Design and development of Smart helmet

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Abstract- *Smart helmet provides safety to the driver by making an intelligent helmet with sensors and AI. Rider gets a warning when he is prone to accident and thus safety of rider is increased. Multiple sensors such as force sensor, breathalyzer, vibration sensor and GSM module. Making a smart helmet contributes to the overall digitization and can ultimately be useful in making the bike smart. GSM module is used to send SMS to SOS contact when the rider has met an accident. Accident is detected using various parameters from sensors and making a prediction based on algorithms. Accuracy of prediction model will keep on increasing with increase in data collected and making analysis using random forest algorithm. The current accuracy of thepredictive model is 70 percent.*

Keywords- Alcohol Breathalyzer, Accelerome- ter, RF module, GSM, Vibration sensor.

I. INTRODUCTION

With advancement of technology in all sectors, we are moving towards a digitized use of all devices. Cars have already integrated with technology and it is necessary to make bike riding secure. Collection of data has significant impact in making in making the device smart. Real challenge for smart object is making a real time prediction. This is made possible by using microchips and microprocessors. Various signals are recorded and a prediction is made. At the same time the data is sent to predictive model in database. In the periodic time, the data collected is reanalyzed and predictive model keepson increasing. [1]

This is made possible by using various AI models. Analyzed data provides the threshold values to the sensor and a fast prediction is made. Thus, increasing the security of the bike.

The major component of this project is the artificial intelligence predictive model. This model works on both analyzing the user and giving a warning to the user when it is prone to accident. When the critical condition is encountered by the rider a message and a call is sent to the given SOS contact. This can be used todetermine the location and call the ambulance.

For detection of fall, force sensor is placed which determines impact. Apart from this accelerometer is used along with vibration to determine the probability of accident. Alcohol sensor is used to detect if driver is drunk or not as drunk driving contributes to large part of accident. If the driver is found drunk a warning is issued.

It is evident from the analysis of data that even after digitization over the years, ambulance still fails to reach the accident in over 60 percent cases. It is improved drastically when the SOS contact will receive the information about the accident of rider. When the driver is driving after being drunk its SOS contact will receive information and can contact the user. This project works on making a secure device to be used alongwith helmet and can improve the security of driver significantly.

II. Technologies used

A. Force sensing resistor

The force sensing resister is placed in the area where the probability of impact is highest.[2] The FSR can be used to detect the intensity of the impact as it is one of the more important factors in determining the severity of an accident.
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B. MQ3 alcohol sensor

[3] MQ-3 gas sensor is used for detecting the presence of alcohol content in the rider's breath. It can be placed just behind the mouth guard of the helmet. The sensor works on the concept of heat sensitivity. Initially the sensor needs to be warmed up for specified amount of time to achieve maximum accuracy.

C. Accelerometer

[4] The ADXL345 is a tiny, tri-axial accelerometer with resolution of 13 bit.
It produces a digital output and uses a 16 bit 2's complement data. It can be connected using an I2C interface. The main aim of using accelerometer in smart headgear is to determine the sudden change in riders' acceleration that may be indicative of an accident. ADXL345 is used for both measurement of static and dynamic acceleration. This data along with FSR's and vibration sensor's reading is taken as parameter for accident predictive model.

D. Vibration sensor

Digital vibration sensor is a digital Plug and Play sensor block.[5] The vibration sensor is small compact module which is place inside the helmet.

The main aim of adding vibration is to improve the accuracy of the predictive model which is done by taking the amount of vibration as a quantifiable value in the parameter.

E. Machine learning

The first thing that is considered is the collection of data from the instances of accidents, then this data is passed as input for the machine learning model for the predictive analysis of the occurrence of accident. As observed from one of the references papers the training dataset consisted of 11,755 samples and 12 different scenarios. As part of this research, a comparative study of the state-of-the-art models of supervised learning is carried out. Moreover, the use of a Deep Convolutional Neural Network (ConvNet/CNN) is proposed for the detection of possible occupational risks. The data are processed to make them suitable for the CNN and the results are compared against a Static Neural Network (NN), Naïve Bayes Classifier (NB) and Support Vector Machine (SVM) along with this the test data was also processed using the Random Forest Algorithm which gave the accuracy of 71%.

III. System design

System consists of a helmet containing control modules, various sensors and control unit which is integrated together with a mobile unit that in turn performs various functionalities. In figure below, block diagram demonstrates the overall architecture of the system.
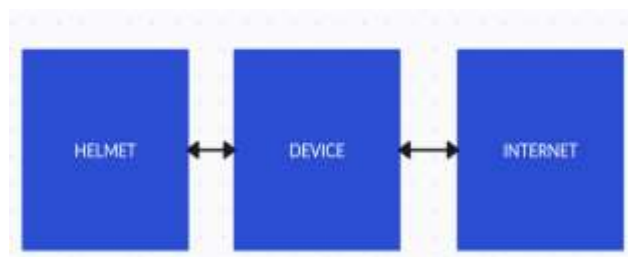
The structure of helmet is made by taking into consideration the orientation of all the sensors. The dimension of the helmet needs to be considered for different scenarios as the domain of smart helmet is much wider than simply detecting road accidents. Force resistor is placed on inside upper part of the helmet where actually head will touch with sensor surface. And alcohol sensor is placed in front of rider's mouth so that it can sense the presence the of alcohol easily. And the power source along with the circuit is fixed inside the helmet.
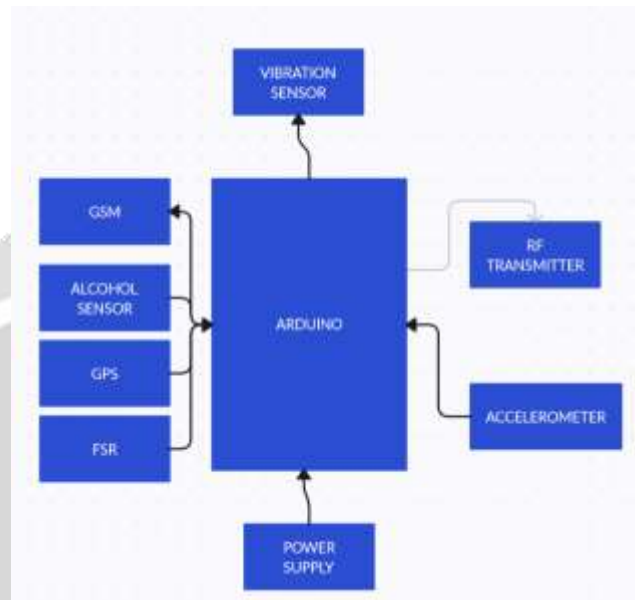
The RF receiver accepts all the data from the helmet unit. Depending on the conditions, the appropriate actions are taken. The GSM m o d u l e continuously sends location information of the rider. Based on whether the accident has occurred or not, it also initiates a call to the SOS contacts.

The project focuses on determining the occurrence of the accident using force sensing sensors, vibration sensors and accelerometer. The head gear continuously listens to the RF for Data and interprets data for predictive analysis. Then we proceed to check the level of alcohol. Alcoholic content in users' breath to identify whether we need to send an emergency message to SOS contacts or not

Conclusion

Helmet is an essential part of the bike that provides some safety in the case of accident.

However there hasn't been much advancement to the helmet. The goal is to create a smart headgear which not only safeguards the rider but also help in preventing the accident in future.

Machine learning has been integrated into the system which in turn enrich the data supply. It was aimed at bringing the real time data from the Iot model for real time analysis. This feature is integrated with headgear without hampering its normal functionalities.

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