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VEHICLE DETECTION & ACCIDENT ALERT SYSTEM
Project Domain: Embedded System

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Abstract: Our proposed system is designed with the paramount objective of swiftly detecting accidents and promptly notifying the appropriate emergency services. It operates by accurately recording the latitude and longitude of the vehicle involved in the accident and transmitting this critical data to the nearest emergency service provider. In today's vehicular technology landscape, GPS has become an indispensable component. Additionally, an accelerometer is employed to detect sudden shifts in the vehicle's axles, a function tested using Arduino. When an accident is detected, Arduino activates the GSM module to send an alert message to either the police control room or a designated rescue team, providing precise details of the accident location. Subsequently, authorities can leverage the GPS module to automatically pinpoint the accident location and take swift and effective action upon verification of the incident.

IndexTerms: GSM Module, GPS Modem, Ardunio Uno, Google Map Link.

I. INTRODUCTION

Over the past decade, there has been a steady increase in the use of automobiles, which has consequently elevated the risk to human life. Automatic accident detection systems play a pivotal role in swiftly recognizing accident locations and ensuring timely response. When it comes to ambulance services, every second is precious, and delays in response can lead to loss of life. This automation facilitates the timely arrival of ambulances at hospitals, thereby saving lives. Ineffective medical assistance can significantly increase the risk of death among crash victims, with studies showing that every minute without emergency medical attention elevates this risk. To mitigate these risks, the concept of a life-saving system emerges. The system leverages pre-installed smart sensing accelerometers to provide real-time vehicle lo cation information, which is recorded and accessible remotely to provide essential services to accident victims. employing GPS and GSM technology to transmit data to a remote server for analysis.

The collected information is then used to render emergency services to individuals in need. The submitted systems use popular technology that integrates smartphone applications with microcontrollers. It is easy to make and has a low cost compared to others. A device installed in a vehicle that uses the Global Positioning System (GPS) and Global Communication for Mobile Communications. It is one of the most common ways to track vehicles. The device is embedded in the vehicle.

The microcontroller has a GPS module for obtaining geographical coordinates at regular intervals. Developed to constantly monitor vehicle locations, the Google Maps API is used to display vehicles on the map in the smartphone app. Therefore, the user will be able to monitor the vehicle on demand using the Smartphone app and determine the approximate distance and time to reach the designated destination. The vehicle tracking system is a comprehensive solution for safety and fleet management.

It’s a technique for detecting cars that employs a variety of approaches, including GPS and other satellite-based and ground-based navigation systems. The vehicle tracking system in the car is built-in, which provides real-time space and can also store and upload data to the computer that can be used for future analysis. This system is a basic tool to track the car that the owner ever wants to monitor and is now very popular among those with expensive cars, used to prevent theft and fix stolen cars. The collected data can be found on online maps and software.

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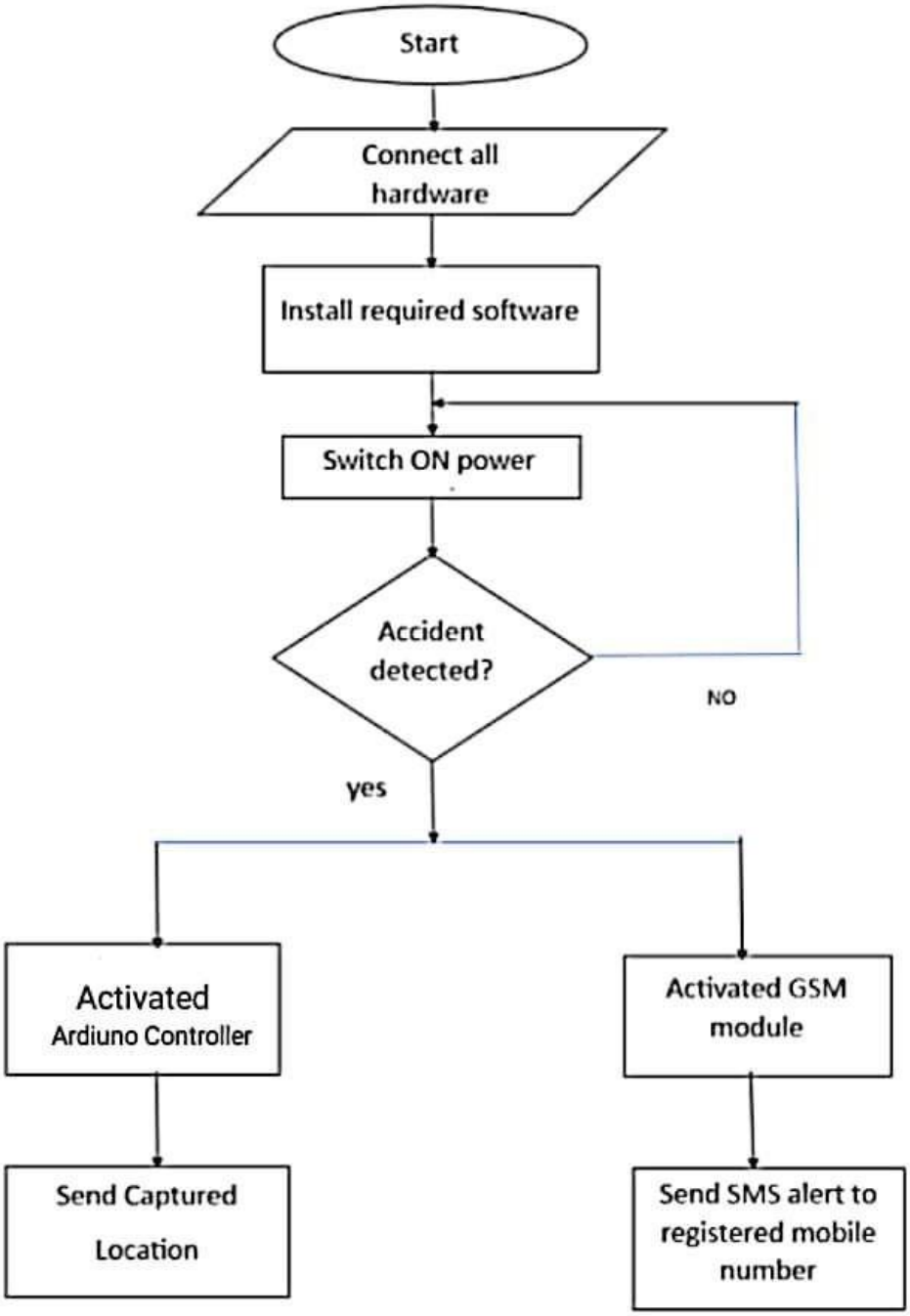
II. METHODS



1. Arduino Uno initializes and establishes connections with GSM, GPS, and MPU6050.
2. MPU6050 measures vehicle motion and sends data to Arduino for analysis.
3. GPS module determines accurate location and sends data to Arduino.
4. Arduino processes sensor data to detect potential accidents using algorithms.
5. If an accident is detected, Arduino triggers the GSM module for alert transmission.
6. GSM module sends alerts to predefined emergency contacts or services via cellular communication.
7. Emergency responders or contacts receive the alerts and respond accordingly.
8. Meanwhile, Arduino continues monitoring sensor data for any changes.
9. System remains active, continuously assessing vehicle motion and location
10. The cycle repeats, ensuring real-time accident detection and alerting capabilities.

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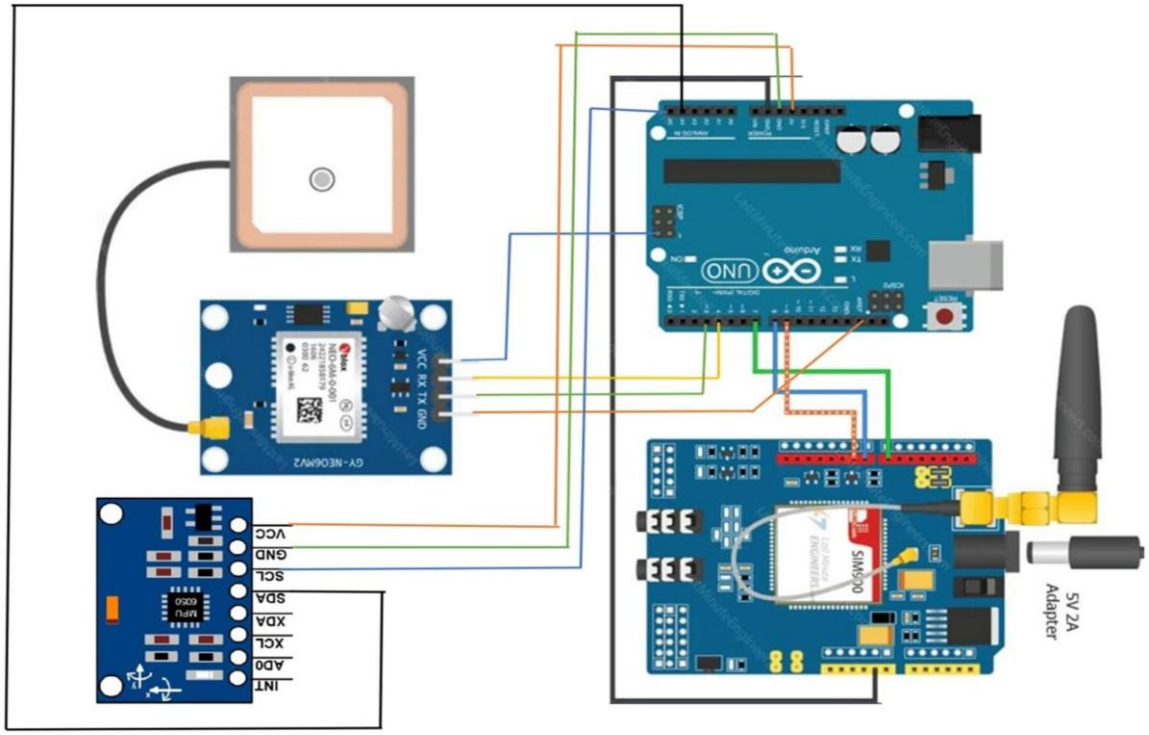

The Arduino Uno stands as a cornerstone in the realm of microcontroller boards, cherished for its simplicity and versatility. Powered by the ATmega328P chip, it boasts 14 digital input/output pins, 6 analog inputs, and a 16 MHz crystal oscillator. Its USB connection facilitates both programming and power, making it accessible for beginners and experts alike. With its open-source nature, it enjoys a vast ecosystem of libraries and community support, enabling rapid development. From basic LED blinking to complex IoT projects, its flexibility knows few bounds. Moreover, its compatibility with a myriad of shields and modules extends its functionality for diverse applications. Whether you're delving into robotics, automation, or interactive art, the Arduino Uno remains a go-to choice. Its affordability, accessibility, and extensive documentation make it a favorite in educational settings and professional environments alike. With continuous updates and a passionate community behind it, the Arduino Uno continues to inspire innovation and creativity worldwide

The MPU6050 sensor module serves as a compact solution for 6-axis motion tracking, comprising a 3-axis gyroscope, 3-axis accelerometer, and Digital Motion Processor (DMP), accompanied by an integrated temperature sensor. Its communication with microcontrollers occurs via an I2C bus interface. This Micro Electro-Mechanical Systems (MEMS) module facilitates the measurement of diverse motion-related parameters, such as acceleration, velocity, orientation, and displacement, for systems or objects. A notable feature is its Digital Motion Processor (DMP), which adeptly handles complex calculations, thereby relieving the microcontroller of computational tasks. Additionally, it provides two auxiliary pins for potential connections to external I2C modules, like a magnetometer, although this functionality is optional. The module's I2C address is configurable, enabling the use of the AD0 pin to connect multiple MPU6050 sensors to a single microcontroller. Furthermore, it benefits from well-documented and regularly updated libraries, streamlining integration with widely used platforms such as Arduino.

The NEO-6M GPS module is designed to receive signals from GPS satellites, allowing for highly accurate determination of the device's location. Integrating this module into your system enables precise tracking of vehicle positions, essential for notifying emergency responders or relevant parties in case of accidents. Part of the NEO-6 module series, these standalone GPS receivers utilize the u-blox 6 positioning engine, renowned for its exceptional performance. Housed in a compact 16 x 12.2 x 2.4 mm enclosure, these receivers offer various connectivity options and are cost-effective. Ideal for battery-operated mobile devices with space and cost constraints, NEO-6 modules stand out due to their compact design, power efficiency, and memory options. The u- blox 6 positioning engine, featuring 50 channels, ensures a Time-To-First-Fix (TTFF) of less than 1 second. Its dedicated acquisition engine, equipped with 2 million correlators, enables extensive simultaneous time/frequency space searches, facilitating rapid satellite acquisition. Moreover, NEO-6 GPS receivers deliver superior navigation performance, even in challenging environments, thanks to innovative design and technology that effectively suppresses jamming sources and mitigates multipath interference.

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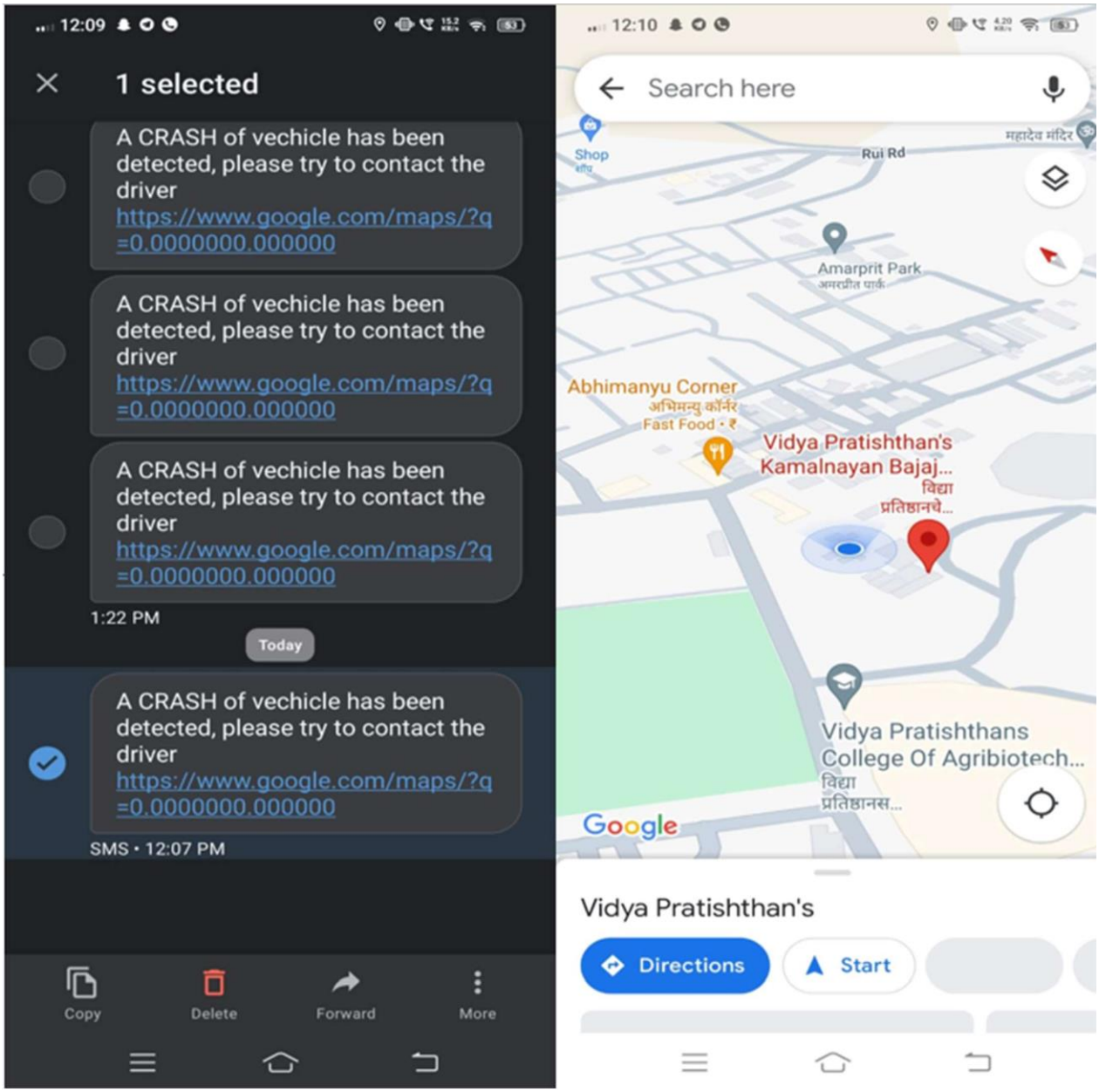
The GSM 9000A is a sophisticated communication device primarily used in professional settings such as law enforcement, security, and government agencies. It features advanced encryption protocols, ensuring secure transmission of sensitive information. Equipped with cutting-edge technology, it supports multiple communication channels including voice, data, and messaging. The device boasts a rugged design, suitable for harsh environments and field operations. Its compact size and lightweight construction enhance portability and ease of use. The GSM 9000A incorporates features like GPS tracking and remote activation for added functionality and convenience. With its long battery life and durable construction, it's a reliable tool for professionals requiring secure and efficient communication capabilities The device undergoes rigorous testing to meet stringent quality and reliability standards, ensuring optimal performance in demanding situations. Its intuitive interface and user friendly controls facilitate seamless operation even in high-pressure scenarios. Overall, the GSM 9000A is a dependable solution for secure communication needs in demanding environments.

III. RESULT



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IV. RESULTS AND DISCUSSION

• The Map Widget on Android is a versatile tool that allows you to visualize and interact with geographical data in real-time. Here are some common use cases for the Map Widget with Android:

• GPS Tracking: Display the real-time location of a GPS-enabled device on the map. Monitor the movement and track the path of a vehicle, person, or any mobile asset.

V. CONCLUSION

Ardiuno Module: Assess the communication capabilities, ensuring that the module can establish a reliable connection with the network. Evaluate the compatibility with other components, especially the GSM and GPS modules.

GSM Module (e.g., SIM900a): Verify the ability to send and receive SMS or data, as this is crucial for real- time communication in accident detection systems. Evaluate network connectivity and signal strength to ensure robust communication.

GPS Module: Check the accuracy and precision of location tracking provided by the GPS module. Assess the time taken to acquire a GPS fix and whether it meets the real-time requirements of accident detection.

Gyro Sensor: Evaluate the gyro sensor's sensitivity and responsiveness in detecting changes in orientation or acceleration. Ensure that the sensor provides reliable data for assessing the vehicle's movement and potential accidents

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