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"SMART HELMET – FALL DETECTION OF RIDERS USING INERTIAL SENSORS AND TO AVOID ACCIDENTS OCCURRENCE"

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Abstract-
Motorcycle accidents are occurring with intimidating frequency and the number of losses of lives is also adding up day by day. The smart helmet is a wearable device designed to enhance the safety and security of motorcycle riders. It uses IR detectors, GPS, GSM modules, alcohol detectors and ultrasonic detectors. It provides an array of features.
The smart helmet has a module that tries to determine whether the rider is wearing the helmet or not. The vehicle is not able to start, if the rider did not wear the helmet and if he is an alcoholic. For this we use IR detectors and alcohol detectors. The ultrasonic detector provides accident avoidance by detecting any objects approaching the rider from the rear, which alerts the rider by a beep sound and displays the information on the LCD screen. GPS and GSM modules are used in accident detection.
Overall, the smart helmet provides an advanced position of safety and security to motorcycle riders, making their trip safer and further secure.
Keywords- *smart helmet, IR detectors, GPS, GSM modules, alcohol detectors and ultrasonic detectors*

Introduction:

The safety of motorcycles is increased by a smart helmet using GSM and GPS technology. Another benefit of this initiative is that it allows for the testing of intoxicated cyclists. For use on a helmet, we are creating an embedded kit or embedded system. In that system the helmet acts as a key and if the alcohol level exceeds the threshold, the ignition will stop. The sensors on the bike warn the user if a barrier is very close by. This is done by beeping and displaying a message on the LCD screen at the rear of the vehicle. In case of an accident, the family member receives the latitude and longitude of the accident location through the global positioning system.
However the main objective of our work is to make it illegal for riders to wear helmets while riding, as well as to address other significant accident-related problems. This sense of moral obligation to society thus served as the impetus for our "Smart Helmet" initiative.
An integrated system is a particular type of computer system that is primarily made to carry out several activities, including accessing, processing, storing, and controlling the data in various electronics-based systems. Embedded systems are made up of both hardware and software, with the software—often referred to as firmware—being included within the hardware. These systems' ability to deliver O/P within deadlines is one of its most important qualities.
Supporting embedded systems improves productivity and convenience at work. Hence, integrated systems can be used in both basic and complicated devices. The principal usage of embedded systems are in the equipment we use every day, such as microwaves, calculators, TV remote controls, home security systems, and local traffic management systems.

Objective:

- To design smart helmet to provide safety to bike riders as well as provide information to family members regarding the location of an accident.
- To determine whether the rider wear a helmet or not.
- To determine whether the rider is drunk or not.
- To detect obstacles or vehicles coming close to the back of the bike.

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Transmitter section:

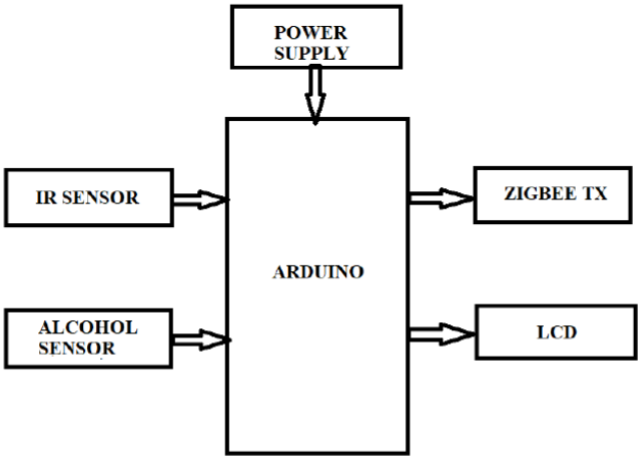
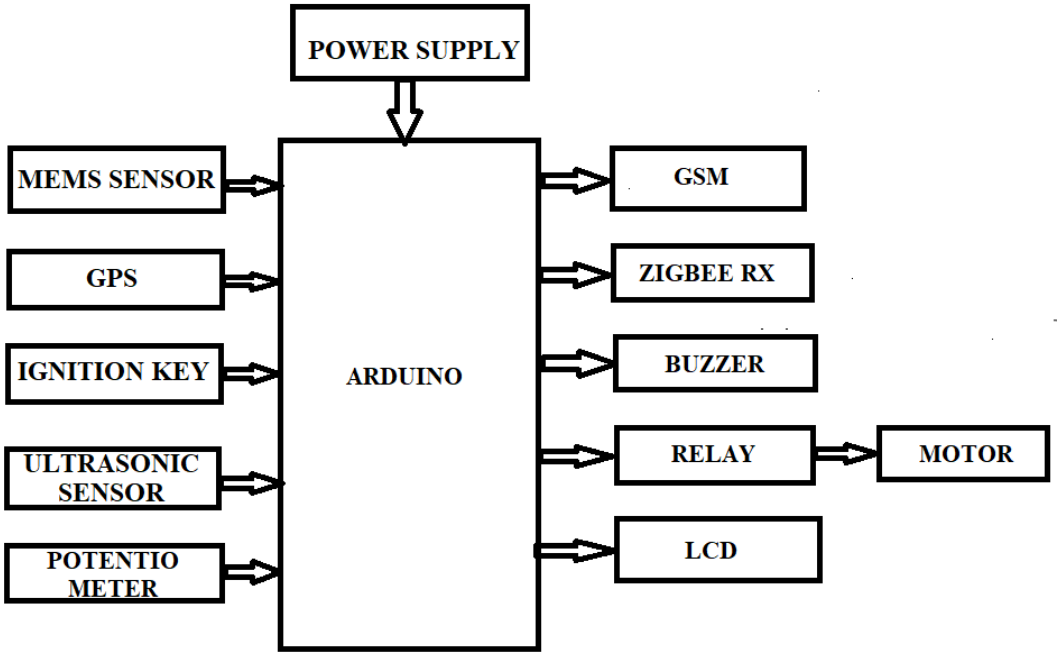


Fig:1 Block diagram of transmitter

Receiver section:



Block diagram of receiver

Components: Arduino , Arduino Pinout, Ultrasonic sensor, Potentiometer, Zigbee Module, IR sensor, MQ2 sensor, GPS, GSM, Relay, LCD.

Methodology:

In this paper, the code is divided into 2 categories.

1. Transmitter code
2. Receiver code

Transmitter code:

#include<LiquidCrystal.h>

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```
#include<SoftwareSerial.h>
#define ir 2
#define gas 3
LiquidCrystal lcd(4,5,6,7,8,9);
//LiquidCrystal lcd(rs,en,d4,d5,d6,d7);
SoftwareSerial ss(10,11);
void setup() {
// put your setup code here, to run once:
Serial.begin(9600);
ss.begin(9600);
lcd.begin(16,2);
pinMode(ir,INPUT);
pinMode(gas,INPUT);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("SMART HELMET ");
delay(1000);
}
void loop() {
// put your main code here, to run repeatedly:
int a = digitalRead(ir);
Serial.print("ir:");
Serial.println(a);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("IR: ");
lcd.setCursor(0,1);
lcd.print(a);
delay(1000);
int b = digitalRead(gas);
Serial.print("alcohol:");
Serial.println(b);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Alcohol: ");
lcd.setCursor(0,1);
lcd.print(b);
delay(1000);
if(a == 0 && b == 1)
{
Serial.println("motor on");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Helmet detected");
lcd.setCursor(0,1);
lcd.print("No alcohol detects");
delay(1000);
ss.write('a');
Serial.println("a");
}
else if(a==1 && b==0)
{
```

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Receiver code :

```
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_ADXL345_U.h>
Adafruit_ADXL345_Unified accel = Adafruit_ADXL345_Unified();
#include <TinyGPS.h>
#include <SoftwareSerial.h>
SoftwareSerial ss(4, 3);
#include <LiquidCrystal.h>
const int rs=2,en=9,d4=10,d5=11,d6=12,d7=13 ;
LiquidCrystal lcd(rs,en,d4,d5,d6,d7);
int S=A0;
int key=8;
int buzzer=A1;
int trigPin=6;
int echoPin=5;
int distance;
long duration;
#define relay 7
//static const int RXPin = 4, TXPin = 3;
//
//static const uint32_t GPSBaud = 9600;
String msg;
// The TinyGPSPlus object
TinyGPSgps;
float flat,flon;
// The serial connection to the GPS device
//SoftwareSerial ss(RXPin, TXPin);
void setup() {
// put your setup code here, to run once:
Serial.begin(9600);
ss.begin(9600);
lcd.begin(16,2);
Serial.print("GPS "); Serial.println(TinyGPS::library_version());
Serial.println("Ready to Start");
Serial.println();
pinMode(buzzer, OUTPUT);
pinMode(relay, OUTPUT);
pinMode(key, INPUT_PULLUP);
pinMode(trigPin, OUTPUT);
pinMode(echoPin,INPUT);
if(!accel.begin())
{
Serial.println("No ADXL345 sensor detected.");
while(1);
}
digitalWrite(relay,LOW);
digitalWrite(buzzer,LOW);
}
void loop() {
while(Serial.available()>0)
```

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```
{
char k =(char)Serial.read();;
Serial.println(k);
if(k=='a')
{
KEY();
Serial.println("motor on");
// digitalWrite(relay,HIGH);
// lcd.clear();
// lcd.setCursor(0,0);
// lcd.print("ENGINE ON");
// delay(1000);
}
if(k=='b')
{
digitalWrite(relay,LOW);
Serial.println("motor off");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("ENGINE OFF");
delay(1000);
}
if(k=='c')
{
digitalWrite(relay,LOW);
Serial.println("motor off");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("ENGINE OFF");
delay(1000);
}
if(k=='d')
{
digitalWrite(relay,LOW);
Serial.println("motor off");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Alcohol detected");
lcd.setCursor(0,1);
lcd.print("ENGINE OFF");
SEND();
delay(1000);
}
}
sensors_event_t event;
accel.getEvent(&event);
Serial.print("X: "); Serial.print(event.acceleration.x); Serial.print(" ");
Serial.print("Y: "); Serial.print(event.acceleration.y); Serial.print(" ");
Serial.print("Z: "); Serial.print(event.acceleration.z); Serial.print(" ");
Serial.println("m/s^2 ");
delay(500);
if(event.acceleration.y<7){
```

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```
digitalWrite(relay, LOW);
Serial.println("ACCIDENT OCCURED");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("ACCIDENT OCCURED");
delay(2000);
msg="ACCIDENT OCCURED";
SEND();
}
bool newData = false;
unsigned long chars;
unsigned short sentences, failed;
// For one second we parse GPS data and report some key values
for (unsigned long start = millis(); millis() - start < 1000;)
{
while (ss.available())
{
char c = ss.read();
// Serial.write(c); // uncomment this line if you want to see the GPS data flowing
if (gps.encode(c)) // Did a new valid sentence come in?
newData = true;
}
}
if (newData)
{
// float flat, flon;
unsigned long age;
gps.f_get_position(&flat, &flon, &age);
Serial.println("LAT=");
Serial.println(flat == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flat, 6);
// Serial.println(flat);
Serial.println(" LON=");
Serial.println(flon == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flon, 6);
}
int Speed=analogRead(S);
Serial.println("SPEED");
Serial.println(Speed);
lcd.clear();
lcd.setCursor(0,0);
lcd.println("SPEED");
lcd.setCursor(0,1);
lcd.println(Speed);
if(Speed > 600){
Serial.println("VEhicle");
digitalWrite(trigPin, LOW);
delay(200);
digitalWrite(trigPin, HIGH);
delay(500);
digitalWrite(trigPin,LOW);
duration = pulseIn(echoPin, HIGH);
distance = duration* 0.034 / 2;
Serial.println("Distance: ");
```

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```
Serial.println(distance);
Serial.println("cm");
lcd.clear();
lcd.setCursor(0,0);
lcd.println("Distance: ");
lcd.setCursor(0,1);
lcd.println(distance);
lcd.setCursor(10,1);
lcd.println("cm");
delay(2000);
if (distance<15){
digitalWrite(buzzer,HIGH);
delay(2000);
digitalWrite(buzzer,LOW);
delay(100);
Serial.println("MOTOR ON");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Vehicle in back side");
lcd.setCursor(0,1);
lcd.print(" side");
msg=" Vehicle in back side ";
SEND();
delay(1000);
}
}
}
void SEND()
{
ss.println("AT");
delay(200);
ss.println("ATE0");
delay(200);
ss.println("AT+CMGF=1");
delay(200);
ss.println("AT+CMGS=\"+917702188531\"");
delay(200);
ss.println(msg);
ss.println( "http://www.google.com/maps/place/" + String(flat) + "," + String(flon));
delay(300);
ss.write(26);
Serial.println("Message sent..");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Message sent..");
delay(2000);
}
void KEY(){
int key_val=digitalRead(key);
Serial.println("KEY");
Serial.println(key_val);
lcd.clear();
```

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```
lcd.setCursor(0,0);
lcd.println("KEY");
lcd.setCursor(0,1);
lcd.println(key_val);
delay(1000);
if(key_val== 0){
digitalWrite(relay,HIGH);
Serial.println("MOTOR ON");
lcd.clear();
lcd.setCursor(0,1);
lcd.print("MOTOR ON");
delay(3000);
digitalWrite(relay,LOW);
delay(100);
}}
Serial.println("motor off");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Alcohol detected");
lcd.setCursor(0,1);
lcd.print("Wear a helmet");
delay(1000);
ss.write('b');
Serial.println("b");
}
else if(a==1 && b==1)
{
Serial.println("motor off");
lcd.clear();
lcd.setCursor(0,0);
//lcd.print("Alcohol detected");
lcd.setCursor(0,1);
lcd.print("Wear a helmet");
delay(1000);
ss.write('c');
Serial.println("c");
}
else if(a==0 && b==0)
{
Serial.println("motor off");
lcd.clear();
lcd.setCursor(0,0);
//lcd.print("Alcohol detected");
//lcd.setCursor(0,1);
//lcd.print("Wear a helmet");
delay(1000);
ss.write('d');
Serial.println("d");
    }}
```

Result:

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smart helmet-fall detection system using inertial sensors and to avoid accident occurrence system is designed for motorcycle riders to maintain a high level of safety and security. As a result of this project, the death rate of motorcycle riders will decrease.

• When the riders not wear the helmet then display shows the message wear the helmet

Fig 2: LCD Display wears the helmet alert

• If the riders wear the helmet then the ignition is on in our project the ignition means a motor is on.

Fig 3: LCD Display the motor is on

• If the rider drink's alcohol then the sensor in the helmet is detected and engine will off.

Fig 4: LCD display the alcohol detected warning

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• If the other vehicle come near to our vehicle then beep sound is given by the buzzer and shows the message that vehicle in back side .

Fig 5: LCD display the vehicle in back side

• If any accident will occur at deserted places then message will sent to your family members with that particular location.

Fig 6: LCD display the accident occurred

Fig 7: LCD display the message sent

• The notification receive to the phone from GSM & GPS module

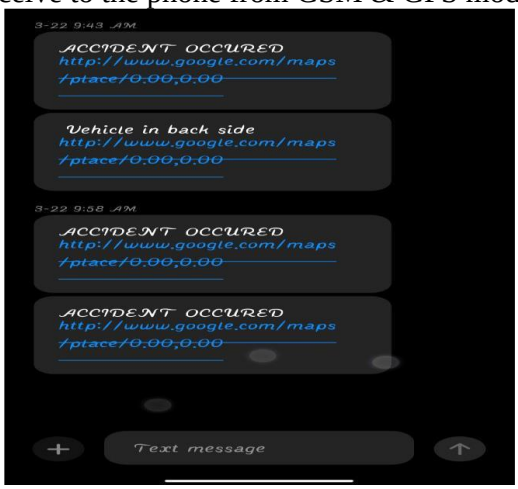

Fig 8 : SMS receives to the phone

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Fig 9:Transmitter section

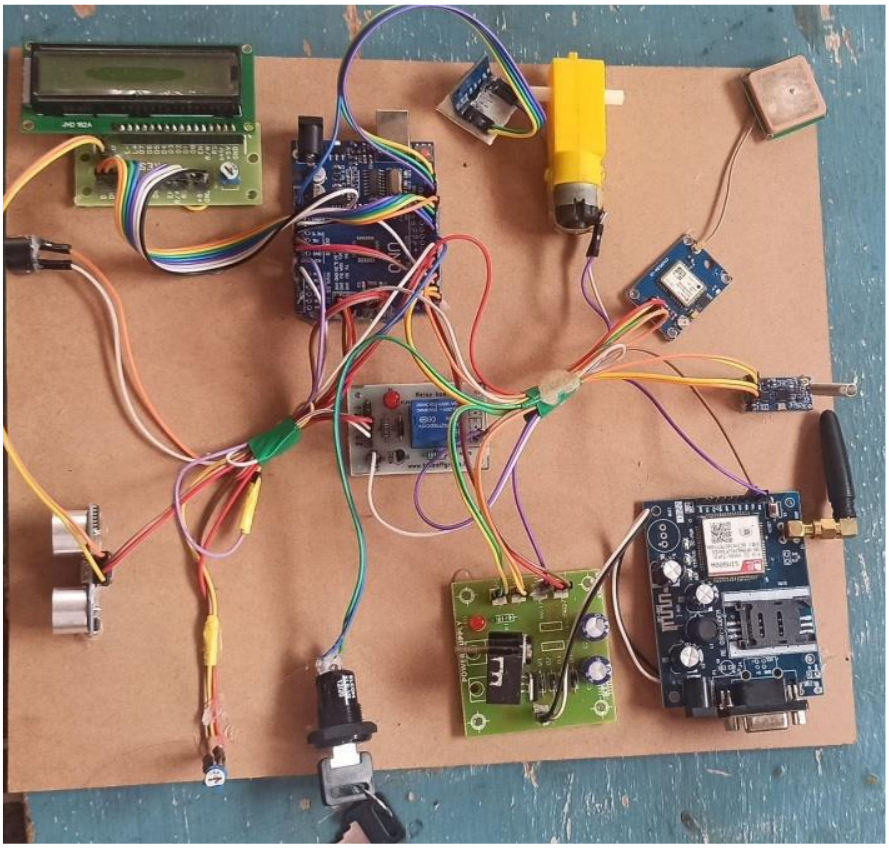

Fig 10 : Receiver section

Conclusion:

The outcomes of the project have shown that the bike ignition will start if the helmet is worn (using IR sensor), the ignition of the bike stops when the rider is consuming alcohol (using MQ2 sensor), alerting the rider when obstacles or vehicles come close to the back of the bike (using ultrasonic sensor) and sending the accident location to the family member (using the GPS and GSM module). So, it will automatically reduce the effects of the accident. Arduino is good in controlling all the system and the sensors.

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