Smart Moto Helmet

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ABSTRACT

Safety on a two-wheeler is the main reason why we came up with this smart motohelmet idea. The smart motohelmet would help any citizen follow the rules of the road and thus lead to safe and easy driving for everyone. In our research findings, two-wheelers account for 25% of total road crash deaths in India- the top five reasons to this includes drunken driving and avoiding safety gears like helmets or seat belts. As engineers, it is our duty to implement a design that would solve a societal concern, is cost-effective without compromising on safety. The need for this project in our country is high, as annually there is 10% increase on the population that buys a new two wheeler, which caters the need of a helmet and due to its safety features people opt for this smart motohelmet. The benefitted audience would be all riders of two-wheelers: motorbikes, scooter.

KEYWORDS: Smart motohelmet, bike, force sensing resistor, GSM, GPS, accelerometer, Zigbee, MQ3, ignition control

I. INTRODUCTION

Motorcycles are one of the most widely used vehicles in India. Hence it has a major contribution to the accidents and road crash deaths. This was the birth of the idea to make a Smart Motohelmet which will help in practicing safe riding, not just to keep the rider safe but also other fellow riders.

Hence, our motive is to make a helmet that is easy to use by all age groups with a cost-effective design by making the set-up on a general PCB to benefit the users with continuous checks on alcohol consumption & helmet being worn to control the ignition of bike, Fall/Accident detection with immediate alert system to the rider's emergency contacts and with night driving visibility for the rider. The arrangement of the circuitry would be embedded inside the helmet which include the general PCB and few other sensors placed in various locations of the helmet. This solution is very much required to prevent and reduce such accidents in a country wherein the purchase of a new two-wheeler increases with a large percentage every year.

II.EXISTING METHODS AND LIMITATIONS

The research performed by our team concludes that the existing system ensures safety of the rider but has comprised on features offered, as cost was an issue and the implementation of the project is not embedded into a helmet through a less interconnected circuit such as using wire wrap board.

Features on the helmet provided are limited to use of only alcohol detection, only accident detection. The compactness of the system is not investigated as there is no use of wire wrap board to prevent interconnections. The existing technology focuses on four-wheeler vehicle's safety and is limited in perspective on terms of reach and cost. The cost of a smart helmet available goes as high as $2000.The size of the system is not considered as key.

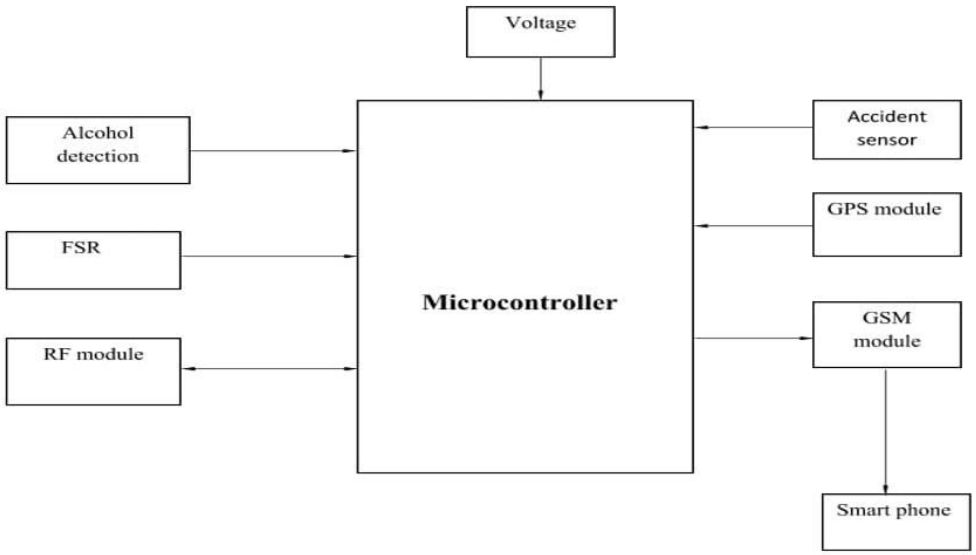
III. PROPOSED SYSTEM

A. Overview of the features of helmet

The features included in the project are:

Night driving visibilities is used to make the rider's helmet thoroughly visible to rear fellow travellers as LED panels are created to indicate the left and right indicators.
Helmet is worn checks are performed before switching ON the bike's ignition by means of a FSR embedded in the core of helmet, with this data we determine whether to ignite the bike or not.
Accident sensor A GPS module sends the location of the rider via text message sent from a GSM module when an accident has occurred which is sensed using this sensor.
Alcohol consumption detector MQ-3 sensors present in the helmet are used to detect alcohol levels of the rider - if alcohol levels are found to be high, the ignition of the bike is not switched ON.
The sensors, modules are placed inside the helmet and padding is done such that the rider will not feel uncomfortable.

The block diagram of the proposed system is as follows:



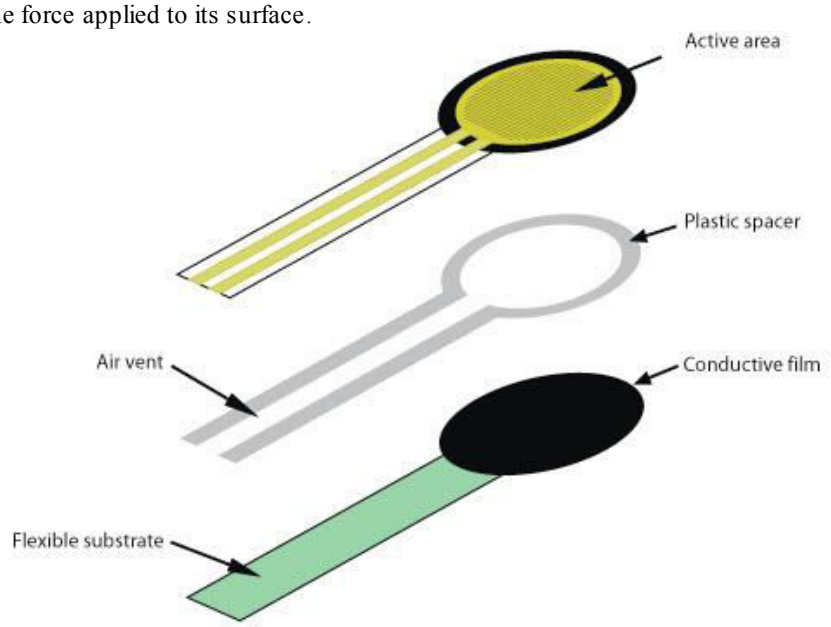
B. The features in detail

We are using Arduino Nano board in both the helmet and the bike sections. The reason for this is its small size, it's compatibility with all the sensors, modules used and arduino boards are easy to work with.

Two wheeler riders avoid the use of helmet even though it is made compulsory in almost all the cities in India. We came up with the idea of using the basic principles of force/pressure and resistance in order to check if the rider has his helmet on and thus switching on the ignition [3], [8], [9]. The alcohol detector and the helmet worn detector work in conjunction with the Zigbee module to control the ignition.

Resistors are passive components that are widely used in electrical and electronics circuits. A force sensing resistor (FSR) is a material whose resistance changes due to application of force, pressure or mechanical stress. It is sometimes

known as force-sensitive-resistor. The FSR sensors are made of conductive polymer which has a property of changing its resistance based on the force applied to its surface.



If force is applied to a surface of sensing film, then the particles touches the conducting electrodes and thus resistance of the film changes. There are several resistive based sensors but force sensing resistors operate satisfactorily in difficult environments and also require a simple interface compared to other resistive based sensors.

Even though there various types of force sensors, the force sensing resistors are having several advantages such as thin size (less than 0.5mm), very low cost and also good shock resistance. The only disadvantage of FSR sensors is low precision; there will be approximately 10% or more difference in measurement results.

The problem of drunk and driving cases can be eliminated to a great extent with the use of the alcohol detector present in the helmet with the help of which the alcohol levels of the rider will be constantly monitored and ignition will be controlled accordingly [1]. We are using a simple MQ3 sensor for this detection which has a threshold value set. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05mg/L to 10mg/L. the sensitive material used for this sensor is SnO2, whose conductivity increases as the concentration of alcohol gases increases. It provides both analog and digital outputs. It is suitable for detecting alcohol concentration on breath just like the common breathalyzer and has a high sensitivity and a fast response time. It can operate between 10°C-70°C. It is fixed near the buckling portion of the helmet so that the levels of alcohol can be determined clearly.

If the amount of alcohol is lower than the threshold value then the bike starts else the transmitter Zigbee module is used to turn off the ignition by communicating the message to the receiver Zigbee module present in the bike. Zigbee is an IEEE 802.15.4 based specification for a suite of high level communication protocols used to create personal area networks. It is a low-power, low data rate, and close proximity wireless ad hoc network. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi.

Accidents during night times can be avoided with the help of the LED lights present on the top of the helmet which help displaying the turns of the bike. An accelerometer present near the handle of the bike is used to detect the amount of tilt and then indicate the left and right directions. ADXL337 is a low-power 3-axis accelerometer which operates on a supply in the range of 1.8V to 3.6V and can be used in tilt-sensing applications. It is capable of measuring acceleration with a minimum full-scale range of +-3g. It is capable of measuring static acceleration due to gravity. We have checked the amount of tilt by placing the accelerometer in various directions and set threshold values for both the directions.

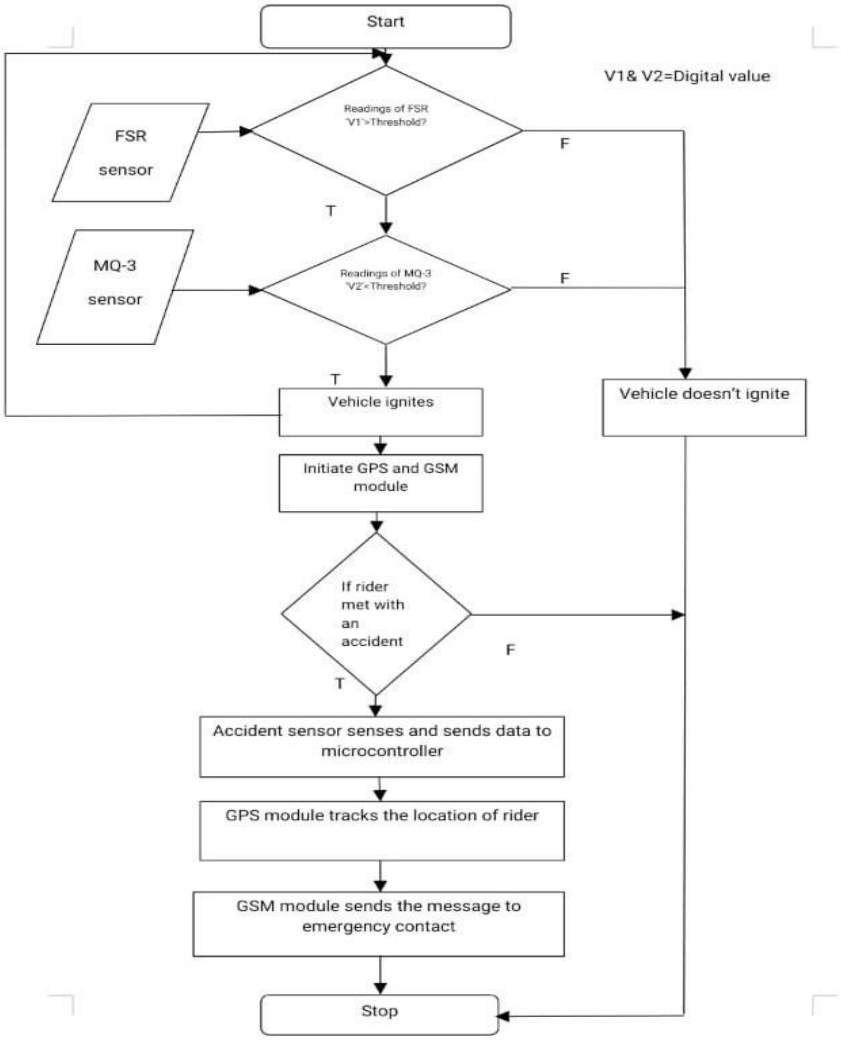
The reason for not reporting the accidents in time is one of reasons of deaths [10]. Another accelerometer is used inside the helmet and an accident condition is recorded if there's a sudden change in the threshold value of the accelerometer during the ride [5]. Using the GPS and GSM modules in the helmet the rider can be rescued by sending the location of accident to his emergency contacts which is already fed in the module. [2], [4], [6], [7]

Due to the wide availability of GSM it is chosen as the medium for transfer of location information. The simple and inexpensive short message service (SMS) allows users to send up to 160 characters. SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. After connecting power module boots up, searches for cellular network and login automatically. On board LED displays connection state (no network coverage - fast blinking, logged in - slow blinking). It has a 3.7-4.2V voltage requirement.

GPS receivers use a constellation of satellites and ground stations to compute position and time almost anywhere on earth. At any given time, there are at least 24 active satellites orbiting over 12,000 miles above earth. The positions of the satellites are constructed in a way that the sky above your location will always contain at most 12 satellites. The primary purpose of the 12 visible satellites is to transmit information back to earth over radio frequency (ranging from 1.1 to 1.5 GHz). With this information and some math, a ground based receiver or GPS module can calculate its position and time**.** NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25x25x4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, we can monitor the status of the module. The module can save the data when the main power is shut down accidentally due to the presence of data backup battery. It requires 3-5V of supply and the default baud rate is 9600bps. We are using 3.7V 1000mAH Li-Po battery to power up this module. We are using a boost regulator to use the same battery but supply power to all other modules in the helmet as they require 5V. The batteries are rechargeable and this comes as an added advantage.

Wire wrap board is used for housing components to make a circuit for compactness, simplicity of servicing and case of interconnection which is later embedded inside the helmet.

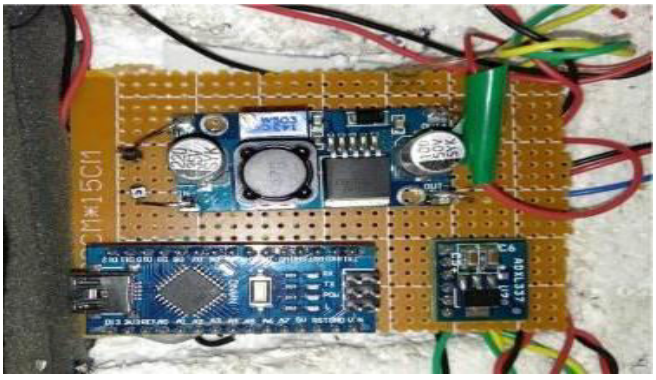
Flow chart for the proposed system:



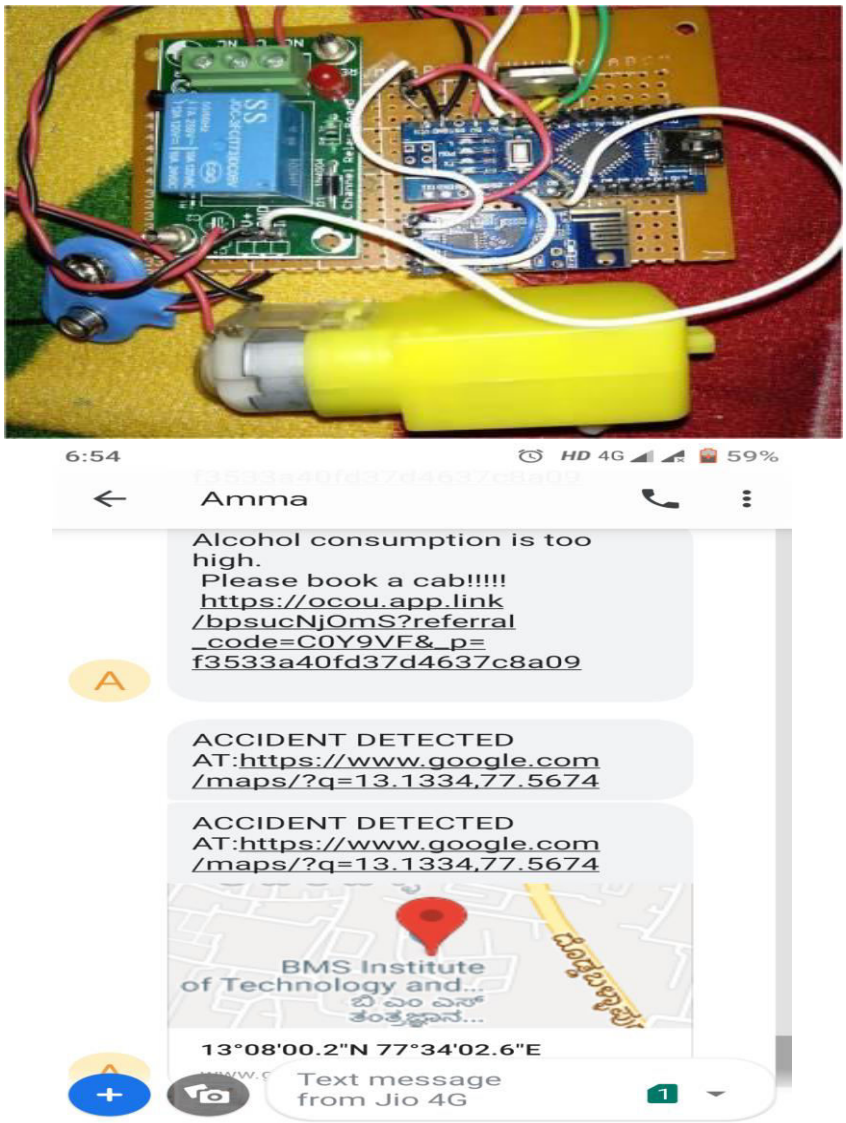
IV.RESULTS AND DISCUSSION

Space optimization is achieved as we selected the smallest available modules and made sure they are fit at various places inside the helmet and are soldered to the wire wrap board. We were able to check the ignition and the accident conditions.

General PCB:



Zigbee receiver side (controls ignition):



V.CONCLUSION AND FUTURE WORK

In the paper we talked about the smart motohelmet prototype. A system for the helmet has thus been developed which, through communication between a module in the helmet and one on the vehicle ensures safety aspects. The accident feature can be extended to sending the location to the nearby hospitals and police station or calling the ambulance. We can keep sending the location in particular time intervals until the emergency contact acknowledges until the acknowledgment is received. We can make use of the solar panels for powering up the modules in the helmet. Another alternative could be the use of wind energy. We can also add another helmet worn check by using a switch near the buckle of helmet that warns the rider if the helmet is not buckled up. We can implement various bioelectric sensors on the helmet to measure various activities. We can use small camera for the recording the driver's activity. We can add a heat sink or a fan to reduce the temperature. An air bag system can also be incorporated for additional safety purpose.

ACKNOWLEDMENT

We students would like to express our heartfelt gratitude towards our guides Prof. Shilpa Hiremath and Prof. Thyagaraj Tanjavur of ECE department, BMS Institute of Technology and Management, Bangalore. We would love to thank the

other professors from our department who encouraged us to continue our work. On a personal note, we would love to thank our parents, family and friends whose support has been so valuable.

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