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Accidents Preventing Smart Helmet Using EEG Sensor

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Abstract

India is a developing country which is also the largest democracy in the world with 1.36 billion people, where most people own a motorcycle. Hence, motorcycles accidents are prevalent across the nation, resulting in lose of lives. The objective of this paper is to propose an Electroencephalography (EEG) Monitoring control system enabled helmet, which provides convenient and enhanced protection by alerting and speed limiting the motorcycle. An Atmega328 Microcontroller controls the overall operation of the system. It interfaces with subsystems present in the helmet periphery enclosing the EEG sensor and the wireless transceiver (Bluetooth) module.The Bluetooth module is a master/slave model, through which wirelessly data are communicated and processed in the main system. The response time of the controller will be increased by implementing PI controller and thus a closed loop system is established. Feedback from accelerometer senses and measures the dynamic motion. Once the accident takes place the Global Positioning System (GPS) collects the coordinates of the accident site which is later transmitted to the registered mobile numbers as an act to communicate with the rider's close contacts. An alcohol sensor is added to the model which senses the condition of the rider before starting the vehicle.

Keywords: *Arduino, Smart helmet, GSM, GPRS, Microcontroller, Accident, EEG sensor, Alcohol sensor.*

I. INTRODUCTION

India has the most elevated number of street mishap passing's on the planet, according to a WHO report. As per a study of India there are around 6989 mishaps happening because of bicycle crashes every year referenced in [1]. The prime reasons, as indicated by [2] for the mishaps might be numerous, for example, speeding, tipsy driving, wild driving, plan deserts, rash driving, absence of consideration.

As indicated by [3] now and again, the individual harmed in a mishap may not be legitimately liable for the mishap, it might be the flaw of some other rider, yet toward the day's end it's both the drivers engaged with the mishaps will endure.

One of the main reasons for the occurrence of most of the accidents is due to lack of our concentration on the road as a result of lack of focus visible in EEG waveforms [4]. The proposed model solves this problem by continuously monitoring the rider's attention level and warns him if his attention is very low. Even if

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the accident occurs by the other person's mistake it should be made sure that proper safetymeasures are taken. In [5] a text message will be sent immediately to the registered mobile number and they are informed about the location of the accident.

In India greater part of individuals favor bikes when contrasted with other type of vehicle because of straightforwardness and ease. There is significant bleakness and mortality because of bike street car crashes. Riders are at the danger of enduring horrendous cerebrum damage in the event that they are in a mishap. Consequently, protective caps are of essential significance to maintain a strategic distance from passing's because of extreme head wounds. The idea of assuming liability of society brought about the proposed model the "Street Accidents Preventing Smart Helmet utilizing EEG Sensor".

The proposed helmet design includes the following

1.Accelerometersensor
2.AlcoholSensor
3.EEGSensor
4. GPRS
5.GSM
6. Microcontroller(Arduino)

The Arduino development board features the (Atmega328) microcontroller, GSM technology with Arduino to give information by sending messages to the registered number along with GPRS location indicating the perfect location about where and when the accident occurred and EEG sensor to monitor the rider for their attention.

II. HARDWARE DESCRIPTION

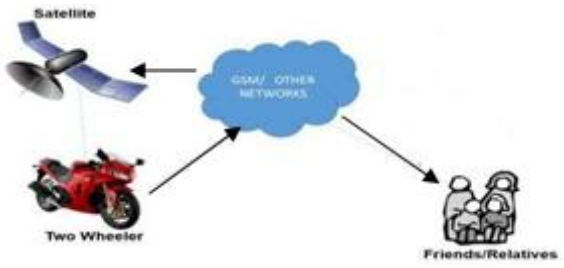

Figure 1. Proposed System

The Figure 1 depicts the primary goal of the system. The transfer of information is clearly shown in figure.

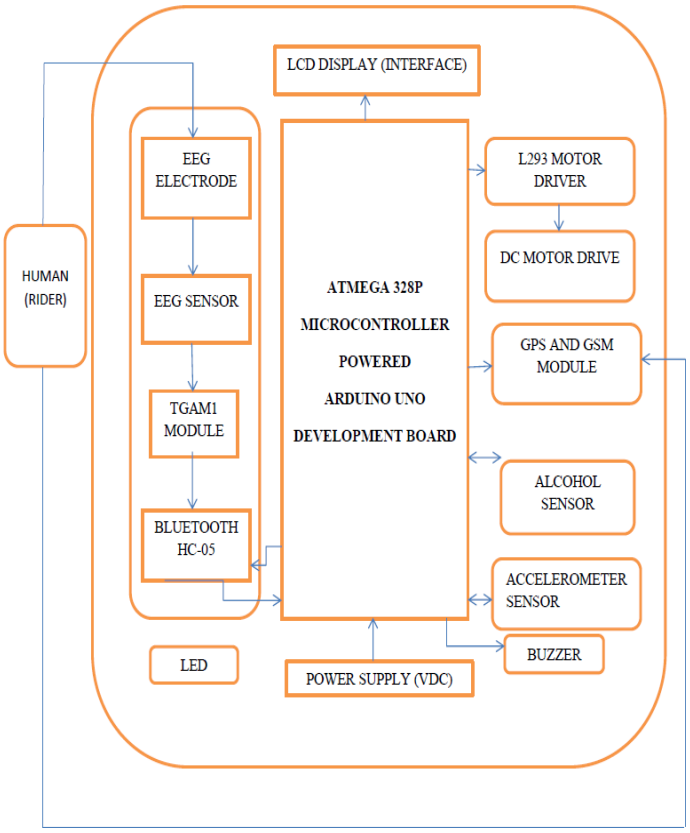

Figure 2. Block diagram of the Proposed System

As appeared in Figure 2 the square graph of the framework
comprises of,

1. EEG (Electroencephalogram) sensor used to distinguish the consideration level of the rider.
2. Accelerometer sensor used to gauge the even tilting situation of the cap.
3. Alcohol sensor to guarantee that the rider has not expended the liquor.
4. GPRS to recognize the area of the mishap [10].
5. GSM system to send the alarm message.

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The fundamental part; modules and different pieces of the framework are midway controlled utilizing a smaller scale controller Arduino (Atmega328).

A. *EEGSensor*

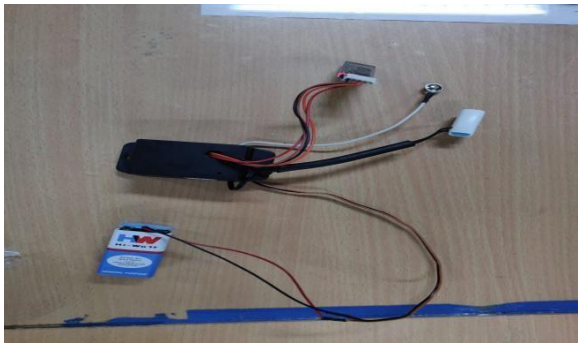

Figure 3. EEG Sensor

The EEG sensor placed in the helmet monitors the attention level of the rider. It also captures the bio-potential signal from the rider and sends the signal to the Arduino (microcontroller). If his attention level is low, the motor speed will be reduced drastically.

B. *AccelerometerSensor*

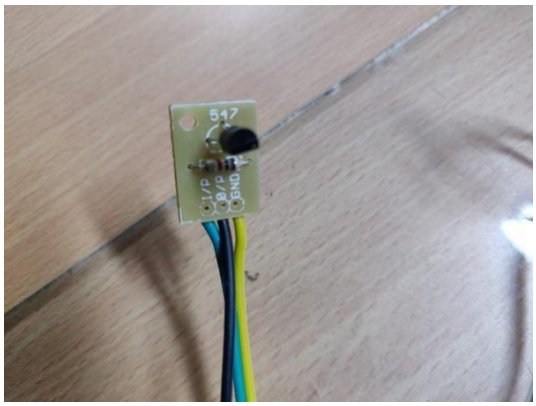

Figure 4. Accelerometer Sensor

The accelerometer sensor is put in the vehicle. The accelerometer sends a sign to the Arduino on the event of a mishap. At that point the Arduino will communicate something specific containing data about the mishap and area of mishap.

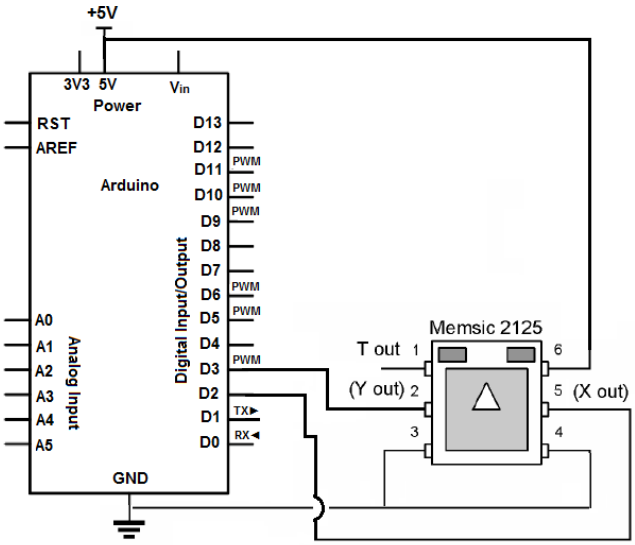

Figure 5. Accelerometer Sensor Configuration with Arduino

C. *AlcoholSensor*

Figure 6. Alcohol Sensor

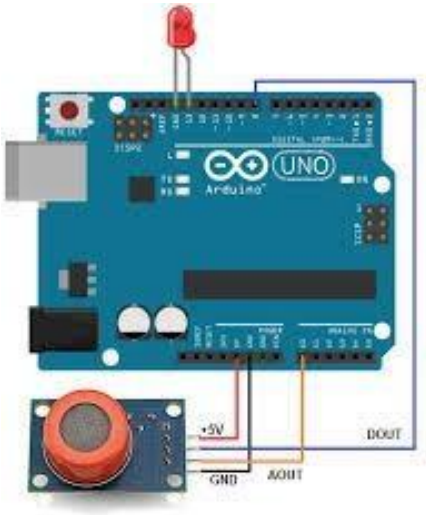

Figure 7. Alcohol Sensor configuration with Arduino

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The Alcohol sensor is placed in the helmet. When it senses that the rider has consumed alcohol, the sensor will send the signal to the Arduino and the vehicle will be prevented from starting.

D. Bluetooth

Bluetooth is used here to ensure the wireless communication. It is used to transmit signals to and fro from Arduino to different components.

Figure 8. Bluetooth

Arduino GSMShield

The Arduino GSM Shield interfaces the Arduino to head protector utilizing the GPRS remote system. This module is simply stopped onto the Arduino board alongside a SIM card from an administrator offering GPRS inclusion. It is conceivable to make/get voice calls with the guide of an outer speaker and mouthpiece circuit and furthermore send/get SMS messages. The Arduino GSM shield is appeared in Figure 10. The Arduino GSM Shield takes a shot at 5V Operating voltage which provided from the Arduino Board and the Connection with Arduino Uno on pins 2, 3 (Software Serial) and 7 (reset).

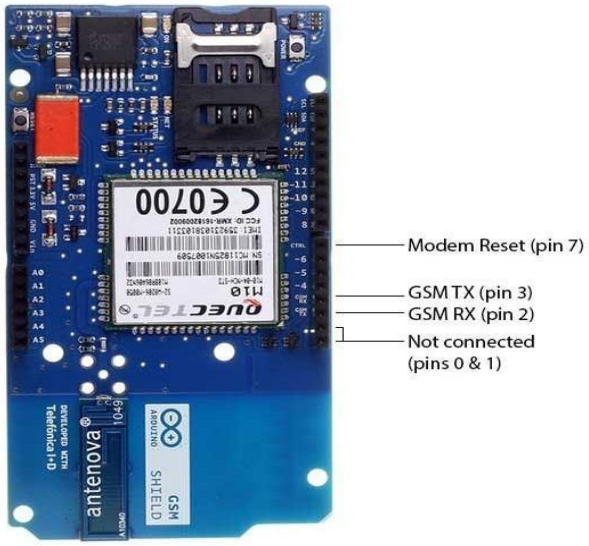

Figure 9.Arduino GSM shield

Table 1. Specifications of GSM shield and Arduinodevelopment board with Atmega328p

PARAMETERS	SPECIFICATIONS
Access method	TDMA/FDMA
Uplink frequency band	890 TO 915 MHz
Downlink frequency band	935 to 960 MHz
System bandwidth	200 KHz
Users per channel	8
Frame duration	4.615 ms
Spectral efficiency	1.35 b/s/Hz
Data rate per user	33.6 kbps
Quad-band	850/900/18001900 MHz
GPRS multi-slot class	10/8
Dimensions	24*24*3 mm
Weight	3.4g
Control via AT commands	(GSM 07.0707.05 and SIMCOM enhanced AT Commands)
Low power consumption	1.0 mA (In sleep mode)
Operation temperature	-40^{O}C to +85^{O}C

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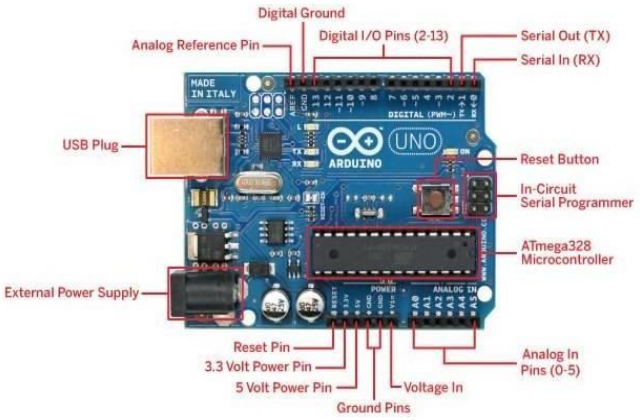

Figure 10.Arduino Uno (Atmega328) Microcontroller

The most widely recognized rendition of the Arduino will be Arduino UNO. The Arduino UNO is a microcontroller board dependent on the ATmega328. It is anything but difficult to interface with sensors, smaller in size. It has 14 advanced information/yield pins. It contains everything expected to help the microcontroller. It needs to simply be associated with a PC with a USB link or power it with an AC-to-DC connector or battery to begin.

Table 2. Specifications of Arduino UNO (Atmega328P)

PARAMETERS	SPECIFICATION
Microcontroller	Atmega328p
Operating voltage	5V
Input voltage (recommended)	7 to 12 V
Input voltage (limits)	6 to 20 V
Digital I/O pins	14 (of which 6 pins provide PWM output)
Analog input pins	6
DC current per I/O pin	40 mA
DC current for 3.3V pin	50 mA
Flash memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Clock speed	16 MHz

PROPOSEDSYSTEM

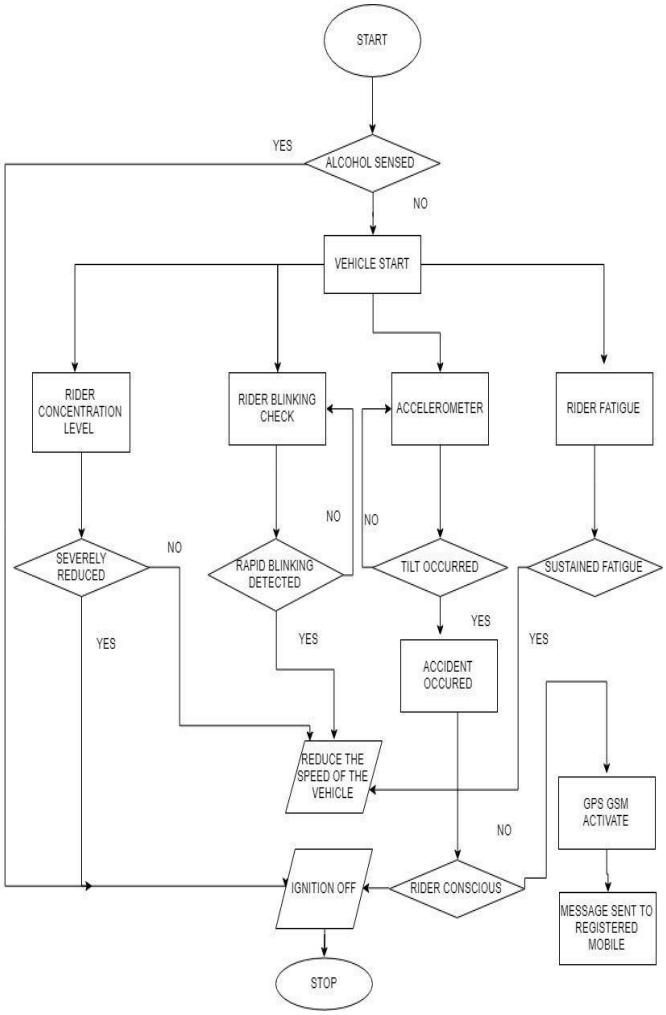

Figure 11. Flow chart of the Proposed System

The Figure 11 shows the flow chart of the proposed system design. The flow of the system is initiated by acquiring the signals from three sub-systems. They are alcohol sensor, (EEG) sensor, and the accelerometer sensor. Two signals from EEG sensor and one each from the remaining sensors. If the alcohol presence is detected the vehicle will be preventedfromStarting

Once the vehicle is started the EEG sensor and accelerometer sensor actively monitors the rider. If the rider loses their control over the motorcycle, due to severely reduced concentration, the motorcycle ignition is turned off. If the rider undergoes rapid blinking, the blink detection sensor present in the EEG module reduces the speed of the motorcycle. If the rider is sensed to

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be highly fatigued due to continues travel the speed of the motorcycle is reduced. If the accelerometer sensor, senses sudden tilts beyond the preset limit, it is understood that the motorcycle has met with an accident. Immediately the (GPS-GSM) module sends a text message about the accident and the location (coordinates) of the accident to the rider's registered mobile number as an act of communicating the incident to the family member or friends of the rider.
PROTOTYPE

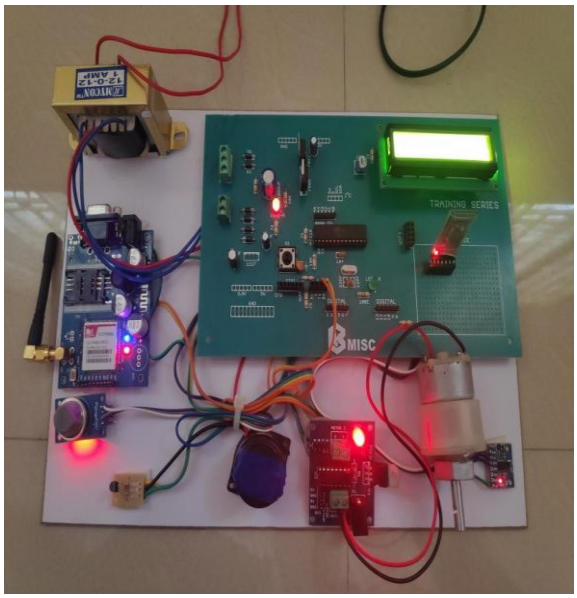

Figure 12. Hardware interfacing of Arduino Atmega328, GSM shield, GPS on board

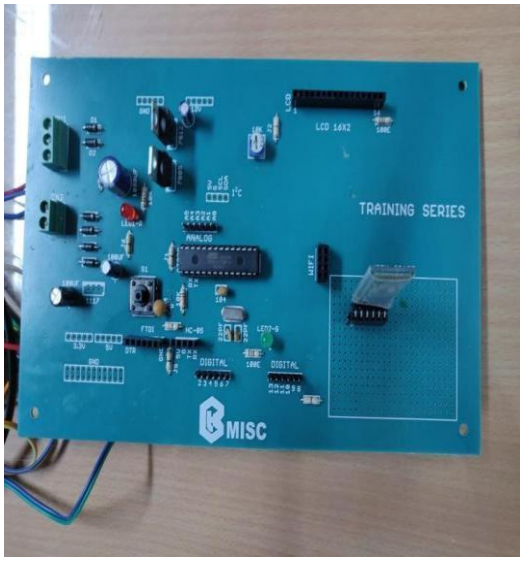

Figure 13. Development board without power supply

Figures 11, 12, and 13 show the hardware implementations of the proposed design.

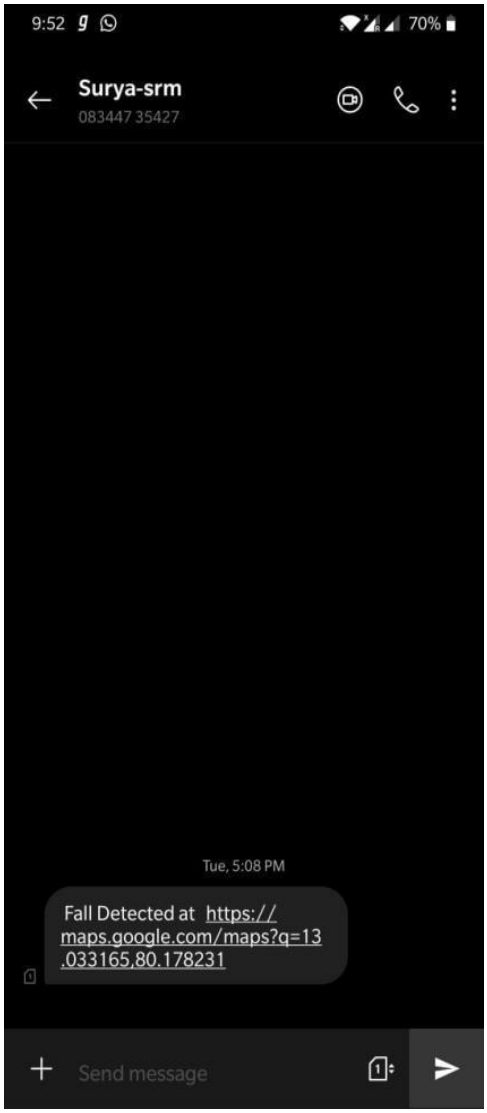

Figure 14. Text Message

In Figure 14. The text message has been received in a registered mobile number from the site of accident, through the GPS acquired location via the GSM module which is present in the EEG module of the proposed model.

III. CONCLUSION

Millions of years of evolution gave birth to the modern civilization and the inventions of the present day. One such is the IC engine powered motorcycle. Many accidents are taking place in our day to day life involving motorcycles in ourcountry.

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At first the various incidents involving the bike accidents were briefly discussed. Our proposed model overcomes the challenges faced by the previous works. In this proposed model EEG sensor is incorporated which is used to monitor the bio-potential signals reflecting the concentration levels of the rider. When the concentration level goes down it alerts the rider and also helps the rider in evading potential accidents. It also ensures in providing necessaryassistanceincasewhentheaccidentoccurs.I tisdone by employing the proposed model in the helmets of the motorcycle rider. The benefits are

- The smart helmet is designed to provide security, safetyand comfort for therider.
- With the arrival of smart helmets in the market.there will be a decline in the frequent occurrence of the accidents due to fatigue , carelessness and lack ofalertness.
- In future there will be a massive demand for these kindof helmets. Since the helmet brands in the market have realized the need of innovation into their helmet design to market their product to the targeting theyouth.
- With the advancements in technology the whole circuitcan be manufactured in thin film printed circuits and integrated in the inner periphery of the helmet so that the circuit becomes hidden from consumer and can be easily fitted into thehelmets.

More Bio-Electronic Circuitry like (EMG) which is a Bio-potential Electrode Sensor can be integrated into the proposed model which would increase the level of precision of measurement of bio-signals.

Light weight fabric materials specially fabricated with nano technology which could withstand highest degree of impact from accidents and consequently reduce the weight of the overall model can be used in the future into the proposed model.

In the near future (IPC-CC-830) coated circuits can be implemented which makes the circuit to resist moisture and corrosion as a result making it water resistant. This can be made possible byNanotechnology.

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REFERENCES

[1] G. Kaur and E. H. Kaur, "Prediction of the cause of accident and accident prone location on roads using data mining techniques," *2017 8th International Conference on Computing, Communication and Networking Technologies (ICCCNT)*,Delhi,2017,pp.1-7.

[2] N. R. Vatti, P. Vatti, R. Vatti and C. Garde, "Smart Road Accident Detection and communication System," *2018 International Conference on Current Trends towards Converging Technologies (ICCTCT)*, Coimbatore, 2018, pp.1-4.

[3] A. Das, A. Ray, A. Ghosh, S. Bhattacharyya, D. Mukherjee and T. K. Rana, "Vehicle accident prevent cum location monitoring system," *2017 8th Annual Industrial Automation and Electromechanical Engineering Conference (IEMECON)*, Bangkok, 2017, pp.101-105.

[4] A. Ajay, G. Vishnu, V. Kishoreswaminathan, V. Vishwanth, K. Srinivasan and S.Jeevanantham,"Accidental identification and navigation system in helmet," *2017 International Conference on Nextgen Electronic Technologies:Silicon-Software(ICNETS2)*, Chennai, 2017, pp.202-204.