

Safety Ignition System in Two Wheelers

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Abstract - The increment in thefts of two wheelers and the alarming number of road accidents and the death rate of people as a result of such accidents, calls for the need of a system that could both prevent the theft of the vehicle as well as ensure the safety of the rider. One way of enhancing the security of the system could be replacing the traditional lock and key system with biometrics system. And the safety of the rider can be ensured by the fact that the system must incorporate in it an intelligent system which does not allow the rider to start the ignition of the vehicle if he is not wearing a helmet or is not sober. The system requires firstly to authenticate the rider from the preloaded fingerprints from the database of the microcontrollers also making it compulsory for the rider to wear the helmet as per the government guidelines. The system consists of alcohol sensor. Microcontroller ATmega328 is used for the performing the efficient working of system. RF module performing the communication part along with the help of IR sensor.

Index Terms - Alcohol sensor, Microcontroller, IR sensor, RF module, GPS, GSM.

INTRODUCTION

Per vehicle mile traveled, motorcyclists are about 30 times more likely than a passenger in a car to die in a crash. And, more than half of motorcycle fatalities in 2013 were unhelmeted riders [1]. Most motorcycle accidents that result in death are caused by a head injury. Saving a life and prevent a brain injury rider should wear a helmet. Serious injuries are greatly reduced both in severity and in frequency by the simple act of wearing a helmet. Now accidents on roads have become a serious concern for all the thousands of people especially youngsters are either getting killed or injured every year. Transport Ministry road accident report 2014 which stresses the need to tackle this issue as soon as possible seventy-five thousand youngsters killed in road crashes last year. This clearly suggests that Indian roads present a depressing scenario most of these people who lost

their lives were aged between 15 and 34 years according to the road accidents report 2014. Besides, over 82% of these victims were males. The report reveals that the age group of 15 to 34 years accounted for 53.8% of the total road accident [2]. Fatalities followed by the age group of 35 to 64 years accounted for 35.7%. About 1.2 million Indians have killed car accidents over the past decade on average one every four minutes while 5.5 million was seriously injured. The latest estimate by the World Health Organization also shows that globally world road traffic injuries are the number one cause of death among young people aged 15 to 29 years. Annually, about 3.4 lakh youngsters in this age group died in accidents according to the report prepared by the ministries transport research wing. The total number of road crashes has increased marginally from 3.86 lakhs in 2013 to 4.50 lakhs in 2014. The number of fatalities has also gone up by about 1.5 percent [3]. This shows that there is a need to pay attention to make young people more aware of road safety issues. It is a mammoth loss and calculating the social cost would reveal how big it is a rise in the number of accidents and the number of people getting killed or injured in those accidents is certainly a major concern. However, it is the responsibility of every individual especially the youngsters who come onto the roads that they have to be safe and follow the traffic rules.

Motorcycle helmets have two main protective components. First is outer shell typically made from plastic, fiberglass, or Kevlar, and second is inner, usually made of polystyrene foam. The purpose of the hard outer shell is to prevent penetration of the helmet or head and to provide structure to the soft inner liner to keep it stable upon impact. The purpose of the foam liner is to crush during impact to increase the distance and the amount of time head has to stop and to reduce its deceleration. Helmeted bikers experienced significantly fewer and less severe head and neck injuries than unhelmeted riders. People who were

injured had head and neck caused by the safety helmets, each of these injuries was relatively minor, and helmets protected them from potentially fatal injuries. Therefore, helmets greatly reduce the number of deaths and injuries by motorcycle accidents. The main contributions of this paper can be brief as follows: a) preventing accident, b) reducing accident causality, c) identifying the accident, and d) developing the accident-related traffic management system. In this paper, we propose a model of a smart helmet for accident identification and preventing the accident. There use IR sensors, gas sensors, and load sensors for preventing an accident. The 3-axis accelerometer is used for detecting any accident. Arduino is used for processing sensors data and building a communication system between sensors and mobile applications. The mobile application is connected with a central monitoring system and authority can monitor every user accident history. When any accidents occur, the accident location sends to the monitoring database, and the monitoring system sends the location to the nearest hospital and police center.

RELATED WORK

In India still most of the people prefer two wheelers compared to other form of vehicle due to simplicity and its low cost. One important problem is bike riders suffer from inadequate roads and bad driving conditions. Other important problem with bikers is that most of the time they do not like to wear helmet which could be fatal when accidents happen. Two wheelers in everyone's life play vital role, moreover the safety is considered to be primary of all. According to some statistics 50% of accident occurs due to bad conditions of road and not wearing helmet [2]. To avoid accidents and to encourage people to wear helmet is to be introduced that includes smart interactive robotic helmet with features like road hazard warning, wireless bike authentication and traffic adaptive mp3 playback. This helmet will warn the rider when road hazard is ahead, helmet will also communicate with rider if he is not wearing it and will perform wireless bike authentication that act as prevention from theft. It will also adjust the volume of the speakers automatically while rider is listening to music as a safety precaution. Since in India the usage of two wheelers is more compared to four wheelers, it requires more attention as far as safety is concerned.

Safety-along with security plays a vital role in today's society. The goal of this Anti-theft mechanism system is to design embedded safety and security system for vehicle by integrating and modifying existing modules. This system endures mainly with three modules namely Gas sensing module, Obstacle detection module and Anti-Theft alert system; these are interfaced with ATmega16 microcontroller. IR sensors transmit signal from its sensor head and again receive the signal reflected from an obstacle and instruct the microcontroller which alerts the driver with an alarm and controls the vehicle by stopping it. The gas sensor here is mounted inside the vehicle such that it senses the presence of the gases inside the vehicle cabin if there is any increase in the level of the toxic gases it informs to the microcontroller which alerts the persons inside the vehicle with an alarm and also sends a SMS to the authorized user through GSM [3] At the same time automatic ventilation will be provided to the vehicle. When an unauthorized person opens the car door, the car anti-theft system becomes active and gives indication by raising an alarm that the car is being under theft.

The researches that have been noted are not far away from the system that has been proposed. Intelligent Helmet, a paper presented by AISSMS' IOIT, SPPU, Pune, India, have used an RF transmitter that triggers the vehicle if the rider is drunk. This does not allow the vehicle to start its ignition. An excerpt from the paper they have presented says "A toggle switch is used to check whether the helmet is worn or not. An RF transmitter which can transmit data up to 3 KHz from any microprocessor/controller or standard Encode IC has been used. The RF transmitter transmits the data from the microcontroller on the helmet side to the receiver on the vehicle side." [4] As for a paper presented by Vimal Jyothi Engineering College, Kannur, India, have shown the collision detection using an Arduino Uno; and the message is delivered using a Router and GSM modem. They mention "It consist of a GPS receiver, GSM modem, Arduino using ATMEGA 328 IC, vibration sensors, buzzer and a power supply system. The heart of the system is the Arduino uno board, which controls all other blocks in this system." Further they also mention "it takes the value of latitude and longitude from the GPS receiver and transfer it to the pre-programmed mobile number via SMS through GSM modem. And it operates the audio alarm." [5]

Manjesh N et al [6] the authors have proposed a model for the accident prevention which states when the system is switched on, LED will be ON indicating that power is supplied to the circuit. The RF is used to start the two-wheeler firstly it checks whether the driver is drunken or not if drunken it will not allow to start two-wheeler. The small voltage of ignition of the two-wheeler is grounded. In normal condition when the helmet is used the pressure sensor is senses pressure and the RF transmitter radiates the FM modulated Signal. The RF receiver is connected with the two-wheeler which is receive the radiated signal and activate the relay. The relay is removing the ignition wire from the ground and connected with the starter switch now the two-wheeler will start. When driver met with accident vibration sensor sends message to microcontroller. The GPS receives the location of the vehicle that met with an accident and gives the information back. This information will be sent to a mobile number through a message. This message will be received using GSM modem present in the circuit. The message will give the information of longitude and latitude values. Using these values, the position of the vehicle can be estimated.

Priyanka Rani et al [6] Fingerprint authentication is most sophisticated method of all biometric techniques & has been thoroughly verified through various applications. A fingerprint occurs uniquely to an individual & remains unchanged for lifetime. Priyanka Rani (M. Tech Scholar) and Pink Sharma (Assistant Professor) of H.C.T.M Kaithal, Haryana India worked on fingerprint identification system & on the basis of their study & research they published a Review Paper titled " A Review Paper on Fingerprint Identification system". Their paper defines various aspects & methods to be used for fingerprint identification. In this paper, they have shown different methods & techniques which can be used to identify a person through his fingerprint. These methods conclude that fingerprint is fast, secure, accurate & reliable system. Gabor filter method is applied for feature examination. Methodology for this technology is represented with the help of block diagrams & flowcharts. Future research can be carried out to improve quality of image for image enhancement and to develop better matching techniques.

Arsalaan. F. Rashid et al [7] the authors of the paper entitled "Biometric Fingerprint Identification- Is It a Reliable Tool or Not?" presented a study which was undertaken on the employees and students of a University undergoing biometric verification for purpose of attendance. A total of 3250 staff and non-staff members of this University campus who were taking biometric identification for daily attendances were analyzed for this study. The key tool of their study was the biometric fingerprint identification method which compared to a visual comparison of signatures or photo IDs is more accurate and less time consuming making it less fallible and potentially much faster. As a result of this study, it was observed and noted that the error rate in biometric identification significantly increases with increase in age group because aging results in loss of collagen. Compared to younger skin, aging skin is loose and dry, and decreased skin firmness directly affects the quality of fingerprints acquired by sensors. An important conclusion of the study is that biometric identification is not infallible and is prone to non-correctable errors. Wearing down of fingerprint pattern was found to be a major source of errors in registering biometric fingerprint attendance. Also, in agrarian rural economies like India where hard manual labor may be the only means of subsistence for a large population, this inaccuracy can be a source of problems for poor and hardworking people. Databases developed by such methods are prone to limitations which have to be thoughtfully corrected before the system is fully institutionalized. Therefore, the authors concluded that, excessive reliability on such systems needs to be re-evaluated and possible corrections should be made in technology to address these problems.

system architecture

The proposed model of this project is an intelligent two-wheeler ignition system with an additional intelligent helmet for the safety of the rider. The system ensures the safety of the vehicle and the rider both at the same time. The system requires firstly to authenticate the rider from the preloaded fingerprints from the database of the microcontrollers also making it compulsory for the rider to wear the helmet as per the government guidelines.

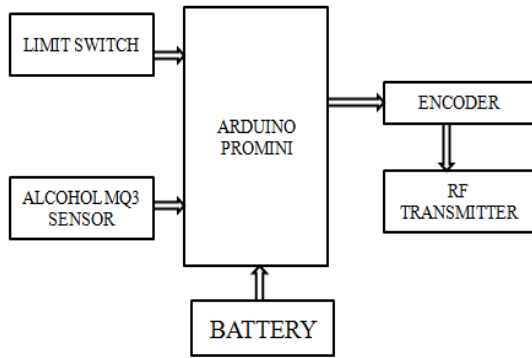


Fig 1: Helmet Unit

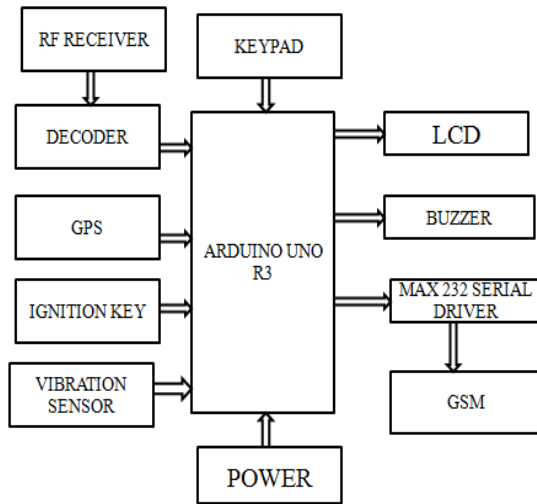


Fig 2: Vehicle Unit

Hardware Requirements

- Arduino Uno R3
- 433 Mhz Rf Tx & Rx
- Ht12e Encoder
- Ht12d Decoder
- Neo 6m Gps Receiver
- Sim 800c Gsm Modem
- Vibration Sensor
- Ignition Switch
- Mq3 Alcohol Sensor
- Limit Switch
- Power Supply Unit
- Battert
- 16*2 Lcd

Software Requirement

- ARDUINO IDE
- Embedded C

HARDWARE IMPLEMENTATION

Arduino UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under Common Creative Attribution Share-Alike 2.5 license and is available on the arduino website. Layout and production files for some versions of the hardware are also available. "UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The UNO board and version 1.0 of arduino Software (IDE) were the reference versions of arduino, now evolved to newer releases. The UNO board is the first in a series of USB arduino boards, and the reference model for the arduino platform. The ATmega328P on the arduino UNO comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The UNO also differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it uses the Atmega16U (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.



Fig -3: Arduino Board

LCD

Liquid Crystal Display (LCD) is used to display the output to the user in the form of GUI (Graphic User

Interface) and a mono chromatic display. LCD used in this project is JHD162A series. There are 16 pins in all. They are numbered from left to right 1 to 16 (if you are reading from the backside). Generating custom characters on LCD is not very hard. It requires the knowledge about custom generated random-access memory (CG-RAM) of LCD and the LCD chip controller. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 byte providing the option of creating eight characters at a time. Each character is eight byte in size.

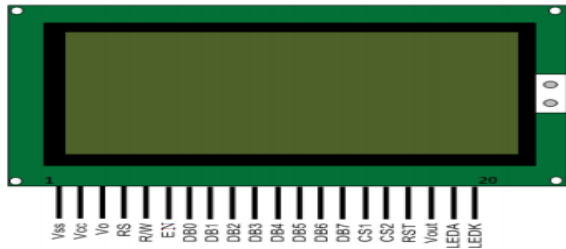


Fig 4: LCD

MQ-3 Gas Sensor

MQ-3 module is the mostly use electrochemical gas sensor to detect alcohol. Tin Dioxide (SnO₂) is used in the sensor which conductivity is lower than clean air. As the alcohol concentration is high, the conductivity of the sensor will be high. Therefore, the internal resistance of the sensor goes lower. The resistance of two points varies for detecting the presence of alcohol in the rider’s breath.



Fig 4. Alcohol sensor that acts as a breath analyser

Keypad module

A toggle may be a category of electrical switches that area unit manually motivated by a mechanical lever, handle, or rocking mechanism. The phrase “toggle switch” is applied to a switch with a brief handle and a positive snap-action, whether or not it really contains a toggle mechanism or not. once the actuator-the toggle itself-is affected, the coil within the switch

moves the transferable contact into position either energizing the circuit or de-energizing it.

GSM Modem

While accessing the system, we do not replace the password verification. If password is correct, the system will capture and match fingerprint of the customer. As shown in Fig 4, if fingerprint does not match with the account registry for three times, buzzer will be made ON and a message will be delivered to customer’s cell phone and bank authority. Thus, GSM MODEM to communicate with the mobile phone to which we are going to send the message is also interfaced with Arduino.

GPS sensor

The GPS system provides critical positioning capabilities to military, civil, and commercial users around the world. In our project we are using the GPS sensor module EM-406A, as it is new improved GPS Module with built-in antenna and memory back-up for OEM. This unit features low power consumption, high sensitivity. The unit is ideal for navigation systems, distance measurements, vehicle monitoring and recording, boating direction, and location, together with hiking and cross country exploring.

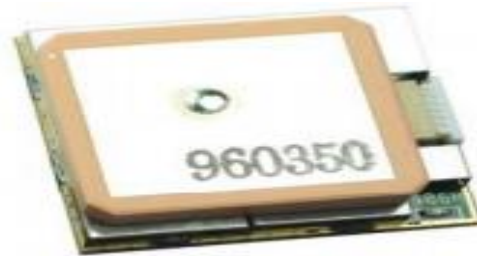


Fig 7: GPS Receiver

RF Technology

Radio frequency (RF) is a frequency or rate of oscillation within the range of about 3 Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate that most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits or electromagnetic radiation.

RF Advantages:

- No line of sight is needed.

- Not blocked by common materials: It can penetrate most solids and pass-through walls.
- Longer range.
- It is not sensitive to the light.
- It is not much sensitive to the environmental changes and weather conditions.

The data is received by the RF receiver from the antenna pin and this data is available on the data pins. Two Data pins are provided in the receiver module. Thus, this data can be used for further applications.

RESULTS AND DISCUSSION

With the help of helmet detection key, driver without helmet can be avoided. If rider does not wear helmet, then the LCD will display as “NO HELMET PLS WEAR IT” in figure 5.

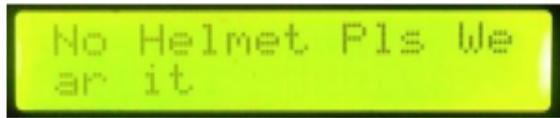


Fig.5: Helmet Detection Result

Illegal consumption of alcohol during driving is 0.08 mg/L as per the government act but for demonstration purpose, it is programmed to the threshold limit 0.04 mg/L. threshold can be adjusted using potentiometer. If sensitivity of MQ-3 is more 0.04 mg/L of alcohol in breath, then the helmet unit will communicate with vehicle unit and show “Driver is drunken “thereafter the ignition system get switched off as shown in figure 6.



Fig. 6: Alcohol Detection Result

Figure 10 shows the bike unit construction. If the decoder receives the signal from helmet unit, it will move on to a security system. If rider enter an encrypted password, it enables the ignition system through relay. Otherwise, it locks the ignition system. If any accidents occur, the vibration sensor senses the vibration value [9]. If it reaches the threshold value, it will send a signal to microcontroller and GSM. The SMS will be sent to a registered mobile number through GSM [10]. The accident location will be sent to a registered mobile number through GPS based on latitude and longitude value.

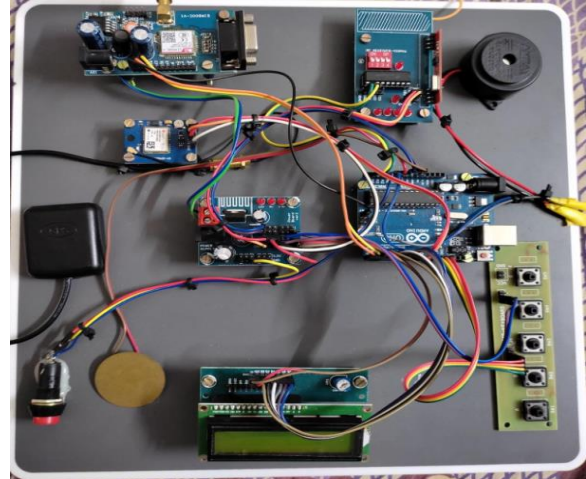


Fig 7: Vehicle Unit

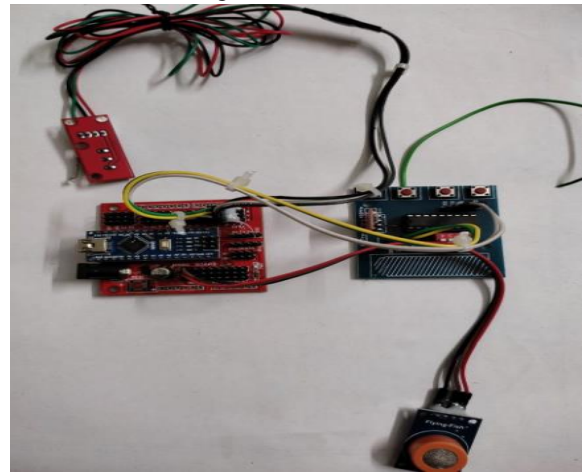


Fig 8. Helmet Unit

CONCLUSION

The developed system efficiently ensures. Rider is wearing helmet throughout the rider. Rider should not be under influence of alcohol, Accident detection & theft protection. By implementing this system, a safe two-wheeler journey is possible which would decrease the head injuries during accidents and also reduce the accident rate due to driving bike after consuming alcohol. A helmet is not 100% foolproof but it definitely the first line of defense for the rider in case of an accident to prevent fatal brain injuries. The proposed approach makes it mandatory for the ruder to use this protective guard in order to drive a two-wheeler vehicle and ensures the safety of human brain and therefore reduces the risk of brain injuries and deaths in case of an accidents. Besides the developed system prevents the theft of two-wheeler.

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