International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

SMART TWO-WHEELER

Shaik Maqsood[1], P. Anish Jaisimha[2], Konda Avinash[3], Neeli Sreekeerthan[4]

[1,2,3,4]*UG student, Dept. of Mechatronics Engineering, Mahatma Gandhi Institute of Technology, Telangana, India*

Abstract - *As the bikers in our country are increasing, the road mishaps are also increasing day by day, due to which many casualties, most of them are caused due to most common negligence of not wearing helmets, and also many deaths occur due to lack of prompt medical attention needed by the injured person. This motivates us to think about making a system which ensures the safety of bikers, by making it necessary to wear a helmet, as per government guidelines, also to get proper and prompt medical attention, after meeting with an accident. The first step is to identify whether the helmet is worn or not. If the helmet is worn, then the ignition switch can be operated otherwise it cannot be operated. The second step is alcohol detection. Alcohol sensor is used as a breath analyzer that detects the presence of alcohol in the rider's breath and if it exceeds the permissible limit ignition cannot start. When these two conditions are satisfied then only the vehicle starts. The third main issue is accidents and late medical help. If the rider has met with an accident, he may not receive medical help instantly, which is one of the main reasons for death. In fall detection, we place an accelerometer in the vehicle unit. By this mechanism, accidents can be detected. The aim of this system is to make a protection system in a helmet for the safety of the bike rider. This system can be used in a real-time safety system. We can implement the whole circuit into a small module and less power consuming safety system.*

Key Words: Alcohol detection, Helmet detection, Smart two-wheeler.

1. INTRODUCTION

Every day around the world a large percentage of people die from road accidents. An effective approach is made to solve the problem by using an intelligent helmet. An intelligent helmet is a special idea that makes motorcycle driving safer than before. This is implemented using Arduino. The main objective of this project is to build a safety system that is integrated with an intelligent helmet and intelligent bike to reduce the probability of two-wheeler accidents and drunk driving cases. In recent times helmets have been made compulsory in Telangana State. Traffic accidents in India have increased every year. As per Section 129 of Motor Vehicles Act, 1988, every single person riding a two-wheeler is required to wear protective headgear following the standards of BIS (Bureau of Indian Standards). Also, drunken driving under the influence (DUI) is a criminal offense according to the Motor Vehicle act 1939, which states that the bike rider will get punished. Currently, bike riders easily escape from the law. These are the three main issues that motivate us for developing this system. There are two main units in this project. Each unit uses a microcontroller. Signal transmission between the helmet unit and vehicle unit is done using RF communication. An intelligent helmet is a type of protective headgear used by the rider which makes bike driving safer than before.

2. HARDWARE COMPONENTS

Power Supply Section

This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V ac to 9V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification, the obtained rippled dc is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained dc voltage.

Figure-1. Power supply

Microcontroller Section

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, reset circuitry, pull up resistors (if needed), and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

Figure-2. Microcontroller section.

LCD Display Section

This section is basically meant to show up the status of the project. This project makes use of Liquid Crystal Display to display/prompt for necessary information.

Figure-3. LCD Display

Driver circuit

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

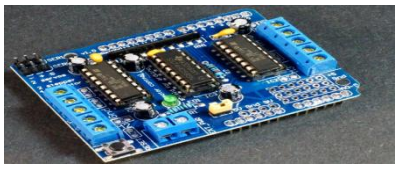

Figure -4. Motor driver shield.

DC Motor

The motor is output for this project. A DC motor is connected to the microcontroller. And this motor is controlled by the microcontroller with the respective inputs given by us. Its speed will be varied according to the speed set by the switches.

Figure-5. DC Motor.

Alcohol sensor

The sensitive material of the MQ-3 gas sensor is SnO2, which has lower conductivity in clean air. When the target alcohol gas exists, the sensor's conductivity is higher along with the gas concentration rising. This component is used in order to ensure that rider is not under the influence of alcohol more than the limit while riding.

Figure-6. Alcohol sensor

GSM module

This section consists of a GSM module. The module will communicate with the microcontroller using serial communication. The modem is interfaced to the microcontroller using MAX 232, a serial driver. The Global System for Mobile Communications is a TDMA based digital wireless network technology that is used for communication between cellular devices. GSM phones make use of a SIM card to identify the user's account.

Figure-7. GSM module

MEMS

Accelerometers are acceleration sensors. An inertial mass suspended by springs is acted upon by acceleration forces that cause the mass to be deflected from its initial position. This deflection is converted to an electrical signal, which appears at the sensor output. The application of MEMS technology to accelerometers is a relatively new development.

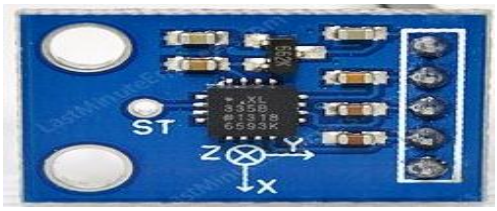

Figure-8. Accelerometer sensor.

GPS module

A GPS module is used to get the signals and receive signals from the satellites. In this project, the GPS modem gets the signals from the satellites and those are given to the microcontroller. The signals may be in the form of the coordinates; these are represented in the form of the latitudes, longitudes, and altitudes.

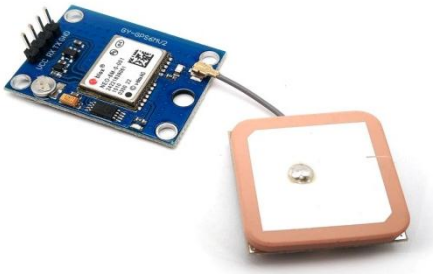

Figure-9. GPS module

RF Transmitter

In this project, ST-TX01-ASK is used as the RF transmitter module. The encoded signal is given to the RF transmitters data pin. Then the signal is modulated (ASK) by the RF transmitter module and transmitted through the antenna. This section is fully described in the RF communication section.

Encoder

We are using IC HT12E Encoder which is an 18 pin IC. This encoder circuit will encode the data sent by the microcontroller and then transmits the data serially to the RF transmitter module. Here we are using the ST-TX01 transmitter module for transmitting the data.

RF Receiver

In this section, we are using the ST-RX04 RF Receiver module. The transmitted signal is received by this receiver module. The received data is transmitted to the decoder to decode the data as we encoded the data while transmitting.

Decoder

We are using IC HT12D Decoder which is an 18 pin IC. This Decoder circuit will decode the data from the receiver and then send the decoded data to the microcontroller.

Figure-10. RF Receiver and transmitter.

3. SOFTWARE DESCRIPTION

The software which we use here is Arduino IDE.

The main features we need to know about it are:

- **Code area:** This is where you will type all your code
- **Verify:** This allows you to compile your code to code the Arduino understands. Any mistakes you have made in the syntax of your code will be shown in the info panel
- **Upload:** This does the same as verify but will then send your code to your Arduino if the code is verified successfully
- **Info panel:** This will show any errors during compiling or uploading code to your Arduino
- **Serial Monitor:** This will open a window that allows you to send text to and from an Arduino.

4. BLOCK DIAGRAM

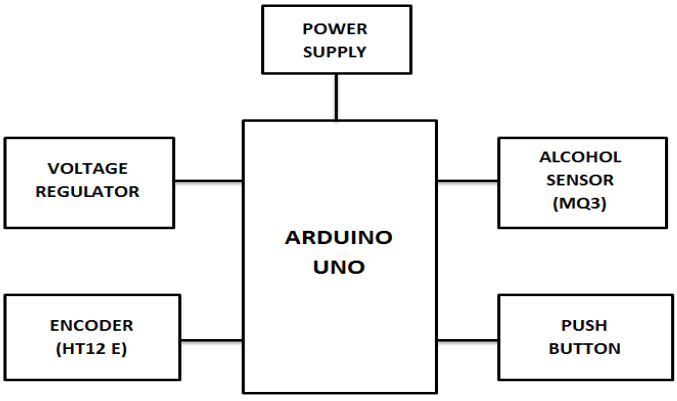

Figure-11. Block diagram of the Helmet section.

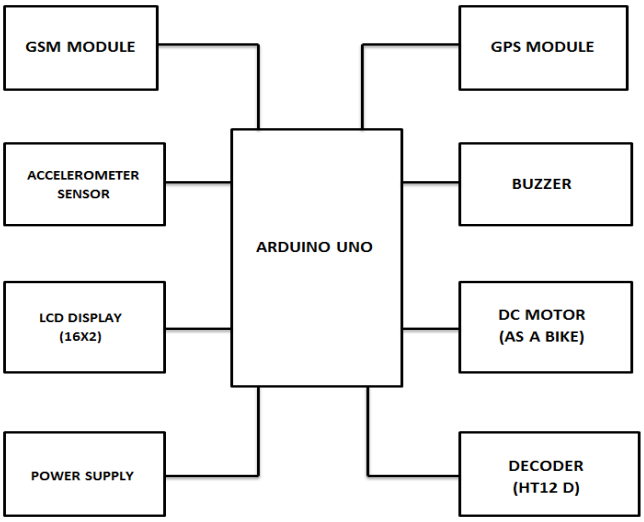

Figure-12. Block diagram of the Vehicle section

5. FLOWCHART

All the conditions in the system can be explained in following flowchart:

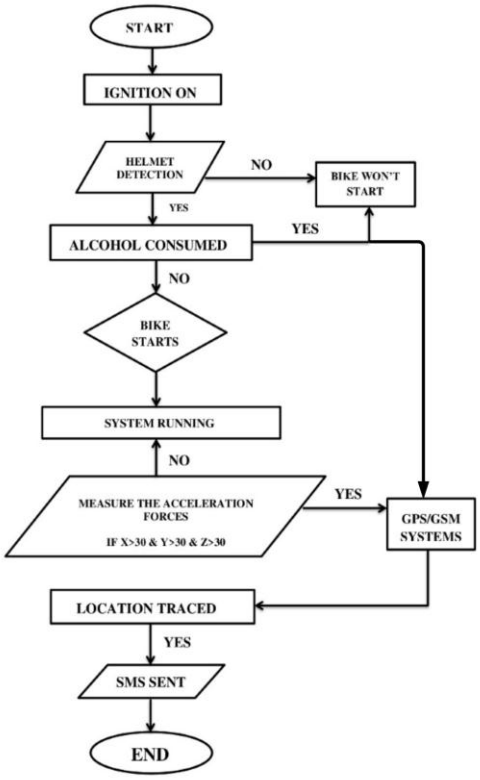

Figure-13. Flow chart representing working of the system

6. WORKING

This system ensures the following conditions

- If the push button is activated and alcohol detected is within the permissible limit, then the bike will get started.
- And if an accident is detected while the vehicle is running then vehicle stops and SMS is sent to predefined contact.

Alcohol sensor is placed to check if the rider has drunk. If the rider is drunk, then the bike cannot get started. The circuit uses a gas sensor (MQ-3) which can detect the presence of LPG, propane, methane and other combustible materials. The sensor is made up of SnO2 which has lower conductivity in clean air when concentration of LPG, Propane or Butane increases in air near the sensor, its conductivity increases so it can be placed just below the face. The surface of the sensor is sensitive to various alcoholic concentrations. It detects the alcohol from the rider's breath. The resistance value drops which leads to a change in voltage. This changed voltage is fed to a comparator which compares the changed voltage with a predefined voltage which corresponds to alcohol concentration below the illegal consumption level. If the voltage from the sensor exceeds the predefined voltage comparator output goes high and the microcontroller acts accordingly. Generally, the illegal consumption of alcohol during driving is 0.04mg/L as per the government act. The blood alcohol content (BAC) legal limit is 0.03% or 30 µl alcohol in 100 ml blood.

In order to confirm the proper wearing of the helmet push button is used which only when short circuited produces logic 0 which is sent to the microcontroller thereby causing the motor to start. So, the wearing of the helmet is confirmed by the system and similarly the alcohol sensor fitted in the mouthpiece of the helmet detects the alcohol in the breath and sends the amount of alcohol to the controller. If both criteria are met in an appropriate manner, then the 2 control signals are sent from the helmet unit to the vehicle control unit. The decoded RF signal is distributed to the controller within the vehicle unit to start / stop the vehicle.

GPS GSM module is used to send the message and locate the bike if the bike met an accident the vibration sensor is placed in the bike to send the signal to GSM if the bike met an accident. LCD display and is used for monitoring the output. All the outputs are displayed on the LCD screen.

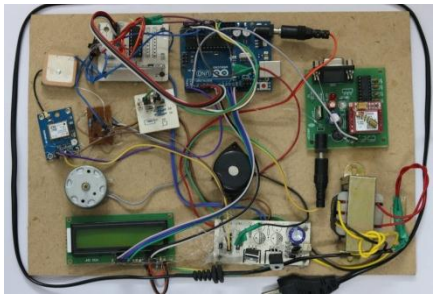

Figure-14. Prototype of the Vehicle section

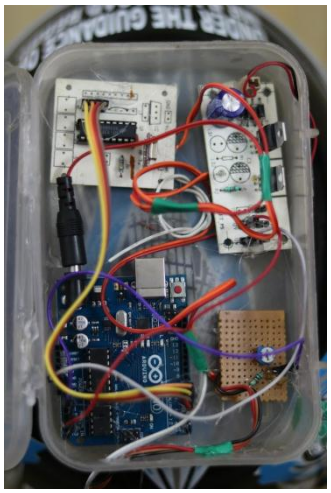

Figure-15. Prototype of the helmet section

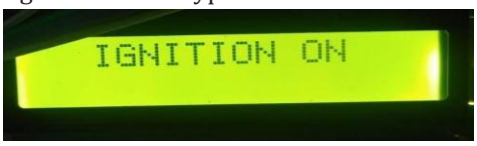

Figure-16. LCD Display when Ignition on

Figure-17 LCD Display when Helmet not detected

Figure-18. LCD Display when Helmet worn

Figure-19. LCD Display when alcohol detected higher than the limit

Figure-20. LCD Display when alcohol is detected higher than the limit and then Vehicle is locked

Figure-21. LCD Display when accident detected

Figure-22. LCD Display when accident detected, and the vehicle is Getting GPS data

Figure-23. LCD Display when the accident is detected, and the vehicle detects the location

Figure-24. LCD Display when the accident or alcohol is detected, and the vehicle detects the location and that SMS is sent to the required help and family members

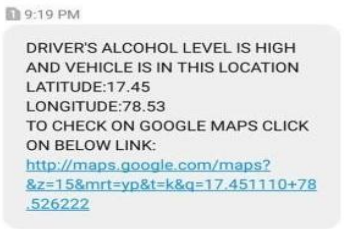

Figure-25. Message received when the driver is under the influence of alcohol

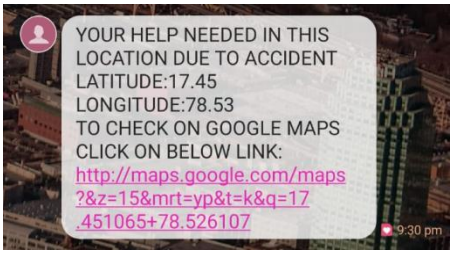

Figure-26. Message received when the driver has met with an accident and help is required

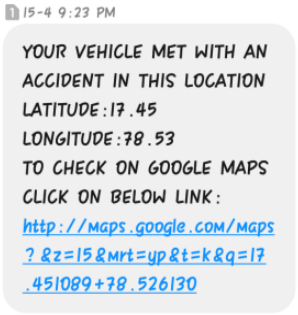

Figure-27. Message received when the driver has met with an accident and the family is notified

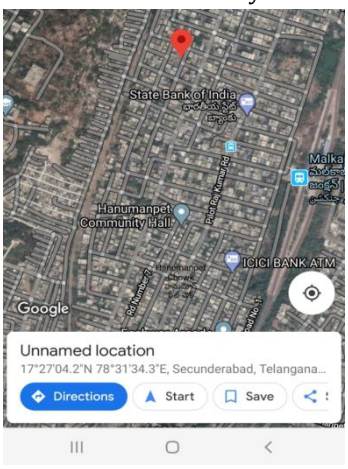

Figure-28. The location of the vehicle detected in googles map

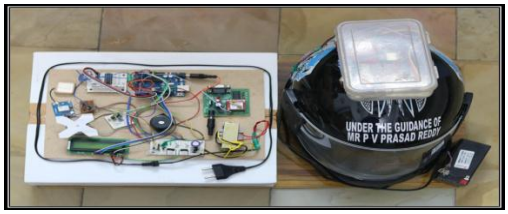

Figure-29. Complete system

7. Advantages

1. Accidents can be detected in accident-prone zones easily and thus medical services can be provided easily.
2. By using alcohol detectors, the drunken drive will be simply avoided, hence reduces the probability of accidents.
3. It is economical and can avoid the fine imposed by making the helmet-wearing compulsory.
4. Easy to implement.
5. Cost-effective and efficient.
6. By the usage of various sensors, it is easily replaceable.

8. CONCLUSION

Nowadays, most cases of accidents occur by motor bikes. The severity of these accidents is increased because of the absence of a helmet or by the usage of alcoholic drinks. This system develops an electronic intelligent helmet system that efficiently checks the wearing of helmet and drunken driving. The system also efficiently sends messages to the authority in case alcohol is detected which helps in creating a disciplined environment. By implementing this system, a safe two-wheeler journey is possible which decreases the injuries caused due to drunken driving and absence of helmet. In future the system can be developed in compact size and can be made globally acceptable by all countries. Government can enforce laws to install such systems in all the two wheelers. In case of any accident it might send the messages to the relatives and friends about the location of the accident till the first aid reaches the rider. This system may also be used to know the location of the vehicle for rescuing in case of theft incidents.

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BIOGRAPHIES

Shaik Maqsood
B.Tech Final Year
Department of Mechanical Engineering (Mechatronics)
Mahatma Gandhi Institue of Technology. Hyderabad.

P. Anish Jaisimha
B.Tech Final Year
Department of Mechanical Engineering (Mechatronics)
Mahatma Gandhi Institue of Technology. Hyderabad.

K. Avinash
B.Tech Final Year
Department of Mechanical Engineering (Mechatronics)
Mahatma Gandhi Institue of Technology. Hyderabad.

N. Sreekeerthan
B.Tech Final Year
Department of Mechanical Engineering (Mechatronics)
Mahatma Gandhi Institue of Technology. Hyderabad.