LEADING UNIVERSITY

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ASSET TRACKING SYSTEM IOT

PROJECT PROPOSAL

PREPARED FOR

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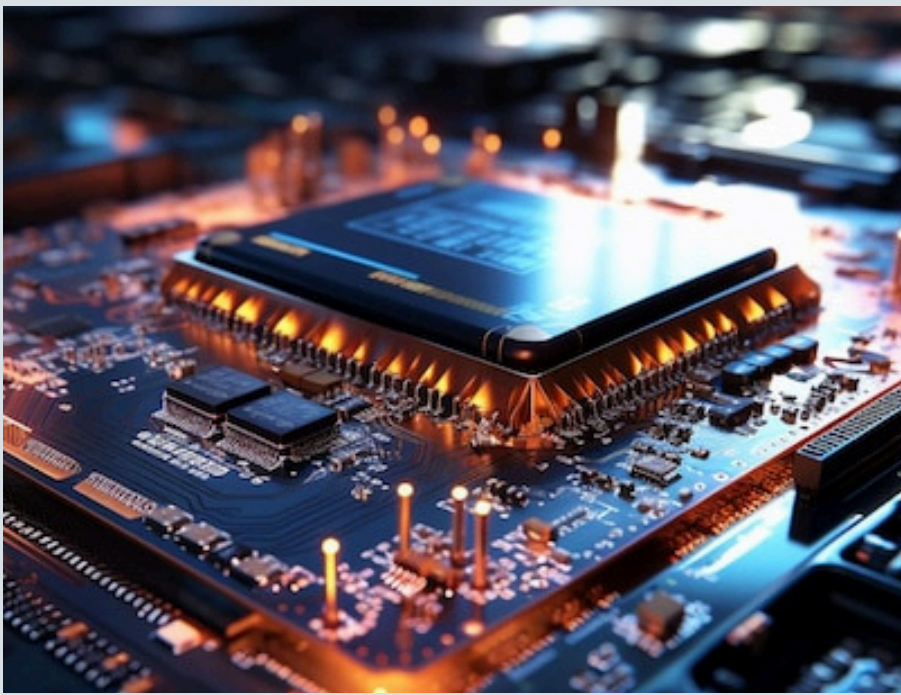
PRESENTED BY

ASTRAL PROJECTORS



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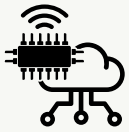
SMART TRACKING SOLUTIONS: AN IOT-BASED APPROACH TO ASSET MANAGEMENT

In today's fast-paced world, efficient management and tracking of valuable assets are crucial for businesses and organizations. The IoT-based Asset Tracking System is an innovative solution designed to monitor and manage assets in real-time, providing peace of mind and enhancing operational efficiency. By leveraging advanced IoT sensors, such as GPS modules and GSM communication, our system offers seamless tracking of equipment, vehicles, and even university buses.

This project aims to address the common challenges of asset loss and theft, enabling users to keep a constant eye on their valuable items. With a user-friendly web dashboard, stakeholders can access real-time location data, ensuring informed decision-making and swift responses to potential issues. As a result, this system not only reduces operational risks but also promotes a smarter approach to asset management.

OBJECTIVE

This IoT-based asset tracking system project aims to create a comprehensive solution that allows for real-time monitoring and management of assets throughout their existence. The solution uses Internet of Things (IoT) technologies to improve asset visibility and responsibility across several locations. It intends to use sensors and communication technologies to gather information on asset location, status, and usage patterns, which will then be communicated to a centralized platform for analysis and reporting. The ultimate goal is to improve operational efficiency, reduce losses and theft, optimize resource allocation, and enable informed decision-making by generating actionable insights from the data acquired. Implementing this technology allows firms to gain greater control over their assets, resulting in increased production and cost savings.



METHODOLOGY

The IoT-Based Asset Tracking System is designed to track and manage assets in real-time using a combination of IoT technology, GPS, and wireless communication networks. This methodology outlines the systematic approach for building and implementing the system.

1. System Design and Hardware Components

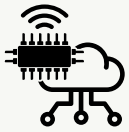
The hardware forms the backbone of the system, and the design starts with selecting key components:

- GPS Module: Accurately tracks the location of the asset.
- Microcontroller: Devices like Arduino or ESP32 handle data processing from the GPS.
- Communication Module: Enables data transmission via Wi-Fi, GSM, based on required communication range and network availability.
- Power Supply: Portable battery ensures the system runs independently, with power-saving strategies for longevity.

All components are integrated into a single compact unit that can be attached to assets.

2. Software Development and Programming

- Microcontroller Programming: The microcontroller is programmed to interface with the GPS and communication module.
- Embedded System Software: It processes real-time location data and formats it for transmission to the cloud.
- Cloud Integration: A cloud platform (e.g., AWS IoT, Google Cloud) is set up for data storage and processing. The use of protocols like MQTT or HTTP ensures secure and efficient data transfer.



METHODOLOGY

3. Data Transmission and Communication Protocols

- Data Transmission: The system sends GPS data to the cloud at defined intervals using the selected communication module.
- Cloud Communication: The system is programmed to use MQTT or HTTP protocols to send and receive data reliably. The cloud platform stores the data and provides real-time updates.

4. User Interface and Real-Time Tracking

- Web/Mobile Application: A user-friendly interface is created to display real-time location data on maps. Users can monitor asset movement and receive notifications for pre-configured events like geo-fencing.
- Geo-Fencing and Alerts: The system can trigger alerts when assets move outside predefined boundaries, allowing for better security and management.

5. System Optimization and Testing

- Calibration: The system undergoes calibration to ensure accurate GPS data and reliable data transmission. Different scenarios, such as urban and rural environments, are tested for performance.
- Battery Optimization: To extend battery life, the device employs low-power modes and efficient data transmission intervals.

6. Security Measures

To ensure data integrity and system reliability, strong security protocols are implemented:

- Data Encryption: All communications between the device and cloud are encrypted using SSL/TLS to prevent unauthorized access.
- Access Control: The user interface employs secure login mechanisms to control access to sensitive tracking data.

METHODOLOGY

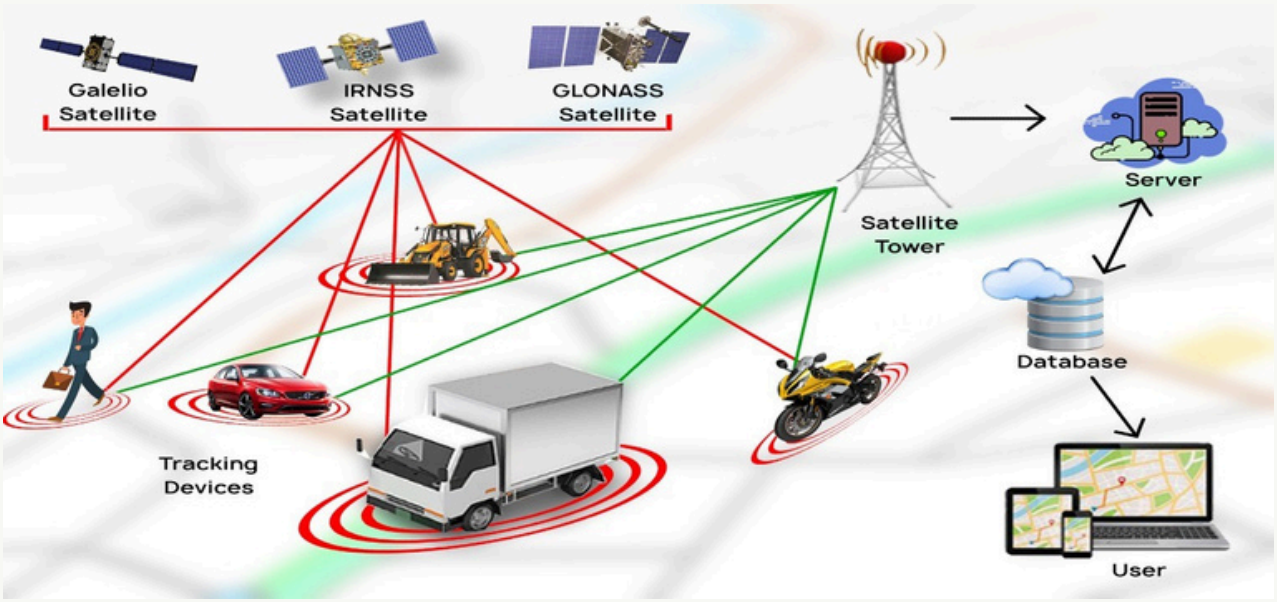
7. Field Testing and Validation

- Real-World Testing: The system is deployed in various environments to test its functionality, accuracy, and robustness. The device is validated for data consistency, GPS accuracy, and network performance.
- System Validation: Feedback from testing is used to refine the system, addressing any latency or accuracy issues to ensure reliability.

8. Scalability and Future Enhancements

The system is designed to scale, allowing the tracking of multiple assets simultaneously. Future developments may include machine learning for predictive asset tracking, enhanced battery management, and integrating additional sensors to monitor asset conditions such as temperature, humidity, or motion.

This ensures a comprehensive, scalable, and secure solution for real-time asset tracking, leveraging IoT technologies for efficient management and monitoring.



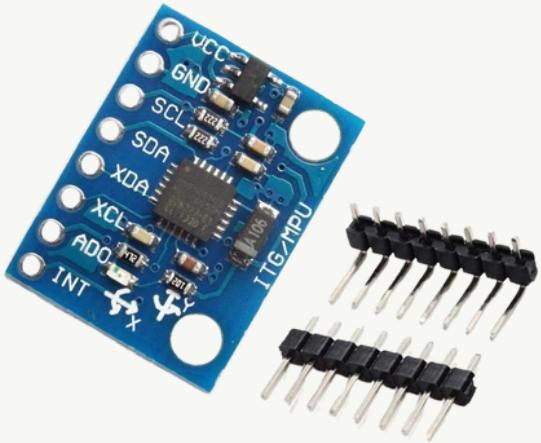
DETAILS OF COMPONENTS

List of Components-

1. U-Blox NEO-6M GPS Module,
2. 6DOF Accelerometer Gyroscope GY-521 MPU-6050,
3. ESP32 for Wemos DI Mini WiFi Bluetooth Development Board,
4. SIM900A Module 5V,
5. Lithium-Ion 3.7 Volt Rechargeable Battery,
6. L7806Cv Linear Voltage Regulator.

U-Blox NEO-6M GPS Module

The U-Blox NEO-6M GPS module is a reliable and efficient choice for various positioning applications. Its combination of high sensitivity, quick acquisition times, and easy integration make it a popular option for hobbyists and professionals alike. Whether you're working on a navigation system for a drone or an IoT device that requires location data, the NEO-6M provides a robust solution for your GPS needs.



6DOF Accelerometer Gyroscope GY-521 MPU-6050

A 6DOF Accelerometer is a sensor that measures motion and orientation in six degrees of freedom (6DOF). It combines both an accelerometer and a gyroscope to track movement in 3 linear axes (X, Y, Z) and 3 rotational axes (pitch, yaw, roll).

DETAILS OF COMPONENTS

ESP32 for Wemos DI Mini WiFi Bluetooth Development Board

The ESP32 is a low-cost, low-power system-on-chip (SoC) with integrated Wi-Fi and Bluetooth capabilities. It's designed for IoT (Internet of Things) applications and is a favorite among hobbyists, engineers, and developers for building connected devices.

SIM900A Module 5V

The SIM900A Mini Module (5V) is similar to the SIM900, but it's designed specifically for certain regions and offers slightly different features. It's commonly used in IoT projects for communication purposes.

Lithium-Ion 3.7 Volt Rechargeable Battery

A Lithium-Ion 3.7 battery-A Lithium-Ion 3.7V battery is a rechargeable battery commonly used in a wide variety of portable electronic devices, such as smartphones, laptops, cameras, and power tools. Lithium-Ion batteries can be sensitive to overcharging, deep discharging, and extreme temperatures. They usually come with integrated protection circuits to prevent damage and ensure safety.

DETAILS OF COMPONENTS

L7806Cv Linear Voltage Regulator

The L7806CV is a linear voltage regulator from the 7800 series. It’s designed to provide a fixed 5V output from a higher voltage input and is commonly used in power supply circuits

MODELING & ANALYSIS

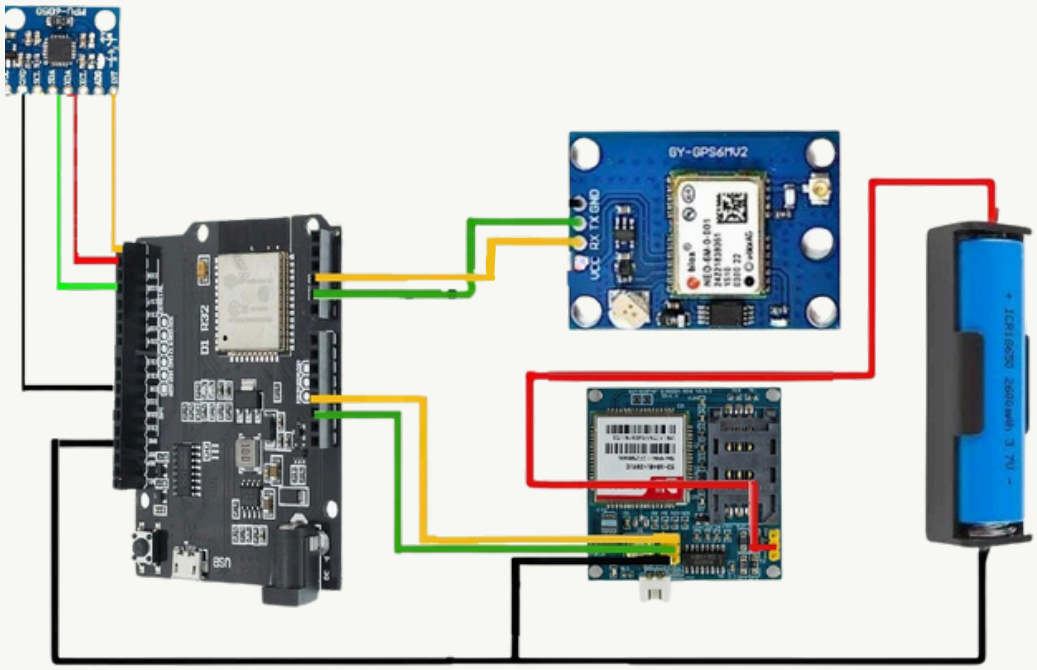


Figure 1 - Circuit Diagram of the tracking system

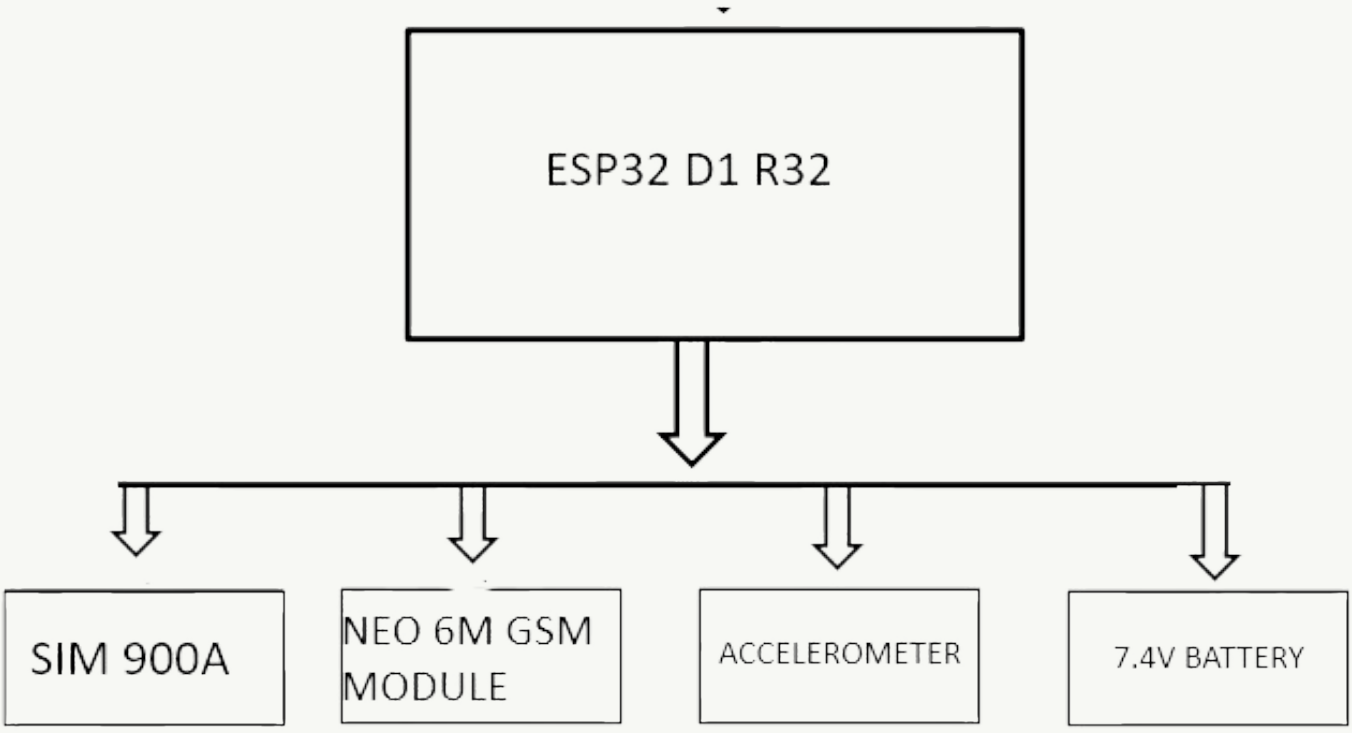


Figure 2 - Block Diagram of the tracking system

MODELING & ANALYSIS

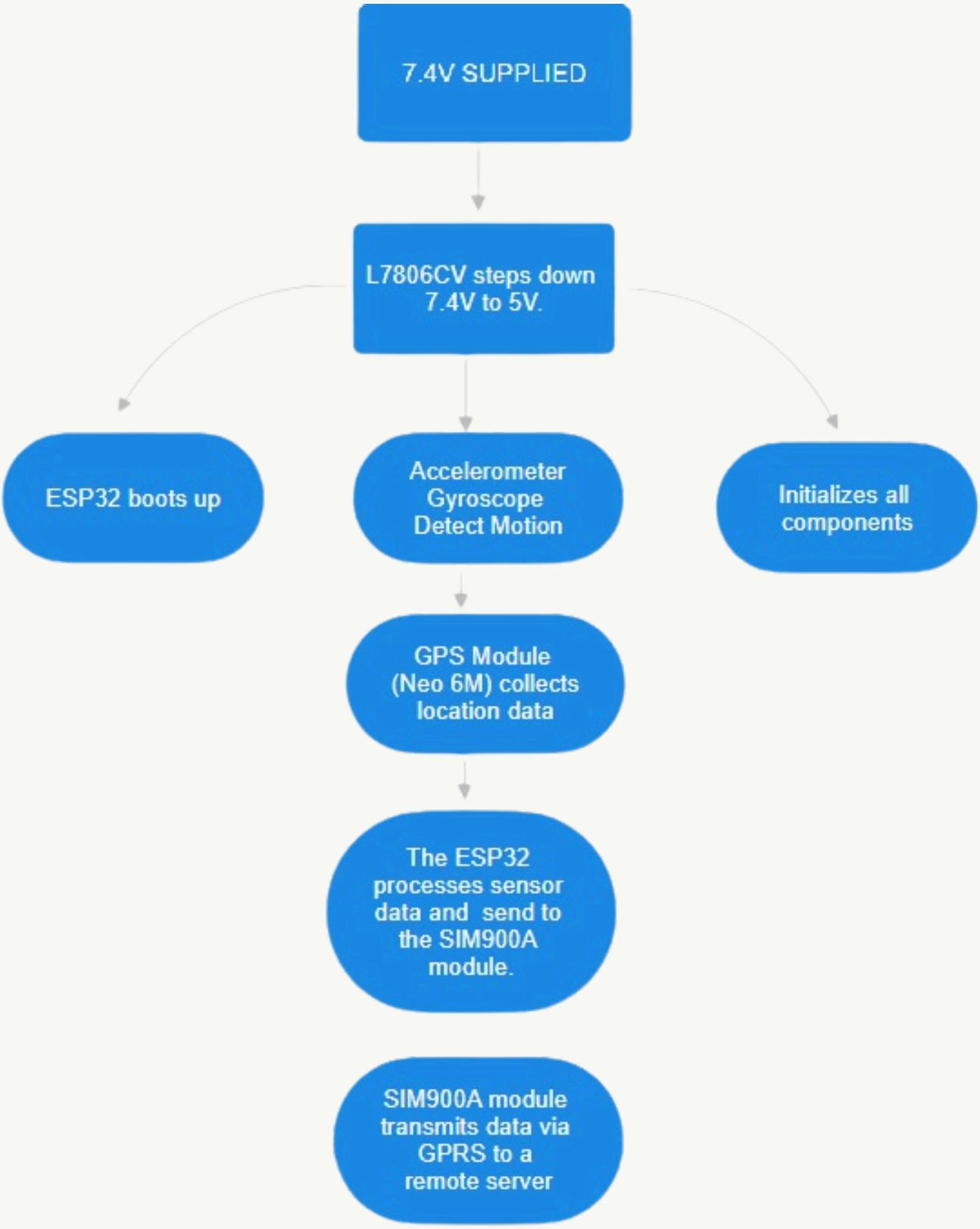
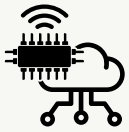


Figure 3 - Flow chart of the tracking system



EXPECTED OUTCOME

Expected Outcome:

1.Real-Time Location Tracking: The system will allow users to see the exact location of assets in real time through a mobile app or web platform, using GPS technology.

2.Motion Detection: Built-in sensors will detect any movement or changes in position, helping track unexpected handling or possible theft.

3.Reliable Communication: The system will use mobile networks to send GPS data and alerts, ensuring it works even when Wi-Fi isn't available.

4. Power for Continuous Operation: The system uses a removable lithium-ion battery or rechargeable batteries to ensure smooth operation. If the battery dies, it can be easily replaced, or if it's rechargeable, it can be charged and reused. This keeps the system running without interruptions, especially in remote areas or for critical tasks. The combination of energy-saving features and a flexible battery system helps reduce downtime and lowers maintenance costs.

5.Stable Power Supply: A voltage regulator will keep the system powered consistently, preventing issues from power fluctuations.

6.Enhanced Security: Users will receive instant notifications if an asset is moved unexpectedly, allowing quick responses to theft or mishandling.

TIMELINE

PHASE 01

(WEEK 1)

Planning and Requirements Gathering

Outline the goals and scope of the project and gather the requirements then identify the technical and functional requirements including hardware and software needs.

PHASE 02

(WEEK 2)

System Design and Hardware Components

Select the hardware components (U-Blox NEO-6M, SIM900A, ESP32, etc.) and design the schematics (create the circuit diagrams and layout for integrating components) then build a testing unit.

PHASE 03

(WEEK 3-4)

Software Development and Programming

Write code to interface the microcontroller with GPS and communication modules, create software to process real-time location data and prepare it for cloud transmission. Then set up cloud platform for data storage and processing.

PHASE 04

(WEEK 5-6)

Data Transmission and Communication Protocols

Program the communication module to send GPS data to the cloud at defined interval and optimize the system to use protocols for reliable data transfer between device and cloud.

TIMELINE

PHASE 05

(WEEK 7)

User Interface Development

Design and develop a user-friendly interface to display real-time location data. Add useful functionalities for geo-fencing and notifications for predefined events.

PHASE 06

(WEEK 8)

System Optimization and Testing

Calibrate the system to ensure accurate GPS data and reliable transmission then test the performance of the system in different environments for performance evaluation. Implement low-power modes and optimize data transmission intervals to extend battery life as possible.

PHASE 07

(WEEK 9)

Field Testing and Validation

Deploy the system in various environments to assess functionality and test the system in real world. Gather feedback on system performance and make adjustments to address any issues.

BUDGET

Budget -

To successfully implement the Asset Tracking System, the following costs are anticipated.

Hardware components:

Serial	Components Name	Quantity	**Price(BDT)**
1	U-Blox NEO-6M GPS Module	1	620
2	6DOF Accelerometer Gyroscope GY-521	1	208
3	ESP32 For Wemos DI Mini WIFI Bluetooth Development Board	1	890
4	SIM900A Mini Module 5V	1	1050
5	3.7 Volt Lithium-Ion Rechargeable Battery	2	160
6	L7806CV Linear Voltage Regulator	2	30
Total			2958/-

CONCLUSION

Project Conclusion:

The proposed asset tracking system is a viable solution for monitoring and managing assets. It includes essential components like a GPS module, GSM/GPRS module, microcontroller, battery, and optional accelerometer. The total cost is reasonable for a basic system. Potential applications include vehicle tracking, equipment monitoring, inventory management, and personal safety. To enhance the system, consider factors like power efficiency, data security, additional features, and customization.

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