

Project Title:

## Real-time Asset Tracking and Management Using IoT

Idea Overview:

Our system is designed to track and monitor construction-related heavy vehicles and equipment that are frequently transported between locations.

The solution enables real-time location tracking, environmental condition monitoring, and intelligent alerting, using IoT devices and a full-stack web platform.

Objectives:

- Track the real-time location of heavy vehicles/equipment.
- Monitor temperature and humidity during transport of sensitive goods (e.g., medicine).
- Enable alerts for critical conditions (e.g., temperature thresholds or unexpected movement).
- Provide a web dashboard for visualization and data analysis.
- Ensure secure, real-time data transfer and storage.

Hardware Components:

- ESP32 - Main microcontroller for processing and connectivity.
- NEO-6M GPS Module - For acquiring real-time geolocation.
- DHT22 Sensor - To monitor temperature and humidity.
- SIM800L GSM Module - For mobile network data transmission.

Software Stack:

Backend:

- Node.js & Express.js - To receive and validate data from the device.
- Firebase Realtime Database - For storing and syncing asset data.

### Frontend:

- React.js - To build a user-friendly web dashboard.
- Firebase SDK - To enable real-time data updates on the UI.
- Leaflet.js - For real-time map rendering of asset locations.

### Workflow:

1. ESP32 collects GPS + temperature + humidity.
2. Data is sent via SIM800L to the Node.js server using HTTP POST.
3. Server validates and stores data in Firebase Realtime Database.
4. React frontend visualizes location on map and displays sensor data live.
5. Optional alerts trigger based on geofencing or environmental limits.

### Key Features:

- Real-time location and condition tracking
- Live map with vehicle/equipment markers
- Dashboard to monitor sensor readings
- Mobile data transmission (no Wi-Fi needed)
- Scalable system supporting multiple assets
- Supports alerts and condition logging

### Security & Reliability:

- API key-based authentication for devices
- Firebase rules to restrict database access
- Real-time updates via Firebase listeners
- System designed for low power and high mobility

### Use Cases:

- Construction vehicle and machinery tracking
- Medical supply transportation
- Logistics and equipment management in remote areas