

AgriRoute: Smart Vehicle Monitoring System for Farmers in Agricultural Transport with Real-Time Alerts.

Mid-Review 3

AY 2021-25

GITAM (Deemed-to-be) University

Department of Electrical Electronics and
Communication Engineering

**Major Project
Project ID: C15**

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Objective and Goals

Objective

- To create a cost-effective Vehicle Tracking System (VTS) using Arduino, GPS, and GSM modules to promote widespread adoption among farmers with limited technical skills.
- To design the system to be scalable, allowing for the integration of additional sensors like temperature, humidity, or load monitoring to meet various agricultural needs and maintain optimal conditions for transported goods.
- To develop an easy-to-use mobile app that offers real-time location tracking, delivery notifications, and transaction history, facilitating smooth communication and coordination among farmers, transporters, and buyers.

Goals

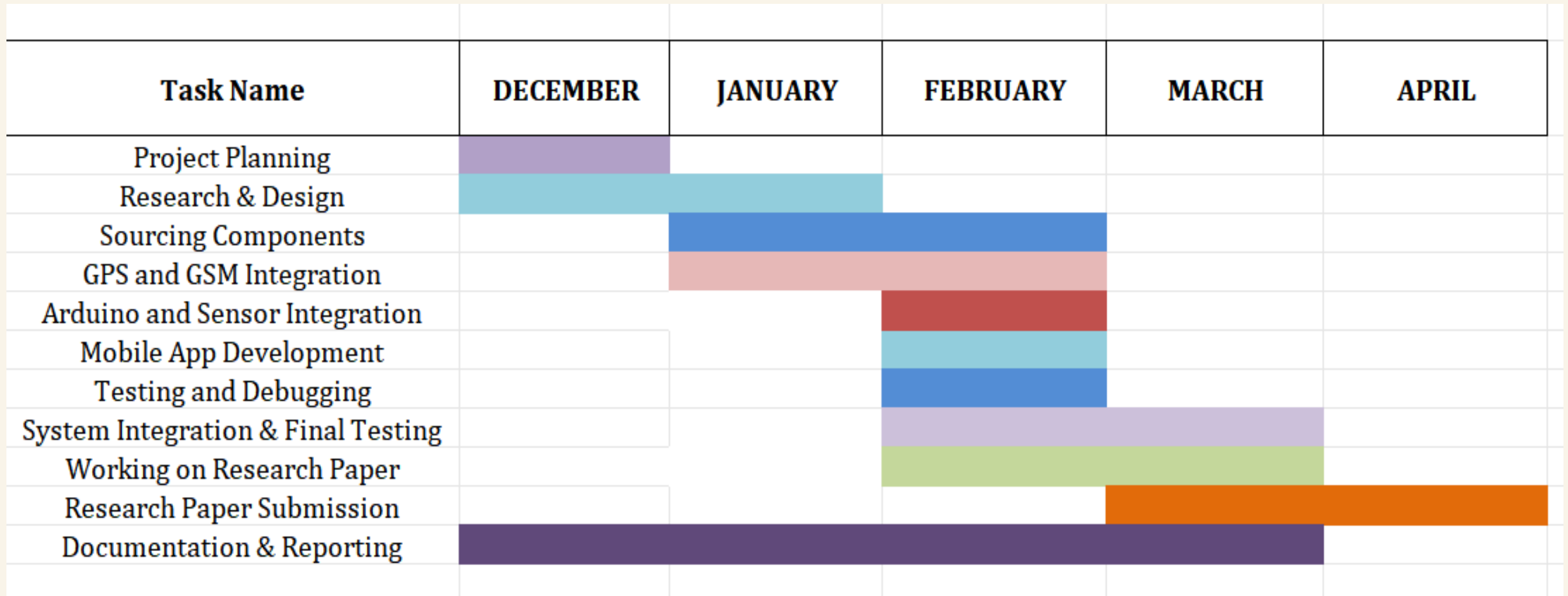
Main Goals :

- Ensure system designed provides accurate real-time location of the vehicle using GPS.
- Incorporate mapping services, such as Google Maps, to display vehicle location data.
- Implementing the tracking features for both clients and the customers.

Additional Goals :

- Ensure that the application is compatible for both iOS and Android platforms to reach a broader user base.
- Enable the feedback system from client for enhancing customer support.

Gantt Chart - Project Plan



Literature Survey

Key Publications

RESEARCH PAPER DETAILS	METHODOLOGY	MERITS	RESEARCH GAP	LINK
<p>Real Time Vehicle Tracking Scheme by Analysing Spatial Position through GPS and GSM</p> <p>Author Name : T. Sindhu ; L. SaiRamesh Date : 2020 Publication Name : IRJMETS</p>	<p>The system integrates GPS, GSM, and Android applications to enable real-time tracking, geo-fencing, and speed detection, ensuring accurate monitoring and notifications.</p> <p>It provides multi-device compatibility through Google Maps and intuitive interfaces, making it accessible for various users and adaptable to diverse applications.</p>	<p>Comprehensive features like real-time monitoring, geo-fencing.</p> <p>User-friendly design and custom GSM alerts ensure ease of use and quick responsiveness, even in emergencies.</p>	<p>The system lacks alternatives for GPS unavailability, energy-efficient tracking.</p> <p>It does not address scalability.</p>	<p>https://www.irjmets.com/uploadedfiles/paper/volume2/issue_9_september_2020/4048/1628083160.pdf</p>

RESEARCH PAPER DETAILS	METHODOLOGY	MERITS	RESEARCH GAP	LINK
<p>Live GPS Location Tracking using GPRS</p> <p>Author's Name : Jayesh Sharma Sai Deepak Guggilla Shashi pidugu Dr. Pandya Vyomal Date: 2021 Publication Name: IJRASET</p>	<p>The system uses GPS and GSM modules connected to a microcontroller to track and transmit vehicle location. Data is uploaded to a cloud server for monitoring. Sensors for collision detection and tampering are integrated.</p> <p>IoT enables predictive analysis, automated alerts, and real-time responses to enhance vehicle security.</p>	<p>AI and IoT enable predictive maintenance and theft detection.</p> <p>It offers scalability for fleet management, while cloud integration allows remote access.</p> <p>The design emphasizes cost-efficiency, user-friendly interfaces, and low power consumption for long-term usability.</p>	<p>The system design is limited to single-vehicle tracking.</p> <p>The paper does not propose a user-friendly interface or mobile app for real-time monitoring.</p> <p>Continuous GPS and GSM module operation may drain power quickly, making the system less viable for long-term vehicle tracking without a stable power source.</p>	<p>https://www.ijraset.com/files/erve.php?FID=36081</p>

RESEARCH PAPER DETAILS	METHODOLOGY	MERITS	RESEARCH GAP	LINK
<p>Vehicle Tracking System using GPS and GSM Technology</p> <p>Author's Name : Niraj Sakla Avinash Pawar Prof. Anamika Dhawan Date: 2022 Publication Name: IJRASET</p>	<p>A microcontroller is used to connect the GPS and GSM modules. The GPS module captures the vehicle's location through latitude and longitude coordinates.</p> <p>This location data is then sent to the user's mobile phone via the GSM module as an SMS. Serial communication is used to transfer data between the GPS and the system.</p>	<p>The system provides real-time tracking, allowing continuous monitoring of vehicles.</p> <p>It is cost-effective.</p> <p>Users receive instant SMS alerts with the vehicle's location, making it easy to track.</p>	<p>The system does not include any features for optimizing energy use.</p> <p>It focuses solely on tracking the vehicle's location without offering additional functionalities.</p>	<p>https://www.ijraset.com/best-journal/vehicle-tracking-system-using-gps-and-gsm-technology</p>

RESEARCH PAPER DETAILS	METHODOLOGY	MERITS	RESEARCH GAP	LINK
<p>Research and Appropriate Implementation on Vehicle Tracking system using IOT</p> <p>Author Name : Anish Khanal, Manoj Shreshta</p> <p>Date : February, 2024</p> <p>Publication Name : IJFMR</p>	<p>Combines GPS, microcontrollers, and cloud storage to track vehicles and manage data efficiently.</p> <p>Enables real-time tracking while ensuring data privacy and security compliance.</p>	<p>Incorporating machine learning for predictive maintenance and optimized routing highlights an innovative approach to fleet management, setting the system apart from traditional tracking solutions.</p> <p>The study's focus on data privacy, security, and regulatory compliance demonstrates an understanding of the ethical implications of IoT-based tracking systems.</p>	<p>Although the framework is described as scalable, there is no in-depth analysis of how the system performs under increasing fleet sizes or varying network conditions.</p> <p>IoT devices often face challenges related to power consumption, but this aspect is not addressed, which is critical for long-term deployments.</p>	<p>https://www.ijfmr.com/papers/2024/1/12591.pdf</p>

RESEARCH PAPER DETAILS	METHODOLOGY	MERITS	RESEARCH GAP	LINK
<p>Development and Performance analysis of a GPS GSM Guided System for Vehicle Tracking</p> <p>Author's Name : B. Adaramola, Ayodeji Olalekan Salau Date: 2020 Publication Name: ICCAKM</p>	<p>The GPS-GSM-based vehicle tracking system uses hardware components such as an Arduino microcontroller, GSM module, GPS module, and vibration sensors.</p> <p>The system integrates these components through software development in the Arduino IDE, which processes inputs and transmits outputs via SMS.</p>	<p>The system offers real-time tracking and an anti-theft feature. It allows multiple vehicles to be tracked efficiently.</p>	<p>The system uses manual data interpretation instead of internet-based tracking, limiting its efficiency in real-time updates and monitoring.</p>	<p>https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9051533&tag=1</p>

Key Resources :

Whitepapers and Research Articles :

- **Agricultural Supply Chain Challenges and Solutions:**

Link: https://www.researchgate.net/publication/271700201_Agricultural_Supply_Chain_and_Logistic_-_trends_and_challenges

Explores challenges in agricultural logistics, including delays, spoilage, and inefficiencies, with proposed solutions.

- **Minimizing Spoilage and Delays in Supply Chains:**

Strategies to mitigate risks in supply chains, including real-time monitoring and predictive analytics.

Link: <https://sloanreview.mit.edu/article/reducing-the-risk-of-supply-chain-disruptions/>

Focuses on technology-driven solutions to reduce delays and enhance supply chain reliability.

Link: <https://www.oracle.com/in/scm/reduce-supply-chain-disruptions/>

Technology Implementation Guides

Arduino Uno R3

Link: <https://vayuya.com/blog/arduino-uno-r3-complete-guide-for-beginners/?srsltid=AfmBOoqvCh2y10AAmdDj1dp1uDIpeXeoNhaPlvJ6o-rFrTXELKq2Lkr>

A detailed introduction to using the Arduino Uno R3, with setup instructions and example projects.

GPS Modules (Neo-6M)

Link: <https://randomnerdtutorials.com/guide-to-neo-6m-gps-module-with-arduino/>

Comprehensive setup and interfacing guide, including example codes and troubleshooting tips.

GSM Modules

Link: <https://robocraze.com/blogs/post/interfacing-gsm-module-with-arduino?srsltid=AfmBOorI-UlgudZ6Dmzmqeq8ZvjzVCx-88QlL0qAGP49HWlogq8wpFvA>

Explains step-by-step connections and code examples for sending/receiving SMS and calls.

DHT11 Sensors

Link: <https://www.electronicwings.com/sensors-modules/dht11>

Covers temperature and humidity sensing with wiring diagrams and code snippets.

HX711 Load Cells

Link: <https://randomnerdtutorials.com/arduino-load-cell-hx711/>

Guides users in measuring weight using HX711 and Arduino, with calibration tips.

Existing Implementations :

• Products:

GPS Tracker on Amazon:

Link: <https://amzn.in/d/iBu4o3z>

A compact GPS tracker for vehicles with real-time tracking capabilities. It provides location updates and theft detection with SIM-based communication.

GSM GPS-Based Vehicle Theft Detection and Tracking System:

Link: <https://projectsfactory.in/product/gsm-gps-based-vehicle-theft-detection-and-tracking/>

A pre-designed project offering GSM and GPS-based theft detection and vehicle tracking. It alerts the owner in case of unauthorized access and provides location updates.

GSM and GPS-Based Vehicle Tracking System:

Link: <https://projectsfactory.in/product/gsm-and-gps-based-vehicle-tracking-system/>

A ready-to-use system for tracking vehicles using GSM and GPS modules. It sends vehicle location data via SMS and is ideal for monitoring fleet movement.

TRACKER Pre-Recharged SIM GPS Tracker on Amazon:

Link: <https://www.amazon.in/TRACKER-Pre-Recharged-SIM-GPS-Tracker/dp/B0DHXY8Q4C>

A portable GPS tracker with pre-recharged SIM, offering easy plug-and-play functionality. It enables location monitoring and anti-theft protection for vehicles.

- **Open Source:**

Location Tracking System Using Arduino:

Link: <https://justdoelectronics.com/gps-gsm-based-location-tracking-system-using-arduino/>

A DIY tutorial on building a GPS and GSM-based tracking system using Arduino. It demonstrates how to fetch location coordinates and send them via SMS.

GSM GPS-Based Vehicle Tracking System (Electronics For You):

Link: <https://www.electronicsforu.com/electronics-projects/hardware-diy/gsm-gps-based-vehicle-tracking-system>

A detailed guide for creating a vehicle tracking system with GSM and GPS modules. It explains hardware assembly and software coding for tracking functionality.

- **GitHub:**

Real-Time Vehicle Tracking System:

Link: <https://github.com/rohitkrtiwari/real-time-vehicle-tracking-system>

A repository featuring an Arduino-based vehicle tracking system. It uses GPS and GSM modules for real-time updates and includes sample code for integration.

Vehicle Tracking System:

Link: <https://github.com/faem/vehicle-tracking-system>

A repository providing a GPS and GSM-based tracking solution. It features Python-based software for tracking and data analysis.

Traccar:

Link: <https://github.com/traccar/traccar>

An open-source GPS tracking platform supporting multiple devices and protocols. It offers real-time tracking and geolocation services with a user-friendly interface.

ESP32-Based IoT Tracking System:

Link: <https://github.com/ranizouaoui/ESP32-Based-IoT-Tracking-System>

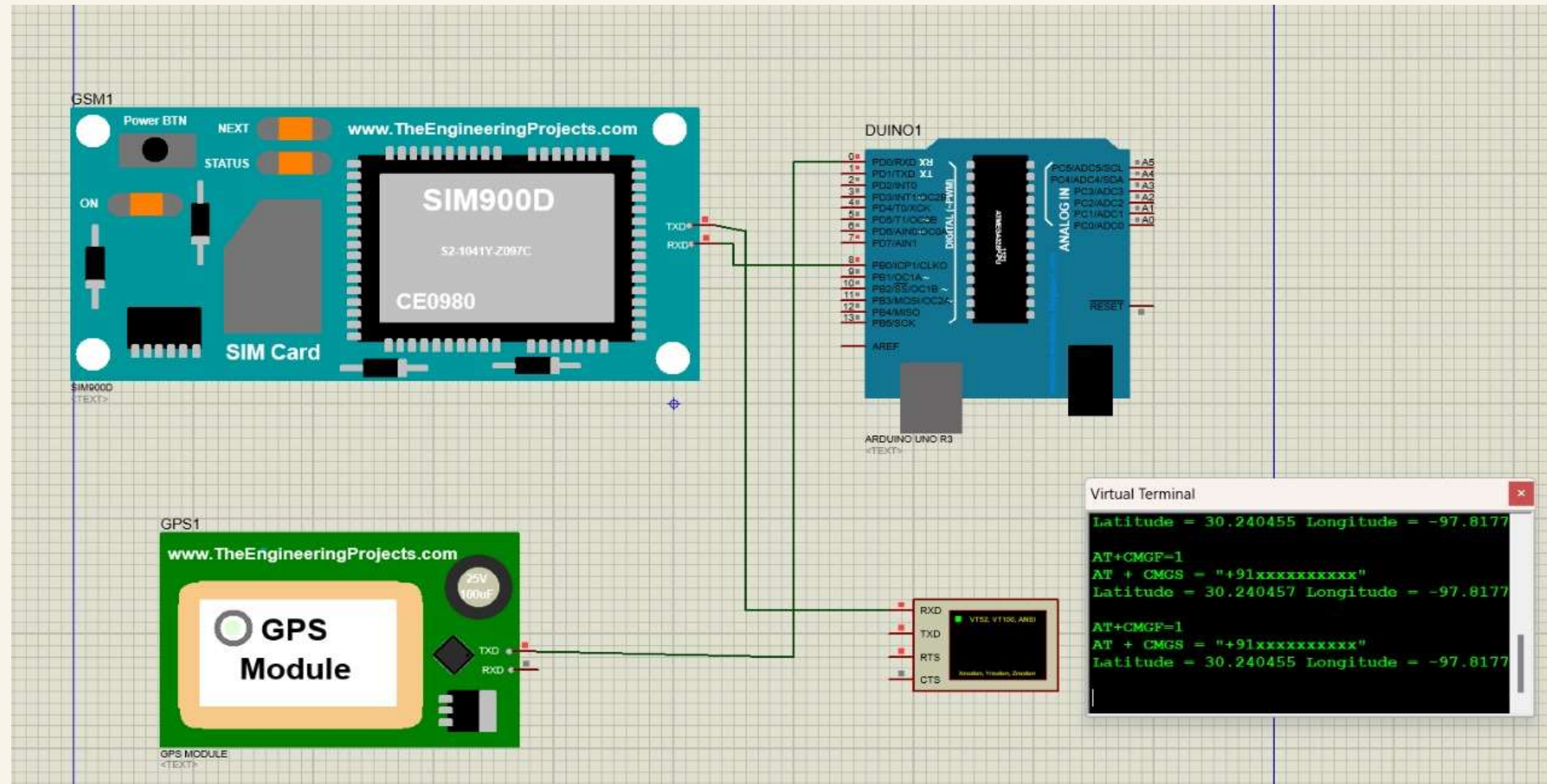
A repository showcasing an IoT-based tracking system using the ESP32 microcontroller. It integrates GPS and GSM modules for precise tracking.

TraceIT:

Link: <https://github.com/race2infinity/TraceIT>

A GitHub project for vehicle tracking and fleet management. It uses GPS technology and offers detailed tracking analytics.

RECAP OF SOFTWARE SIMULATION IN PROTEUS 8 :



APP & WEBSITE BASIC DESIGN OUTLINE :

ChatGPT x Agriroute - Home x +

127.0.0.1:5500/index/index.html

Products Feedback Location History Login

Login to Agriroute

Username

Password

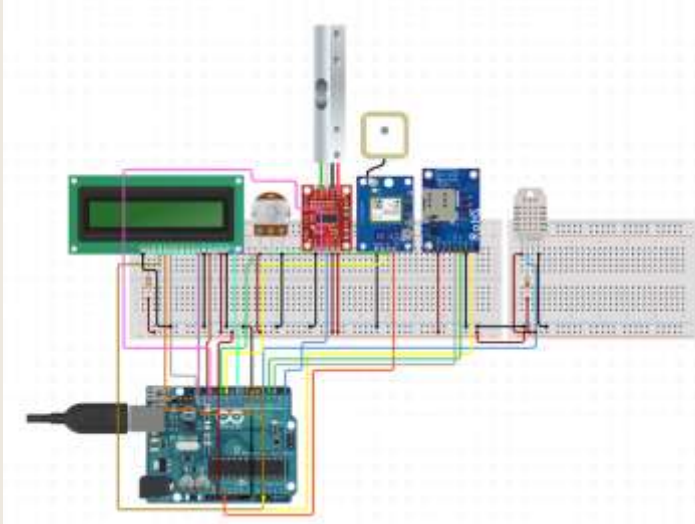
Login

Don't have an account? [Register here](#)

WORK PROGRESS FROM REVIEW-1 TO REVIEW-2



ASSEMBLING COMPONENTS
100% WORK PROGRESS



CIRCUIT DESIGNING
50% WORK PROGRESS

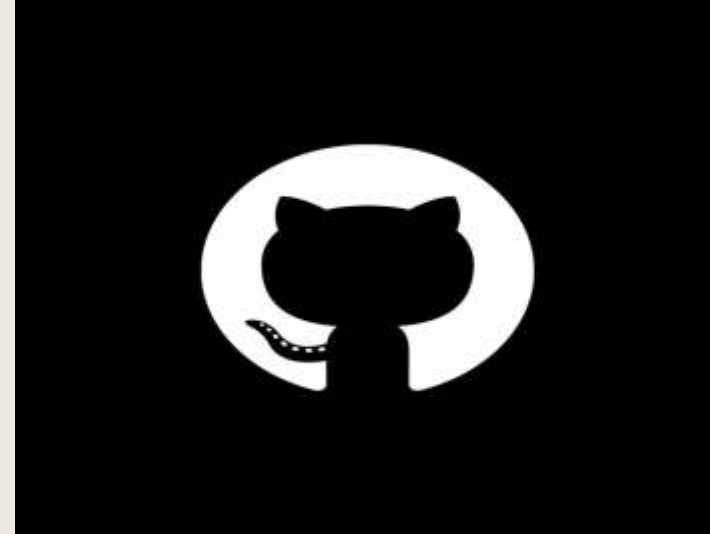


APPLICATION DEVELOPMENT
50% WORK PROGRESS

WORK PROGRESS FROM REVIEW-1 TO REVIEW-2



LIBRARIES & CODE BUILDING
30% WORK PROGRESS



GITHUB REPO UPDATION
70% WORK PROGRESS

Structural Diagram

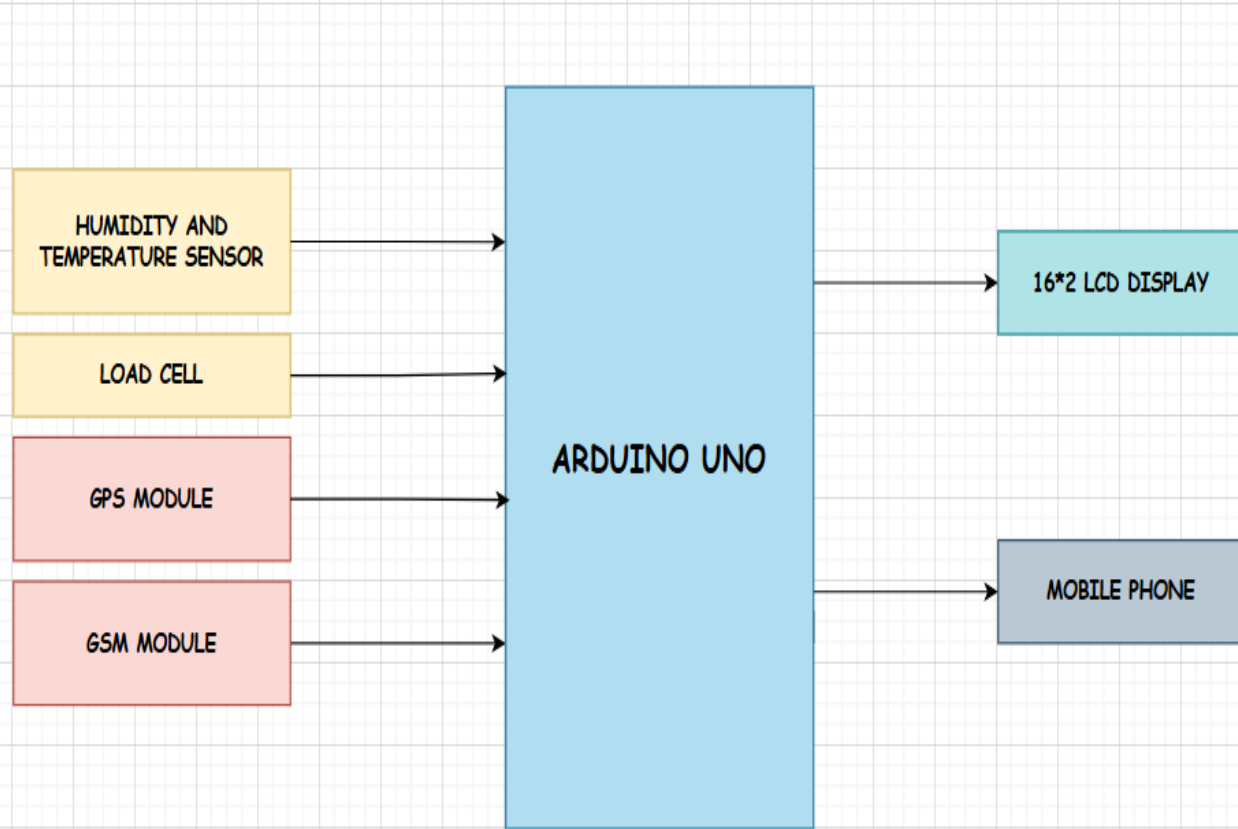


Fig: Block diagram of Vehicle Tracking System

Monitoring Conditions: Temperature and humidity sensor ensures perishable commodities are transported under ideal conditions.

Load Management: Load cell measures item weight during loading and unloading, preventing overloading and ensuring precise delivery counts.

Real-Time Tracking: GPS module tracks vehicle location in real time.

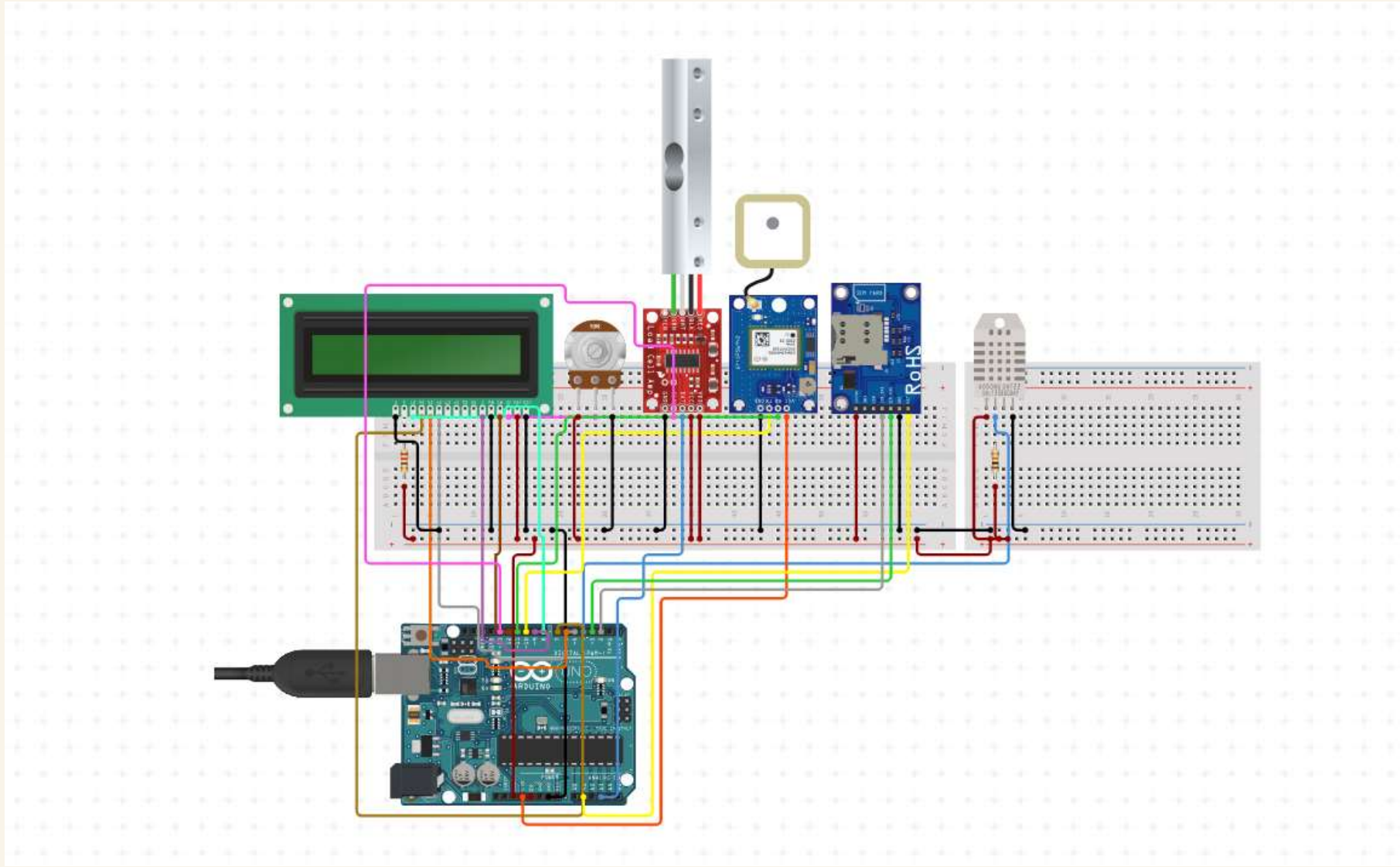
Alerts: GSM module sends SMS alerts to mobile phones with updates on location, weight changes, and abnormal environmental conditions.

Central Controller: Arduino Uno processes sensor data.

Display: 16x2 LCD screen shows statistics like location, temperature and weight.

VISUALIZATION OF THE AGRI-ROUTE CIRCUIT :

REVIEW 2



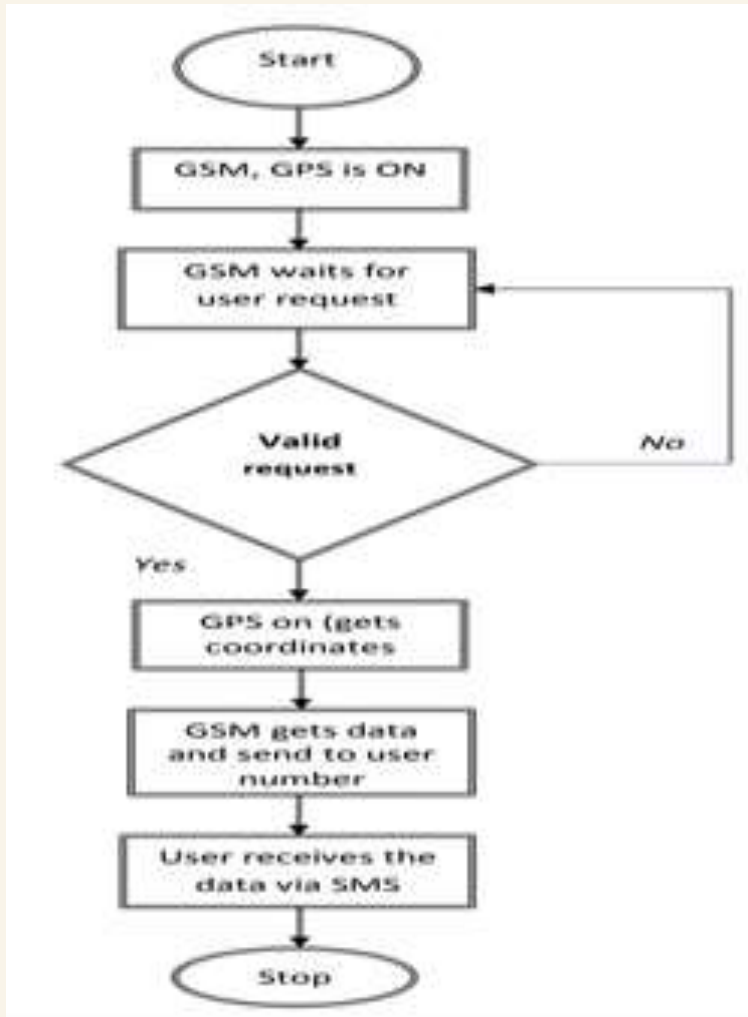


Fig: Flowchart illustrating algorithm for VTS.

The VTS integrates GSM, GPS, temperature and humidity sensors, and a load cell for monitoring and real-time updates.

Initialization Step: The system activates the GSM, GPS modules, and sensors to prepare for data collection.

Waiting for User Request:

The system remains idle until it receives a valid user request.

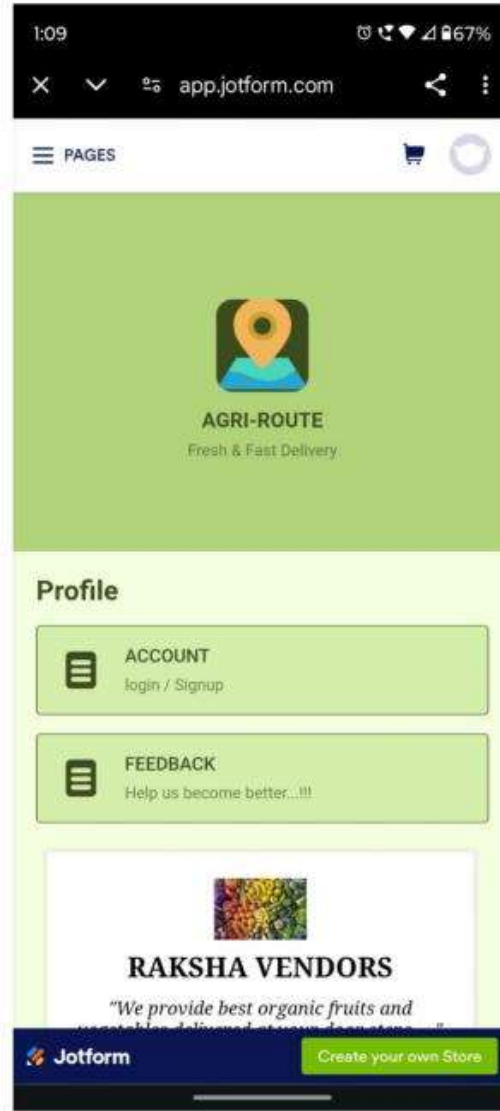
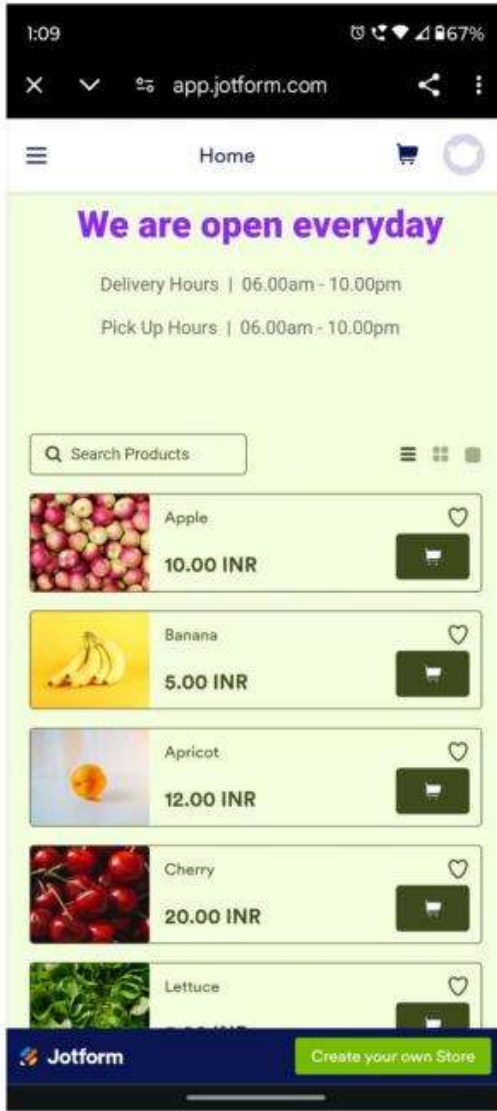
Processing the Request:

The GPS module retrieves the vehicle's location.

Sensors collect data on temperature, humidity, and weight.

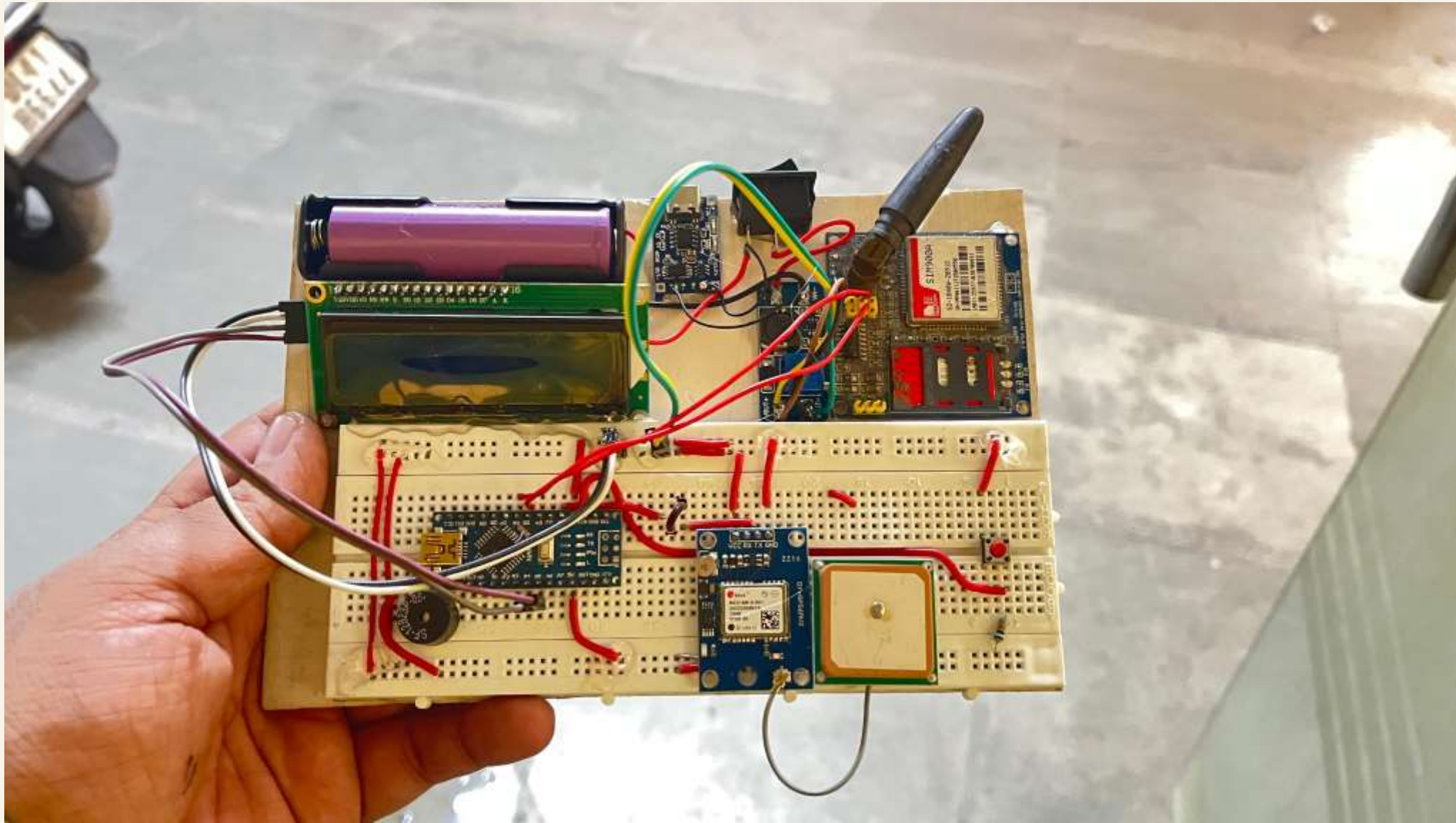
Transmitting Information: GSM module sends an SMS with location, environmental conditions, and weight details to the user's mobile.

Reset for Next Cycle: The system resets after sending the information to handle subsequent user requests.



APPLICATION FEATURES:

- SUPPORTS BOTH ANDRIOD & IOS
- RECIEVES FEEDBACK VIA EMAIL
- RECIEVES ACCOUNT LOGIN DETAILS VIA EMAIL
- CAN BE INSTALLED OR USED AS WEB APPLICATION
- COMPATIBLE FOR BOTH DESKTOP AND MOBILE PLATFORMS



Use Cases & Testing

Use Cases for the Vehicle Tracking System :

Agricultural Logistics – Helps farmers track transportation of goods, ensuring timely deliveries and reducing spoilage.

Fleet Management – Monitors commercial vehicle fleets, optimizing routes and reducing fuel consumption.

Emergency Response – Enables real-time tracking of ambulances and fire trucks for faster emergency services.

School Bus Tracking – Ensures student safety by allowing parents and schools to monitor bus locations.

Cold Chain Logistics – Tracks temperature-sensitive goods like dairy, vaccines, and perishable foods in transit.

Public Transport Optimization – Improves efficiency and passenger experience by tracking buses and taxis in real-time.

Rental & Shared Vehicles – Helps rental services track and manage their vehicles remotely for better asset management.

Implementation and Results – Iteration 1

Iteration 1 : Results

Accurate Tracking –

The system successfully provided real-time location updates using GPS and GSM.

Reliable Communication –

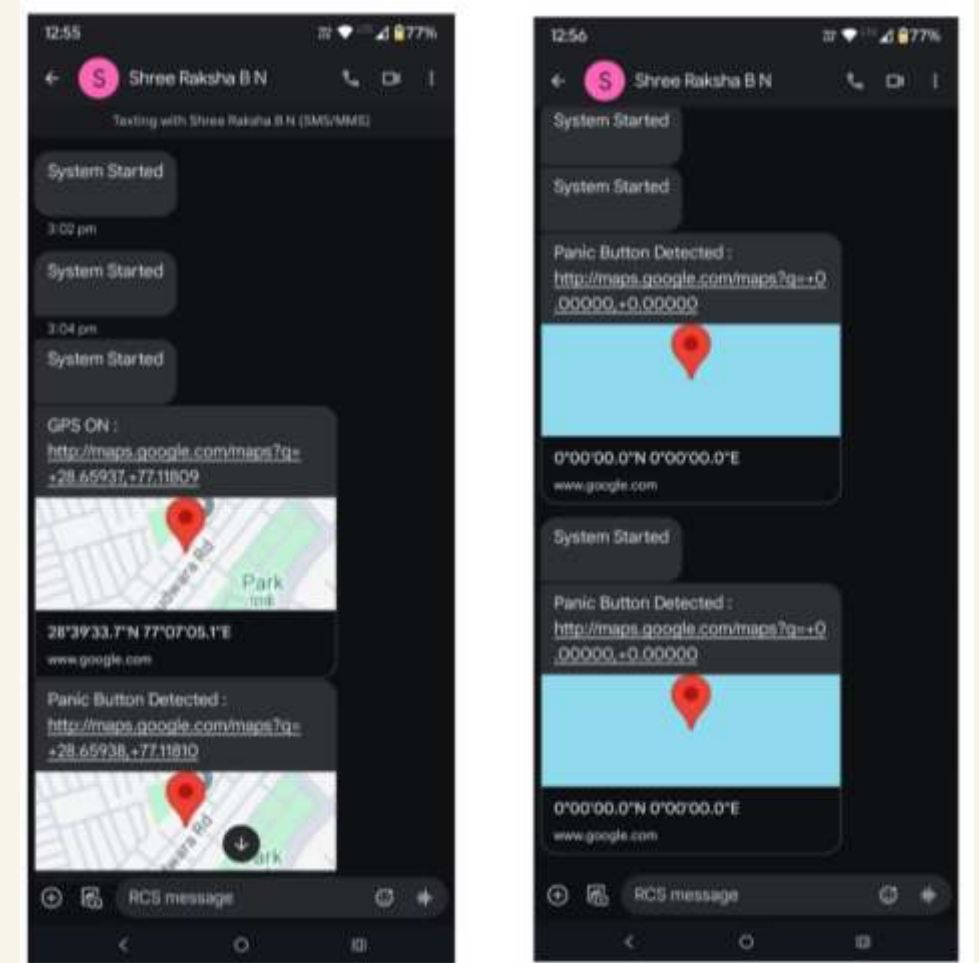
SMS-based tracking worked well in low-internet areas, ensuring accessibility.

Power Efficiency –

The use of 18650 lithium-ion batteries improved battery life and system stability.

User-Friendly Application –

The Agri-Route app working to facilitate seamless user-friendly.



Implementation and Results – Iteration 2

Iteration : Results + Validation against the use cases and test cases

Results :

GPS & GSM Functionality – Successfully provided real-time tracking.

SMS-Based Tracking – Location updates were sent and received without internet dependency.

Panic Button – Emergency alerts with location details were triggered successfully.

Power Performance – 18650 lithium-ion batteries ensured stable operation.

Agri-Route App – Enabled basic transactions, but UI improvements are needed.

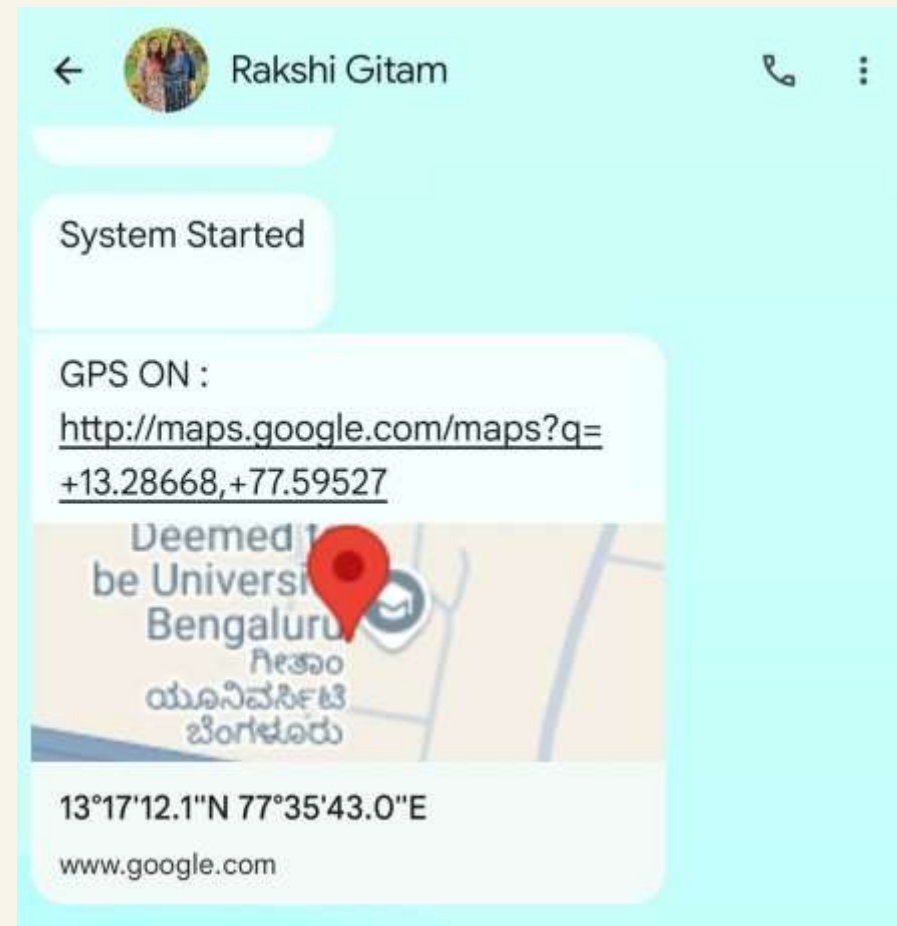
Validation :

Accurate Tracking – System provided real-time location updates as expected.

Reliable Emergency Alerts – Panic button effectively sent location-based notifications.

Transaction Processing – Agri-Route app functioned but requires enhancements.

Offline Functionality – SMS-based tracking worked without internet access.



Contribution

Team Progress and Movement

- Completed integration of the components
- Application Outline has been designed for easy access
- Targetting IEEE Conference paper (submission on 15th April)
- IEEE International Conferences on Network, Multimedia, and Information Technology (NMITCON)

Individual Contribution

- Key contributions: MEGHANA B
- Circuit & Code Designing, Application Building
- Key contributions: MATAM MANASWINI
- Circuit & Code Designing, Literature survey
- Key contributions: SHREE RAKSHA B N
- Documentation, Circuit Designing, App building

Conclusion & Future Work

Summary and Conclusion :

GPS & GSM-based Tracking –

Uses Arduino Nano and SMS-based tracking for accurate location monitoring, even in rural areas.

Efficient & Secure System –

Features a panic button, Agri-Route app for direct trade, and 18650 batteries for power efficiency.

Scalable IoT Solution –

Overcomes GPS & power issues, enhances supply chain management, and ensures cost-effective logistics.

Future Work :

Cloud-Based Tracking –

Integrate a web dashboard for continuous GPS tracking, reducing reliance on SMS.

Advanced Mobile App –

Develop a custom Android/iOS app with live tracking, push notifications, and analytics.

Improved GPS & Security –

Upgrade to multi-band GPS modules and implement encryption, geofencing, and motion detection.

THANK YOU

Have a Great Day !