Smart Helmet With Sensors For Accident Detection

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Abstract — Smart Helmet using Arduino and GPS module is a project undertaken to increase road safety among motorcyclists. Most of the accidents occurring today are due to the lack of safety as well as drivers being drunk. So, in order to overcome this, our project ensures that the driver has worn the helmet and at the same time s/he is not drunk. For this, we are using an Arduino and GPS module for programming and for location tracking.

Keywords — Rider safety, Alcohol detection, Sensors, wireless transmission, GPS tracking

I. Introduction

THE bike accidents are increasing step by step and lead to the loss of numerous lives. Using a helmet can decrease the probability of bike accidents. By estimating these days 1.2 million people are losing their valuable lives in road accidents. In day-to-day life, there are many accidents occurring for which some solution must be found as soon as the incident occurs. The death rate is not decreasing even when the hospitals are providing ambulance services. So, to overcome all these problems, there are two important criteria verified by a smart helmet before the bike starts. First, check whether the user is using a helmet and not just keeping it. It can be sensed by using the FSR (Force Sensitive Resistor) sensor. Second, there must be no alcoholic substance present in the user's breath. It can be noticed by using an MQ3 (alcohol sensor). It is placed in the helmet. When the person is highly consumed with alcohol, the gas sensor will sense the riders breathe to detect the amount of alcohol content. Third, when a person meets with an accident, If an accident has occurred then the vibration sensor will identify the bike's condition and the person's location will be sent on the device through GPS. The helmet with the sensors for accident prevention, The whole program is compiled on Arduino Uno using Arduino IDE software. When both the conditions are satisfied, the rider will be able to start the engine otherwise not. So, when the rider collides and the rider's helmet hits the ground, the vibration sensor senses the condition and after that, the controller extracts GPS information and this information passes a message to the device. During an ONEISS (Online National Electronic Injury Surveillance System) review led by the Department of Health, it was discovered that 90% of the bike riders killed in accidents were not wearing a helmet at the season of effect. This can be intended to moderate these issues and subsequently the related losses by guaranteeing that the rider will wear the helmet all the time during his/her ride. The helmet can identify an accident, utilizing the locally available vibration sensor. A locally available MQ3 sensor additionally examines the breath of the rider to distinguish if the present level is over the estimated limit. The rest of the paper demonstrated below. Section II has a Literature review. The Methodology/experimental work used in the project are described in Section III. Section IV consists of the Results and discussions. Section V consists of the coding part of the project.Section VI consists of the limitations.The Future Scope of the project is in Section VII. Section VIII concludes the paper with a conclusion.Section IX has the Acknowledgment. At last, the reference part has been added in Section X.

II. Literature Review

1. Smart Helmet Using Arduino: This is a report about a smart helmet that makes motorcycle driving safer than before. The aim of this project is to give information on the accident to ambulance N family members. This is implemented using Arduino. This smart helmet was implemented by placing vibration sensors in different places of the helmet where the probability of hitting is more which are connected to the Arduino board. When the vibration exceeds the minimum stress limit then the GSM module sends a message to family members automatically. The hardware used in this system is an Arduino board, Bluetooth module, vibration sensor and mobile phone

. 2. Smart Helmet for Indian Bike Rider: This paper presents the smart helmet that makes sure that the rider cannot start the bike without wearing it. This helmet replaces the cable connections for wirelessly switching on a bike so that the bike would not start without both the key and the helmet. A LED indicator is used to demonstrate the working of the model. The system is a simple telemetry system, which is activated with the help of a pressure that is applied to the inner side of the helmet when the rider wears it. The framework model uses a DPDT electromechanical relay and hence there is some time lag in wearing the helmet and switching on of the circuit.

3. Smart Helmet Using GSM & GPS Technology for Accident Detection and Reporting System: A smart helmet is an innovative concept that makes motorcycle driving safer than before. It uses GPS and GSM as its core technologies. The mechanism of this smart helmet is very simple, vibration sensors are placed in different sections of the helmet where the chances of hitting are more which are connected to the microcontroller board. So when the rider crashes and the helmet hit the ground, these sensors sense and provide it to the microcontroller board, then the controller extracts GPS data using the GPS module that is

integrated into it. When the data goes below the minimum stress limit then the GSM module automatically sends an alerting message to ambulance or family members. The hardware used in this system is an alcohol sensor, GSM, GPS, microcontroller, pressure sensor and vibration sensor.

4. Alcohol Detection Using Smart Helmet System: The system automatically checks whether the person is wearing the helmet and has non-alcoholic breath while driving. There is a transmitter at the helmet and a receiver at the bike. There is a switch used to ensure the wearing of the helmet on the head. The data to be transferred is coded with an RF encoder and transmitted through a radio frequency transmitter. The receiver on the bike collects the data and decodes it through an RF decoder. MCU controls the function of the relay and thus the ignition; it controls the engine through a relay and a relay interfacing circuit.

III. METHODOLOGY/EXPERIMENTAL

- *Theory-*

The smart helmet has two modules of operation i.e receiver part and the transmitter part. The transmitter part is embedded in the helmet itself and the receiver is placed in the bike this wireless connection takes place between two modules The Input taken from the MQ3 sensor & FSR sensor is sent to the RF Transmitter Part which consists of the Arduino Uno r3 microcontroller then this microcontroller processes the input and then send it the modulo RX which then sends it to the modulo TX. Then this modulo TX further feeds the information taken from RF Transmitter to the RF Receiver in that the information is then further processed by the microcontroller and then it processes that data and tells the engine whether to start or not and displays the conditions on the LCD. The Vibration sensor detects vibrations when an accident occurs the vibration sensor detects vibrations if the vibrations are greater than usual then it sends the signal to the microcontroller (Simulino uno) which further process the signal and shows the GPS location of the rider on the LCD and give its coordinates on the GPS device.

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- *Flowchart -*

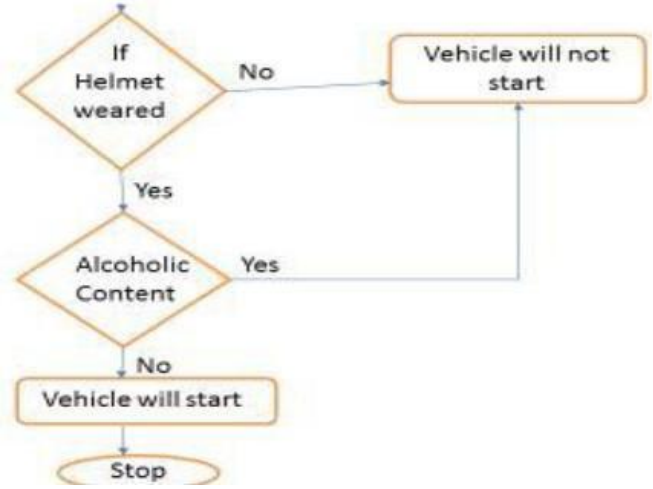

Fig. 1

Fig. 2

- *Components-*

A. MQ3 (Alcohol Sensor): MQ -3gas detector (alcohol sensor) is used to detect the alcohol content from the breath of the rider .It is placed in the face defend so that it can sense easily. If the rider is drunk the resistance value drops which leads to a sudden change in the voltage value then this value transfers to the microcontroller and it prevents the ignition of the bike.

Fig. 3

B. FSR (Force Sensitive Resistor): The Flex sensor is used to detect whether the helmet is worn or not. Here the flex sensor is connected with the Arduino in the helmet unit. It is a flex sensor that is 2.2 inches in length. This sensor works by bending the sensor itself. As the sensor is being flexed or bent, the resistance across the sensor increases. The greater the angle of bending, the greater the resistance. This can be tested with a multimeter

Fig. 4

C. Vibration Sensor: A vibration Sensor can distinguish whether any impact development or vibration occurs. It yields a low beat flag when vibration is recognized. The vibration sensor is the digital input device. Inside the sensor, a comparison circuit is present which is used to give voltage to the controller. The VCC pin of the sensor is interfaced with the 5V pin of the microcontroller. The ground is interfaced with the ground of the microcontroller. The A0 pin of the sensor is interfaced with the 8th pin of the microcontroller. It identifies the vibration in the range of 0-1023. The Vibration Sensor is shown below

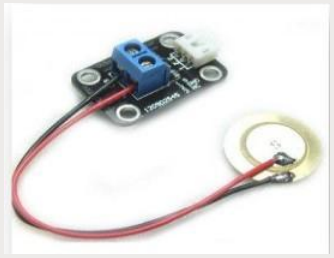

Fig. 5

D. Microcontroller: The Arduino Uno R3/Simulino Uno is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded onto it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno

Fig. 6

E. LCD: LCD stands for Liquid Crystal Display. LCD is finding widespread use replacing LEDs (seven-segment LEDs or other multi-segment LEDs) because of the following reasons:

1. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
2. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
3. Ease of programming for characters and graphics.

Fig. 7

F. RF Modules (ModuloTX & ModuloRX): This circuit utilizes the RF module (Tx/Rx) for making a wireless remote, which could be used to drive output from a distant place. RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate. A receiver can receive these signals only if it is configured for that frequency. The input signals, at the transmitter side, are taken while the outputs are monitored on the LCD corresponding to each input switch

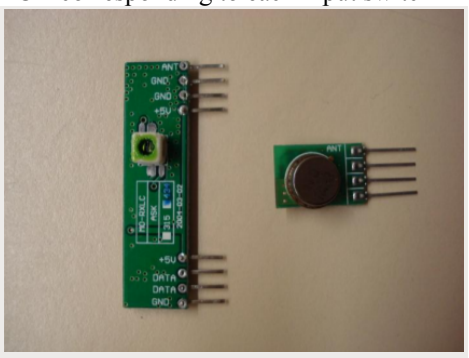

Fig. 8

G. GPS Technology: The Global Positioning System (GPS) is a satellite-based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology, one can determine location, velocity and time, 24 hours a day, in any weather conditions anywhere in the world for free.GPS was formerly known as the NAVSTAR (Navigation Satellite Timing and Ranging)

The Global Positioning System was originally developed for the military. Because of its popular navigation capabilities and because GPS technology can be accessed

using small, inexpensive equipment, the government made the system available for civilian use. The USA owns GPS technology and the Department of Defense maintains it.

How GPS works-

1.GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time.
2.Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock
3.Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock

Fig. 9

IV. Results and Discussions

The developed project efficiently ensures:
1.Rider is wearing a helmet throughout the ride.
2.Rider should not be under the influence of alcohol.
3. Accident detection.
By implementing this project, a safe two-wheeler journey is possible which would decrease the head injuries during accidents and also reduce the accident rate due to driving a bike after consuming alcohol. The helmet may not be a 100% foolproof but is definitely the first line of defense for the rider in case of an accident to prevent fatal injuries

In the Fig. 10 you can see the outcome of the GPS Module circuit which is showing you the coordinates of the rider.

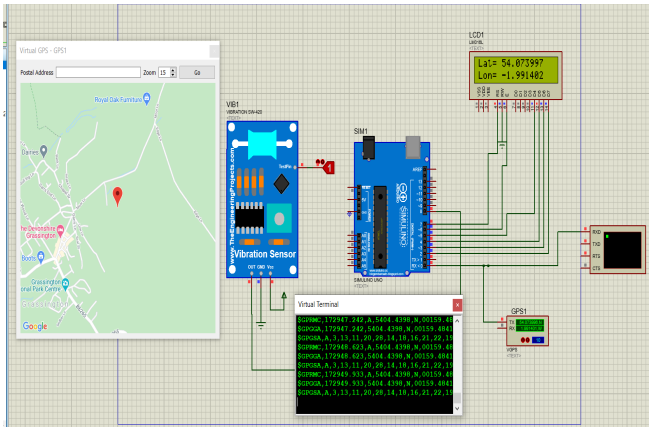

Fig. 10

In the Fig. 11 you can see the LCD is showing you the conditions and also whether the engine will start or not.

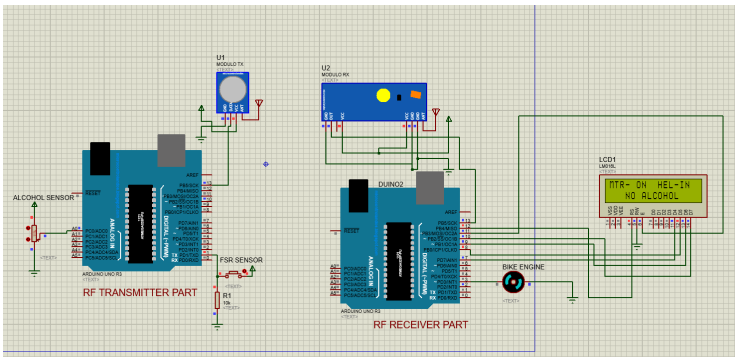

Fig. 11

V. CODING

We have used C language for programming the Rf transmitter and Rf receiver which is basically "Arduino uno r3" microcontroller. All the Arduino uno r3 programming was done in "Arduino IDE" .So basically the separated the code into two parts one is the "bike part" coding which is the programming of the receiver and the other is the "helmet part" coding which is the programming of the transmitter. Once the code is created on Arduino IDE we convert it into a "HEX" file and then upload it in their respective microcontroller.

VI. LIMITATION

The design of the helmet won't remain sleek. It doesn't really provide the the exact SMS to the desired

VII. Future Scope

We can use solar panels for helmet power supply and this same power supply can be used for the components required in the project. In future we can add a Mems sensor to avoid rash driving. It detects the motion of the handle and it is based on the handlebar control of the vehicle. we can design a GSM module which we can use to develop . Government should enforce laws to install such systems in each two wheeler. We can implement various bioelectric sensors on the helmet to measure various activities. We can use a small camera for recording of the driver's activity. It can be used for passing messages from one vehicle to another vehicle by using a wireless transmitter. If a helmet gets stolen then the bike can be started by the password. We can have a encrypted barcode imbibed

VIII. Conclusion

The two-wheeler safety system developed with a smart helmet and intelligent bike system is reliable and aims to help in the prevention, detection and reporting of accidents hence reducing the probability of drunk drive cases. It also has several advantages compared to the previous systems. Our proposed system gives the primary importance of preventing the accidents and ensures safety for a greater extent in two wheelers. Nowadays, most accident cases occur due to motor bikes. The severity of those accidents are increased because of the absence of a helmet or by the usage

of alcoholic drinks. By implementing this system, a safe two wheeler journey is possible which would decrease the head injuries throughout accidents caused due to the absence of helmet and additionally reduce the accident rate due to drunken driving. The helmet may not be 100% foolproof but is definitely the first line of defense for the rider in case of an accident to prevent fatal injuries and ensure the rider's safety.

IX. Acknowledgment

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