Smart Helmet with Intelligent Vehicle System

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***Abstract*—**With growing human population, the demand for transport is increasing rapidly. According to the global report, two wheelers cover of 77 % of automobile industry. As the use of two wheelers increase, the accidents caused by them see a steady rise which often leads to deaths. Thousands of people die due to road accidents involving a two wheeler. The most common reasons of fatalities due to these accidents are drunk driving and improper/no use of helmet. A large number of these fatalities could be avoided by following safety norms during driving.

***Index Terms*—Smart helmet, Safety, Accident detection, Alcohol detection, Intelligent systems.**

I. INTRODUCTION

The safety features in the motorcycles and their helmets have evolved for the better. But irrespective of strict government rules regarding road safety, people tend to not use helmet appropriately. This not only turns out to be ineffective but also gives false confidence of safety to the rider. Often drunk driving, even after proper safety measures, turns out to be a serious case of injury or fatality. Moreover, after the accident has occurred, usually in a remote place, it takes time for help to reach the destination. This delay has potential of fatalities too.

There have been attempts to build a helmet with more features than the regular use helmets but the selection of features were with respect to the luxury and comfort of the rider rather than the mere safety.

The idea proposed here is of a Smart Helmet with Intelligent Vehicle system. The project aims to give a solution for the above mentioned problems which will ensure better safety of motorcycle rider. All the functions of the project include ensuring the helmet is worn by the rider, the rider is not drunk before the ride starts, detection of accident, sending out emergency message and location for help to arrive.

This project comprises of two main units, namely, Helmet Unit and Vehicle Unit. Helmet Unit is comprises of an alcohol sensor for alcohol detection, a limit switch to ensure that the rider is wearing the helmet, a rechargeable battery, and a RF (Radio Frequency) module which consists of RF encoder and RF transmitter. The Vehicle unit comprises of a microcontroller, a GSM (Global System for Mobile Communication) Module for sending emergency message in case of accident, a GPS (Global Positioning System) Module for sending out the location of accident, a vibration sensor for detection of jerk/accident, a LCD (Liquid Crystal Display) screen to display the message, a motor driver to signify the engine of the vehicle, a DPDT (Double Pole Double Throw) relay to connect GPS module and GSM module to the microcontroller.

II. LITERATURE REVIEW

The goal of this literature survey is to compare several approaches and methodologies that have been published in the field of smart helmet design. Smart Helmet for Safe Driving. The use of FSR is to check whether the helmet is being worn by the user [3], MQ-3 alcohol sensor is used to check whether the driver is drunk or not, vibration sensors are present to detect vibration and RF module for communication are the modules proposed in this work for smart helmet in [3]

It also has a feature which prevents drunk and drive scenarios of the rider called as ALCHO-LOCK and upon detecting accidents it automatically sends a message to concerned person or a list of the speed dial emergency contacts [2]. A smart helmet using GSM and GPS with module SIM808, a limit switch to detect whether helmet is being worn or not. In reference, they have used FSR to check whether helmet is being worn or not and accordingly the bike will start. They have even used MQ3 i.e. alcohol sensor to check the permissible range of alcohol to start the bike. GPS system in bike will track the location and send message if injured or if the driver is rendered unconscious after being involved in a gruesome accident. In various research papers they have used a limit switch for checking of helmet worn by the user or not, GSM module to communicate the message[1] It also provides vital information about the conventional design of the helmet and the benefits of using helmets along with a statistical case study of accidents in Thailand as reference In the study conducted, a car accident was reconstructed in order to simulate and analyze the motion, impact velocity, impact angle in the collision helmet device for detecting and reporting bike accidents.

Smart helmet system comprises of various sensors, and it identifies the accident by evaluating uneven or irregular variations obtained from sensor system. Based on the current evidence, using smart helmets helps in reducing injuries as numerous studies are introduced by different authors all over the world and these innovations will prove beneficial for the people. The emergency contacts will be

alerted through text message, e-mail, and phone call until they acknowledge the incident. In real time, this system assures a reliable and quick delivery of information relating to the accident. The smart helmet which is proposed also consists of a RF transmitter and RF receiver. The transmitter is connected to the helmet and the receiver is placed on the ignition switch of the bike [3]. Unless and until the driver does not wear the helmet the bike will not start which ultimately helps in preventing any fatal injuries if something happens. If the driver removes the helmet while driving, the bike will automatically stop which acts as a preventive measure for driving without helmets.

In a research paper [3], they even used an accelerometer to measure the static acceleration of gravity. Free fall sensing which notices if the bike is falling. We came across a fresher perspective through a research paper [4] whose main focus/objective was to provide an overview about the design of a smart helmet for industry workers so as to protect them from the hazardous misfortunate circumstances that they have to toil through because of their environment. It used various sensors such as alcohol, humidity, temperature, CO2, GPS and altitude sensor. It aimed to bridge the communication gap between the workers and the rescue management staff.

In the research paper by Manjesh N & Prof. Sudarshan Raj [5], it inclines with the guidelines and motives of our project which is to prioritize the safety of the rider by the means of a safe and secure helmet. The project uses a vibration sensor to detect a fall as well as respective GPS and GSM modules for intimating the concerned individuals by sending an SMS (Short Message Service). They used an eco-friendly and sustainable power source in the form of solar energy which was an admirable and respectable decision.

III. PROJECT BLOCK DIAGRAMS

A. *Helmet Unit*

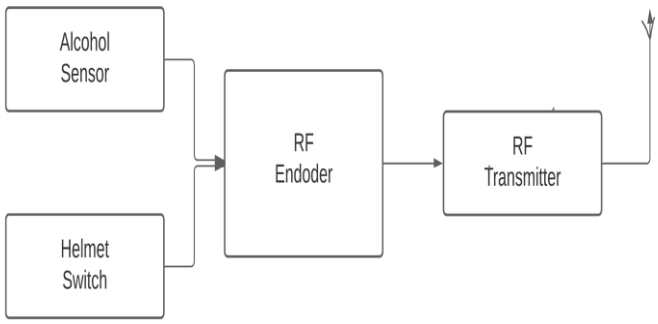

Fig 1: Helmet Unit Block Diagram

The helmet Unit consists of a MQ3 alcohol sensor, limit switch, and a RF module (encoder and transmitter). The alcohol sensor and limit switch are directly connected to the to the RF encoder. The RF encoder converts the input data from the sensor and the switch to a compatible for RF transmission. The data from encoder is transmitted to the vehicle unit using RF transmitter. The antenna is connected to the RF Module.

B. *Vehicle Unit*

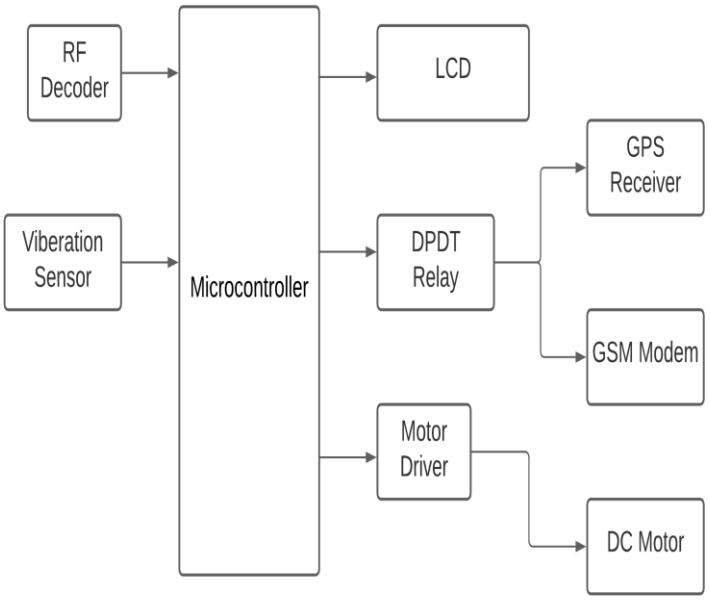

Fig 2: Vehicle Unit Block Diagram

Vehicle unit comprises of an ATMEGA 32 microcontroller, RF module (decoder and receiver), LCD display screen, vibration sensor, motor driver, GPS module, GSM module, DC (Direct Current) motor, and a DPDT relay. The data received from the Helmet unit along with the data from vibration sensor goes to the microcontroller. LCD display is directly attached to the microcontroller for the display of messages. The DPDT relay is used to connect GPS and GSM module to the microcontroller with a single UART (Universal asynchronous receiver-transmitter) port. Motor driver and further DC motor are directly connected to microcontroller, signifying the motor engine.

IV. FLOW AND WORKING OF THE CIRCUIT

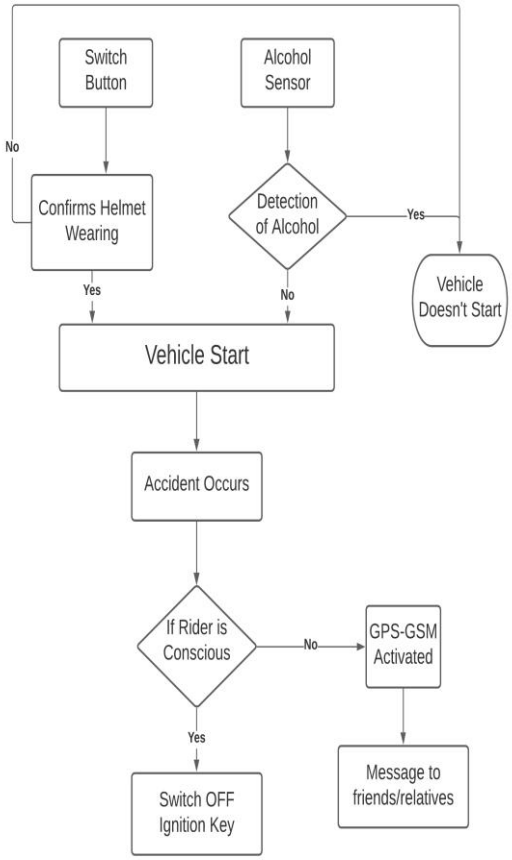

Fig 3: Flow chart

The microcontroller is fed with a custom made program in C which helps in the main working of the project. The inputs from Helmet Unit give confirmation of the rider's safety. The limit switch is placed on the insides of the helmet, which when worn by the rider turns the limit switch on. In case the rider does not put on the helmet, the limit switch will be off and the motor will not start. An alcohol sensor is placed in the helmet near the mouth piece, which detects the presence of alcohol from the rider's mouth; if detected, it will send a signal to the microcontroller to not start the engine.

If the above two conditions are satisfied, the engine will start on ignition. Now in case of an accident, the vibration sensor will detect the jerk (above a set limit). The microcontroller is programmed to wait for a buffer period, in case the accident is minor and rider is cautious, so the rider can reset the system. In case of no activity from the rider, the microcontroller will send an emergency message to the registered mobile number, inclusive of the location (longitude and latitude) of the accident.

V. IMPLEMENTAION AND TESTING

A. Components Required

1) AT mega 32A Microprocessor –

It is a 40 pin microcontroller in which 2 pins are for power, 1 pin for reset, 2 oscillator pins, 3 pins for reference voltage and 32 I/O pins. This microcontroller belongs to Atmel AVR series family. It has three data transfer modules – two wire interfaces, USART, Serial Peripheral Interface.

2) 16*2 LCD Display –

This is an alphanumeric 16*2 LCD display module which has an operating voltage of 4.7V – 5.3V. Each row can display 16 characters and each character is built by a 5*8 pixel box. It can work on 4-bit and 8- bit mode.

3) HT12 RF Module -

This RF module has both encoder and decoder units. Both units have 18 pins each. The transmitter and receiver works at 433MHz. It has 3 resistors of value 100-330 ohms. 1 Mega ohm resistor for transmitter.

4) SIM 800L GSM Modem –

Fig 4: GSM Modem

It has an operating voltage from 3.3V – 4.4V. It has to be attached to microcontroller through UART. It supports baud rates from 1200bps to 115200bps. It can send and receive SMS and accepts micro SIM Card.

5) GPS Receiver -

Fig 5: GPS Receiver

It is a Neo 6M GPS module which consists of a logical converter and voltage regulator. It uses a UART interface with 3.3V – 5V interface compatible antenna.

6) 12V DPDT Relay -

Fig 6: DPDT Relay

It is a dual pole DPDT relay rated to work at 12VDC. Coil resistance 960-990 ohms. It is used to interface GPS and GSM module to the microcontroller.

7) Vibration Sensor –

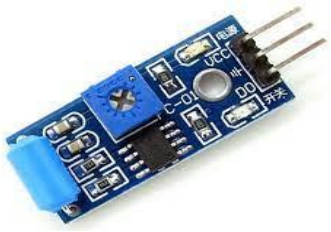

Fig 7: Vibration Sensor

This sensor module consists of vibration sensor SW 420 and comparator LM 393. Threshold is adjusted by the potentiometer on the module. For no vibration it provides low logic and for vibration detection it gives high logic. Operating voltage: 3.3V – 5V. Operating current 15mA.

8) DC Gear Motor -

It is a basic DC gear motor. It runs on 12V with a RPM of 100.

9) 12V Battery –

Basic commercial 12V battery.

10) Limit Switch –

A limit switch is a switch operated by the motion of a machine part or presence of an object. A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection.

11) Alcohol Sensor –

An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperatures ranging from -10 to 50° C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalyzers.

12) RF Transmitter Module -

An RF transmitter module is a small PCB (Printed Circuit board) sub-assembly capable of transmitting a radio wave and modulating that wave to carry data.

13) 900mAH Li-Po battery –

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated as LiPo, LIP, Li-poly, lithium-poly and others), is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte.

B. Testing

Sr no.	Distance(cm)	Result
1	0.5	Detected
2	1	Detected
3	2	Detected
4	3	Not detected

VI. RESULTS

A. Helmet Unit

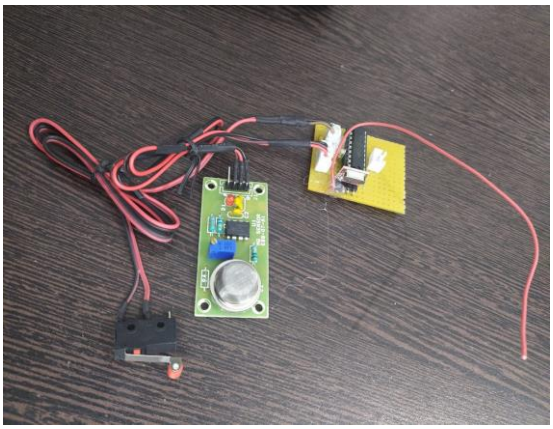

Fig 8: Helmet Unit Assembly

Fig 9: Helmet Unit Placing

Fig 10: Limit Switch Placing

The limit switch is placed in such a way that it will turn on only when the rider wears the helmet.

B. Vehicle Unit

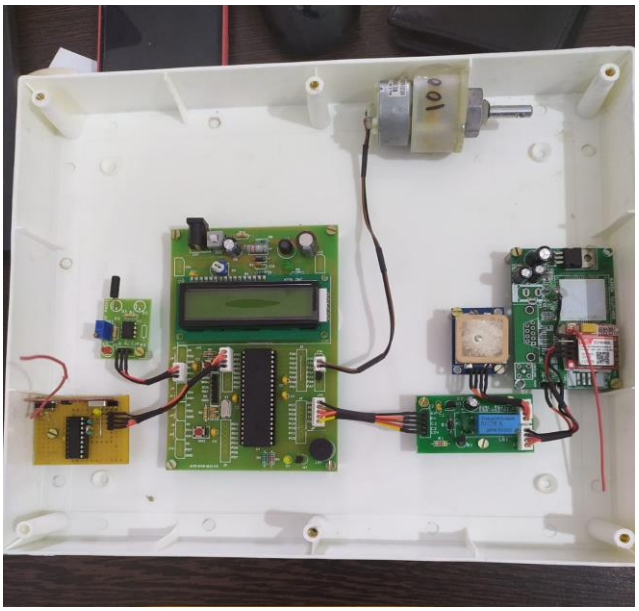

Fig 11: Vehicle Unit Hardware

Fig 12: Alcohol Consumed Message

This message is displayed when the alcohol sensor detects alcohol near the mouth piece and eventually stops the motor.

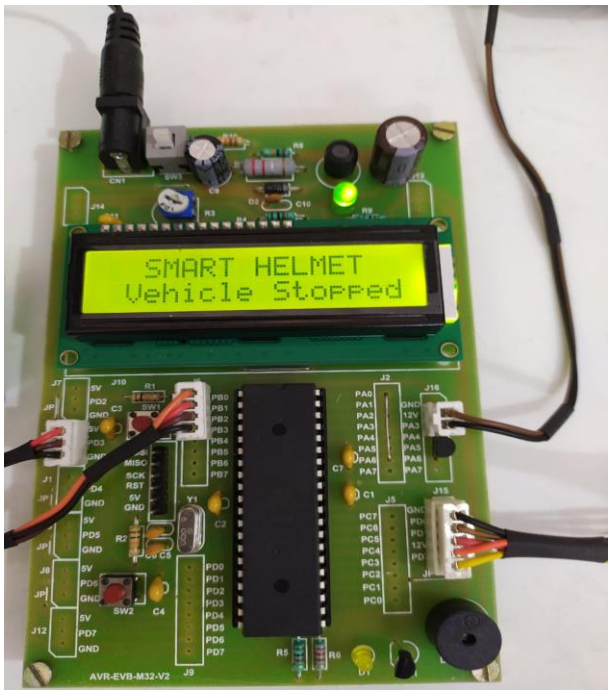

Fig 13: Vehicle stopped Message Display

This message appears when the rider takes off the helmet and the limit switch turns off. Hence the vehicle stops.

Fig 14: Vehicle stopped Message Display

This message appears when the rider puts on the helmet and the limit switch is pressed.

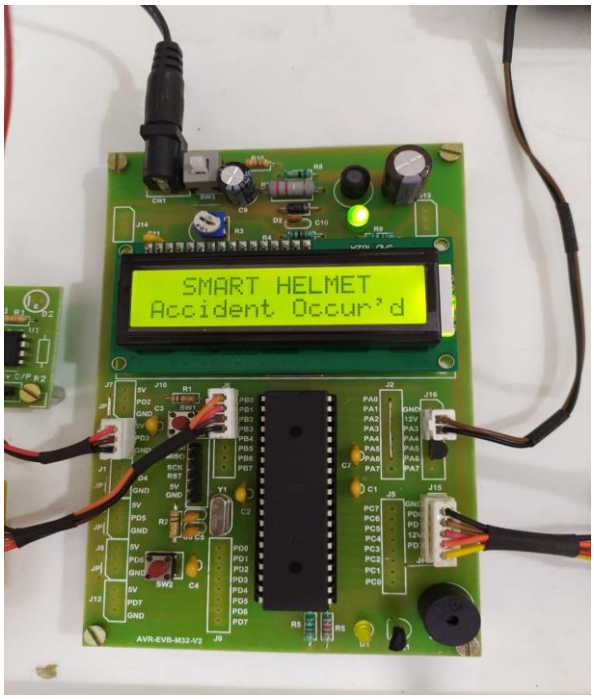

Fig 15: Accident Occured Message Display

This message appears when the vibration sensor detects an accident. The buffer time before sending emergency message starts after this message appears.

Fig 16: Emergency Message Display

This message appears when the buffer time is over and the emergency message is sent to the allocated number for help.

VII. FUTURE SCOPE

In future the helmet can be enhanced by adding an automatically ignition key switch off which provides better safety and security of the rider. As the accident happens and biker gets unconscious so after some delay bikes ignition goes off and it protects raider and other people also from further accident. We put an Ultrasonic Sensor at the end of the bike which an alert the raider about the distance between the vehicle so if they are close and by this we can prevent the accident from happening

VIII. CONCLUSION

We can conclude that after testing of the proposed model, a helmet with basic safety features as mentioned in the project could be manufactured ensuring the safety of the rider. The vehicle unit could be brought into practical use with same mechanism when extended in order to be compatible with the actual vehicle. Using RF technology along with GPS and GSM this helmet has a lot of safety as compared to the conventional helmets. With all the emergency communication installed in this project, the rider's safety can be highly improved. With a few enhancement this concept can used for commercial purposes. With this project we can hope to bring down accident rates of two wheeler all across the world.

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