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# GPS- Based Asset Tracking System

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**Abstract:** *GPS-based asset tracking solutions provide real-time monitoring and control over precious assets with higher security and effectiveness in use. Our proposed system consists of modules such as GPS modules, communication network (GSM/GPRS/LTE/Satellite), cloud-based server, and web or mobile user-friendly interface. The system enables features such as real-time tracking updates, geofencing, history tracking, and movement notification alerts for unauthorized use. Inbuilt sophisticated sensor capability (temperature, humidity, vibration) enhances the asset condition monitoring further. The system uses a robust database to save and process data effectively, enabling trend detection and performance measurement. With a modular and scalable architecture, our solution supports different asset types, offering a cost-effective and reliable means of optimizing asset utilization, minimizing risks, and enhancing decision-making for individuals and organizations*

**Keywords:** GPS, Asset Tracking, IoT, Arduinonano, GSM, RFID, Geofencing, Real-Time Monitoring, Wireless Communication, Sensor Integration, Security, Automation

## I. INTRODUCTION

Security and asset management are the most critical elements of our time. Asset tracking with IoT helps to keep valuable assets secure and under control within industrial sites, warehouses, and logistics firms. The system monitors asset locations through RF signals in real-time. It provides security through the employment of sensors like audio and vibration sensors that register abnormal movement. The system employs Radio Frequency Identification (RFID) which consists of a transmitter mounted on the asset and a receiver of identifying signals. Any time an asset moves a specified distance away, messages or calls are activated using the Global System for Mobile Communication (GSM). In addition, a web-based application is utilized for remote tracking and management of assets. Companies and supply chains are well-suited for these kinds of tracking systems as they enhance operation efficiency and simplify inventory handling. Managers such as logistics managers and warehouse managers oversee the operations so that workflow can be free-flowing. An IoT-capable asset tracking solution enhances security checks on valuable products, sensitive goods, and strategic equipment. The IoT and RFID technologies are combined to enable real-time tracking through RFID tags, barcode reading, and other aspects of automatic tracking, which offers a cost-effective and scalable asset management solution.

## II. LITERATURE SURVEY

In paper [1] authors discuss the Internet of Things (IoT) asset tracking system for security and safety things like small children and mental person or any valuable object. It uses radio frequency (RF) technologyGlobal System for Mobile communication (GSM), and a Global Positioning System (GPS) for tracking objects the project includes a sound sensor for alert mobile numbers when an asset goes out of range and also displays a real location of the asset this system is also used for our works and also uses in future applications.

In paper [2] authors discuss the development of an Internet of Things (IoT) Asset Tracking System for safety and security purposes, particularly for any objects, valuable things and personal materials.it includes several latest technologies including sensors, GPS, and RF modules, to monitor and track assets in real-time. The system is used for specific purposes when the asset crosses its ranges then we give the location of this asset via Google Maps. This paper also considers improving the GPs and expanding capability for vehicle accidents.

The author of [3] presents an architecture of GPS and GSM-based vehicle tracking that is capable of supporting real-time monitoring of the vehicles. Global Positioning System (GPS) technology and Global System for Mobile Communications (GSM) are utilized by the system to track the locations of vehicles. It functions by implementing an

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electronic module inside the vehicle, which determines its location and reports information over GSM. Users with permission may observe this online. The system is primarily designed for automobile security, guarding, and fleet management, utilizing advanced technology to provide accurate location tracking. Key components include an onboard module, a base station, and data storage along with monitoring software to enhance tracking efficiency and reliability.

In paper[4] the authors discuss the Hospital management system (HMS) that aims to increase the productivity of a Hospital by improving patient care and reducing the work of the nurse. The working of this system includes laboratory testing, pharmacy management and medical programs all these activities made it easy. The paper highlights the importance of bringing together various operations in a common platform to avoid manual mistakes.

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In [5] paper authors discuss The Real-Time Vehicle Tracking System Using GSM and GPS Technology – An Anti-Theft Tracking System" presents the design of an embedded vehicle tracking system using Global Positioning System (GPS) and Global System for Mobile Communication (GSM) technology for real-time vehicle tracking. It explains how an AT89C51 microcontroller is utilized to integrate a GPS receiver and a GSM modem to allow the system to send location alerts over SMS to the users. The paper points out different applications such as theft protection, wildlife tracking, and fleet management, highlighting its affordability and applicability to four-wheelers and two-wheelers. Moreover, it provides the technical specifications of the components employed and indicates possible improvements, like adding extra sensors for enhanced tracking.

In Paper [6] authors discuss IoT-Based GPS Location Tracker Using NodeMCU and GPS Module explains the implementation of a GPS tracking system using a NodeMCU microcontroller, a NEO-6M GPS module, and an OLED display. It points out the application of GPS technology in real-time car tracking and makes a comparison between passive and active tracking systems. The article outlines the components required, such as NodeMCU specifications, and describes the design and development of a printed circuit board (PCB) for the tracker. It further addresses the configuration of a local web server to display location information in a usable format via Google Maps. The study is a detailed manual for developing a minimalist and effective GPS tracker for general applications.

The paper[7]authors discuss about the Design and Implementation of an Asset Tracking System Based on the Internet of Things suggests an indoor location and tracking system with the capability of detecting moving assets, i.e., smartphones, by WiFi and Bluetooth Low Energy (BLE) signals. ESP-32 modules serve as beacon transmitters to scan target object signals and transfer them to a NodeJS-based server. The server calculates this data by employing a weighted average approach to find real-time positions. A web interface provides the ability to see asset locations on a floor plan in real time and with node detail information. The study defines the limitation of conventional GPS to perform well indoors to monitor locations and presents the effectiveness of using WiFi and BLE technologies combined to improve the accuracy of positioning in different environments

The paper [8] mention The research paper titled "Asset Tracking Solution Based On IoT" describes the implementation of Internet of Things (IoT) technology in asset management systems, targeting tracking and monitoring IT assets throughout their life cycle phases. The research offers a proposed solution through RFID tags, cloud synchronization, and mobile applications for improving the effectiveness of asset tracking, particularly in equipment-intensive industries. The article points out the advantages of asset tracking automation to minimize errors that come with manual methods, enhance data accuracy, and enable remote monitoring. It also proposes future improvement by integrating machine learning and artificial intelligence to further streamline asset management processes.

The author of the paper [9] mentions the paper gives a comprehensive overview of a GPS tracking system based on LoRaWAN for efficient transmission of geo-location data with low power consumption. The system architecture is described, such as end nodes to receive location information from GPS, gateways to send this information to servers through UDP/IP protocol, and an end-user application to process and display the information on Google Maps. The system can function well in poor network connectivity environments, including coal mines and mountainous areas, owing to the benefits of LoRa technology to provide continuous and synchronous data transmission while using

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extremely little power. The cost-effectiveness of the system and its potential future uses in numerous challenging environments are highlighted in the paper.

In the paper [10] author explains The name IOT Asset Tracking System refers to a systematic process of monitoring and tracking assets, primarily in hospitals, using Internet of Things (IoT) technology. It considers the necessity of tracking medical equipment and personnel to make them safer and more efficient, using components like GPS, ESP8266 Wi-Fi modules, and sensors to provide real-time feedback on where and how assets are. The system outlined in this report will enhance the effectiveness of operations and transparency in hospital administration by leveraging Radio Frequency Identification (RFID) technology, which allows automatic tracking of assets. The paper additionally explores the limitations of existing tracking technologies, such as barcodes, and identifies the benefits of integrating IoT solutions for improved asset management throughout their lifecycle

## III. METHODOLOGY

### 1.System Overview

The intended GPS-based asset tracking system is aimed at offering real-time location tracking through Global Positioning System (GPS) technology, wireless communication networks, and cloud computing. The system has four key components: the GPS tracking device, the communication network (GSM/GPRS/LTE/Satellite), the cloud-based server, and the user interface (web/mobile application).

### 2. Introduction

The system suggested is an asset tracking system that monitors and locates valuable assets through GPS and GSM technology. It is divided into two major modules:

Transmitter Module (fixed to the asset) – Tracks the location of the asset continuously and sends data through RF communication. In case the asset moves out of range, alerts through GSM SMS.

Receiver Module (held by the user) – It accepts input from the transmitter and warns the user in case the asset is out of range. The receiver module provides alerts on an LCD screen and an alarm buzzer

The system offers real-time asset monitoring with location updates and is suited for logistics, industries, and body guarding use.

### 3. System Architecture

The system can be split into two modules:

**1] Transmitter Module (Asset-Side):**

This module is responsible for monitoring the location of the asset at all times and sending its status to the receiver. It comprises:

**A) Arduino Nano**

Serves as the processing unit.Gets the input from the GPS module and verifies whether the asset is in range or out of range. If the asset is out of range, it sends an alarm via NRF24L01 and sends the GPS location via GSM.

**B) GPS NEO-6M Module**

Replicates reading of the asset's latitude and longitude

Sends data to Arduino Nano for processing.

**C) GSM SIM800L Module**

Sends a notification through SMS to the user when the asset is out of range.

The SMS contains a link to Google Maps with the current GPS coordinates.

**D) NRF24L01 Module**

Enables wireless communication between transmitter and receiver. Sends alerts to the receiver module when the asset goes out of range.

**E) Li-ion 2-cell Battery**

Powers the transmitter module.

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**F) LM2596 Voltage Regulator**

Steps down voltage from 7.4V (Li-ion battery) to 5V needed by Arduino and others. Gives power regulation to maintain smooth operation.

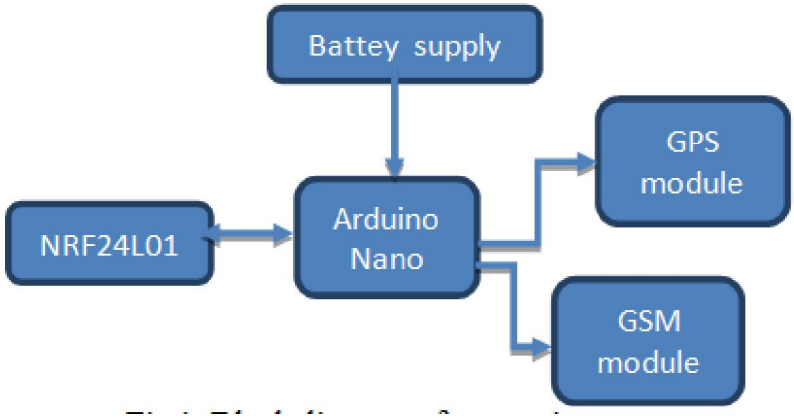


Fig 1. Block diagram of transmitter

2) User-Side Receiver Module:-

Worn by the user and informs them when the asset moves out of range.

A) Arduino Nano

Serves as the control unit.Reads data from the NRF24L01 module.Displays alerts on the LCD screen and activates the buzzer.

B) NRF24L01 Module

Reads data from the transmitter module.Informs of the asset going out of range.

C) 16x2 LCD Display

Displays status messages like "Asset in range" or "Asset Stolen".

D) 5V Buzzer

Produces a sound audio alarm whenever the asset is out of range.

E) 5V 1A Adapter

Provides power to the receiver module.

Other Components:-

Connecting Wires – For connection purposes in the circuit.

PCB/Zero PCB – Keeps and joins the components.

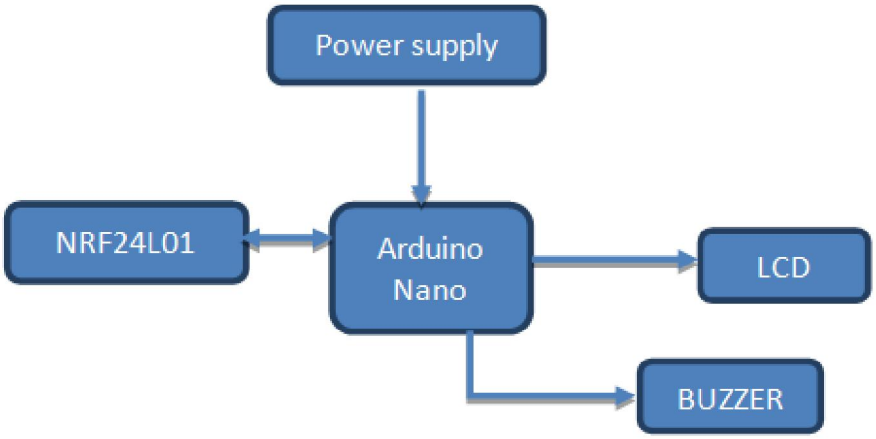


Fig 2. Block diagram of receiver

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## IV. SYSTEM WORKING PRINCIPLE AND DESIGN

The process operates by continuously tracking the location of the asset and sending warnings whenever required.

1) Transmitter Module operation:-

The GPS module reads the asset's latitude and longitude at regular intervals. The Arduino Nano interprets the GPS information and checks for proximity to the set time.When the asset is in range, the NRF24L01 module sends a "safe" message to the receiver.

When the asset is out of range, the transmitter:

Triggers the GSM module to SMS the asset location. Triggers a notification through NRF24L01 to the receiver module.

2) Functionality of Receiver Module

NRF24L01 module serves as the receiving point of data from the transmitter. When the asset is in range: LCD displays "Asset in Range". No alarm is raised. When the asset strays out of range:

LCD displays "Asset Stolen". The buzzer generates an alarm beep to notify the user. The user gets an SMS notification along with the GPS coordinates of the asset.

## V. IMPLEMENTATION HARDWARE

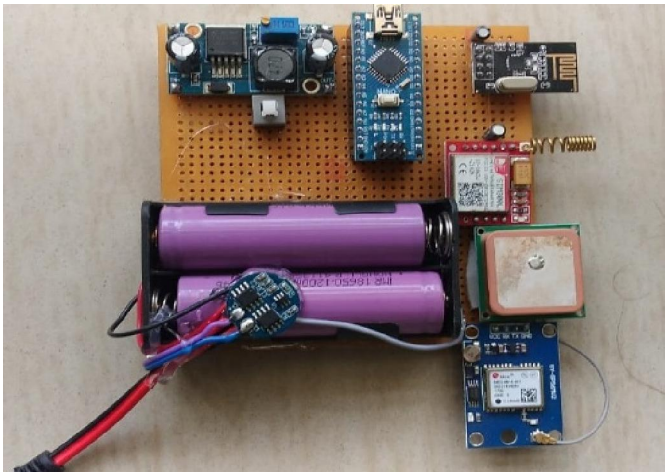

Fig 3.Transmitter section

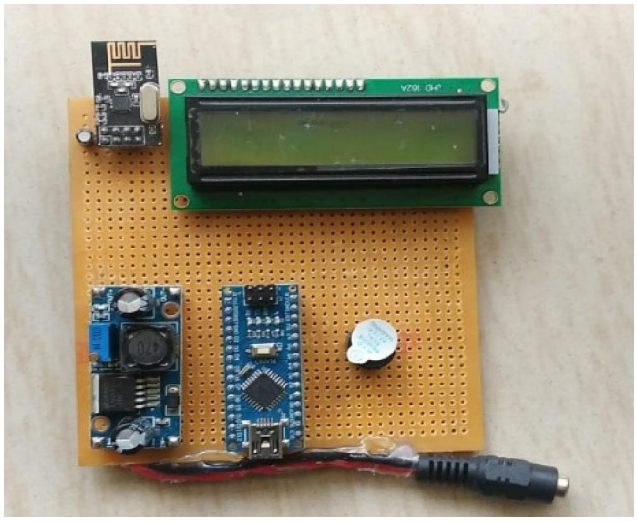

Fig 4. Receiver Section

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**Testing and Evaluation**

The system is tested in diverse conditions:

1) Range Testing:-

Verifies NRF24L01 communication is reliable.Verifies optimal range before out-of-range warning is provided.

2) GPS Accuracy Testing:-

Verifies GPS module provides accurate location.

3) SMS Alert Testing:-

Verifies GSM module provides real-time SMS alert.

4) Power Consumption Testing:-

Verifies battery life and power efficiency.

## VI. CONCLUSION

The implemented asset tracking system can use GPS, GSM, and RF communication in an efficient way to monitor and secure expensive assets. The transmitter module that isattached to the asset continuously monitors the position of the asset, and the receiver module the user holds provides instant alerts whenever the asset is out of range.The system employs Arduino Nano, NRF24L01, GPS NEO-6M, and GSMSIM800L for effective tracking through SMS messages and buzzer beeps.

Testing confirmed the system's accuracy in range detection, GPS location, and SMS alert delivery, proving its applicability to logistics, industrial asset management, and security applications. It is low-power and real-time responsive. There can be further development with the inclusion of IoT, cloud tracking, and integration with mobile applications to make it more accessible and automated. The system offers cost-effective, scalable, and efficient real-time asset tracking and security solutions.

## VII. FUTURE SCOPE

Future applications of this asset tracking solution are IoT and cloud integration to store real-time GPS data in cloud platforms to be remotely viewed using mobile applications and web consoles. Artificial Intelligence (AI) and Machine Learning (ML) can enhance predictive analytics, which detects suspicious asset movement and enhances tracking accuracy. Advanced wireless communications using LoRa, Zigbee, or 5G can enhance range and reliability. Geofencing technology can also give smart alerts if an asset moves overinto or out of designated areas, which improves security. Solar-powered and low-power IoT modules can also make it more energy-efficient, thereby making the system more sustainable. All these will also improve scalability, efficiency, and flexibility, which makes it usable in logistics, industrial asset management, and security.

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