

SMART HELMET FOR TWO WHEELER DRIVERS

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ABSTRACT

The idea of developing this paper comes from the social responsibility to prevent the people from the road accidents. This aims the safety and security for the bike rider. The purpose of the paper to encourage the people to wearing helmet. This system ensures that the bike will not start unless the driver does not wear the helmet and has not consumed alcohol. This system alerts the bike rider if any obstacle comes to rear part of bike. If accident occurs then the GSM module sends the message signal to the nearest police station, relatives and other people whose name is registered in module.

Keywords: GPS , GSM, ARDUINO, PIR sensor, BAC, Wireless sensors.

NOMENCLATURE

MQ-3: Alcohol Gas Sensor.

GPS: Global Positioning System

GSM: Global System for Mobile

Communication.

PIR : Passive Infrared Sensor.

BAC : Breath Alcohol Content.

GaN: Gallium Nitride.

CsNO₃ : Caesium Nitrate

UNO: Italian word i.e. One.

LNA : Low Noise Amplifier.

I. INTRODUCTION

In India every hour 16 deaths occur due to road accident [6]. Piezoelectric sensor can be used in vehicle to sense vibration. GPS can be used to get the location of accident of vehicle. GSM can be used to sent the message of accident to their relatives [1]. The alcohol sensor MQ-3 can be used detect

the presence of alcohol content in human breath. The ignition system will operate based on the level of Blood Alcohol Content [7]. Passive infrared sensor measures infrared light emitted objects that generate heat and therefore infrared radiation in its field of view [8]. Drunken driving is one of the leading causes of road fatalities. There is one death every four minutes due to a road accident in India.

It is difficult to monitor that each person worn the helmet and consumed alcohol or not, is the main problem. According to National Crime Records Bureau, Ministry of Road Transport and Highway there are top cities with the highest number of road crash deaths in India.

Accidents involving with two wheelers are more dangerous than four wheelers due to the absence of air bags and seat belt.

The developed prototype consists of the two sections to complete a system. The first section is the hardware section and the second one is the software section.

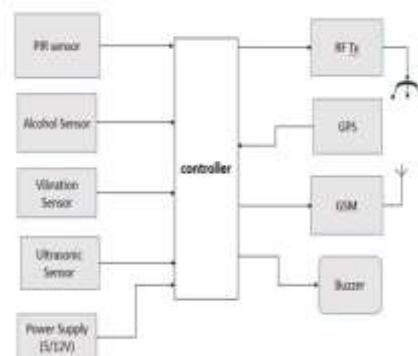


Fig-1 Helmet Section

The hardware section concerned about the microcontroller, sensors and electronics devices. The software section concerned about the microcontroller program.

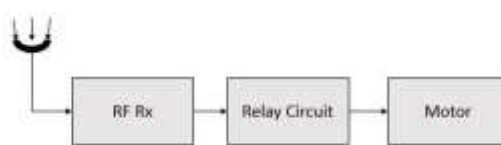


Fig-2 Bike Section

Human movement detection and identification is done by Infrared sensor. The Alcohol consumption in human breath is detected by MQ-3 sensor. Vehicle accident detection is done by Piezoelectric sensor. The messaging along with the vehicle positioning is done by GSM and GPS module at the time of accident.

2. SENSORS FOR SMART HELMET

A. Passive Infrared Sensor:-

PIR sensor is most important sensor and is made up of Pyroelectric material. Typically the dimension of the sensor are approximately $\frac{1}{4}$ inch square and taken in the form of thin film. Material commonly used in PIR sensors are gallium nitride (GaN), caesium nitrate (CsNO₃), polyvinyl fluoride, derivatives of phenyl pyridine and cobalt phthalocyanine.

It is also known as IR sensor. This sensor is used to sense the motion of human head inside the helmet within in sensor's range. It is used to check whether the human wears the helmet or not. PIR sensor detects motion by measuring the change in the infrared radiation levels emitted by surrounding objects. This motion can be detected by checking for a high infrared signal on a single input/output pin. When the bike rider's head is detected while he is trying to wear helmet, then the infrared radiation is detected by the sensor which will give high output of used PIR sensor.

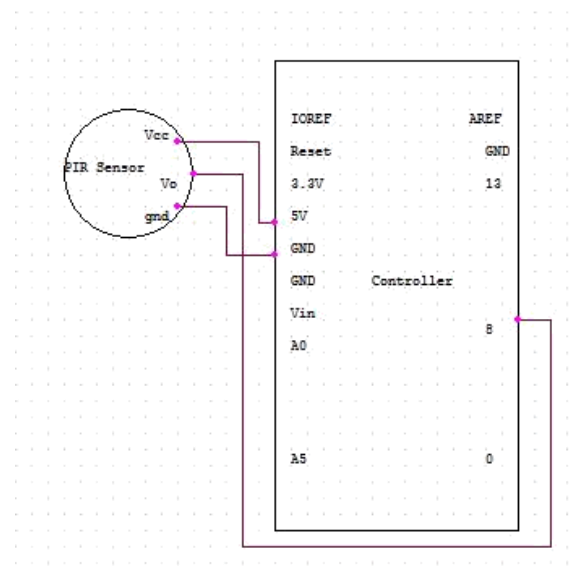


Fig-3 Passive Infrared Sensor

The PIR sensor is made of a crystalline material that generates an electric charge when it is exposed to infrared radiation. The changes in amount of infrared radiation striking the element which changes the voltage generated, which are measured by an amplifier. This device contains a special filter called a fresnel lens, which focuses the infrared radiation signals onto the element. When the ambient infrared signals change rapidly, the amplifier trips the output to indicate motion.

B. MQ-3 sensor:-

It is difficult for police to check each and every vehicle for drunken drivers, so it needed an effective system which automatically prevents drunken drive. This system can be integrated with the ignition system thus allowing only the people who does not taken the alcohol to handle the motorbike. MQ-3 gas sensor is suitable for detecting alcohol content from the breath. So it can be placed below the face shield and above the additional face protection. The surface of the sensor is very sensitive to various alcoholic concentrations. Generally the illegal consumption of alcohol during driving is 0.08 mg/L as per the government act.

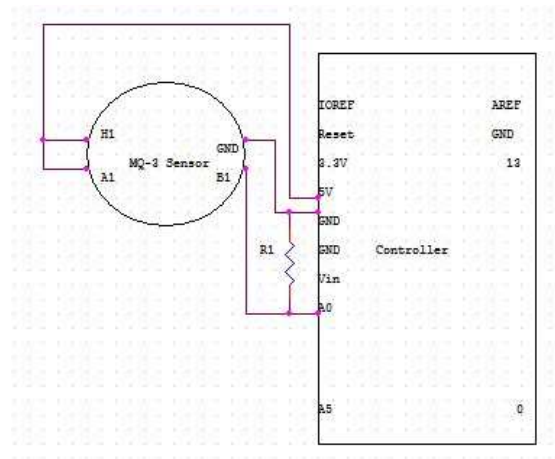


Fig-4 MQ-3 sensor

But for good performance purpose, we programmed the threshold limit as 0.04 mg/L and threshold can be adjusted using variable resistor. The alcohol sensor circuit will detect the alcohol depends on human breath and the signal will send data to Arduino microcontroller. The alcohol sensor MQ-3 is selected in this system due to its sensitivity in detection the small value of BAC. It has high sensitivity to alcohol and small sensitivity to benzene. It able to detect BAC with different concentration and classified the range of BAC detected into a few level.

C. Piezoelectric sensor:-

In our busy life, due to lack of quality of the parts of our vehicles or due to our hurry or some other reasons some times accident take place. Even though we have advanced medical equipments, we are unable to save many of lives. This is because of we are not getting information about the accident location in right time. So we are using the piezoelectric sensor in this paper. It also referred as vibration sensor.

The device which works on the piezoelectric effect and used to measure changes in acceleration, pressure, temperature strain or force by converting them to an electrical charge.

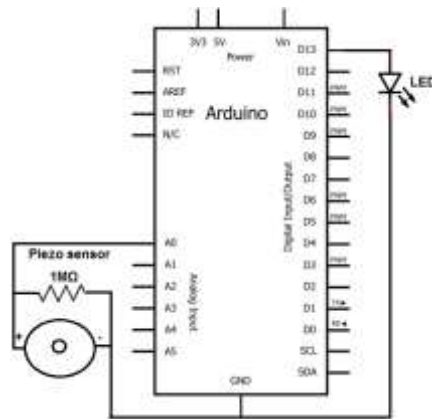


Fig-5 Piezoelectric sensor

Piezoelectric material have high modulus of elasticity is comparable to that of many metals and goes up to 10^6 N/m². Tourmaline shows pyro electricity in addition to piezoelectric effect.

D. Ultrasonic Sensor:-

It is a non-contact distance measurement sensor which measures the distance of any obstacle coming in its path from the rear end of the vehicle about 2 cm (0.8 inches) to 3 meters with the use of ultrasonic sensor. It will fixed on the rear side of the vehicle.

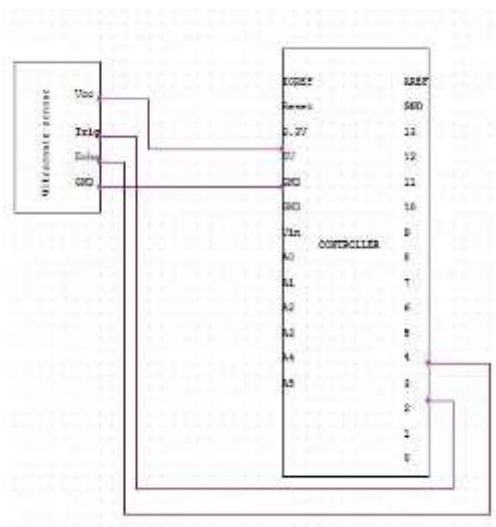


Fig-6 Ultrasonic Sensor

This device is a transducer that convert ultrasound waves into electrical signals or vice-versa. This device works on principle similar to that of transducer used in radar or sonar system. It works by transmitting an ultrasonic burst and provides an output pulse that corresponds to the time required for the echo to return to the sensor. By measuring the echo pulse the distance to target can easily be calculated.

II. Controller for Smart Helmet:-

Arduino UNO is a microcontroller board which is based on the ATmega328P-PU. It has 14 digital input/output pins, 6 analog inputs, a quartz crystal of 16MHz, a USB connection, a power jack, an ICSP(In circuit serial programming) header and a reset button

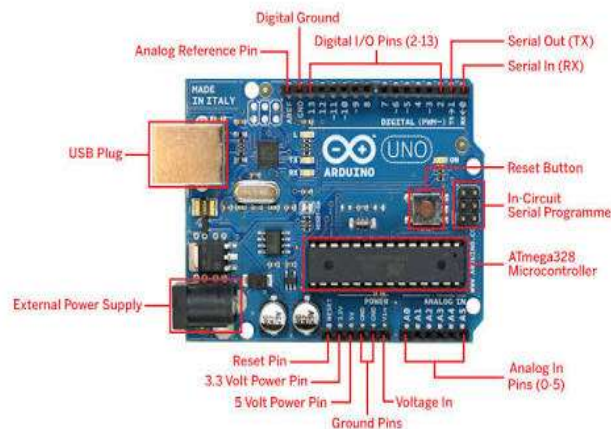


Fig-7 Controller

It consists everything needed to support the microcontroller.

It is simply connected to a computer with a USB cable or it is power with a AC-to-DC adapter or battery to get started. Arduino microcontroller is the main part of smart helmet. It gets all the analog and digital signal from all the sensors and according to that it works. For example if alcohol content found in bike rider's breath then it is detected by the alcohol sensor and the alcohol sensor gives an analog signal to the Arduino and according to the signal Arduino gives the command to cut the power. If any accident occurs then the analog signal from piezoelectric sensor is given to the Arduino according to that signal Arduino gives command to the GSM to send the message to the predefined number.

3. MODULES FOR SMART HELMET

A. GSM module (800C):-

A GSM modem is a special type of modem which can accept a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone.

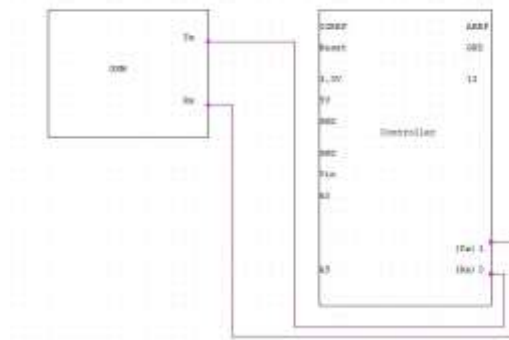


Fig-8 GSM modem

The GSM module plays a very important role in this paper. If any accident happens then because of not getting information about the accident location in right time so many SIM28ML supports various locations and navigation application accident sufferers die. So we are using GSM device. It is global system for mobile communication and used to send message to predefined number in program. SIM800C is a complete Quad-band GSM/GPRS solution in a surface mount technology type, which can be embedded in many applications. It supports Quad-band 850/900/1800/1900MHz. At the time of accident occur the force applied to the piezoelectric sensor is converted into electrical signal and sends to the ARDUINO microcontroller which convert electrical signal to appropriate message signal which is sends by GSM module to the defined number. It can transmit Voice, SMS and data. Our system works for this information with low power consumption.

B. GPS module (SIM28ml):-

It is known as global positioning system. It is a standalone or A-GPS receiver with built in Low noise amplifier. It relaxes antenna requirement and don't need for external LNA (Low noise amplifier).

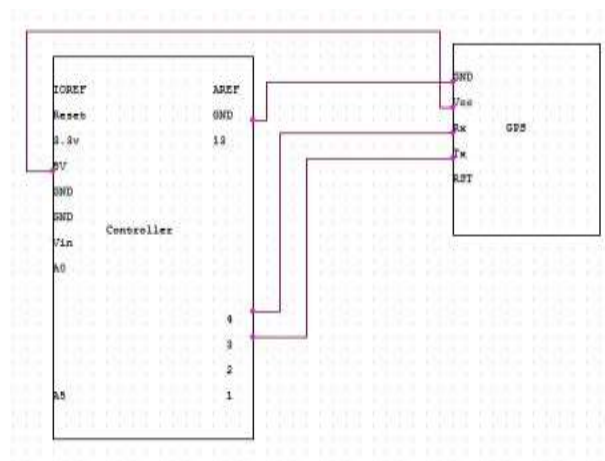


Fig-9 GPS module

SIM28ML can track as low as -165 dBm signal even without network assistance. It is used to get the exact location of vehicle at time of accident. The message consists the longitude and latitude of the location. So the people can get easily the location of the accident. The SIM28ML has excellent low power consumption characteristic. SIM28ML supports various locations and navigation application.

C. RF transmitter:-

It is two channel Radio Frequency Transmitter specially tuned with its RF Receiver part in carrier frequency. Radio frequency (RF) transmitter is used to modulate up, convert, and amplify signals for transmission into free space. It has a modulator that modulates an input signal and a radio frequency power amplifier that is coupled with the modulator that amplifies the modulated input signal. The radio frequency power amplifier is coupled to an antenna that transmits the amplified modulated.

D. RF receiver:-

The HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by an RF receiver, to the parallel data and sends them to output data pins.

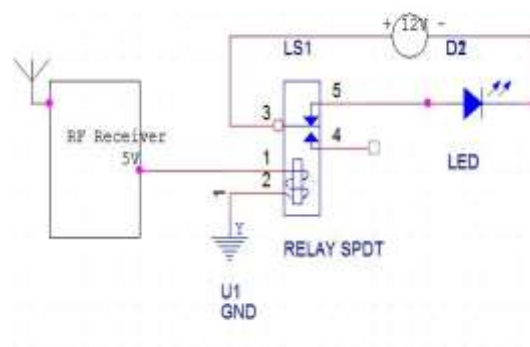


Fig.-10 RF Receiver

The received serial input data is compared three times with the local addresses continuously. The input data code is decoded when unmatched codes are found. A valid transmission is indicated by a high signal at the VT pin and then relay turns on. A string of address and data bit is used to prevent it from false triggering.

4. CONCLUSION

The proposed system is very effective for the safety purpose of the driver. User has to wear helmet to ride two wheeler vehicle and hence traffic rules will be followed with this. Ride two wheeler vehicle having safety in hand and in budget also. Its easy to operate this system. It provides a better security to the rider.

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