

Smart Helmet for Rider (SHR) and Accident Detection using IOT

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Abstract

In recent times there has been a rapid increase in development in the field of IoT as the internet has become a priority for everyone. The main objective is to motivate the motorcyclist from wearing a helmet which will help to reduce the number of accidents occurring nowadays because a person doesn't wear a helmet while driving regularly. It has a helmet section and a vehicle section. In the helmet, the RF transmitter will be attached which will be directly connected to the RF receiver which is in the vehicle section so only if the person wears the helmet then the ignition starts. Also, it has an alcohol sensor to check whether the person is drunk. If found drunk the ignition will stop and the vibration sensor to detect an accident. GPS is incorporated to check the location of the accident and the message will be sent to the emergency contact with the location coordinates with the help of the GSM module. So that all the proper measures can be taken by the authorities within the desired time.

Keywords: *Bike Helmet, Accident Detection, Alcohol Detection*

Introduction

There is a rapid increase in the number of bike accidents taking place worldwide which is leading to a loss of numerous life and families are losing their dear ones. So some solution needs to be found out so that number of deaths and accident can be reduced. The main and very important reason of death is the head injury as head is one of the main part of the person to survive. Road accidents have increased twice or thrice of the number it was happening 10 years back. A helmet is a type of protective gear used by the rider. The main purpose of the helmet is to provide the protection to the head of the riders.

So to tackle this problem a smart helmet for rider is developed. Two main points were identified. First to check whether helmet is worn or not which is done with the help of the RF transmitter by sending the analog signal to the RF receiver and second if there is any alcohol content present in rider's breath. It can be done with the help of leaf switch sensor which is placed inside the helmet and for alcohol detection alcohol sensor can be used to check the alcohol consumption value.

Once these conditions are satisfied then only the motor engine will start. If a person met with an accident then GPS and GSM sensors present will come into use. They will send the exact coordinates of the location to all the emergency contacts as well as nearby hospital so that necessary actions can be done and Arduino help all the sensors to work together

Accident can be detected with the help of vibration sensor present in the system once the sensors cross the threshold value the alert message is generated and send to the Arduino and to which GSM is connected which will notify all the emergency contacts with the exact location.

This system can be used by all the automobile developing companies as it would act as an additional safety feature towards the road safety and accident detection as well as preventing the accident beforehand as it would detect the alcohol value in the rider and send the messages to the emergency contacts so that they are well aware of the situation of the rider and can take rescue steps beforehand. These can be monitored with the help of IoT portal which provides all the information's that are captured with the help of the sensors.

Literature Survey

In IOT field specifically with human safety and preventions of accidents many papers are presented in various projects but many of them lack accuracy. These works are either done independent and only using one sensor and it usually direct poor output.^[1] A. Ajay, G. Vishnu, V. Kishore in their work accidental identification and navigation system tried to develop a system which was made developed looking at many days to day use cases. This was a special idea to encourage riders to wear helmets so that they are safe on

the roads and don't met with an accident. So, this prototype was made to promote usage of helmet whenever we go for a ride and deaths can also be reused on the road.^[2] Sreenithy chandra, Shena Chandrasekhar, Edna Elizabeth N in their work build a smart helmet which was loaded with many sensors. Wi-Fi enabled processor and cloud computing infrastructures were also used in development in of the system. The system was fitted with accelerometer and it regularly monitors the all the erratic vibration. Whenever something wrong happens all the details of the rider are shared with all the emergency contacts with the help of cloud-based services. With the help of GPS motorcycle location is recoded. With the help of cloud service location is shared which was a really quick and reliable form of communication and it provide real time with the help of Konnect. But if sometime there was low internet connection there was no communication with the people.^[3] Mingi Jeong, Hyesum Lee, Myungam Bae, Dong Beom Shin, Sun-Hwa Lim, Kang Bok Lee in their work smart helmet for disaster and safety they made a prototype of smart helmet which have a lot of sensors like infrared camera , electro optical camera , drone camera , oxygen residual sensor , 6-axis inertial sensor and a smart watch device which was monitored through head mounted display and was controlled centrally with the help of all these sensors. They developed a new software framework to manage all these bunch of sensors so that all can be managed efficiently. The main aim of the helmet was to that it should be used in disaster management which would help the disaster team to find out all the people and rescue they as soon as possible so that quick medical help can be provided and no if deaths can be reduced. They also used IoT to get the data to the server. Infrared sensor was used to detect all the people buried in the building rock. Drone camera was used to get a wider picture of the area. Oxygen residual sensor was used to check the oxygen value of the patient. But it had few setbacks as drone was not able to detect people which were buried deep inside the build rocks. As well as in few cases they were asked to remove the helmet and it was not useful at all. As there were a lot of sensors it used to take time to analysis as well as to get to the final result which would help the disaster management team to make a road map for the further process.

^[4] Durga K Prasad, Gudavalli, Bh. SudhaRani, C. Vidyasagar in their work Hemet Operated iSmart iE-Bike. It was having two operating nodes iwhich are SLS security lock system and SES safety engine system. The first node sols have RIFD reader as well as two RIFD tags. When a unique id tags matches any of the RFID reader then only handle lock will open and the user will be able to operate the bike and the second operating part was using a force sensing sensor. But there were some drawbacks during no internet connection they sensors were not able to connect with the database and this would lead to slow response and more time wastage of the users.^[5] Jesudoss A, Vyabhavi R, Anusha B in their work design of smart helmet for accident avoidance it was loaded with very less sensors and gas sensor was used for alcohol detection which is quite impractical as alcohol sensor should be used to for alcohol detection. They also had a clip that was fixed in the helmet as soon as the clip is attached and when the connection gets completed it will share the information with the sensor and which start the bike. They also did not have any IOT or Wi-Fi enabled device which can be used to transfer the data from the sensors. It should be always be connected to a mobile device so that all the data can be received and analyzed which would take a long time. Since It was not connected to any data transmitting sensors so it was not use full for any authority.

^[6] Mohd khairul afiq mohd rasli, Nina korlina madzhi , Julian Johari in their work smart helmet with sensors for accident prevention. They used a lot of sensors such a force sensing sensor FSR, brushites direct current BLDC, Comparator IC, IC Timer 555. So all these seniors were a complex sensors and required a lot of time to execute each and every formula to get an accurate results .They also put a RF data transmission module which was quite bulky and required a lot of space and proper arranges to be kept so that accurate results could be found or else the results shown were not accurate. This was a great example of human development and required a lot of good development skills to develop this but this was quite bulky to handle and all the sensors put as well as display was quite costly so it was not a pocket friendly product to handle. ^[7] G.sasikala , Kiran padol ,Aniket A Katekar and Surrender dhanasekaran int their work safeguarding of motorcyclist through helmet recognition was an interesting example of electronic sensor work as it all the required sensors and they also added and decoder and encoder to decode all the sensors data so that all the signals are kept secret and cannot be caught by anyone and be used so this was an interesting feature of the project. But because of these encryptions all the processing time was lost in this and it was taking a lot of time to

show results. Time the time is showed results the rider must have met with ana accident or was riding under the influence of alcohol . This project was a best example of electronics engineering but not useful in the view of computer science as it was not having any IoT or WIFI enable sensors to send the data.

[8] Divyasudha N, Arulmozihvarman P in their work analysis of smart helmet an iot based helmet worked out on an amazing prototype as it has all the sensors required for the project and were getting accurate values and also accurate results within real time but a major drawback of the prototype was that they added a solar sensor which was used to provide electricity to the modules .But this was not very successful in the places where sun shine is not good to run the sensors .So in those city the prototype was failing and required a lot of further development so that in each end every atmospheric condition it can work and provide good results with very less chance of error in the final output.^[9] Dikshant mancho, Ankita purkayastha ,Yatin Chachra, Namit Rastogi, Varun goel in their work helmet detection using M L and IoT was a great example of machine learning as it required a lot of development and good amount of coding for the project as well as face detection algorithm and number plate reading . In this they added an face recognition capabilities i.e. the camera present will check whether the person has worn helmet or not if the helmet is not there then engine won't start and all the details of the rider will be sent to the police authority to prepare a challan so this was a non-tamper proof prototype and required a lot of development. But it had a big drawback that the sensor was not able to recognize the ride in low light or at night. ^[10] Satish Patil, Vivek Waugh ,Vipul Jagdish, Vinod Malpure in their project IoT inferred smart helmet for accident detection was the which was good but were not having any additional feature to save the rider. They only checked that weather the helmet is there or not. If the helmet is there then only the bike will ignite or else it won't. They used the received which were not up to the mark light connection of the switch would allow the engine to start. They were also not providing the location of the rider or weather he is driving under the influence of alcohol or not.

Proposed Work

- It can provide more accurate detection.
- It can reduce the number of accidents
- Automatic controlling of vehicle without helmet.
- Fast transfer of data through wireless sensors.
- Alcohol Sensor detect any illegal activity.

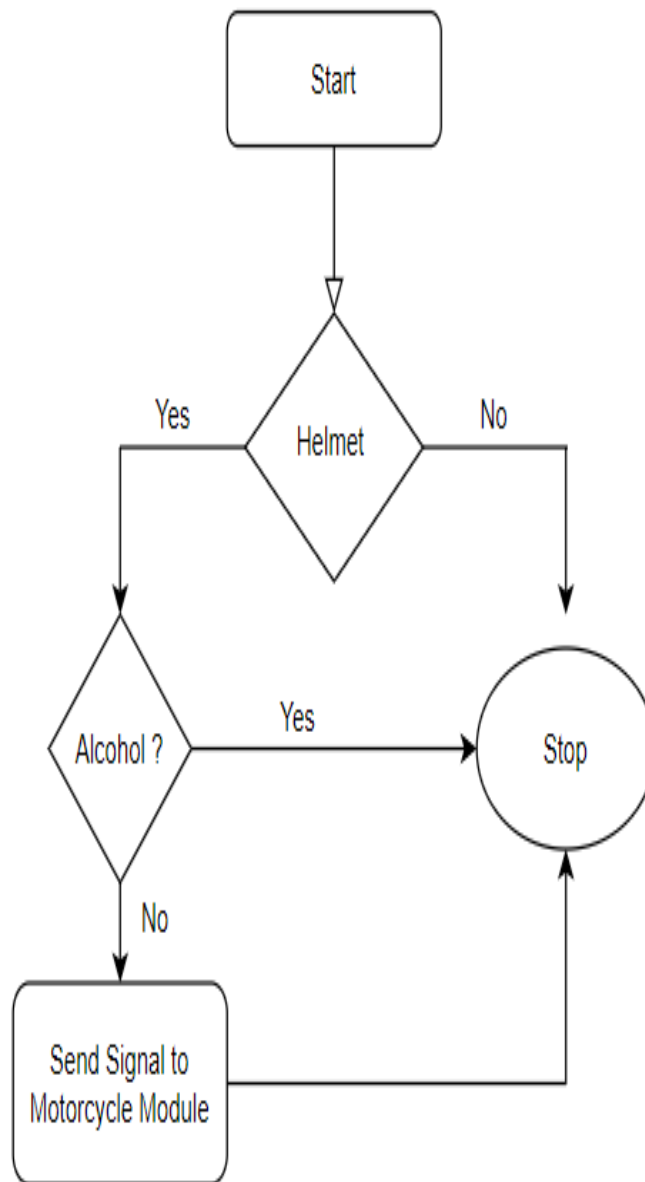


Figure1: Flow chart of proposed System

Working Model

Helmet system consists of the RF transmitter which is connected to the battery. This transmitter will help to wirelessly connect the vehicle system. The transmitter is connected to the clip. When the person wears the helmet the clip will be pressed and the transmitter starts working i.e., it will continuously send the signals to the RF receiver present in the vehicle system.

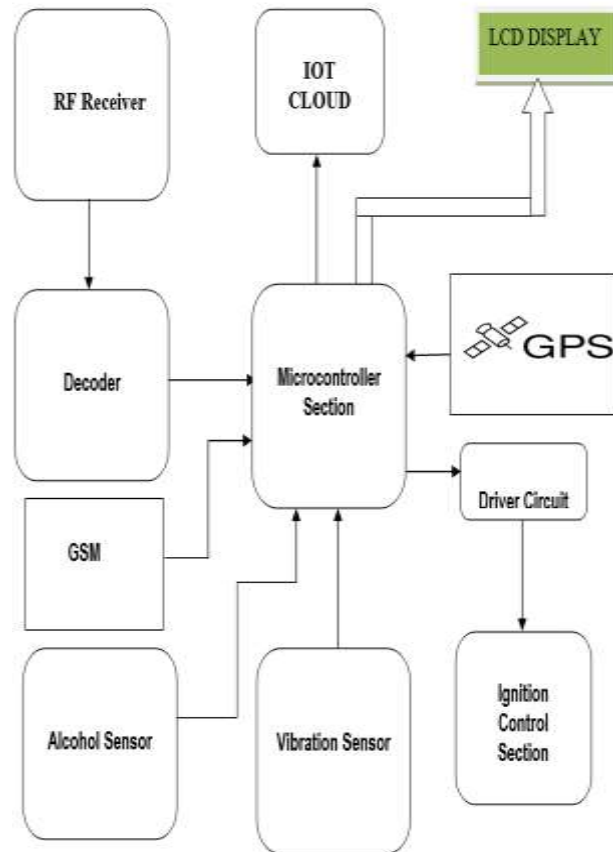


Figure 2: Architecture of SHR

The analog signal from the RF transmitter is decoded by the RF receiver and sends the digital signal data to Arduino which ensures that the person is wearing the helmet and Arduino acknowledges relay that the ignition can start. Detection of the accident using vibration sensor. Threshold value is given if that crosses the data will be send to the Arduino and accident is displayed on the LCD. Detection of alcohol using alcohol sensor. It senses the molecule particles of alcohol from the breadth. When the threshold value crosses the data is send to the Arduino and the message is displayed on the LCD. Global system for mobile communication (GSM) sends the message to the emergency contact when accident occurs and exact location of the motorcycle. Global Positioning System (GPS) module for the exact location of the motorcycle. ESP, an IOT module to send the data on internet.

This is a cost-effective solution to prevent the accident from happening beforehand with the help of sensors embedded in the system. It provides full safety and security to the riders against the road accident. The system is divided into two parts i.e. transmitter and receiver. The transmitter module is placed in the helmet whereas the receiver module can be placed on the part of the bike. So that once the receiver receives the signals from the transmitter then only the ignition of the bike will start else it won't start unless all the predefined conations are satisfied.

The whole module is based on the Arduino sensors which are open-source hardware with on-chip flash memory.

The Arduino board is programmed via a USB. It provides 14 digital I/O pins six of them produce pulse-width modulated signals and six produce analog signals which can also be used as digital I/O pins.

The transmitter switch is present inside the helmet once the switch is pressed signals are sent to the wireless receiver so that further process can start. When the rider takes off the helmet switch present will not be able to receive any pressure signals that will lead to circuit breakdown and the bike ignition will stop. An RF

transmitter and receiver are electronic devices. They are used to transmit and receive radio signals between them. They are desirable to communicate with each other wirelessly transmitter module is used for transmitting a radio wave and modulating that wave to carry data. This wireless communication is successful by Radio Frequency (RF) communication. RF receiver module helps in receiving the modulated RF signal and demodulates it.

The alcohol sensor presents on the modules check the alcohol consumption value of the riders. If the value is more than the threshold value then the circuit would not be completed the will lead to the break-in circuit. The alcohol sensor reacts to different molecule particles in alcohol and decides whether the rider is drunk. The sensor supports both digital and analog outputs. Then come the sensors which are used to send all the ground location of the rider to the emergency contacts GPS.

Global Positioning System (GPS) module is used to obtain the exact position of where it is located. It uses ground stations and satellites to calculate and compute its position on the earth. PS is also used as a navigation system. It has four communication pins that are used for communication VCC, RX, TXGND. VCC is power positive, RX is UART receiver pin, TX is UART transmitter pin and GND is the ground pin. Then comes the GSM sensor which is used to send SMS to the emergency contacts so that all the contacts have the exact location of the rider. Global system for mobile communication (GSM) is a digital system which uses a technique called time division multiple access (TDMA) for communication purpose.

A GSM is an open and digital cellular technology that sends the digital data down through a channel. it can carry 65 kbps to 125mbps of data rates. All this data is transferred to with the help of the IoT module to the website which gets updated in real-time. IoT module -ESP is Wi-Fi empowered framework on chip (SoC) module created by Espresso framework. It is used for the advancement of IoT (Internet of Things) inserted applications. Some properties of ESP are it supports 2.4 GHz WIFI, its main purpose is input or output, analog to digital conversion. All the vibrations are captured with the help of a vibration sensor present on the module.

The digital vibration sensor is a digital plug and play sensor block. It detects the weak vibration signals and when the accident occurs, it detects the pressure iand sends the data to the Arduino which further sends the message to the registered mobile number using a Global system for mobile communication (GSM). This is the last part of the module as once all the test cases are passed successfully then only the relay will come to play as the relay is an electromechanical switch starts by an electrical current. A single relay consists of the driver circuit, power supply, and an isolation circuit. The driver circuit consists of transistors for switching on/off operations. The power supply is used for switching the relay. The isolation circuit helps to prevent the reverse voltage from the relay and protects the transistor and controller from damage.

Output Display Results



Figure 3: Helmet with RF transmitter

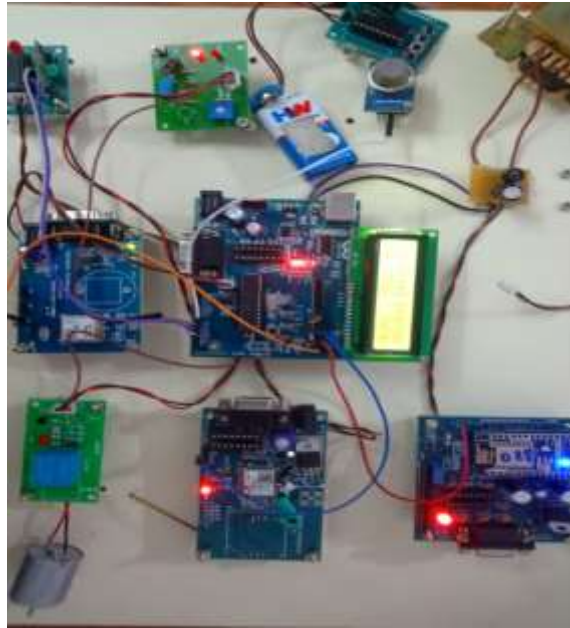


Figure 4: SHR and accident detection system

Advantages

- In remote areas accidents can be detected very easily and medical help can be providing within short interval of time.
- It will reduce accidents on road as it will detect alcohol beforehand with the help of alcohol detector.

Future Scope

- Biometrics could be added to the system to measure various other work.
- Biometric can be linked with Aadhaar database which will provide exact information of the rider to the authorities.
- A small go pro camera device can be added on the top of the helmet which will record all the activities of the rider and it can be used to transmit; messages to nearby vehicle using a wireless sensor.
- Another type of transmission and be used instead of RF transmitter because RF transmitter has only one way communication.
- Buzzer can be added inside the helmet so the rider can be alerted when it exceeds the speed limit.
- Small solar panel can be placed on the helmet which can be used to charge mobile phone.
- Inbuilt GPS Device can be installed inside the helmet so that no external devices are required for navigation.

System Implementation

There are four main apparatus in system which are rider, Helmet, Motorcycle, and Family. At the point when rider put the helmet in the head, sensor which is present in helmet module, it checks the head of the rider and send signals. If there is a correct response, then alcohol sensor will come into picture and start it work. It checks the alcohol consumption limit if it below the designated value then only it sends signal to the bike module. Bike module checks not the response and then validates them, if they are fulling the condition then only engine will start. After ignition of the bike start on the route vibration sensor checks for all the vibration and once the designated value is crossed it will send messages to the family with the help of GPS from GSM module and I can also be viewed on the website using IOT.

Conclusion

The system designed confirms full safety of the riders, by extensive use of safety equipment's. Also is promises that no rider will ride bike without any intake of alcohol or else engine will not start under any circumstance. It also has a further security feature that it sends immediate message to emergency contacts with the location in the case of accident occurs.

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