Campus Assest Management System

A Project Report Submitted To Pimpri Chinchwad University

In Partial Fulfillment For The Award

Of

Internet Of Things

By

Under the Guidance

Of

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IOT Project Report

Programme:

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IOT Project Title:

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CAMPUS ASSET MANAGEMENT SYSTEM

1. Abstract

Asset management in educational institutions and corporate environments is crucial to prevent unauthorized movement, theft, or misplacement of valuable resources. Traditional tracking methods, such as manual logging and RFID-based systems, often lack real-time monitoring capabilities, making it difficult to track assets efficiently. The Campus Asset Management System is an IoT-based solution that leverages Arduino Uno, BN-880 GPS module, and a buzzer to provide real-time asset tracking and alert mechanisms. This system ensures that assets remain within a predefined safe range and notifies users if they move beyond the specified boundary.

The system functions by continuously monitoring asset locations through GPS coordinates and comparing them with a pre-set safe zone. If an asset moves beyond this zone, an alarm is triggered to alert users. Additionally, the system integrates with Google Maps API, allowing administrators to view the asset's real-time location remotely. This feature enhances security, reduces the risk of misplacement, and allows for quick asset recovery.

Compared to existing solutions, this system offers higher accuracy, automation, and efficiency without requiring an internet connection. Unlike RFID or Bluetooth-based tracking, which are limited in range, the GPS-based approach provides real-time location tracking over a much wider area. The system can be applied in various settings, including universities, offices**,** hospitals, and logistics, making it a cost-effective and scalable solution for asset management.

This report provides a detailed literature survey, implementation process, hardware-software integration, performance analysis, challenges, and future enhancements of the system. The proposed system is expected to improve asset security, minimize losses, and optimize resource management across different institutions. Future improvements, such as cloud storage integration, mobile application support, and solar-powered systems**,** will further enhance the efficiency and usability of the Campus Asset Management System**.**

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2. Introduction

2.1 Overview

Tracking campus assets like lab equipment, library resources, and other essential materials is often challenging. Traditional tracking methods, such as manual logging and RFID-based systems, have limitations in terms of accuracy, automation, and real-time monitoring.
This IoT-based tracking system addresses these challenges by integrating GPS-based tracking and an automated alert system.

2.2 Objectives

The main objectives of this project are:

1. To develop an automated system for tracking campus assets.
2. To integrate GPS-based location tracking for real-time monitoring.
3. To implement an alert system (buzzer) to notify when an asset moves beyond a predefined range.
4. To use Google Maps API to display asset locations in real time.
5. To improve security and prevent theft or misplacement of campus assets.

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3. Literature Survey

Several tracking systems have been implemented in various domains, including RFID-based, Bluetooth-based, and cloud-integrated GPS tracking systems.

3.1 Existing Solutions and Their Limitations

Solution Type	Advantages	Limitations
RFID Tracking	Fast scanning, low power usage	Limited range, requires infrastructure (RFID readers)
Bluetooth-Based Tracking	Works indoors, energy-efficient	Short-range (~10m), dependent on smartphones
Cloud-Based GPS Tracking	Real-time tracking, scalable	Requires internet connectivity, costly cloud storage

3.2 Why Our System?

Our system combines the benefits of GPS tracking with an alert mechanism, making it a cost-effective and efficient solution without requiring an internet connection.

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4. Implementation

4.1 Hardware Components

- Arduino Uno – Acts as the central processing unit.
- BN-880 GPS Module – Provides real-time latitude and longitude coordinates.
- Buzzer – Alerts when an asset moves out of range.
- Power Supply – Supplies power to the Arduino.
- LCD Display (Optional) – Displays asset location coordinates.

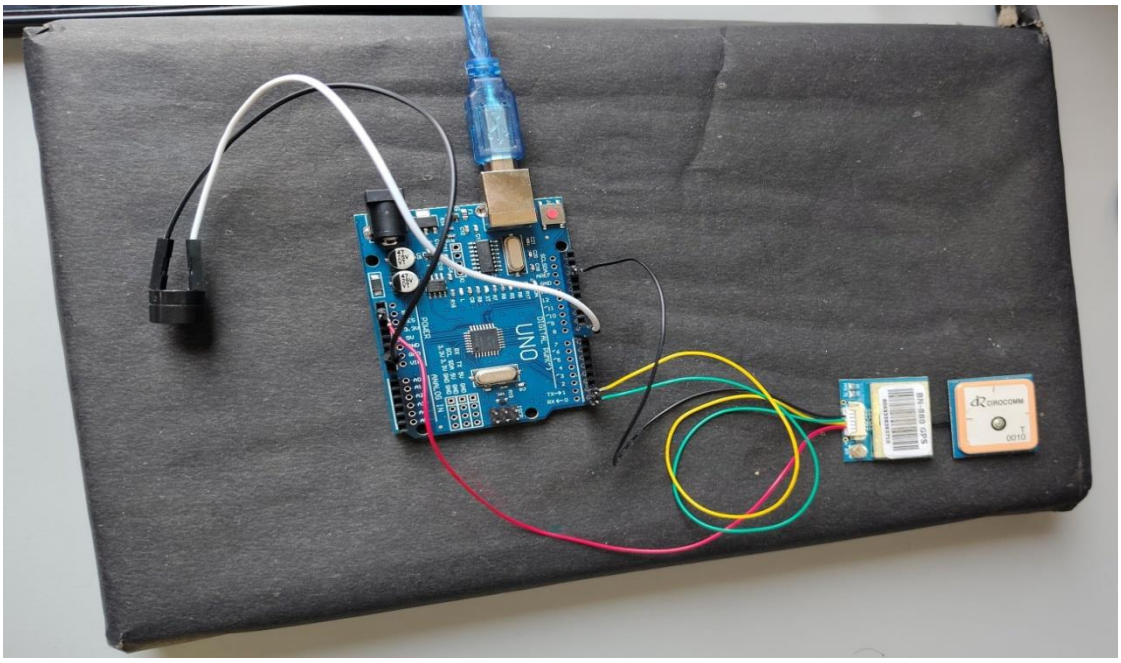
4.2 Software and Libraries Used

- **Arduino IDE** – Used for programming the system.
- **Software Serial Library** – Handles serial communication with GPS.
- **TinyGPS++ Library** – Extracts and processes GPS data.
- **Google Maps** – Helps in location visualization.

4.3 Circuit Wiring and Connections

Component	Connected To
GPS Module TX	Arduino RX (Pin 0)
GPS Module RX	Arduino TX (Pin 1)
GPS Module VCC	5V Power Source
Buzzer Positive	Arduino Pin 8
Buzzer Negative	Ground (GND)

4.4Picture of the System:



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5. Working Mechanism

1.The GPS module continuously monitors the asset's location by retrieving latitude and longitude coordinates in real time. It updates the location at regular intervals**,** ensuring accurate tracking.

2.The Arduino processes the GPS data and compares it with a predefined safe range (10 meters). It calculates the distance between the current and reference locations to determine if the asset remains within the designated boundary.

3.If the asset moves beyond the 50-meter range**,** the buzzer is triggered to alert users immediately.

4.The system generates a Google Maps link containing the asset's current coordinates. Users can click the link to view the exact location on Google Maps, making it easy to track and recover the asset efficiently.

5.1 Implementation Code

```
#include <SoftwareSerial.h>
#include <TinyGPS++.h>

SoftwareSerial gpsSerial(4, 3);
TinyGPSPlus gps;
const int buzzer = 8;

void setup() {
    Serial.begin(9600);
    gpsSerial.begin(9600);
    pinMode(buzzer, OUTPUT);
}

void loop() {
    while (gpsSerial.available() > 0) {
        if (gps.encode(gpsSerial.read())) {
            double lat = gps.location.lat();
            double lon = gps.location.lng();

            if (isOutOfRange(lat, lon)) {
                digitalWrite(buzzer, HIGH);
                Serial.println("Alert! Asset moved.");
            } else {
                digitalWrite(buzzer, LOW);
            }
        }
    }
}

bool isOutOfRange(double lat, double lon) {
    double baseLat = 28.6139, baseLon = 77.2090; // Example location
    double distance = 111.32 * sqrt(pow(lat - baseLat, 2) + pow((lon -
baseLon) * cos(baseLat * 0.01745), 2));
    return distance > 50;}
```

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6. Results & Discussion

6.1 Performance Analysis:

Parameter	Result
Accuracy	±3 meters
Response Time	~5 seconds
Power Consumption	Moderate (depends on power supply)

6.2 Google Maps Integration Example

A dynamically generated URL allows real-time tracking:

```
https://www.google.com/maps?q=<latitude>,<longitude>
```

6.3 Use Cases

- University Campuses: Tracking lab equipment.
- Corporate Offices: Monitoring office assets.
- Hospitals: Managing medical equipment.

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7. Challenges & Limitations

7.1 Challenges Faced

- GPS Signal Issues – Weak signals indoors.
- Power Consumption – Continuous operation requires stable power.
- Environmental Factors – GPS accuracy is affected by weather conditions.

7.2 System Limitations

- Requires an external power source for continuous use.
- Alerts only work beyond a specific range (not for small movements).

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8. Conclusion

The Campus Asset Management System successfully enables real-time tracking of assets using GPS technology and an automated alert mechanism. The system ensures security, improves asset management, and provides Google Maps integration for monitoring asset location. Future enhancements such as mobile app integration and cloud-based tracking can further improve the efficiency and usability of the system.

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9. References

1. Arduino Official Documentation - www.arduino.cc
2. TinyGPS++ Library - https://github.com/mikalhart/TinyGPSPlus
3. GPS-Based IoT Tracking Systems - Journal of Embedded Systems, 2023.
