EMERGENCY ALERT HELMET

A MINI-PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project **"EMERGENCY ALERT HELMET"** is the bonafide work of **"SANJAY S (210701231) and SHRIRAM KUMAR A N (210701247)"** who carried out the projectwork under my supervision.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

The Emergency Alert Helmet is a groundbreaking innovation designed to expedite emergency response times and enhance the chances of survival for accident victims. This smart helmet, equipped with a force resistive sensor, a GPS module, and a GSM module integrated with an Arduino microcontroller, detects significant impacts indicative of an accident. Upon detecting a force exceeding a predefined threshold, the helmet's system automatically triggers an alert message, including the precise location of the accident, which is sent to the nearest ambulance service and emergency contacts. By bridging the gap between the occurrence of an accident and the arrival of medical help, the Emergency Alert Helmet stands as a beacon of hope, potentially reducing fatalities and improving outcomes for accident victims. Timely medical assistance is paramount in the critical moments following a road accident. The helmet's ability to initiate swift responses and provide accurate location data can significantly increase the chances of survival and reduce the severity of injuries sustained. This innovative technology represents a significant advancement in road safety, leveraging sensors, communication modules, GPS tracking, and microcontrollers to revolutionize emergency response capabilities. The Emergency Alert Helmet has the potential to save lives by ensuring that medical help is dispatched as quickly and accurately as possible following an accident.

ACKNOWLEDGEMENT

First, we thank the almighty god for the successful completion of the project. Our sincere thanks to our Chairman **Mr. S. Meganathan, B.E., F.I.E**., for his sincere endeavor in educating us in his premier institution. We would like to express our deep gratitude to our beloved Chairperson **Dr. Thangam Meganathan, Ph.D.,** for her enthusiastic motivation which inspired us a lot in completing this project and Vice Chairman **Mr. Abhay Shankar Meganathan, B.E., M.S.,** for providing us with the requisite infrastructure. We also express our sincere gratitude to our college Principal**, Dr. S.N. Murugesan M.E., PhD.,** and **Dr. P. KUMAR, M.E.,** Head of the Department of Computer Science and Engineering and our project guide **Mr. S. SURESH KUMAR, M.E.,** for his encouragement and guiding us throughout the project and to our parents,friends, all faculty members and supporting staffs for their direct and indirect involvement in successful completion of the project for their encouragement and support.

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CHAPTER 1

INTRODUCTION

In an era where road safety is of paramount concern, the Emergency Alert Helmet emerges as a beacon of innovation, poised to revolutionize the way we respond to road accidents. This project is at the forefront of integrating technology with personal safety equipment to create a proactive system that not only protects but also communicates in critical times of need. The Emergency Alert Helmet is designed with the vision of harnessing the power of smart technology to save lives. It is a sophisticated blend of a force resistive sensor, a GPS module, and a GSM module, coupled with an Arduino microcontroller, to detect and respond to the immediate aftermath of road accidents. The helmet's ability to sense significant impacts and automatically relay crucial information, such as the wearer's precise location, to emergency services is a game-changer in emergency medical response.

The introduction of this helmet into the market aims to address the urgent need for faster and more efficient emergency medical interventions following road accidents. By providing a direct line of communication between the accident victim and emergency responders, the Emergency Alert Helmet significantly cuts down the time it takes for help to arrive. This is not just a piece of safety equipment; it is a potential lifesaver, offering peace of mind to riders and their loved ones. This project stands as a testament to the incredible advancements in wearable technology and its application in real-world scenarios where every second counts.

CHAPTER 2

LITERATURE SURVEY

In [1] the paper explains about the bike accidents happening around us right now. a number of the causes individuals fall ill or can die is because they are not wearing helmets. If a helmet had been worn at that point of the tragedy, many individuals may have survived. There is constant breaking of traffic laws. A smart helmet with a system of internal controls is suggested as a solution to these issues. The purpose of the Smart Helmet for Bikers project aims to improve motorcycle riders' rate of road safety. The concept was developed as it became apparent that motorcycle riders are becoming increasingly concerned about the rising frequency of fatal traffic incidents over time. It is made up of an RF reception system and an RF transmitter.

In [2] This paper works a smart helmet is a wearable device that has attracted attention in various fields, especially in applied sciences, where extensive studies have been conducted in the past decade. In this study, the current status and trends of smart helmet research were systematically reviewed. Five research questions were set to investigate the research status of smart helmets according to the year and application field, as well as the trend of smart helmet development in terms of types of sensors, microcontrollers, and wireless communication technology.

In [3] safety with luxurious and intelligent features using a smart helmet. Two modules one on the helmet and bike each will work in synchronization, to ensure that the biker is wearing the helmet. A radio frequency module is responsible for the wireless communication between the helmet and the bike circuit. The Piezo electric buzzer is used to detect speeding and this feature is extended by limiting the speed of the user.

[4] This paper introduces the development of the smart helmet needed to respond to accidents of rescue workers in the event of a disaster. With the emergence of many IoT-based devices and applications, many of the services that use them are active. However, each service was developed in a specific field, making it difficult to apply new devices, modify application and make changes to services. Our researchers have developed the new software framework enable to integrate a wide range of devices and services and efficiently manage resources.

[5] This paper aims for avoidance of accidents and develop helmet detection system. The proposed system is an intelligent/safety helmet. A module affixed in the helmet, such that, the module will sync with the module affixed on bike and will also ensure that biker has worn Helmet. Additional feature of accident avoidance detection module will be installed on the bike.

[6]A smart helmet is a type of protective headgear used by the rider which makes bike driving safer than before. The main purpose of this helmet is to provide safety for the rider. This can be implemented by using advanced features like alcohol detection, accident identification, location tracking, use as a hands free device, fall detection. This makes it not only a smart helmet but also a feature of a smart bike. It is compulsory to wear the helmet, without which the ignition switch cannot turn ON. An RF Module can be used as wireless link for communication between transmitter and receiver. If the rider is drunk the ignition gets automatically locked, and sends a message to the registered number with his current location.

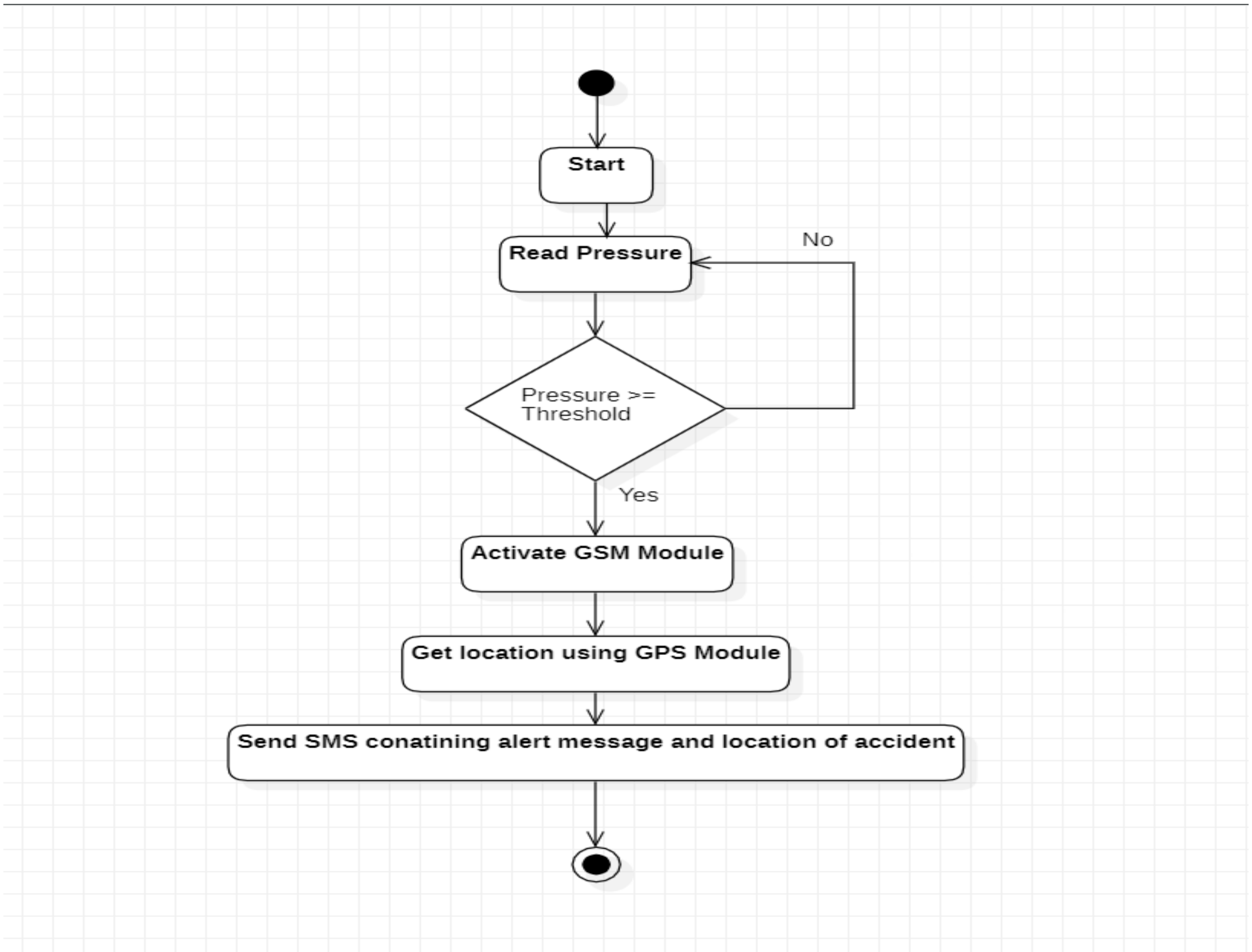
[7] Road accidents are increasing day by day because the riders are not using the helmet and due to consumption of alcohol. In today's world, huge numbers of people are dying on road accidents. By using smart helmet, the accidents can be detected. The main target of the project is designing a smart helmet for accident avoidance and alcohol detection. The IR sensor checks if the person is wearing the helmet or not. The Gas sensor recognizes the alcoholic substance in the rider's breath. If the person is not wearing the helmet and if he consumes alcohol, the bike will not start. If there is no sign of alcoholic substance present and helmet is used, then only the bike will start.

2.1 EXISTING SYSTEM

The current methods for responding to road accidents and ensuring timely medical intervention rely heavily on manual processes and traditional communication channels. In the event of an accident, bystanders or victims must manually contact emergency services, which involves dialing emergency numbers, providing location details, and describing the situation—tasks that can be challenging under stress. Some advancements include smartphone applications that detect impacts and trigger alerts, vehicle-based systems with automatic emergency calls, and wearable devices that detect falls. However, these solutions have significant drawbacks: they often require manual intervention, are costly and thus not widely adopted, and can suffer from location accuracy issues. The reliance on manual calls can delay help if the victim is unable to call, and the high cost of advanced systems limits their use to newer or high-end models and specific regions. There is a clear need for an automated, reliable, and affordable system that detects accidents and promptly alerts emergency services with precise location details, ensuring quicker response times and potentially saving lives. The Emergency Alert Helmet aims to address this need by integrating advanced detection and communication technologies into a single, effective solution.

CHAPTER 3

PROJECT DESCRIPTION



The depicted activity diagram outlines a process triggered by pressure detection. When the pressure value meets or exceeds a predefined threshold, the system activates a GSM module, retrieves the location using a GPS module, and sends an SMS containing an alert message along with the accident location. Conversely, if the pressure remains below the threshold, no further action is taken. This system appears to be designed for safety monitoring, possibly related to emergencies or accidents.

3.1 PROPOSED SYSTEM

The proposed system aims to revolutionize emergency response for road accidents by integrating advanced technology into a smart helmet. This system eliminates the delays and challenges associated with traditional methods of seeking help after an accident. Equipped with a force resistive sensor, a GPS module, and a GSM module, all integrated with an Arduino microcontroller, the Emergency Alert Helmet automatically detects significant impacts indicative of an accident. Upon detecting such an impact, the system instantly sends an alert message containing the precise location of the accident to the nearest ambulance service and emergency contacts. This automation drastically reduces the time taken for emergency services to be notified, bypassing the need for manual intervention. By leveraging the GPS module, the system provides accurate location data, ensuring that medical responders can reach the accident site as quickly as possible. The integration of these technologies into a single, wearable device offers a reliable, cost-effective solution that is easy to implement and can significantly enhance road safety. The Emergency Alert Helmet also allows for scalability and improvements. Multiple helmets can be deployed across different regions, and the system can be updated to include additional features or improved sensors. By offering a direct line of communication between accident victims and emergency services, this system minimizes the chances of delays in medical assistance, potentially saving lives and reducing the severity of injuries sustained in road accidents.

3.2 REQUIREMENTS

3.2.1 HARDWARE REQUIREMENTS

- ARDUINO UNO
- GSM MODULE (SIM 900A)
- FORCE RESISTIVE SENSOR
- GPS MODULE (NEO-6M)
- JUMPER WIRES
- POWER ADAPTER
- LAPTOP

3.2.2 SOFTWARE REQUIREMENTS

- ARDUINO IDE

3.3 ARCHITECTURE DIAGRAM

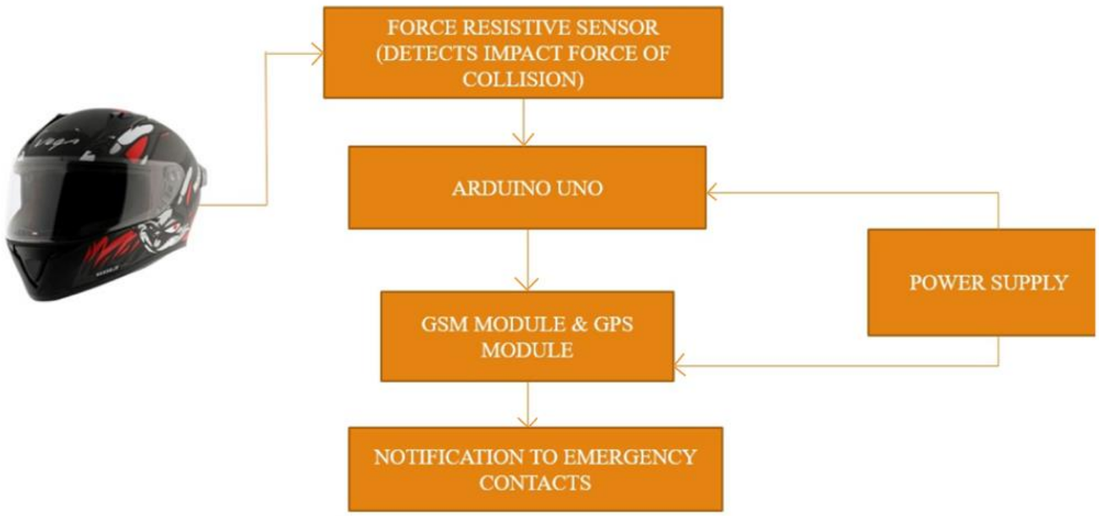
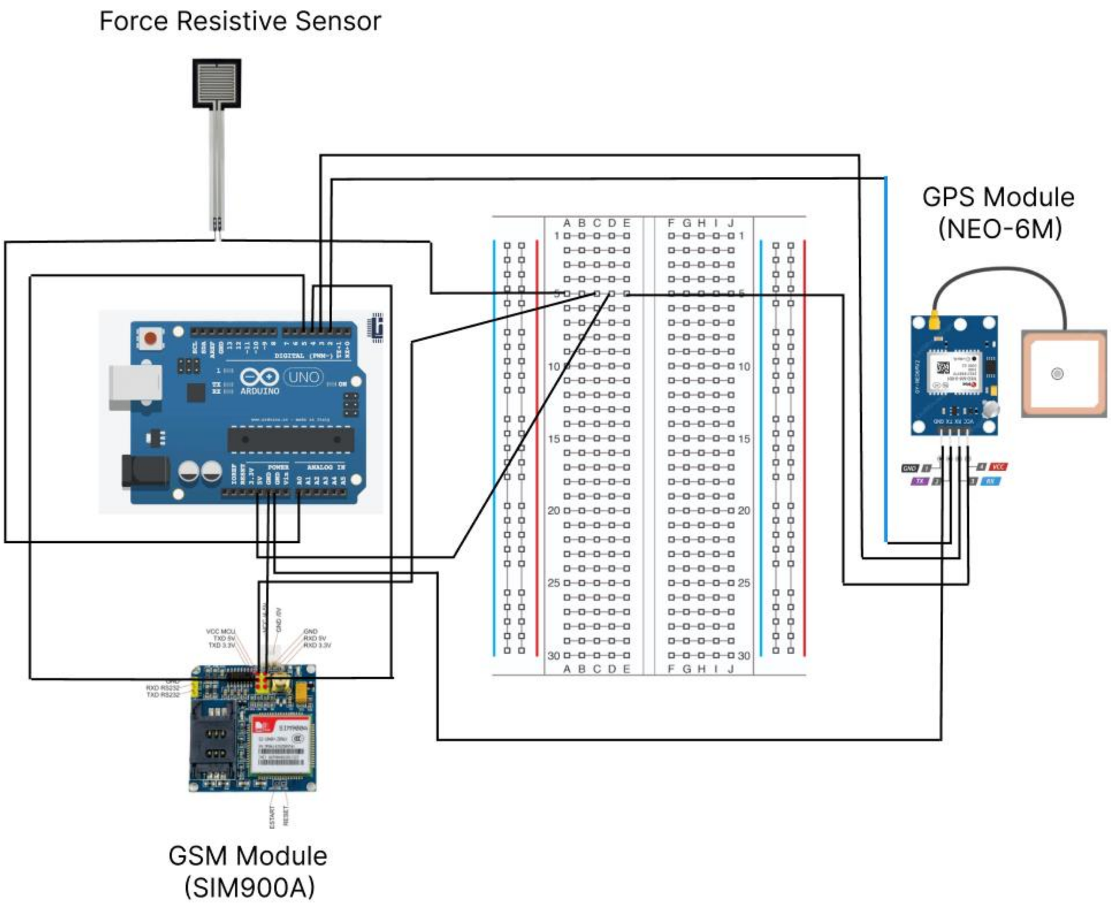


Figure 2

The figure above represents the architecture diagram of the Emergency Alert Helmet system in which an Arduino microcontroller is interfaced with a force resistive sensor, a GPS module, and a GSM module. When a significant impact is detected by the force resistive sensor, the helmet’s system activates, using the GPS module to determine the precise location of the accident and the GSM module to send an alert message to the nearest ambulance service and emergency contacts. The data is securely managed, ensuring that only authorized personnel can update or access the system's configuration, maintaining the reliability and integrity of the emergency response mechanism. This setup, utilizing the specified hardware components, provides an efficient and effective solution for improving road safety and reducing emergency response times.

3.4 CIRCUIT DIAGRAM



In this setup, several key connections are made to facilitate the functionality of the project. The GSM module is interfaced with the Arduino using pins 5 (RX) and 4 (TX) through the SoftwareSerial library, allowing the Arduino to send and receive SMS messages. The RX pin of the GSM module is connected to pin 5 of the Arduino, and the TX pin of the GSM module is connected to pin 4 of the Arduino. Similarly, the GPS module is connected to the Arduino using pins 2 (RX) and 3 (TX) through another instance of the SoftwareSerial library. The RX pin of the GPS module is connected to pin 2 of the Arduino, and the TX pin of the GPS module is connected to pin 3 of the Arduino. This setup enables the Arduino to receive GPS data such as latitude and longitude.

An analog sensor, likely a pressure sensor, is connected to the analog input pin A0 of the Arduino. The sensor provides an analog voltage output proportional to the measured pressure. This voltage is read by the Arduino through the analogRead function, which converts it to a corresponding digital value between 0 and 1023. The sensor's output voltage is then used to calculate the pressure in units based on the predefined constants for zero pressure voltage and voltage per unit pressure.

The Arduino uses the data from the pressure sensor to determine if the helmet has fallen by comparing the calculated pressure to a predefined threshold value (FALL_THRESHOLD_PRESSURE). When the pressure exceeds this threshold, the Arduino checks for the availability of GPS data. If valid GPS data is available, the Arduino retrieves the latitude and longitude coordinates. It then constructs a message containing the fall alert and location information and sends this message to a predefined phone number using the GSM module. If GPS data is not available, the Arduino sends a message indicating the fall without location details. Additionally, the Serial Monitor is used for debugging and monitoring purposes, with Serial.begin(9600) initializing the serial communication at a baud rate of 9600. The Serial Monitor outputs the voltage readings, pressure calculations, and status messages, providing real-time feedback on the system's operations.

3.5 OUTPUT

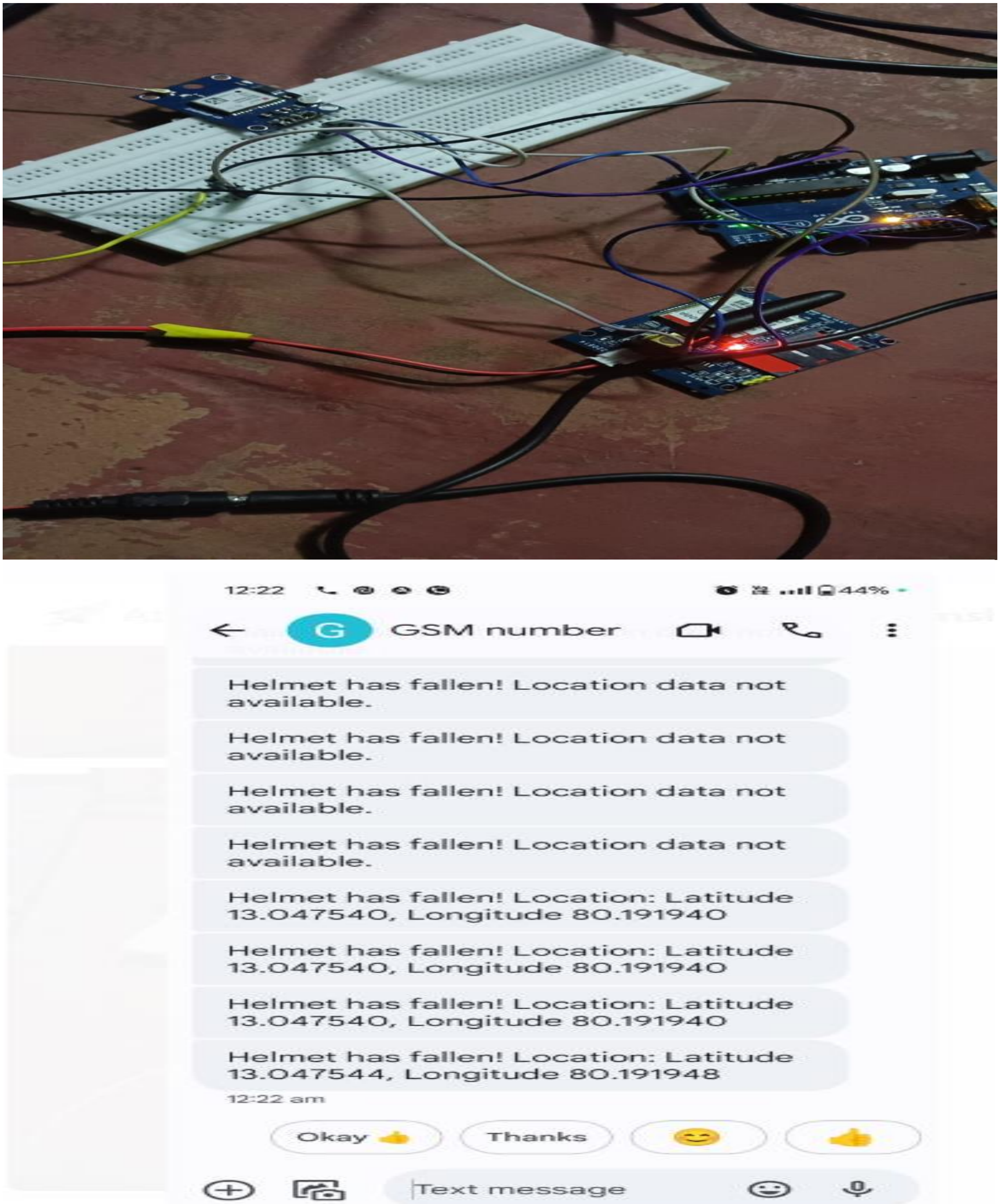

12:22
44%
GSM number
Helmet has fallen! Location data not available.
Helmet has fallen! Location data not available.
Helmet has fallen! Location data not available.
Helmet has fallen! Location data not available.
Helmet has fallen! Location: Latitude 13.047540, Longitude 80.191940
Helmet has fallen! Location: Latitude 13.047540, Longitude 80.191940
Helmet has fallen! Location: Latitude 13.047540, Longitude 80.191940
Helmet has fallen! Location: Latitude 13.047544, Longitude 80.191948
12:22 am
Okay
Thanks
Text message

Figure 6

The connection setup for the Emergency Alert Helmet involves integrating several critical components to ensure seamless operation. The force resistive sensor is attached to the helmet's structure, continuously monitoring for impacts. This sensor is connected to an Arduino microcontroller, which processes the sensor data to determine if the force exceeds the predefined threshold indicative of an accident. Upon detecting such an impact, the Arduino triggers the GSM module to send an alert message. The GSM module, equipped with a SIM card, is pre-programmed with emergency contacts and the nearest ambulance service numbers. When activated, it sends the precise location of the accident, derived from a GPS module connected to the Arduino, ensuring that help is dispatched promptly. This coordinated setup between the sensor, Arduino, GSM module, and GPS ensures a reliable and efficient emergency response system, bridging the critical gap between an accident and the arrival of medical assistance

CHAPTER 4
CONCLUSION AND FUTURE WORK

The Emergency Alert Helmet represents a significant advancement in road safety technology, offering a reliable and efficient solution to expedite emergency response times for accident victims. By integrating a force resistive sensor, GPS module, GSM module, and Arduino microcontroller, this smart helmet automatically detects significant impacts and promptly alerts emergency services with precise location data. The addition of a gyroscope and accelerometer (MPU-6050) further enhances the system’s accuracy in detecting accidents, ensuring a robust and comprehensive response mechanism. Looking ahead, future work will focus on refining sensor accuracy, improving the system’s durability and usability, and exploring additional features such as real-time health monitoring and integration with broader emergency response networks. This ongoing development will aim to further reduce response times, enhance user safety, and ultimately save more lives in road accident scenarios.

APPENDIX I

gsm_gps.c

```
#include <TinyGPS++.h>
#include <SoftwareSerial.h>

const float VOLTAGE_AT_ZERO_PRESSURE = 0.5;  // Voltage output at zero pressure (in volts)
const float VOLTAGE_PER_UNIT_PRESSURE = 0.1; // Change in voltage per unit change in
pressure (in volts per unit)

const float FALL_THRESHOLD_PRESSURE = 42.0;

// Creating an instance of the TinyGPS++ object
TinyGPSPlus gps;

// Creating SoftwareSerial objects for the GPS and GSM modules
SoftwareSerial gsmModule(5, 4); // RX, TX for GSM module
SoftwareSerial gpsSerial(2, 3); // RX, TX for GPS module

// Function to calculate pressure from analog reading
float calculatePressure(int analogReading) {
   // Converting analog reading to voltage (assuming 5V reference voltage)
   float voltage = analogReading * (5.0 / 1023.0);
   Serial.print("Voltage reading: ");
   Serial.println(voltage);
   // Calculating pressure using linear interpolation
   float pressure = (voltage - VOLTAGE_AT_ZERO_PRESSURE) /
VOLTAGE_PER_UNIT_PRESSURE;

   return pressure;
```

```
}

// Function to send SMS
void sendMessage(String phoneNumber, String message) {
  Serial.println("Sending a message to: " + phoneNumber);
  gsmModule.println("AT+CMGF=1"); // Setting the GSM module to text mode
  delay(1000);
  gsmModule.print("AT+CMGS=\""); // AT command for sending a message
  gsmModule.print(phoneNumber); // Phone number to send the message to the emergency no’s
  gsmModule.println("\"");
  delay(1000);
  gsmModule.print(message); // Message content
  delay(100);
  gsmModule.println((char)26); // End of message character
  delay(5000); // Delay for the message to be sent
  Serial.println("Message sent.");
}

void setup() {
  Serial.begin(9600);

  // Initializing the software serial port for communication with the GSM module
  gsmModule.begin(9600);
  delay(1000);
  Serial.println("Initializing GSM module...");
  gsmModule.write("AT\r\n");
  delay(1000);
  gsmModule.write("ATE0\r\n");
  delay(1000);

  // Initializing GPS serial communication
  Serial.println("Initializing GPS module...");
```

```
  gpsSerial.begin(9600);
  Serial.println("GPS module initialized.");

  pinMode(A0, INPUT);
}

void loop() {
  // Reading the analog sensor value
  int sensorValue = analogRead(A0);

  // Calculating pressure
  float pressure = calculatePressure(sensorValue);

  // Printing pressure to serial monitor
  Serial.print("Pressure: ");
  Serial.println(pressure);

  // Feed any data from GPS to the TinyGPS++ object
  while (gpsSerial.available() > 0) {
    gps.encode(gpsSerial.read());
  }

  // Checking if the helmet falls with a certain force
  if (pressure >= FALL_THRESHOLD_PRESSURE) {
    // Helmet has fallen with sufficient force
    Serial.println("Helmet has fallen!");

    // Wait a bit to ensure GPS data is ready
    delay(1000);

    // Check if GPS data is available
    if (gps.location.isValid()) {
```

```
        // Get latitude and longitude
        double latitude = gps.location.lat();
        double longitude = gps.location.lng();

        // Create message with location
        String message = "Helmet has fallen! Location: Latitude " + String(latitude, 6) + ",
Longitude " + String(longitude, 6);

        // Send SMS with location
        sendMessage("+919444569083", message);
      } else {
        // If GPS data is not available, send message alone
        sendMessage("+919444569083", "Helmet has fallen! Location data not available.");
      }

      // Delay to avoid repeated messages
      delay(2000);
    }

    delay(1000); // Delay for stability
```

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