VEHICLE ACCIDENT PREVENTION,DETECTION AND REPORTING SYSTEM

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CONTENTS

INTRODUCTION

Our mini-project proposes a *Vehicle Accident Prevention, Detection, and Reporting System* using Arduino to enhance road safety.

The system incorporates an alcohol sensor to detect intoxicated driving, a vibration sensor to identify collisions, and a GPS and GSM module for real-time location tracking and immediate communication during emergencies. Additionally, it includes a driver alertness system to mitigate the risks of sudden driver fatigue or drowsiness.

AIM

- Detect alcohol consumption in drivers using an alcohol sensor and alert them to prevent vehicle operation while intoxicated.
- Prevent accident which happens due to sudden asleep of driver.
- Use a accelerometer to detect sudden impacts or collisions and trigger necessary actions.
- Automatically report accident details, including location, to emergency services and preconfigured contacts for prompt assistance.
- Minimize accidents by addressing key factors like impaired driving and delayed response times.

OBJECTIVE

- Real-Time Location Reporting
- Real-Time Alerts and Notifications
- Cost Efficiency
- Power Efficiency
- User-Friendly Interface
- Scalability and Upgradability
- Improve Road Safety

SOCIAL RELEVANCE

The **social relevance** of your **accident prevention system** is significant as it directly contributes to improving road safety, reducing fatalities, and minimizing injuries caused by accidents.

This project can:

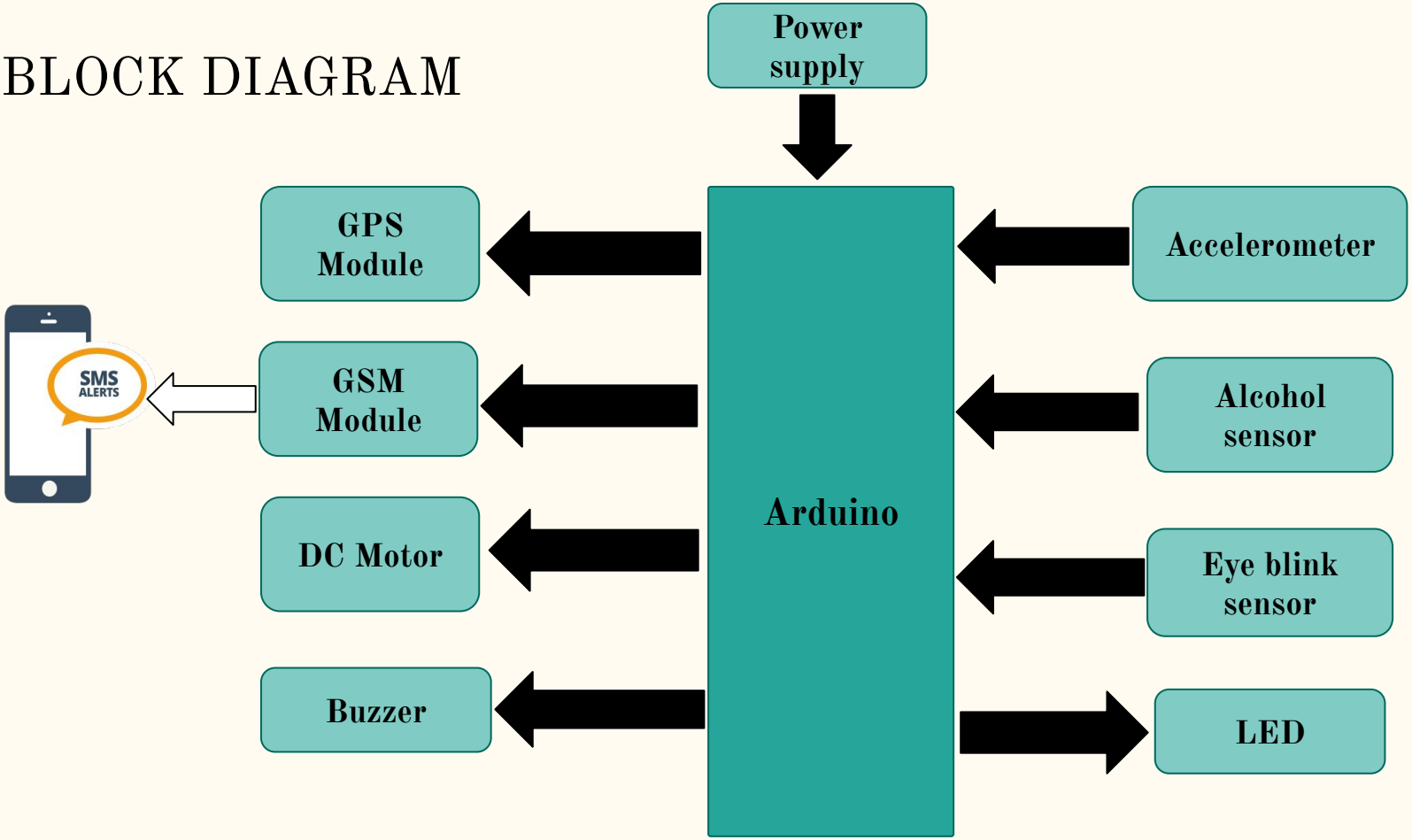
- **Save lives** by preventing drunk driving and alerting drivers when drowsy, promoting safer driving practices.
- **Improve emergency response times** by providing real-time location data in case of an accident, ensuring timely assistance.
- **Raise awareness** about road safety and the potential for technology to mitigate preventable accidents

LITERATURE SURVEY

ARTICLE	CATEGORY & DETAILS	REFERENCE
International Journal of Advanced Research in Computer Science published an article titled "Preventing Drunk Driving Accidents using IoT" in March-April 2017	**Drunk Driving Detection** - Alcohol sensors (e.g., MQ-3) detect alcohol content in breath.- Prevents vehicle operation if alcohol level exceeds legal threshold.	- **Verma et al. (2017):** Used alcohol sensors with Arduino to disable vehicle ignition if alcohol level exceeds 0.08%.
International Journal of Engineering & Technology published an article titled "Detection of Driver Drowsiness using Eye Blink Sensor" in 2018, detailing a system that alerts drivers when prolonged eye closure is detected.	**Drowsiness Detection** - Eye blink sensors detect eye closure and blink rate to monitor drowsiness.- Alerts the driver when drowsiness is detected.	- **Kumar et al. (2016):** Developed an eye blink sensor-based drowsiness detection system integrated with Arduino to alert the driver when eye closure is prolonged.
Study titled "Real-Time Vehicle Accident Alert System Based on Arduino with SMS Notification" discusses a system with accelerometers to detect accidents, GPS to determine the vehicle's location, and GSM to send alerts	**Accident Detection & Reporting** - Accelerometers detect sudden changes in speed, indicating a collision.- GPS records vehicle location during an accident.- GSM sends real-time alerts.	- **Soni et al. (2018):** Integrated accelerometer and GPS with Arduino to detect crashes and send vehicle location via GSM to emergency contacts.

ARTICLE	CATEGORY AND DETAILS	REFERENCE
"Integrated Safety System based on IoT": This article, published in the Journal of the Korea Society of Computer and Information, explores the integration of sensors within the Internet of Things (IoT) framework to enhance safety systems.	**Integrated Safety Systems** - Integration of multiple sensors (alcohol, eye blink, accelerometer, GPS, GSM) into a single system for comprehensive monitoring.- Improves overall vehicle safety.	- **Rai et al. (2020):** Created an integrated system combining alcohol sensors, eye blink sensors, accelerometers, and GPS for real-time monitoring and accident prevention.
The article "12 Mind-Blowing Arduino AI Projects That Will Transform Your Tech Skills," published by Jaycon Systems,	**Scalability and Expansion** - Systems need to be scalable for future improvements.- Easy integration of additional features like external cameras or advanced AI.	- Modular designs with Arduino allow for future upgrades such as adding more sensors (e.g., facial recognition for drowsiness) or AI-based predictive accident models.
"GPS & GSM Based Accident Detection and Auto Intimation" by Fernandez et al. (2018)	**Emergency Response Time** - Reducing the time between accident detection and emergency response is critical.- Real-time data sharing with emergency contacts or services via GSM.	- **Soni et al. (2018):** Used GSM module to send immediate accident alerts with GPS coordinates to emergency responders, reducing response time and potentially saving lives.

BLOCK DIAGRAM



METHODOLOGY

1. Data Collection: Sensors detect the presence of alcohol , drowsiness of driver ,impact, or sudden changes.

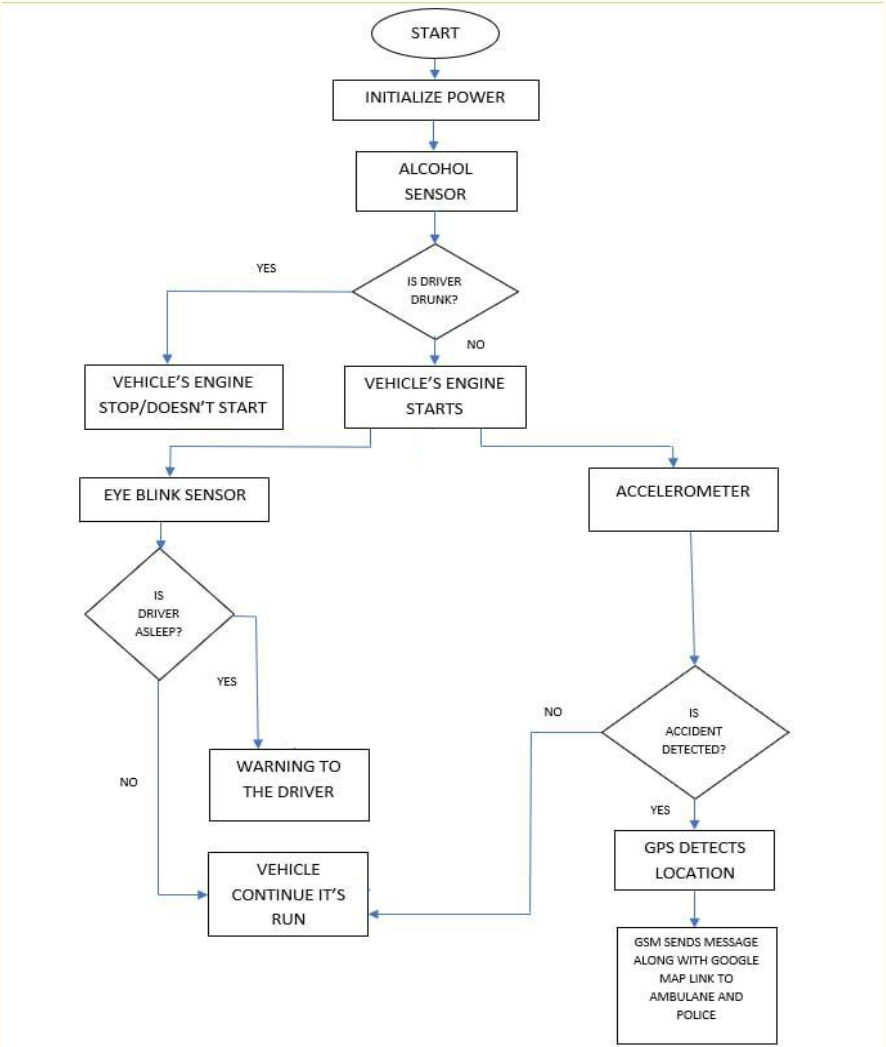
2. Processing: The Arduino processes the data

3. Action:

- If the driver is drunk system provides warning and engine stops ,if not vehicle starts properly.
- If the driver is drowsy system warns him with alarm and red light alert
- If a crash is detected, the system triggers safety responses

4. Communication: The system uses the vehicle's battery and can communicate through GPS or GSM modules.

FLOW CHART

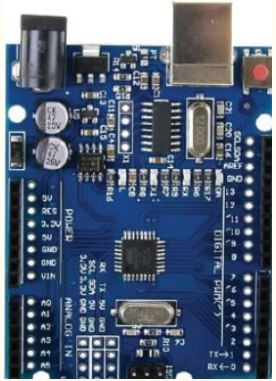

START
INITIALIZE POWER
ALCOHOL SENSOR
IS DRIVER DRUNK?
YES
NO
VEHICLE'S ENGINE STOP/DOESN'T START
VEHICLE'S ENGINE STARTS
EYE BLINK SENSOR
ACCELEROMETER
IS DRIVER ASLEEP?
YES
NO
WARNING TO THE DRIVER
VEHICLE CONTINUE IT'S RUN
IS ACCIDENT DETECTED?
NO
YES
GPS DETECTS LOCATION
GSM SENDS MESSAGE ALONG WITH GOOGLE MAP LINK TO AMBULANE AND POLICE

COMPONENTS

- Arduino Uno
- Accelerometer
- Alcohol sensor
- Eye blink sensor
- LED
- Buzzer
- GPS module
- GSM module
- DC motor
- Motor driver

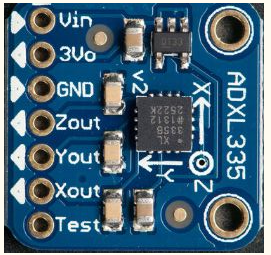
DESIGN AND SPECIFICATION

1.Arduino Uno



- It consumes **low power**, making it ideal for real-time accident detection applications.
- The Arduino Uno has an **easy-to-use** development environment (Arduino IDE) with a vast community of support.
- Since accident prevention and detection systems require a **real-time response**, the **Uno's simple architecture and lack of OS overhead** make it **more reliable** than complex systems like Raspberry Pi.

2.Accelerometer(ADXL335)



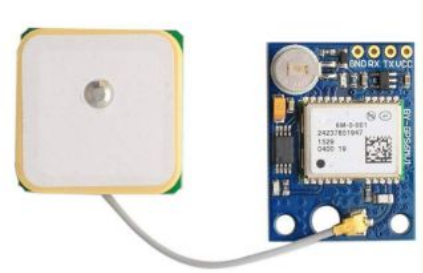
- It operates at **3.3V – 5V** with very low power consumption (~350 µA), making it **suitable for battery-operated systems**.
- When an accident occurs, ADXL335 detects the sudden change in acceleration.

3.GSM module(SIM800L)

- It operates at **3.4V–4.4V**, consuming **less power** compared to alternatives like **SIM900**, which requires higher voltage and power.
- This ensures **real-time accident reporting**, even in areas with poor network coverage.

- Works seamlessly with Arduino Uno

4.GPS module(NEO-6M)



- **NEO-6M provides accurate position tracking** with an accuracy of **2.5 meters**.
- The NEO-6M has a fast **TTFF (Time to First Fix)**
- The NEO-6M can **store previous GPS data**

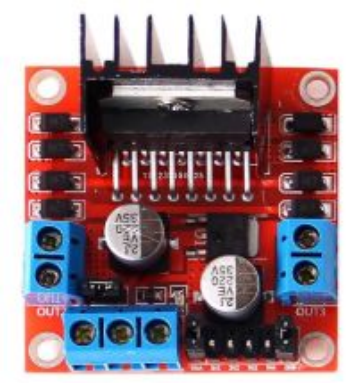
5.Alcohol sensor(MQ-3)

- Provides **analog output**, making it **easy to read alcohol concentration**.
- High sensitivity to alcohol vapors
- Simple integration with Arduino & microcontrollers

6.Motor driver module(L298)

- The **L298 motor driver** is used to **control the DC motors or relay systems** in accident prevention applications.
- Allows **simultaneous control of two DC motors**, making it ideal for **automated braking systems or electric vehicle control**.

- Automatic braking and engine cut-off in emergencies



7.Eye blink sensor

- The sensor detects **eye closure in milliseconds**, allowing **immediate corrective action**.
- **Does not interfere with normal driving** but ensures safety monitoring.
- Compatible with Arduino
- **Fast detection of drowsiness** for immediate accident prevention
- **Low cost and power consumption**

PREVENTION

- Alcohol Sensor : detects alcohol concentration in the air.
- DC motor : Performs an action based on the detection, such as locking a door.
- Motor Driver Module : Enables the Arduino to drive the DC motor.
- Eye blink sensor:senses eye blink using infrared rays.

DETECTION

- ADXL335 accelerometer : Detects sudden changes in acceleration or orientation during a crash,Can measure vibrations, tilts, and shocks.

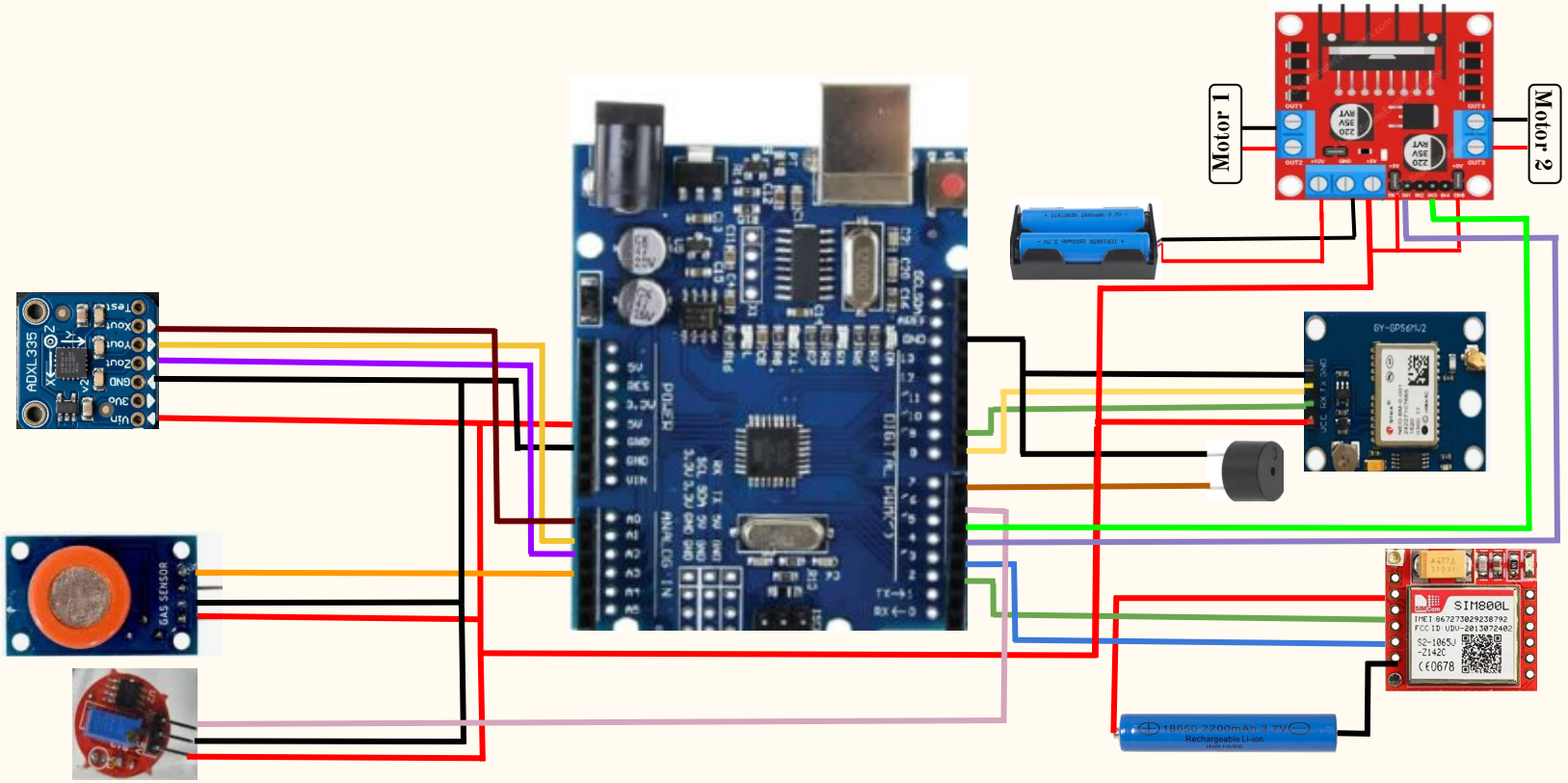
REPORTING

- GPS Module : To determine the exact location of the vehicle during a crash.

- GSM Module : To send crash alerts to emergency contacts or services.

- In a crash scenario, timely information sharing can be life-saving. The GSM module ensures immediate communication.

CIRCUIT DIAGRAM



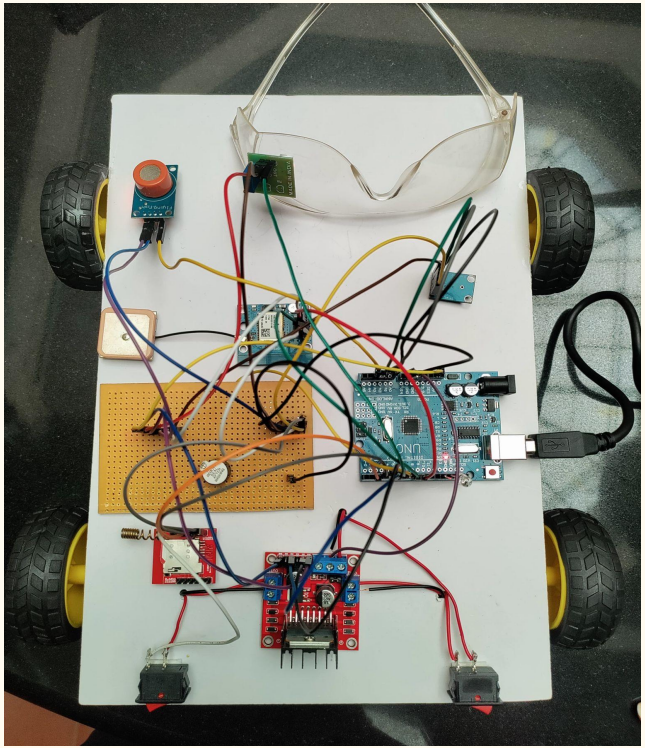
Estimate of product cost

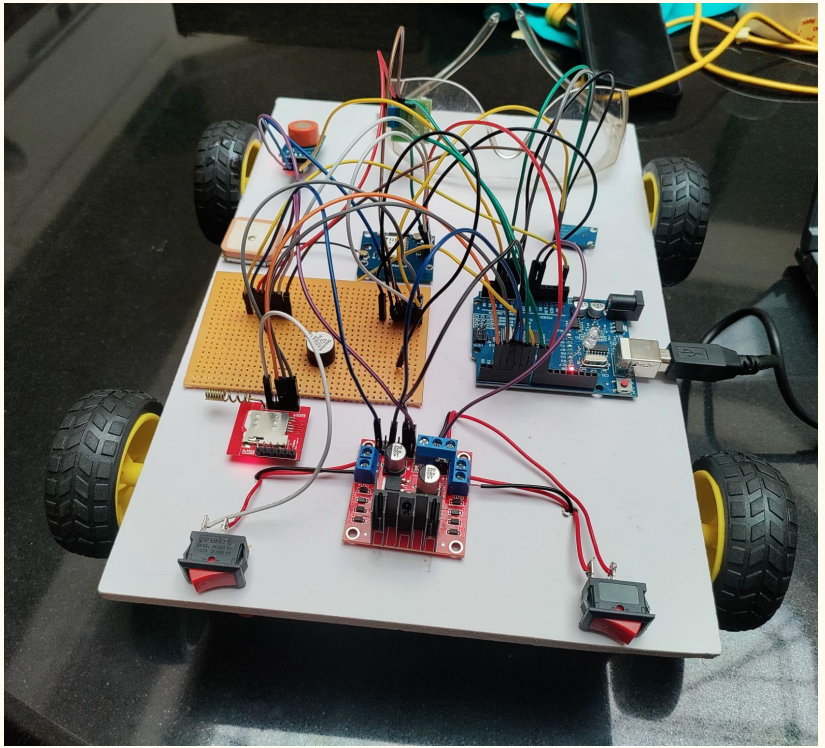
S.no	Component	Quantity	Price(Rs)
1	Accelerometer(335)	1	750
2	GSM800l	1	450
3	GPS neo6m	1	500
4	Alcohol sensor(mq3)	1	195
5	LM298 Motor driver	1	225
6	Eye Blink sensor	1	330
7	Buzzer	1	15
8	LED	1	1
9	DC Motor	2	90*(2)=180

10	Arduino UNO R3	1	400
11	Jumper wires	30	2.5*(30)=75
12	Wheels	4	50*(4)=200
13	Switch	2	5*(2)=10
14	3.7V Battery	3	130*(3)=390
15	PCB	1	20

Total	3,561

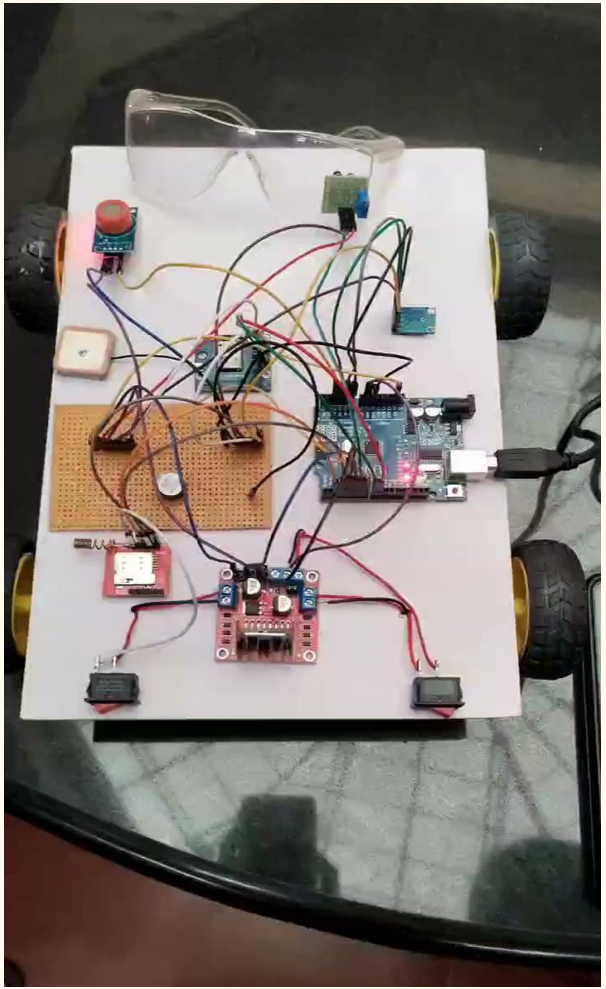
FINAL PROTOTYPE



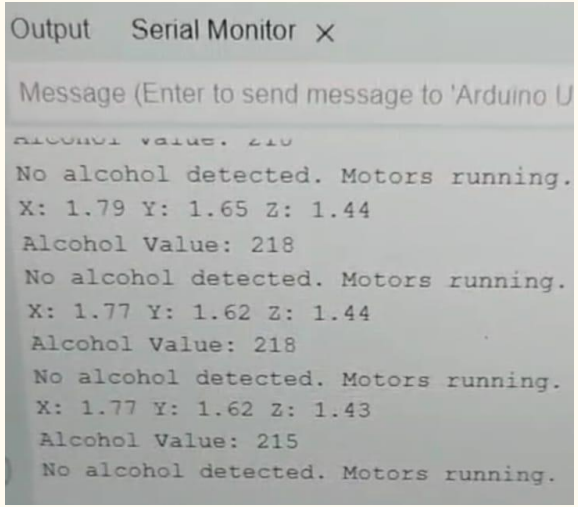


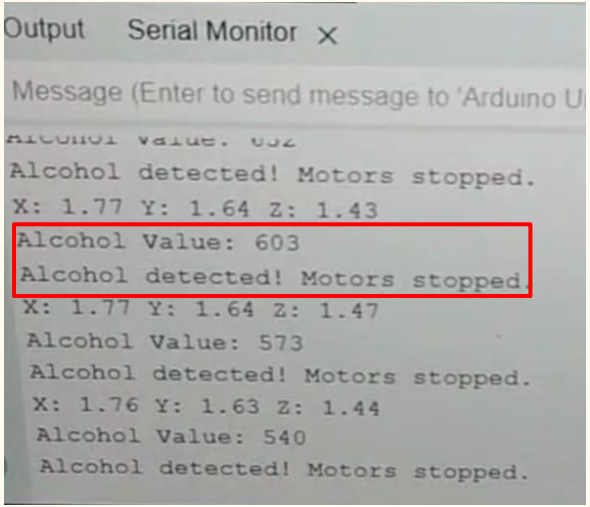
VIDEO

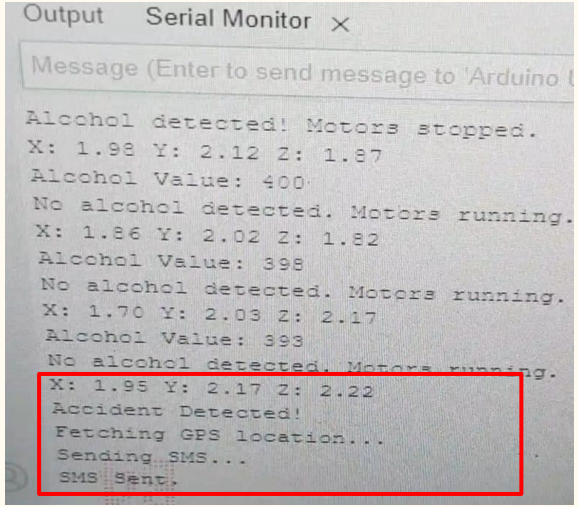
https://drive.google.com/file/d/1uhTlI9ZkK2eT7mGENugCGMl-QnHJWQnW/view?usp=drivesdk

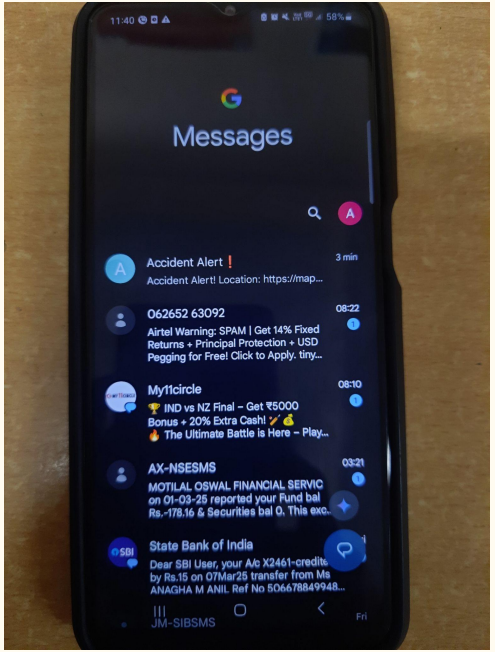


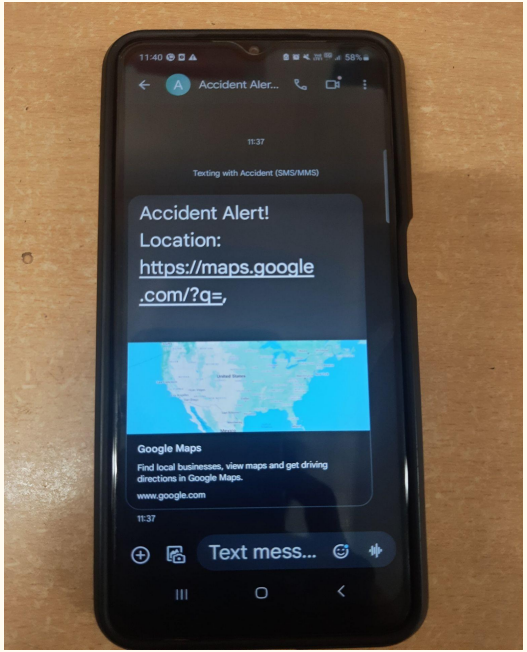
OUTPUT

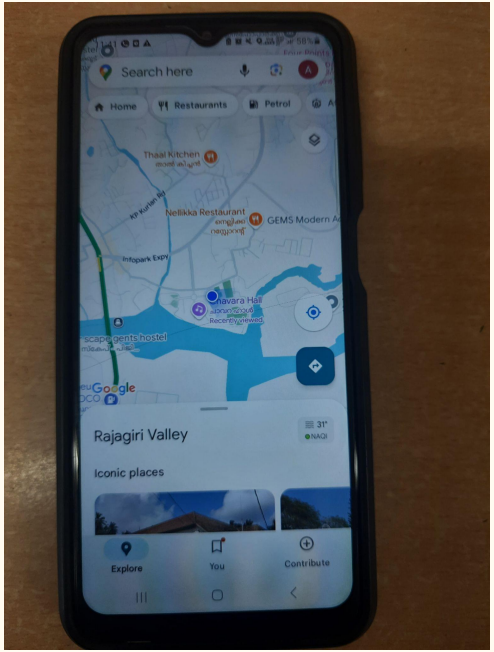

Output
Serial Monitor
Message (Enter to send message to 'Arduino U
No alcohol detected. Motors running.
X: 1.79 Y: 1.65 Z: 1.44
Alcohol Value: 218
No alcohol detected. Motors running.
X: 1.77 Y: 1.62 Z: 1.44
Alcohol Value: 218
No alcohol detected. Motors running.
X: 1.77 Y: 1.62 Z: 1.43
Alcohol Value: 215
No alcohol detected. Motors running.


Output
Serial Monitor
Message (Enter to send message to 'Arduino U
Alcohol detected! Motors stopped.
X: 1.77 Y: 1.64 Z: 1.43
Alcohol Value: 603
Alcohol detected! Motors stopped.
X: 1.77 Y: 1.64 Z: 1.47
Alcohol Value: 573
Alcohol detected! Motors stopped.
X: 1.76 Y: 1.63 Z: 1.44
Alcohol Value: 540
Alcohol detected! Motors stopped.


Output
Serial Monitor
Message (Enter to send message to 'Arduino
Alcohol detected! Motors stopped.
X: 1.98 Y: 2.12 Z: 1.87
Alcohol Value: 400
No alcohol detected. Motors running.
X: 1.86 Y: 2.02 Z: 1.82
Alcohol Value: 398
No alcohol detected. Motors running.
X: 1.70 Y: 2.03 Z: 2.17
Alcohol Value: 393
X: 1.95 Y: 2.17 Z: 2.22
Accident Detected!
Fetching GPS location...
Sending SMS...
SMS Sent.


Messages
Accident Alert !
Accident Alert! Location: https://map...
3 min
062652 63092
Airtel Warning: SPAM | Get 14% Fixed Returns + Principal Protection + USD Pegging for Free! Click to Apply. tiny...
08:22
My11circle
IND vs NZ Final – Get ₹5000 Bonus + 20% Extra Cash!
The Ultimate Battle is Here – Play...
08:10
AX-NSESMS
MOTILAL OSWAL FINANCIAL SERVIC on 01-03-25 reported your Fund bal Rs.-178.16 & Securities bal 0. This exc...
03:21
State Bank of India
Dear SBI User, your A/c X2461-credite by Rs.15 on 07Mar25 transfer from Ms ANAGHA M ANIL Ref No 506678849948...
JM-SIBSMS
Fri


Accident Aler...
Texting with Accident (SMS/MMS)
Accident Alert!
Location:
https://maps.google.com/?q=,
Google Maps
Find local businesses, view maps and get driving directions in Google Maps.
www.google.com
Text mess...


Search here
Home
Restaurants
Petrol
Thaal Kitchen
Nellikka Restaurant
GEMS Modern
Infopark Expy
Google
Rajagiri Valley
Iconic places
Explore
You
Contribute

CHALLENGES

- **GSM Module (SIM800L) Issues:**
  - Unable to connect to the network, especially indoors.Weak signal strength affecting SMS transmission.

- **GPS Module (NEO-6M) Issues:**
  - Unable to lock onto satellites.Poor signal reception, especially in indoor environments.
  - Longer time to get a GPS fix (TTFF – Time to First Fix).

- **Sensor Calibration and Accuracy**:
  - Ensuring that sensors like the alcohol sensor, eye-blink sensor, accelerometer, and GPS provide accurate and consistent data.

- **False Positives/Negatives**:
  - Avoiding false alarms for drunk driving, drowsiness, or accidents due to sensor errors or environmental factors

- **System Integration**:
  - Seamlessly integrating all components (sensors, motor, GSM, GPS) into a single, functional system.

- **Power Supply Issues with lm298**:
  - If the voltage or current provided to the motor is not stable or within the required range, the LM298 may fail to drive the motor correctly, or cause erratic behavior.

STATUS OF PROJECT

1. Accident Detection:

- **Implemented using an accelerometer to detect sudden impacts.**
- **Successfully triggers the accident alert mechanism.**

2. Accident Reporting:

- **SMS notification successfully sent to an emergency contact.**
- **Accident location included in the SMS for precise emergency response.**

3. Accident Prevention:

- **Eye-blink sensor implemented to monitor driver drowsiness.**
- **Alcohol detection sensor integrated to monitor driver sobriety.**
- **Both sensors work together to help prevent accidents caused by fatigue and impaired driving.**

ADVANTAGES

1. **Real-Time Alerts**: These systems can provide real-time alerts to drivers, reminding them to take breaks, stay alert, or avoid driving altogether if they are impaired.
2. **Enhanced Safety**: By addressing various driving risks, these systems significantly enhance road safety for all drivers
3. **Emergency Response**: Automatically notifies 911 with location and crash details.
4. **Roadside Assistance**: Alerts tow services or repair providers.
5. **Family Notifications**: Informs emergency contacts of an accident.
6. **Insurance Claims**: Provides crash data for faster and accurate claims processing.
7. **Medical Pre-Triage**: Sends passenger and injury details to hospitals pre-arrival.
8. **Traffic Law Enforcement**: Supplies crash evidence for investigations.

FUTURE SCOPE

- **AI Integration**: Implementing **machine learning** or **AI algorithms** to enhance drowsiness detection or accident prediction based on sensor data.

- **Smart Vehicle Connectivity**: Future systems may integrate with **smart vehicle networks**, allowing for more accurate accident detection and quicker emergency responses.

- **Vehicle-to-Vehicle Communication**: With the advent of **V2V (Vehicle-to-Vehicle)** communication, systems may one day allow vehicles to communicate with each other to prevent accidents in real-time.

CONCLUSION

This project improves vehicle safety by detecting accidents caused by drunk driving and drowsiness. It uses a low-cost, automatic system with GPS and GSM to alert emergency services, ensuring quick response and saving lives. The system is affordable and easy to install in all vehicles.

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[3] L. Ramalingam, Umamagewaran Jambulingam, S. Muthumarilakshmi, N. Malathi, and M. Venkatesh, “IoT-Based Car Safety System With Airbag Notification for Emergency Assistance,” vol. 9, pp. 484–489, Aug. 2023, doi: https://doi.org/10.1109/smarttechcon57526.2023.10391442

[4] VENUSREE. T. Student, T. R. Student, and P. j Student, “Car Safety System With Airbag Notification,” Nov. 2024, doi: https://doi.org/10.21203/rs.3.rs-5391967/v1.

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