# 8.Smart Helmet

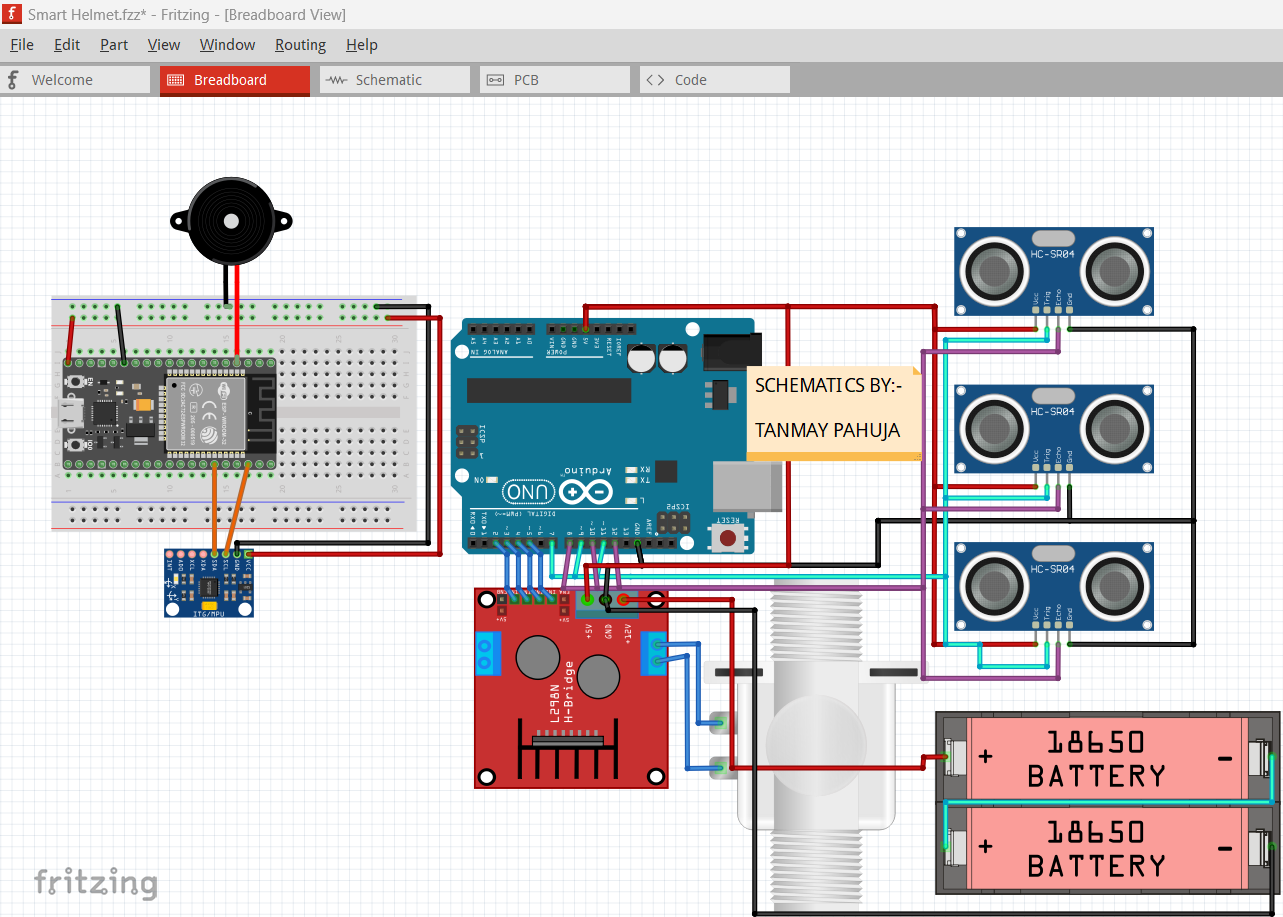
## Project Description: -

The Smart Helmet is an advanced safety device designed to protect motorcycle riders by integrating real-time accident detection, obstacle avoidance, and wireless alert systems. The helmet operates independently, without requiring direct communication with the motorcycle. The system includes multiple sensors to monitor the rider's safety, including an IMU for accident detection and ultrasonic sensors for obstacle detection. If an accident occurs, a buzzer is triggered to alert nearby individuals. Additionally, if an obstacle is detected within a critical range, a pump is activated via an L298N motor driver. The helmet also features Wi-Fi connectivity, utilizing Adafruit MQTT to send alerts to a cloud-based dashboard for emergency response. This ensures rapid assistance in case of an accident while enhancing rider safety through automated protective measures.

## Apparatus: -

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Name** | **Description** | **Qty** |
| 1 | ESP32 | Main microcontroller | 1 |
| 2 | MPU6050 | IMU sensor for motion detection | 1 |
| 3 | Ultrasonic Sensor | Obstacle detection | 3 |
| 4 | L298N Motor Driver | Controls pump activation | 1 |
| 5 | Pump | Activates on obstacle detection | 1 |
| 6 | Buzzer | Alerts on accident detection | 1 |
| 7 | LED Indicator | Visual safety warning | 1 |
| 8 | Battery Pack | Power source | 1 |

## Connection: -

  
MPU6050 (IMU Sensor): SDA -> GPIO 21, SCL -> GPIO 22

Ultrasonic Sensors:

Sensor 1: TRIG -> GPIO 12, ECHO -> GPIO 14

Sensor 2: TRIG -> GPIO 26, ECHO -> GPIO 27

Sensor 3: TRIG -> GPIO 32, ECHO -> GPIO 33

L298N Motor Driver: IN -> GPIO 4

Buzzer: GPIO 3

LED Indicator: GPIO 5

## Code: -

#include <Wire.h>

#include <MPU6050.h>

#include <WiFi.h>

#include <Adafruit\_MQTT.h>

#include <Adafruit\_MQTT\_Client.h>

MPU6050 mpu;

int buzzer = 3;

int led = 5;

int trigPin1 = 12, echoPin1 = 14;

int trigPin2 = 26, echoPin2 = 27;

int trigPin3 = 32, echoPin3 = 33;

int pumpPin = 4;

const char\* ssid = "YourWiFi";

const char\* password = "YourPassword";

const char\* mqtt\_server = "io.adafruit.com";

WiFiClient client;

Adafruit\_MQTT\_Client mqtt(&client, mqtt\_server, 1883);

void setup() {

  Serial.begin(115200);

  pinMode(trigPin1, OUTPUT);

  pinMode(echoPin1, INPUT);

  pinMode(trigPin2, OUTPUT);

  pinMode(echoPin2, INPUT);

  pinMode(trigPin3, OUTPUT);

  pinMode(echoPin3, INPUT);

  pinMode(pumpPin, OUTPUT);

  pinMode(buzzer, OUTPUT);

  pinMode(led, OUTPUT);

  Wire.begin();

  mpu.initialize();

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL\_CONNECTED) {

    delay(500);

    Serial.print(".");

  }

  Serial.println("WiFi Connected");

}

void loop() {

  float accelerationX, accelerationY, accelerationZ;

  mpu.getAcceleration(&accelerationX, &accelerationY, &accelerationZ);

  if (accelerationX > 2000 || accelerationY > 2000 || accelerationZ > 2000) {

    Serial.println("Accident Detected!");

    digitalWrite(buzzer, HIGH);

  }

  int distance1 = measureDistance(trigPin1, echoPin1);

  int distance2 = measureDistance(trigPin2, echoPin2);

  int distance3 = measureDistance(trigPin3, echoPin3);

  if (distance1 < 20 || distance2 < 20 || distance3 < 20) {

    digitalWrite(pumpPin, HIGH);

    Serial.println("Obstacle detected, Pump activated!");

  } else {

    digitalWrite(pumpPin, LOW);

  }

  delay(500);

}

int measureDistance(int trig, int echo) {

  digitalWrite(trig, LOW);

  delayMicroseconds(2);

  digitalWrite(trig, HIGH);

  delayMicroseconds(10);

  digitalWrite(trig, LOW);

  return pulseIn(echo, HIGH) \* 0.034 / 2;

Project Outcome: -

Accident Detection: The IMU sensor continuously monitors the rider’s movements. If an impact or unusual motion pattern is detected, the system triggers a buzzer to alert nearby individuals. This ensures quick assistance in case of an accident.

Obstacle Avoidance: Three ultrasonic sensors actively scan for obstacles. If an obstacle is detected within a critical distance, the helmet activates a pump via the L298N motor driver, responding to potential dangers automatically.

Wireless Emergency Alerts: The helmet is Wi-Fi-enabled and uses Adafruit MQTT to send notifications about accidents or critical events to a cloud-based dashboard. This allows emergency responders to act swiftly when needed.

Standalone and Portable: Powered by a rechargeable battery pack, the helmet operates independently without requiring a wired connection to the motorcycle, offering convenience and enhanced safety.

Comprehensive Safety Enhancement: By integrating accident detection, obstacle avoidance, and wireless emergency alerts, the Smart Helmet significantly improves motorcycle rider safety, minimizing accident risks and ensuring timely assistance.