Developed a Iot based automatic accident detection and rescue management system

Minor Project Report

Submitted for the partial fulfillment of the degree of

Bachelor of Technology
In
Centre for Internet of Things

Submitted By

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UNDER THE SUPERVISION AND GUIDANCE OF

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Abstract:

This paper presents a technical system for improving emergency response and patient care in ambulances. The system includes a vehicle-embedded accident detection mechanism that operates autonomously to identify accidents. When an accident is detected, this mechanism transmits the location coordinates to the nearest ambulance, facilitating rapid response and deployment.

Upon reaching the accident scene, the system assists in transferring the patient to the ambulance. Subsequently, the patient is connected to a sophisticated monitoring system within the ambulance. This system continuously and remotely monitors vital signs such as pulse rate, body temperature, and blood pressure in real-time.

The real-time monitoring capability provides essential data to medical personnel, enabling them to accurately assess the patient's condition and administer appropriate treatment promptly. This not only enhances the quality of care but also improves the chances of a positive patient outcome.

Additionally, the system is designed to be user-friendly and easily integrated into existing ambulance infrastructure. It is cost-effective and requires minimal maintenance, making it a practical solution for enhancing emergency medical services.

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List of Acronyms:

1. A.I – Analog Input
2. SDA – Serial Data
3. SCL – Serial Clock
4. D.I – Digital Input
5. GND – Ground
6. RX – Receiving Pin
7. TX – Transmitting Pin
8. ST – Self Test Pin
9. VCC - 5V Power Supply
10. X – X Axis Analog Output Pin
11. Y – Y Axis Analog Output Pin
12. Z – Z Axis Analog Output Pin
13. VEE – Contrast Control
14. RS – Register Select
15. RW – Read/Write
16. E - Enable

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Chapter-1: Introduction

1.1 Overview -

In urban environments, accidents are unfortunately common, and the challenges are compounded during nighttime when visibility is reduced. One significant issue is the difficulty faced by ambulance drivers in quickly locating accident sites, especially when relying on phone calls from bystanders. This paper focuses on addressing this challenge by proposing an experimental setup that can automatically detect accidents without requiring human intervention.

The system's automated accident detection feature is crucial, particularly in cases where accidents occur at night and the victim is unconscious. In such scenarios, it can take hours for someone to discover the accident and inform the authorities. By swiftly detecting accidents and transmitting the location coordinates to the ambulance, this setup aims to reduce the time it takes for medical assistance to reach the scene.

Furthermore, after the accident, when the victim is being transported in the ambulance, another setup is employed to continuously monitor the patient's vital signs. This real-time monitoring is essential for ensuring the patient remains stable during transit to the hospital, potentially improving their chances of recovery.

1.2 Basic Theory and Operation

Accidents are a frequent occurrence in urban areas, with some incidents proving challenging to manage, especially at night when visibility is significantly reduced. During such times, ambulance drivers often face difficulty in promptly locating accident sites, relying solely on citizen phone calls for guidance. Precise knowledge of the accident location can dramatically reduce the time it takes to transport the victim to a medical facility, thereby improving their chances of survival and recovery.

the primary objective of this paper is to address the time-sensitive nature of accident response. Nighttime accidents, particularly those involving unconscious victims, can result in significant delays in reporting and response times, potentially leading to life-threatening situations. To mitigate this issue, an experimental setup has been devised to automatically detect accidents without the need for human intervention.

Once an accident is detected, the setup promptly sends the accident coordinates to the nearest ambulance, facilitating quick and efficient location identification. Furthermore, a secondary setup is connected to the patient upon transfer to the ambulance, continuously monitoring vital signs such as pulse, temperature, and blood pressure. This real-time monitoring is crucial for maintaining the patient's stability during transportation, ultimately enhancing their chances of survival.

1.3 Objective

A. To design and implement an automated accident detection system that can operate effectively in urban environments.

B. To develop a mechanism for transmitting accident location coordinates to ambulances in real-time, enabling swift response.

C. To create a monitoring system that continuously tracks vital signs of patients in ambulances, ensuring their stability during transportation.

D. To evaluate the effectiveness and reliability of the system in reducing emergency response times and improving patient outcomes.

Chapter 2 Literature Survey

Chunxiao Liao et al. proposed a "Smart Traffic Accident Detection System Based on Mobile Edge Computing" in 2017. The system aims to detect car crashes using mobile edge computing for proximity, low latency, and vehicle identification. It utilizes smartphones to capture acceleration and speed data and identifies accident scenes primarily on servers to avoid false positives. The system automates accident detection and notifies relevant authorities and facilities like hospitals and transportation departments in real-time.

Sanjana K.R et al. proposed "An Approach on Automated Rescue System with Intelligent Traffic Lights for Emergency Service" in 2015. Their system automatically detects road accidents using sensors and notifies nearby emergency services and family members via GSM. It utilizes Google Maps to locate the accident spot and controls traffic lights to facilitate timely hospital arrival. This system is well-suited for implementation in densely populated countries like India.

Bankar Sanket Anil, Kale Aniket Vilas, and Prof. S. R. Jagtap proposed an "Intelligent System for Vehicular Accident Detection and Notification" in 2014. This system uses a flex sensor and accelerometer to detect accidents and sends SMS notifications containing accident coordinates, time, and vehicle number to designated recipients using a GSM modem. A camera inside the vehicle provides real-time video transmission to assess passenger conditions, emphasizing post-accident assistance.

NajiTaaib Said Al Wadhahi et al. proposed a "Mishaps Detection and Prevention System to Reduce Traffic Hazards using IR Sensors" in 2018. Their system employs IR sensors and Arduino Uno technology. It comprises two phases: Accident Detection and Accident Prevention. The detection phase uses IR sensors to alert individuals by sending SMS via GSM module to predefined numbers with the accident location obtained from GPS. The prevention phase warns the driver about nearby vehicles when the distance exceeds a threshold value.

Nicky Kattukkaran et al. proposed an "Intelligent Accident Detection and Alert System for Emergency Medical Assistance" in 2017. This system detects accidents using an accelerometer in the vehicle and a heartbeat sensor on the user's body to assess the severity of the accident. It then sends alerts to a smartphone via Bluetooth, which notifies the nearest medical center and friends, sharing the accident location for timely assistance.

Arif Shaik et al. proposed "Smart Car: An IoT Based Accident Detection System" in 2018. This system aims to alert emergency services immediately after an accident. It utilizes IoT technology to automatically send a signal from the accelerometer and GPS sensor to the cloud, which then notifies subscribed individuals about the accident's severity and location, enabling prompt assistance.

Chapter-3: Methodology

3.1 Design Structure

The proposed system for intelligent accident detection and emergency response consists of several key components that work together to detect accidents, alert emergency services, and provide timely assistance to the victims. The system architecture can be outlined as follows:

Sensors: The system utilizes various sensors such as accelerometers, IR sensors, and heartbeat sensors to detect accidents and assess their severity. These sensors are integrated into vehicles or worn by individuals to monitor critical parameters.

Data Acquisition Unit: This unit collects data from the sensors and processes it to detect signs of an accident. It may also include preprocessing algorithms to filter out noise and extract relevant information.

Communication Module: Once an accident is detected, the system uses a communication module, such as GSM or Bluetooth, to send alerts to nearby emergency services and designated contacts. This module also enables communication with the cloud and other vehicles on the road.

Cloud Platform: The system's cloud platform receives and processes the accident alerts, including the location and severity of the accident. It can also store historical data for analysis and future improvements.

Emergency Response Center: Alerts from the system are sent to the emergency response center, where operators can assess the situation and dispatch the necessary assistance, such as ambulances or police.

User Interface: The system includes a user interface, which could be a mobile application or a dashboard, to provide real-time updates on accidents, including their location and severity. Users can also use the interface to manually trigger emergency alerts.

Automated Response Mechanism: In some implementations, the system may include automated response mechanisms, such as controlling traffic lights or notifying nearby vehicles, to prevent secondary accidents and assist emergency vehicles in reaching the accident site.

3.2 Block Diagram of the System-

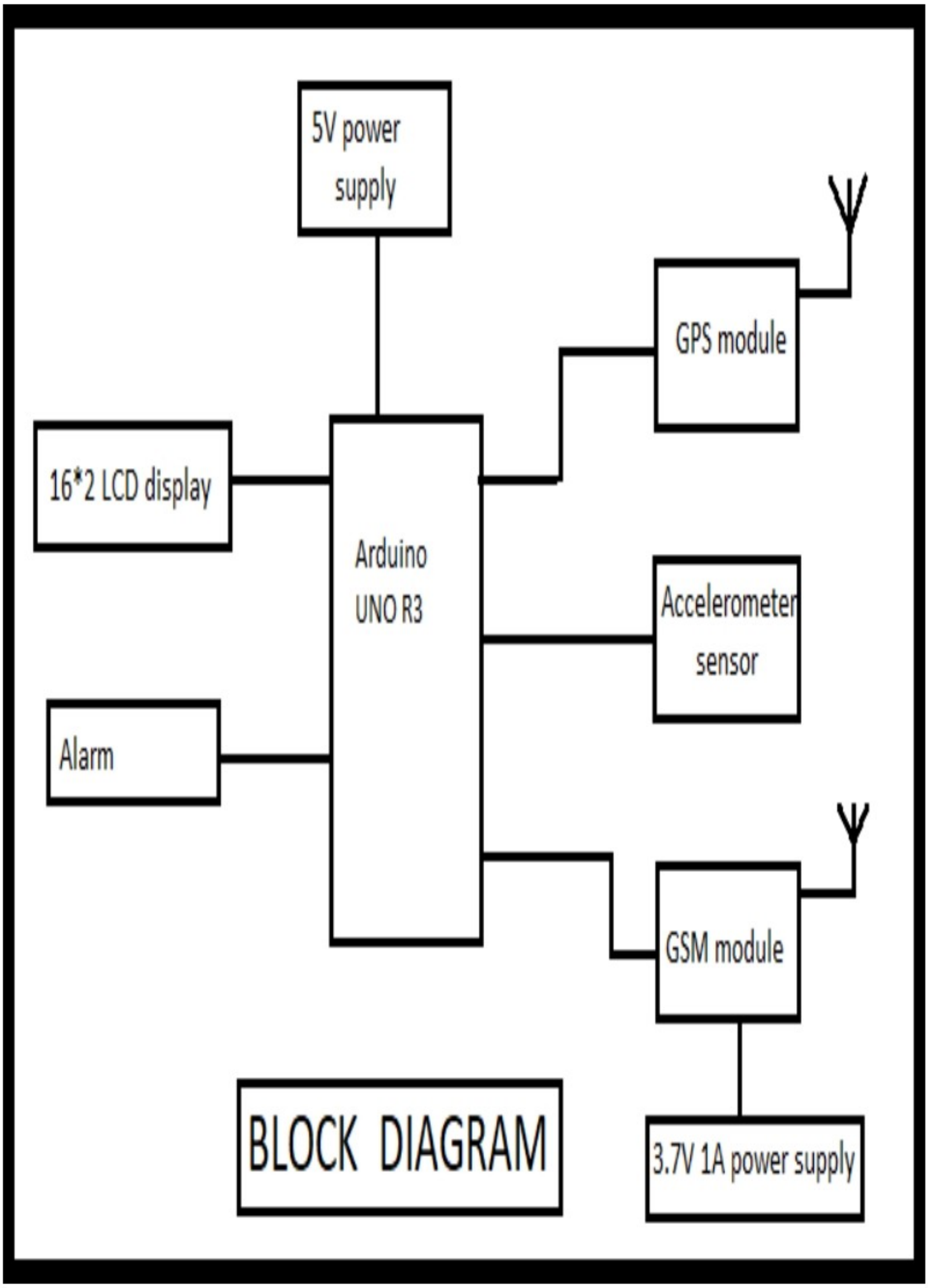

Figure 1: Block Diagram

3.3 Proposed System and Hardware Architecture

3.3.1 Features of Proposed system

The project focuses on detecting and managing vehicle accidents. The system remains active and initialized, sending no messages to the rescue team if the vehicle is operating normally. Constant monitoring of the driver's temperature ensures immediate action if it exceeds a predetermined threshold. In the event of an accident, MEMS, tilt, and fire sensors detect the occurrence, with the controller receiving input from these sensors. The controller then sends accident alert information to a roadside unit, which subsequently notifies the rescue team. Additionally, the system utilizes WiFi and GPS to determine the vehicle's location, which is also relayed to the rescue team. The system aims to establish connectivity with the nearest hospital and provide medical assistance through IoT technology.

3.3.2 Proposed Hardware Architecture

The system comprises several components, including NodeMCU ESP8266, GPS receiver, tilt sensor, buzzer, and a kill switch. In the event of an accident, the car may tilt in various directions (XYZ), triggering the buzzer to emit a beep sound. Simultaneously, the NodeMCU ESP8266 and GPS module utilize WiFi to send the car's location to the nearest ambulance through the Blynk app. This allows the ambulance to quickly reach the accident location, potentially saving lives by transporting the victim to the nearest hospital.

However, in the case of a minor accident, the rescue operation can be stopped using the kill switch. This switch is designed to halt the emergency response process, ensuring that resources are not unnecessarily deployed for non-life-threatening incidents.

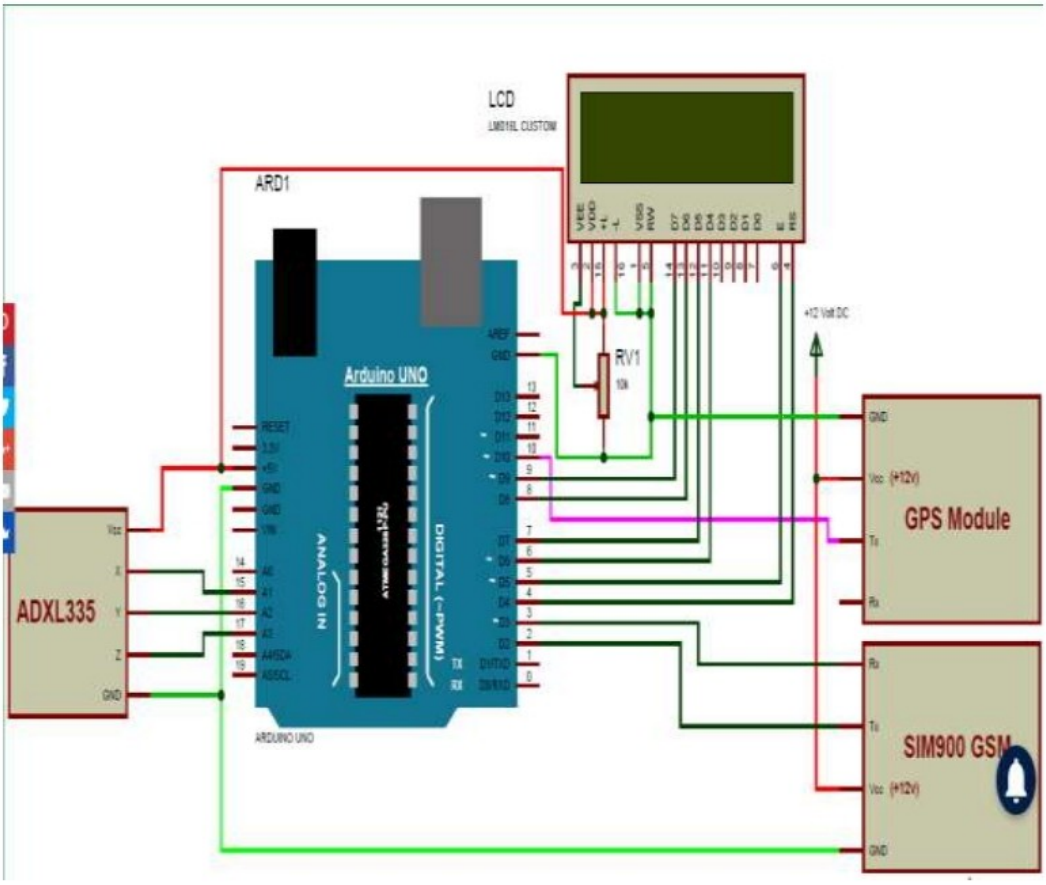

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Figure 2: Hardware Architecture

3.3.3List of Required Hardware Components

Serial No.	Name of the components	Est. Cost
1.	Accelerometer Sensor (ADXL-335)	400
2.	Arduino UNO	400
3.	GSM Module (GSM 800L)	700
4.	GPS Module	600
5.	16*2 LCD Display	150
6.	4056 Charging Module	50
7.	3.7 V Li ion battery	50
8.	Eye Blink Sensor	50
9.	Alcohol Sensor MQ-3	50
10.	Temperature Sensor LM-35	10

3.4 Details of Hardware Components

3.4.1 Accelerometer Sensor (ADXL 335)

An accelerometer is an electromechanical device used to measure acceleration force, typically expressed in g units. It primarily detects acceleration due to gravity (g-force), which on Earth is approximately 9.8 m/s². However, this value varies on different celestial bodies; for example, on the moon, it is approximately 1/6th of Earth's gravity, and on Mars, it is around 1/3rd.

Accelerometers can be used for tilt-sensing applications as well as to measure dynamic acceleration resulting from motion, shock, or vibration. The ADXL335 is an example of an accelerometer that provides complete 3-axis acceleration measurement. It can measure acceleration within a range of ±3 g in the x, y, and z axes.

The output signals of the ADXL335 module are analog voltages that are proportional to the acceleration along each axis. The module contains a polysilicon surface-micromachined sensor and signal conditioning circuitry to accurately measure and output acceleration data

Pin Name	**Description**
VCC	The Vcc pin powers the module, typically with +5V
GND	Power Supply Ground
X	X-axis Analog Output Pin
Y	Y-axis Analog Output Pin
Z	Z-axis Analog Output Pin

ST	Self-Test Pin. This pin controls the Self-Test feature.

Accelerometer ADXL335 Pinout Configuration–

Accelerometer Module Features & Technical Specifications

- Operating Voltage: 3V to 6V DC
- Operating Current: 350µA
- Sensing Range: ±3g
- 3-axis sensing
- High Sensitivity for small movements
- Needs no external components
- Easy to use with Microcontrollers or even with normal Digital/Analog IC
- Small, cheap and easily available

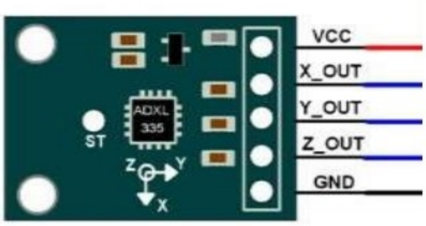


Figure 3: ADXL 335

3.4.2Arduino UNO –

The Arduino Uno is a popular microcontroller board based on the ATmega328P, offering a range of features for electronics projects. It includes 14 digital input/output pins, 6 of which can be used as PWM outputs, and 6 analog inputs. Additionally, it features a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. This board is designed to support the ATmega328P microcontroller, making it easy to connect to a computer via USB or power it with an AC-to-DC adapter or battery.

One of the key advantages of the Arduino Uno is its ease of use and robustness. Users can experiment and prototype without fear of damaging the board, as the ATmega328P chip is easily replaceable for a low cost. The name "Uno," meaning "one" in Italian, was chosen to signify the release of Arduino Software (IDE) version 1.0, with the Uno board being the reference platform for this release. Over time, the Uno has been succeeded by newer Arduino boards, but it remains a popular choice among beginners and experienced makers alike.

Arduino Uno Pinout Configuration

	Pin Name	**Details**
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V

Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Arduino Uno Technical Specifications

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA

DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

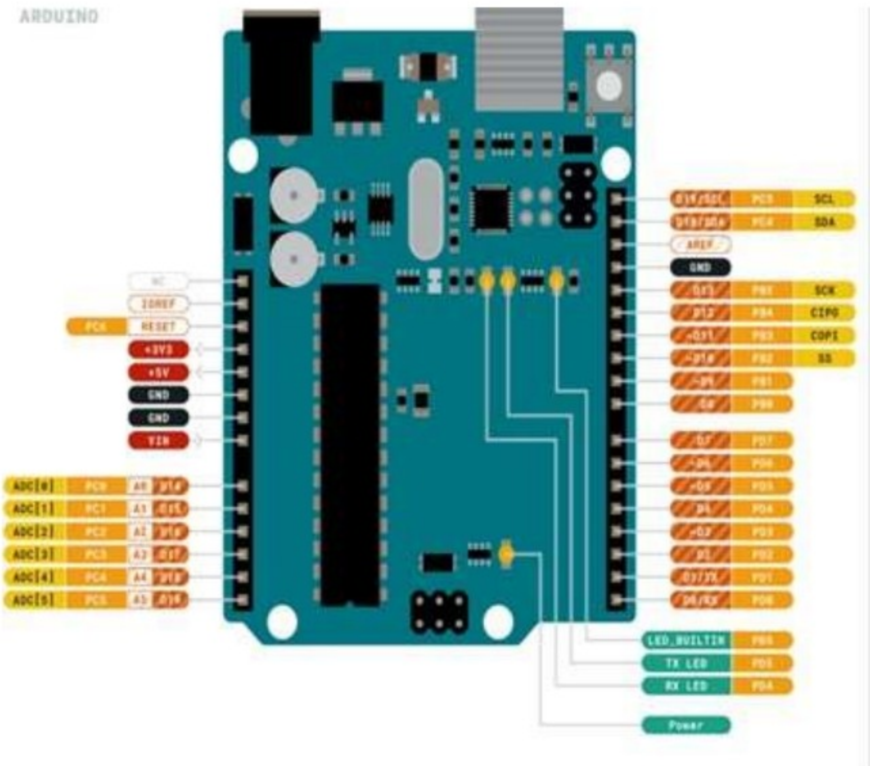


Figure 4: Arduino UNO

3.4.3GSM Module (GSM 800L) –

The SIM800L GSM/GPRS module is a compact GSM modem ideal for a variety of IoT applications. It allows you to remotely monitor your home or control devices like sprinkler systems with just a simple call. With this module, you can send and receive SMS messages, make or receive phone calls, and connect to the internet through GPRS and TCP/IP.

The module is equipped with a quad-band GSM/GPRS network support, ensuring its compatibility worldwide. It is powered by the SIM800L GSM cellular chip from Sim Com, with an operating voltage range of 3.4V to 4.4V, making it suitable for direct LiPo battery supply and ideal for space-constrained projects. The module's data pins are easily accessible through 0.1" pitch headers, simplifying communication with a microcontroller over UART.

It supports baud rates ranging from 1200bps to 115200bps with Auto-Baud detection. An external antenna is required for network connectivity, typically a Helical Antenna that solders directly to the PCB's NET pin. The module also features a U.FL connector for attaching an antenna remotely if needed.

SIM800L Pinout Configuration

Pin Number	**Pin Name**	**Description**
1	NET	External antenna attachment pin
2	VCC	Power supply pin, 3.4V to 4.4V input
3	RST	Reset pin, pull low for 100ms to perform hard reset
4	RXD	Serial data input
5	TXD	Serial data output

6	GND	Module ground reference
7, 8	SPK	Speaker differential output
9, 10	MIC	Microphone differential input
11	DTR	Serial data terminal ready pin, pull high to enable sleep mode
12	RING	Interrupt output, active low

Features and Specifications

- Full modem serial port
- Two microphone inputs and speaker output
- SIM card interface
- Supports FM and PWM
- Sleep mode with 0.7mA current

Figure 5: GSM 800L

3.4.4 GPS Module -

The Global Positioning System (GPS) is a satellite navigation system located around 20,000 kilometers above Earth, providing precise location and time information. It operates continuously, unaffected by weather conditions.

A complete GPS system requires at least 24 satellites, but currently, over 33 satellites are in operation. GPS is extensively used for navigation in aircraft, vehicles (such as cars and trucks), and GPS trackers, which are devices based on GPS positioning technology.

Initially developed by the US Department of Defense (USDOD) for military purposes like missile control, GPS became accessible for civilian use in the 1980s. Since then, its applications have expanded significantly, finding use in various industries and daily activities.

Pinout configuration:

Pin Name	Description
VCC	Positive power pin
RX	UART receive pin
TX	UART transmit pin
GND	Ground

Technical Specifications

Frequency	1575.42MHz-L1 C/A Code
Cold Start Time	45 sec.
I/O Port	UART interface
Warm Start Time	38 sec
Protocol	NMEA 0183
Hot Start Time	10 sec.
GPS Channel	16 Channels
Reacquisition	100ms
Operating Voltage	3.0 V ~ 6.0 V
Update Rate	1Hz
Operating Temperature	-40°C ~ +85°C
External Antenna	
Current Range	2mA ~ 25mA
Power Consumption	27mA
I/O Connector	1.27mm Pin

Figure 6: GPS Module

–3.4.5 LCD Display

The LCD 16×2 display utilizes Liquid Crystal Display technology, commonly found in computer monitors, TVs, smartphones, and other devices. Unlike CRT displays, LCDs use a plane panel display technology. Each pixel on an LCD consists of three sub-pixels (blue, red, green) that can be individually activated or deactivated. A backlight illuminates the pixels arranged in a rectangular network, enabling different color combinations by adjusting the intensity of each sub-pixel.

The LCD 16×2 module is characterized by its 16 columns and 2 rows, allowing it to display a total of 32 characters. Each character is composed of 5×8 (40) pixel dots. Therefore, the total number of pixels in an LCD 16×2 display is calculated as 32 characters multiplied by 40 pixels per character, resulting in 1280 pixels.

In essence, the LCD 16×2 display serves as an electronic device for displaying data and messages. It features a grid of pixels that can be controlled to display information in readable format.

Pin configuration:

r. No	Pin No.	Pin Name	Pin Type	Pin Description	Pin Connection
1	Pin 1	Ground	Source Pin	This is a ground pin of LCD	Connected to the ground of the MCU/ Power source
2	Pin 2	VCC	Source Pin	This is the supply voltage pin of LCD	Connected to the supply pin of Power source
3	Pin 3	V0/VEE	Control Pin	Adjusts the contrast of the LCD.	Connected to a variable POT that can source 0-5V
4	Pin 4	Register Select	Control Pin	Toggles between Command/Data Register	Connected to a MCU pin and gets either 0 or 1. 0 -> Command Mode 1-> Data Mode

5	Pin 5	Read/Write	Control Pin	Toggles the LCD between Read/Write Operation	Connected to a MCU pin and gets either 0 or 1. 0 -> Write Operation 1-> Read Operation
6	Pin 6	Enable	Control Pin	Must be held high to perform Read/Write Operation	Connected to MCU and always held high.
7	Pin 7-14	Data Bits (0-7)	Data/Command Pin	Pins used to send Command or data to the LCD.	In 4-Wire Mode Only 4 pins (0-3) is connected to MCU In 8-Wire Mode All 8 pins(0-7) are connected to MCU
8	Pin 15	LED Positive	LED Pin	Normal LED like operation to illuminate the LCD	Connected to +5V
9	Pin 16	LED Negative	LED Pin	Normal LED like operation to illuminate the LCD connected with GND.	Connected to ground

Technical Specification:

This 16x2 lcd display has the outline size of 80.0 x 36.0 mm and VA size of 66.0 x 16.0 mm and the maximum thickness is 13.2 mm. WH1602W 16x2 LCD Displays are built-in controller ST7066 or equivalent. It is optional for + 5.0 V or + 3.0 V power supply. The LEDs can be driven by pin 1, pin 2, or pin 15 pin 16 or A/K.

Figure 7: 16*2 LCD

3.4.6 TP4056A Li-ion Battery Charging Module –

Pin Configuration:

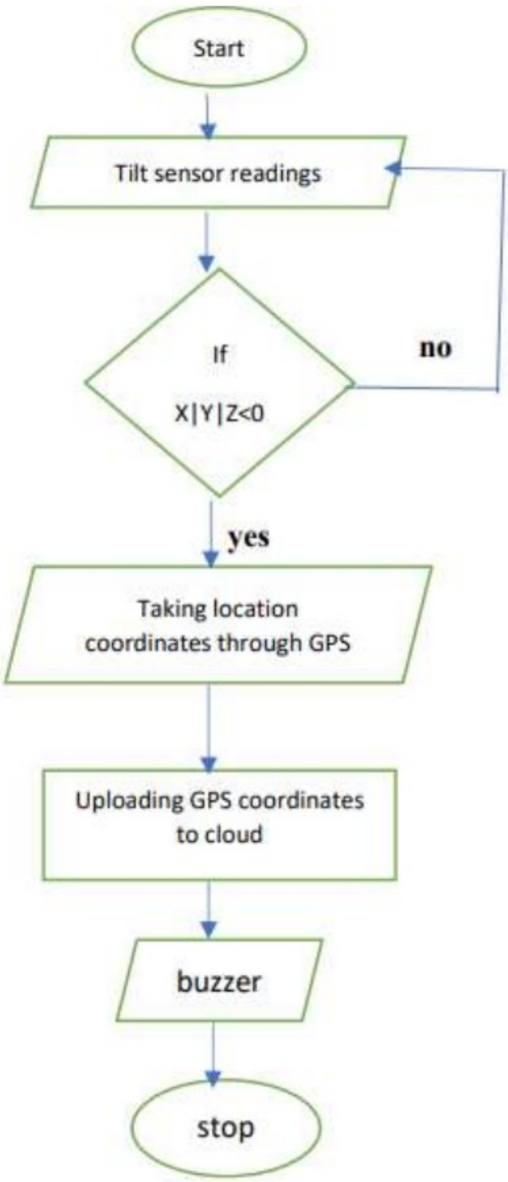
No:	Pin Name	Description
1	OUT +	This pins outputs the positive voltage from battery. It should be connected to the circuit which has to be powered by the battery
2	B +	Outputs positive voltage from USB cable to charge to battery. It should be connected to the positive of the battery
3	B -	Outputs negative voltage from USB cable for charging battery. It should be connected to negative of the battery
4	OUT -	This pin outputs negative voltage from battery. It should be connected to the ground of circuit which has to be powered by the battery
5	IN +	Should provide +5V, can be used if charge cable not available
6	IN -	Should provide ground of the +5V supply, can be used if charge cable not available
7	LED Red	This LED turns on while the battery is charging
8	LED Green	This LED turns on after the battery is fully charged

Module Specifications:

- This module can charge and discharge Lithium batteries safely
- Suitable for 18650 cells and other 3.7V batteries
- Charging current – 1A (adjustable)
- Input Voltage: 4.5V to 5.5V
- Full charge voltage 4.2V
- Protects battery from over charging and over discharging

Chapter 4: Algorithms

4.1 Flow Chart of the System –



4.2 Source Code –

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>
#include <TinyGPS++.h>

// Initialize the I2C LCD
LiquidCrystal_I2C lcd(0x27, 16, 2);

// Initialize the GPS module
TinyGPSPlus gps;
SoftwareSerial gpsSerial(D1, D0); // RX, TX

// Initialize the GSM module
SoftwareSerial gsmSerial(D3, D4); // RX, TX

// Sensor pins
const int accelerometerXPin = A2;
const int accelerometerYPin = A3;
const int accelerometerZPin = A4;
const int eyeBlinkPin = D6;
const int alcoholSensorPin = A0;

// Threshold values for sensors
const int impactThreshold = 800; // Example value for impact detection
const unsigned long blinkInterval = 10000; // 10 seconds for blink detection
const int alcoholSafeLimit = 400; // Example value for alcohol detection

// Variables to keep track of blinks
unsigned long lastBlinkTime = 0;
```

```
void setup() {
  // Start the I2C LCD
  lcd.init();
  lcd.backlight();

  // Start the GPS serial communication
  gpsSerial.begin(9600);

  // Start the GSM serial communication
  gsmSerial.begin(9600);

  // Set sensor pins as input
  pinMode(eyeBlinkPin, INPUT);
  pinMode(alcoholSensorPin, INPUT);

  // Display initial message
  lcd.print("System Ready");
}

void loop() {
  // Read accelerometer data
  checkForAccidents();
  // Check driver alertness
  checkDriverAlertness();
  // Check for intoxication
  checkForIntoxication();
  // Update GPS data
  updateGPS();
  // Placeholder for delay between readings
  delay(1000);
}

void checkForAccidents() {
  int xValue = analogRead(accelerometerXPin);
  int yValue = analogRead(accelerometerYPin);
  int zValue = analogRead(accelerometerZPin);

  if (xValue > impactThreshold || yValue > impactThreshold || zValue > impactThreshold) {
    // Detected a possible accident
    sendAlert("Accident detected!");
  }
}

void checkDriverAlertness() {
  int eyeBlinkValue = digitalRead(eyeBlinkPin);
  unsigned long currentTime = millis();

  if (eyeBlinkValue == HIGH) {
    lastBlinkTime = currentTime; // Update the last blink time
  }

  if (currentTime - lastBlinkTime > blinkInterval) {
    // Driver has not blinked for a while, might be drowsy
    sendAlert("Driver drowsiness detected!");
  }
}

void checkForIntoxication() {
  int alcoholValue = analogRead(alcoholSensorPin);
```

```
void checkForIntoxication() {
  int alcoholValue = analogRead(alcoholSensorPin);

  if (alcoholValue > alcoholSafeLimit) {
    // Detected alcohol above the safe limit
    sendAlert("Intoxication detected!");
  }
}

void updateGPS() {
  while (gpsSerial.available() > 0) {
    if (gps.encode(gpsSerial.read())) {
      if (gps.location.isUpdated()) {
        // GPS location has been updated
        lcd.setCursor(0, 1);
        lcd.print("Lat:");
        lcd.print(gps.location.lat(), 6);
        lcd.print(" Lon:");
        lcd.print(gps.location.lng(), 6);
      }
    }
  }
}

void sendAlert(String message) {
  // Send an SMS with the alert message
  gsmSerial.println("AT+CMGF=1"); // Set GSM module to SMS mode
  delay(1000);
  gsmSerial.println("AT+CMGS=\"+1234567890\""); // Replace with your phone number
  delay(1000);
  delay(1000);
  gsmSerial.println(message);
  delay(1000);
  gsmSerial.write(26); // Send Ctrl+Z to send the SMS
}
```

Chapter 5: Implementation

5.1 Prototype model of the system –

Figure 8: Prototype Model

5.2 Working of the Accident Detection and Alert System using Arduino:

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I. GPS module collects location details (latitude and longitude) of the vehicle/object from satellites.
II. Collected information is sent to an Arduino Uno for processing.
III. Processed information is displayed on an LCD screen and transmitted to a GSM modem.
IV. GSM modem receives information from Arduino Uno.
V. GSM modem sends information to the relevant mobile phone, such as the Traffic police control room, using SMS in text format.
VI. Sensor data characteristics are analyzed for simulated test cases or emergency scenarios.
VII. Severity levels (low-risk, minimum risk, high-risk) are categorized based on sensor responses.
VIII. Emergency responders or contacts are notified based on the severity levels.

Chapter 6: Observation and Result

6.1Details of experimental result –

Figure 10 illustrates the SMS sub-system of the framework. SMS is sent through the GSM module to a number stored in the database, containing detailed information about the accident location. When the system retrieves the stored contact numbers of users, it sends an SMS containing a link to the accident location via the GSM module. GSM (Global System for Mobile Communication) is a mobile communication architecture used worldwide in nearly all countries.

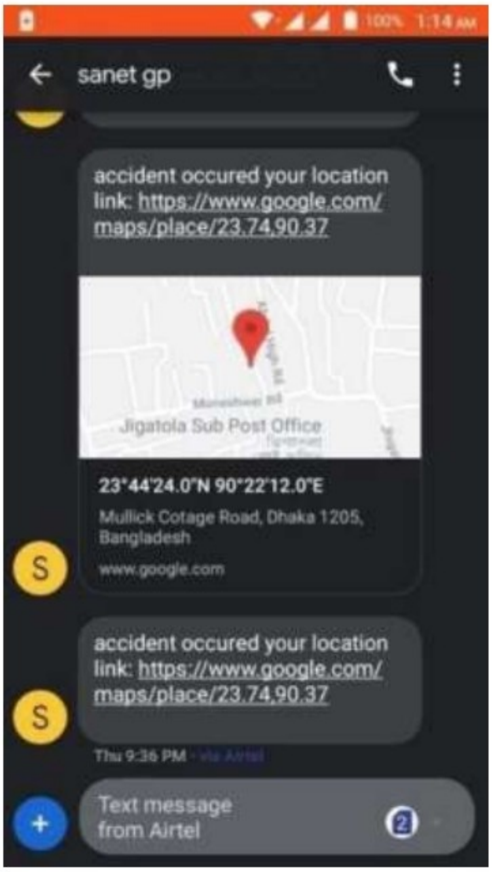

Figure 9 : sms alart

Clicking on the accident location link displays the location on Google Maps. This allows any user or the rescue team to dynamically choose the shortest route to reach the destination. An ambulance can also be directed to the accident location to provide emergency medical assistance.

TABLE I. INTEGRATION TEST RESULT

Test Case Expected	Expected Result	Observed result	Test Result
When the accident occurred the Accelerometer should be able to detect the accident	Can detect an accident.	Can detect accident	pass
GPS module of this system should be able to detect vehicle location correctly	Location should be exact.	Location is exact.	pass
GSM Module of the system should be able to send SMS	SMS will be sent.	SMS has been sent	pass
The Controller should be able to send data to a server using the Wi-Fi module. The microcontroller should be able to retrieve data from the server	Can send and retrieve data to and from the server	Can send Can retrieve data	pass

System testing of software or hardware is conducted in a complete and integrated environment to evaluate its compliance with specified requirements. This testing phase takes all integrated modules that have passed integrated testing as its input. Its primary aim is to detect any inconsistencies between the integrated units. System testing can uncover bugs related to the interaction between different modules of a framework. While these interaction glitches may not have a significant impact at a modular level, they can become more serious when measured on the overall performance of the system. Table II shows test cases, expected results, and observed results of system testing.

TABLE II. SYSTEM TEST RESULT

Test Case Expected	Expected Result	Observed result	Test Result
Users should be able to get SMS from this system successfully	SMS should arrive	SMS received	pass
User should see accident location	Accident location should be seen	Accident location can be seen	pass
Ambulance should be able to get the direction to reach the accident spots	Ambulance should get proper notification	Gets the required notification	pass
Authority should be able to update server data	Can update server data	Data in the server can be updated	pass

6.2 Result Analysis –

The system's ability to detect accident severity through the accelerometer sensor, coupled with its capability to send alerts via the GSM module, ensures quick response and assistance. The GPS module plays a crucial role in pinpointing the accident location accurately, facilitating effective communication with the rescue system. This integrated approach not only aids in reducing fatalities by enabling swift and informed rescue operations but also highlights the system's efficiency in crisis management.

By providing timely information to emergency responders, the system ensures that medical aid reaches the accident site promptly. This proactive approach significantly improves the chances of survival for accident victims. Overall, the system's seamless integration of sensors and communication modules enhances its effectiveness in reducing the overall rate of deaths resulting from accidents.

Chapter: 7 Conclusion and Future Scope

7.1 Conclusion –

The completed module successfully detects accidents using both a tilt sensor and a temperature sensor, connected to GSM and GPS for data transmission via messages or notifications. The module effectively transmits accident location coordinates to mobile devices via the BLYNK App.

The second module of this proposed system is an ambulance unit equipped with a pulse sensor, temperature sensor, and Glucose Dip sensor. The output of each sensor is continuously displayed on an LCD display. Currently, there is no existing technology for accident detection and ambulance monitoring. By combining these two systems, we have created a new, efficient system.

Furthermore, additional concepts can be integrated into this system. Traffic management plays a crucial role in a victim's survival. Implementing a traffic management system using RFID and RF communications can enhance this concept. Such a system would provide reliable traffic management and aid in the overall efficiency of the system.

7.2 Future Scope –

The proposed program focuses on detecting incidents and alerting paramedics to reach the location promptly, providing medical services to those affected and transporting them to the nearest hospital. Additionally, the system can be expanded to include on-site medication for the victims. By enhancing technology and implementing warning systems, we can also prevent accidents by stopping vehicles before they occur.

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