. These parameters were congregated with the help of fuzzy classifier [8].

In [9], author uses binary decision classifier to determine the state of the driver. The parameters needed for the classifier are given by the sensors embedded on steering wheels and lever. Another technique using motion features determines the confused hand movements of a driver while using a steering wheel and detects the driving and vehicle motion to identify the risky and suspicious nature of driving [10].

## III. METHODOLOGY

### A. Pulse Rate Sensor:

The heart beat or pulse rate sensor is used to measure a person's heart beat rate. Here to measure the heart beat or pulse rate of a driver, the sensor has been installed around the steering wheel, which ensures the driver's health condition, and getting stored in a cloud. It ensures the threshold level that has been already mentioned in a program.



Fig.1 Pulse Rate Sensor

### B. GPS Module:

A GPS module can retrieve the location of a user in remote with time stamp from anywhere and at any time. Here it receives the information of user or vehicle and get stored in a real time open source cloud environment. If the value crosses the threshold level of heart rate, the location will get shared to the rescue team and family.



Fig.2 GPS Module

### C. GSM Module:

GSM module is same as GPS system which helps the setup for sending information to the emergency and needed contact numbers in case of any emergency.

### D. Arduino/ NodeMCU Board:

An Arduino board is hardware and also a development board used to design the proposed system which helps to monitor the health condition of a driver and to reduce the accidents on roads.

NodeMCU is a cheapest wifi module with programmable input and output peripherals, memory unit. Here it is used to automate the process that designed for this project. With this Nodemcu module other mentioned sensors are get incorporated for obtaining the output.



Fig.3 NodeMCU ESP8266

### E. Power Supply:

The development can be powered up either by USB or an external power adapter. Recommended voltage range for the board is 7-12volts.

Along with the steering wheel, the above mentioned components are getting embedded to reach our goal to reduce the accidents due to health conditions of drivers.

## IV. EXPERIMENTATION

### A. Block Diagram :

The block diagram for our proposed smart steering wheel system, to determine the driver's health condition comprising of the smart steering rescue team. Proposed system design is given in the block diagram below. The pulse rate sensor collects signals from sensors incorporated on the steering wheel, gives real time monitoring data, analyzing the captured data and reporting to the rescue team if needed.

Each block consists of a module which has different functionalities for a driver's health care. The development board used here is NodeMCU ESP8266 which connects the remaining modules includes pulse rate sensor, GPS module and GSM module. The NodeMCU will get powered up with the help of power supply of 7 to 12 volts.

Pulse rate sensor embedded with the steering wheel is used to measure the heart rate of driver. GPS module sends the current location the driver along with the vehicle information to the cloud storage and also to the rescue team. Whereas GSM module is used to send the required information includes heart rate value to cloud storage as well as to the persons who are in the rescue team and family members if needed.



The block diagram given below in the fig.4 shows the components used. If necessary, LCD display and a buzzer also can be added for passengers, by that they can recognize the situation and act accordingly.

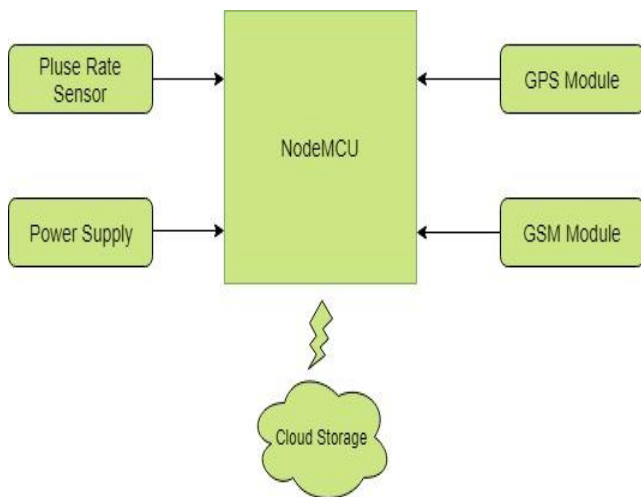


Fig.4 Block Diagram

**B. Flow Chart:**

The flow of process happening in the proposed is explained in terms of flow chart which is in the fig.5 given below. The process of the proposed system is given in the flow chart. The working process starts from powering the development board, here it is NodeMCU ESP8266 which gives connectivity to all other sensors and actuators connected with the board. First, the complete system has to be getting incorporated with the steering wheel of any automotive. When a driver switches on the automotive, the system gets initiated. The pulse rate sensor starts to sense the driver's health condition regularly. Sensed data passed to a cloud storage environment and get stored then and there. For example thinkspeak or adafruit like any application for cloud storage.

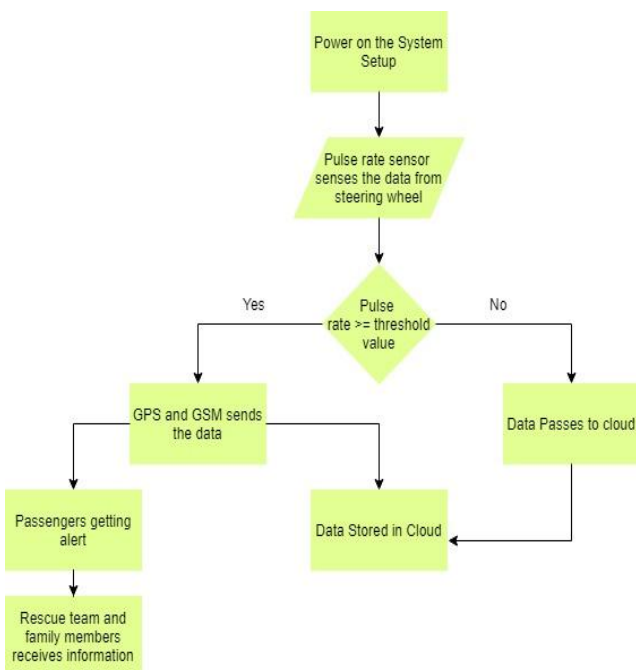


Fig.5 Flow Chart

The proposed system has been programmed like, the sensed data should be comparing with a threshold value that has been already fixed. Therefore the sensed data will get compared with a threshold value then it stored in a cloud.

At the stage of comparing, if the sensed value is greater the threshold level, GSM and GPS system will get enabled. The GPS sends the current location with time stamp whereas GSM send alerting SMS along with sensed data to nearby hospital and rescue team.

To make the passenger alert, a buzzer has been fixed inside the bus or any heavy motor vehicle. If the value reaches the threshold value, the buzzer starts to buzz and alerts the passengers. Hence, anyone can stop the vehicle by supporting driver in addition, the driver's life also get safer.

**V. RESULTS AND DISCUSSION**

The proof of the concept has designed and tested for results. It worked out actually well. The system setup has been shown in the given fig.6 below.

The sensors and actuators are connected with the development board. Once the power supply has been given, the system will start to work. This shown system is going to be incorporated with the steering wheel. Therefore, when the drive holds the steering wheel his health rate will be monitored.

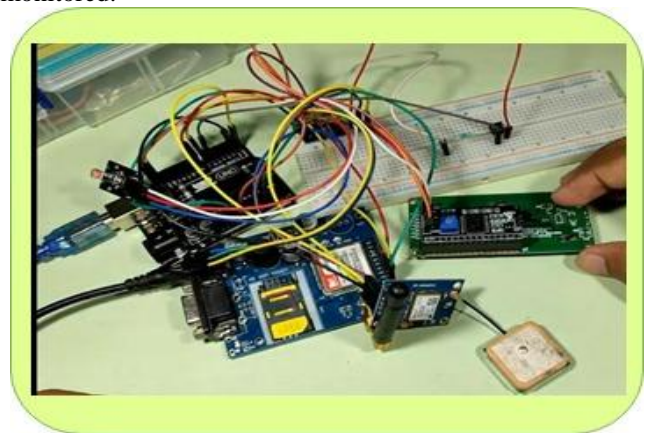


Fig.6 System Setup

The sensed data is being displayed in LCD for reference and this LCD is not compulsory, we can directly store the data in cloud storage environment. Here for clear understanding, LCD has been shown. Pulse rate of a person when he is at normal stage as well as during fatigue stage also noted and displayed. The displayed value of normal stage and fatigue or low pulse rate stage of the driver has been shown in the given fig.7 and fig.8 respectively.



Fig.7 Normal Stage





**Fig.8 Fatigue Stage**

As shown in the above figure, the values are displayed. The same values along with time stamp get stored in cloud storage environment with the help of either a wifi module ESP8266 with an Arduino board or by NodeMCU directly. Once the data has been sensed, it should be compared with the defined threshold value in program. Each and every value of sensor is getting stored in cloud. Though it is getting stored, when the value crosses the threshold value, GPS and GSM get activated.

GPS module sends the live location of vehicle and the driver's pulse rate value to the respective members who are involved in the rescue operation.

Next, GSM get enabled and send the alerting text to the corresponding mobile number, rescue team and nearby hospitals. Text has been received in a mobile as shown in the fig.9.

Simultaneously buzzer in the automobile initiated and produce alerting sound to make passengers alert and anyone can stop the bus for emergency.

Henceforth the process and working model of the proposed system has been explained and the corresponding results are shown in the figures respectively.



**Fig.9 SMS Received**

## VI. CONCLUSION

This paper summarizes of different existing solutions for the mentioned problem. In proposed system, the steering wheel gives the real-time based monitoring. Therefore this work has been aimed to the development of a system which includes multiple sensors incorporated with the steering wheel, it is capable to measure the pulse rate and alert the rescue team dynamically about the health related data of driver, to prevent accidents. Since IoT has been used as a technology background for the proposed system, it is working well and helpful for society. As a future work, researchers can include many other sensors for determining driver's health like blood pressure, nervousness level and

even the level of sweating can also be analyzed for better results.

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