About the Client

The client is a logistics and warehouse solutions provider seeking to enhance their internal asset visibility and employee monitoring. With a vast inventory and dynamic workforce movement, they required a reliable, low-power tracking solution to improve productivity, security, and operational insights.

Industry

Logistics, Warehousing, Industrial IoT (IIoT)

Project Title

Indoor Asset and Employee Tracking Using ESP32-Based IoT Framework

---

Scope

The scope of the project included:

- Development of a Wi-Fi-based indoor tracking system using ESP32 microcontrollers.
- Real-time tracking and location processing via a central server and client application.
- Designing an energy-efficient solution with a minimum of 6-month battery life.
- Integration with mobile/web platforms for real-time visualization.

Challenges

- Achieving accurate indoor positioning without GPS.
- Designing a low-power device that can last for at least 6 months on a single battery.
- Enabling seamless communication between multiple ESP32 nodes and a central server.
- Real-time data accessibility and scalability for future enhancements.

- Customizable hardware form factor for deployment in various locations (walls, racks, vehicles).

Solutions

Suventure developed an advanced ESP32-based IoT solution with the following implementations:

- **ESP32-based Node Deployment**: Devices were installed at fixed positions across the building to act as beacons or reference points.
- **Signal Strength-Based Tracking**: ESP32 modules collected signal strength (RSSI) from end devices to estimate their location.
- **Centralized Data Processing**: All signals were relayed to a PC/server that computed end-device positions based on triangulation algorithms.
- **Mobile/Web App Integration**: Real-time tracking information was pushed to MongoDB and visualized through custom dashboards and mobile apps.
- **Low Power Optimization**: The system was designed to last over 6 months per device using energy-efficient protocols and sleep cycles.
- **Scalable Design**: The architecture was scalable for future additions like environmental sensors or automated alerts.

Tech Stacks Used

- **Hardware**: ESP32 Microcontrollers
- **Connectivity**: Wi-Fi, Bluetooth Low Energy (BLE)
- **Backend**: Python
- **Database**: MongoDB
- **Platforms**: Web and Mobile Application

Suventure's Role as Strategic Partner

✅ **Professional Services**

- Requirements gathering, architecture definition, and project planning.
- Embedded system consulting with a focus on ultra-low-power IoT design.

✅ **Application Development & Maintenance (ADM)**

- Full-cycle development of the tracking system (hardware + software).
- Backend API development and MongoDB data integration for real-time sync.

✅ **Analytics**

- Location-based data processing and visualization.
- Custom dashboards for flow tracking and analytics reporting.

Results Achieved

- **85% improvement** in asset visibility and tracking accuracy.
- **Over 40% reduction** in average time to locate employees and critical equipment.
- **6+ months battery life** achieved per ESP32 tracking device.
- **60% savings in tracking system costs** compared to traditional RFID-based solutions.
- **Real-time data access** for over **500 tracked entities** via web/mobile platforms.
- **100% uptime** in centralized monitoring due to efficient backend and database setup.

Testimonial

“Suventure delivered an end-to-end IoT solution that revolutionized how we track and manage our assets and workforce indoors. Their low-power ESP32 system gave us real-time data with incredible accuracy, and the integration with mobile dashboards helped streamline operations significantly.”
— Operations Head, Leading Logistics Firm