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SMART HELMET FOR BIKE RIDERS USING WIRE LESS SENSOR NETWORKS (GSM)

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ABSTRACT:
The government has implemented several rules and regulations to prevent road accidents, yet the number of accidents is still rising daily. Accidents may be defined as unforeseen events or mistakes that happen and cause injuries, and even fatalities. When compared to other types of vehicles, two-wheelers have a higher accident rate. The government has created adequate traffic laws and regulations to prevent accidents, yet the number of accidents is rising daily. By using helmets and operating cars with caution, this may be prevented. Wearing a helmet, however, may significantly lower the chance of an accident. Using the Internet of Things (IoT) for accident avoidance, accident detection, and fast GPS position recovery, this smart helmet solution offers rider safety in the most efficient and advanced manner possible. This idea aids in understanding the Internet of Things, a technology that is emerging these days.The suggested approach makes use of an Arduino UNO, MEGA, and other reasonably priced sensors, such as an infrared sensor. Only when the rider wears a helmet will the bike's engine start. When a bike rider comes within range, it recognizes their head. The bike unit serves as the receiver and the helmet unit acts as the transmitter in wireless communication thanks to the usage of radio frequency (RF) modules. The most useful feature of this approach is its fall detection, which uses a vibrator sensor and a WIFI module system. This allows emergency medical services to quickly locate the scene of the event and sends an SMS message alert to the rider's registered emergency number. Two-wheeler riders may benefit from smart helmet systems that aid in accident detection, safety, and security.

I. INTRODUCTION OF PROJECT

The creation of this initiative was motivated by the goal of improving society in some manner. Tragically, there are an increasing number of two-wheeler incidents every day that result in fatalities. An Indian study indicates that there are 698 motorcycle-related incidents every year. Numerous factors might contribute to this, such as poor driving technique, insufficient cycling fitness, riding quickly, carrying heavy loads, using a phone while operating a vehicle, driving under the influence, etc. In some cases, the other rider may have been at blame for the crash rather than the injured person. The drivers who were engaged in the crashes, however, will bear the brunt of the consequences. If mishaps are one issue, not getting medical attention quickly is another. A research claims that there are 698 instances in India annually, and only around half of the wounded individuals get timely medical care. There are several reasons for this, such as the fact that there were no witnesses at the scene who might have informed the victim's family or administered first aid, and the ambulance's delayed arrival. This is a common occurrence, thus the thought of finding a way to address it gave rise to the notion of promptly and practically alerting people about accidents. Since timing is crucial, if everything is completed on schedule, we can at least prevent half of the fatal bike accidents. The information provided on the rider will include whether or not they have worn helmets, whether they have drank alcohol, and if

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they have ever been in an accident. The location of the accident will be sent to the emergency contacts' cell numbers via a GSM module and IoT integration.

II. LITERATURE SURVEY

Thanks to the SMART HELMET system, all motorcycle riders in Malaysia are mandated by law to wear helmets, regardless of the distance they are traveling. XBee technology will be used to link the system between the motorcycle-mounted receiver and the transmitter positioned on the helmet. Numerous types of switches, including as clipped switches, temperature heat switches, and signal switches, are utilized to make sure the rider is not deceiving oneself. If the system detects that the user or riders are not wearing their helmets correctly (clipped), the signal won't be transmitted to the motorbike's receiver, which will prohibit the motorcycle from starting and the rider from driving the vehicle.

In addition to existing studies and data on road safety from Malaysian government agencies, the study will concentrate on the mindset and actions of helmet users. The scope will also include study on general applications, behavior, and features of XBee technology, along with advantages and disadvantages. Next, the use of the method in daily life will be discussed.

In order to increase motorcycle riders' degree of road safety, the "Intelligent Safety Helmet for Motorcyclists" project was started. The idea originated from the understanding that, as the number of deadly traffic events rises over time, motorcycle riders are becoming more and more worried. According to the report, this is because the helmets are not equipped with safety measures like a helmet string or the right size. This initiative attempts to implement security measures to encourage motorcycle riders to wear helmets correctly. The Intelligent Safety Helmet for Motorcyclist project claims that an RF transmitter and receiver circuit will allow the motorbike to move in the event that the helmet emits an emission signal. Since the security system used in this project satisfies every need for an ideal rider, its application ought to be highlighted. It is expected that the project would improve safety and reduce accidents, especially those that result in motorcycle deaths.

III. DESIGN OF HARDWARE

This chapter briefly explains about the Hardware. It discuss the circuit diagram of each module in detail.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilize the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

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• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

Fig: ARDUINO UNO

POWER SUPPLY:

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply".

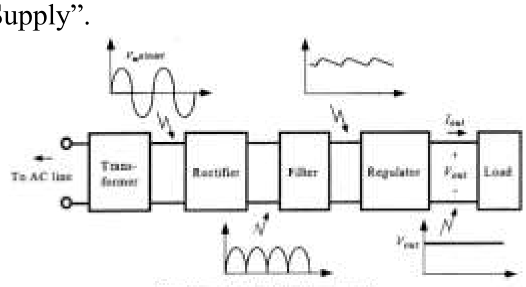


Fig: Block Diagram of Power Supply

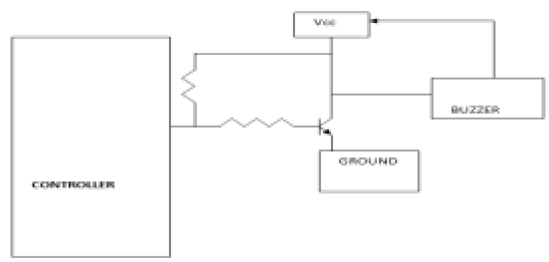
LCD DISPLAY

The model shown here is the one that is most often utilized in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



Vibration Sensor

In order to provide an adjustable digital output dependent on the degree of vibration, this

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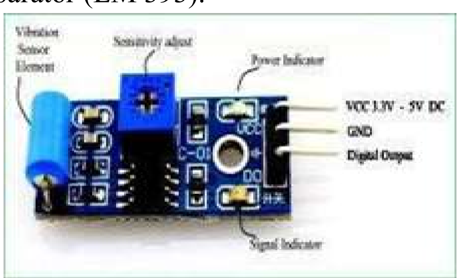
module includes an adjustable potentiometer, a vibration sensor, and an LM393 comparator chip. To get the required quantity, the potentiometer's sensitivity may be changed both up and down. When triggered, the module produces a logic level high (VCC), and when not, it outputs a logic level low (GND). In addition, when the module is activated, an integrated LED illuminates.

Measuring vibration level may lead to the creation of many applications, but precisely detecting vibration is a challenging task. This post will explain the SW-420 vibration sensor and the Arduino interface, which should assist you in creating vibration measurement designs that need less work.

The vibration sensor SW-420 comes with a breakout board that has an LED signal indication, an adjustable on-board potentiometer for choosing the sensitivity threshold, and a comparator (LM 393).



IR SENSOR:

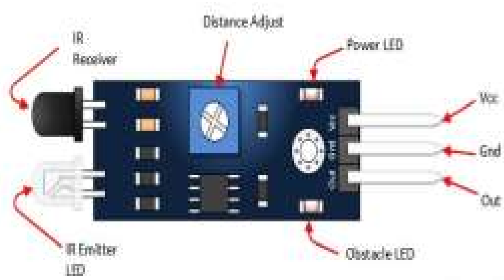
IR technology serves a variety of functions in both industry and everyday life. TVs, for instance, employ infrared sensors to decipher signals sent by remote controls. The key advantages of infrared sensors are their low power consumption, simple construction, and practical properties. Infrared transmissions are invisible to the naked eye. The visible and microwave portions of the electromagnetic spectrum include infrared radiation. These waves typically have wavelengths between 0.7 µm and 1000 µm. There are three sections of the infrared spectrum: near-, mid-, and far-infrared. The wavelength ranges for the near-infrared area are 0.75–3µm, the mid-infrared region is 3–6µm, and the far-infrared region's infrared radiation is more than 6µm.

Numerous wireless applications are addressed by infrared technology. The two primary domains are remote controls and sensors. The near infrared area, mid infrared region, and far infrared region comprise the infrared section of the electromagnetic spectrum. These areas' wavelengths along with their uses are given below.

• Near infrared range: 700–1400 nm; infrared sensors; fiber optic
• Mid-infrared spectrum: heat sensing from 1400 to 3000 nm
• Far infrared range: thermal imaging, 3000 nm to 1 mm

Compared to microwaves, infrared light has a wider frequency range than visible light. In the near infrared, photo optics technologies are employed for optical sensing and optical communication because, when used as a signal source, light is less complicated than radiofrequency (RF). For applications that need short range, optical wireless communication uses infrared data transfer.

To perceive its surroundings, an infrared sensor produces or detects infrared radiation.



ESP 8266:

Produced by Espressif Systems[1] in Shanghai, China, the ESP8266 is a low-cost Wi-Fi microprocessor that has a complete TCP/IP stack and microcontroller functionality. In August 2014, the ESP-01 module, produced by independent producer Ai-Thinker, brought the chip to the notice of Western manufacturers for the first time. With the help of this little module, microcontrollers may establish basic TCP/IP connections and connect to Wi-Fi networks by utilizing Hayes-style instructions.

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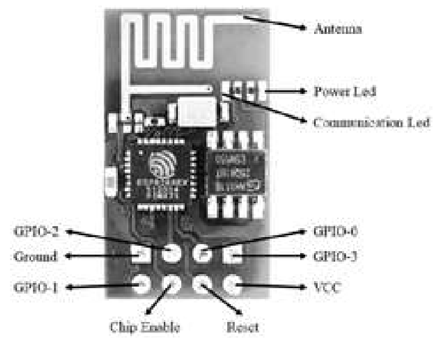
Initially, however, there was very little documentation available in English on the chip and the commands it could execute.[2] Many hackers explored the module, chip, and software, translating the Chinese documentation, because of the very cheap price and the fact that the module had very few external components, suggesting that it may someday be very affordable in production.[3] With its 1 MiB of integrated memory, the ESP8285 is an ESP8266 that enables the creation of single-chip Wi-Fi enabled devices. The pin-compatible ESP32-C3 is part of the ESP32 family of devices, which have replaced these microcontroller chips.

A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 WiFi Module allows any microcontroller to connect to your WiFi network. Either an application may be hosted on the ESP8266, or it can delegate all Wi-Fi networking tasks to another application processor. Since each ESP8266 module has an AT command set firmware pre-programmed, all you have to do is connect it to your Arduino device to obtain about the same amount of WiFi functionality as a WiFi shield—and that's right out of the box! The ESP8266 module is a very affordable board with a large and continuously expanding community.

MQ2- SENSOR



The MQ2 flammable gas and smoke sensor measures the amount of combustible gas present in the atmosphere and provides an analog voltage as a result. The sensor has a 300–10,000 ppm range for measuring combustible gas concentrations. The sensor uses less than 150 mA at 5 V and can function in temperatures ranging from -20 to 50°C.

The heating (H) pins of the sensor may be connected to five volts to maintain a temperature that allows proper operation. The sensor emits an analog voltage on the other pins when five volts are connected to either the A or B pins. The sensitivity of the detector is adjusted by a resistive load placed between the output pins and ground. Please take notice that the datasheet's image of the top arrangement is incorrect. The pin layouts in both variants are identical and align with the bottom configuration. The resistive load should be calibrated using the datasheet's calculations for your specific application; nonetheless, 20 kΩ is a decent place to start when choosing a resistor.

IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

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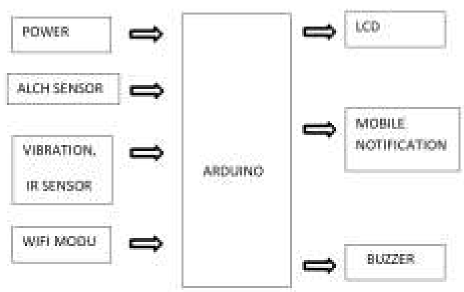
4.1. BLOCK DIAGRAM:



WORKING

The Smart Helmet for Bike Riders integrates a number of sensors and communication components to improve rider safety. The system keeps an eye out for any collisions, makes sure the rider is wearing the helmet correctly, and determines if the rider has had alcohol. In the event of an emergency, the system also uses GSM to transmit notifications. An outline of the system's operation may be found below:

1. System Components

- **IR Sensor (Infrared Sensor)**: Ensures that the helmet is worn correctly by detecting the rider's presence inside the helmet.
- **MQ-2 Gas Sensor**: Detects alcohol consumption by sensing alcohol vapor in the rider's breath.
- **GSM Module (e.g., SIM800L)**: Used for wireless communication, sending alert messages to emergency contacts or authorities in case of an accident.
- **Vibration/Accelerometer Sensor** (optional): Detects if the rider has fallen or if an accident has occurred.
- **Arduino or Microcontroller**: Acts as the central control unit that processes the input from sensors and handles communication through the GSM module.
- **Buzzer/LED Indicator** (optional): Provides an audible or visual alert when alcohol is detected or the helmet is not worn properly.
- **Power Supply**: Batteries or USB power to drive the system.

2. Helmet Detection Using IR Sensor

- The **IR sensor** is placed inside the helmet to detect whether the rider is wearing it. It works by emitting infrared light and detecting its reflection when blocked by an object (in this case, the rider's head).
- If the IR sensor does not detect the rider's presence inside the helmet, the **microcontroller** will prevent the bike from starting by sending a signal to the **ignition control system**.
- The system ensures that the bike will only start if the helmet is properly worn.

3. Alcohol Detection Using MQ-2 Sensor

- The **MQ-2 gas sensor** is used to detect the presence of alcohol in the rider's breath. The sensor is placed inside the helmet near the rider's mouth, and it detects the concentration of alcohol vapor.
- If the alcohol concentration exceeds a predefined threshold, the sensor sends a signal to the **Arduino**, which triggers an alert. This can either:
  - **Prevent the bike from starting** (by controlling the ignition system).
  - **Sound an alarm** using a buzzer or flash an LED to notify the rider.
- The system can also trigger the GSM module to send a message to a predefined emergency contact (e.g., a family member or the authorities) with the rider's location.

4. Accident Detection (Optional)

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- A **vibration or accelerometer sensor** can be used to detect accidents. The sensor monitors sudden movements or impacts that are indicative of an accident.
- If the sensor detects a strong vibration or acceleration beyond a certain threshold, the system assumes that the rider may have been in an accident.
- The Arduino then triggers the **GSM module**, which sends an emergency SMS containing the rider's **GPS location** to emergency contacts for assistance.

5. Wireless Communication Using GSM

- The **GSM module** is responsible for sending text messages in case of an emergency, such as:
  - When the rider is detected as intoxicated (high alcohol levels).
  - When an accident is detected via the accelerometer/vibration sensor.
- The module uses a SIM card and connects to the cellular network to send **SMS** notifications with the necessary details, such as the type of alert (alcohol detection or accident) and the GPS coordinates of the rider (if a GPS module is integrated).

V. CONCLUSION

IR sensors, MQ-2 gas sensors, and GSM connectivity are just a few of the technologies that are integrated into the Smart Helmet for Bike Riders to provide a strong safety system for riders. Riders' primary safety concerns are addressed by the system, which also provides real-time accident detection, alcohol consumption detection, and helmet use verification. Improving rider safety and facilitating quicker emergency response are made possible by the capability to transmit automated notifications in the case of an accident or when alcohol is detected.

The preventative procedures of the system, which include turning off the bike's ignition if the helmet is not worn or alcohol is detected, assist lower the hazards related to driving while intoxicated and to helmet noncompliance. Emergency warnings and position information may be delivered in real-time to predetermined contacts via the use of GSM technology for cellular communication, providing a lifeline in dire circumstances.

Although the technology greatly increases rider safety, there are many drawbacks, including its reliance on battery life and the availability of the GSM network. However, the smart helmet is a useful invention that may improve motorcycle safety going forward, and it can be improved even further with new developments in battery management, communication technology, and sensor accuracy.

All things considered, this smart helmet system provides a workable, scalable, and efficient way to lessen the hazards that bike riders encounter and can significantly increase road safety.

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