

POTHOLE DETECTION AND MAPPING SYSTEM

Problem Statement

Potholes are a common road hazard that can cause damage to vehicles and pose safety risks to drivers. Detecting and addressing potholes promptly is essential for maintaining road infrastructure.

Objectives

Our project aims to: **Detect potholes:** Use the Micro:bit accelerometer to identify sudden jolts or impacts (indicative of potholes) in vehicles. **Collect GPS data:** Utilize the GPS sensor to obtain accurate location coordinates. **Visualize potholes:** Display pothole locations on a real-time map accessible via a central server.

Components and Architecture

a. *Hardware Components* **Micro:bit:** A compact development board with an accelerometer and Bluetooth capabilities. **GPS Module:** An external GPS sensor that provides latitude and longitude coordinates. **Vehicle Integration:** Install the Micro:bit and GPS module in each vehicle.

b. *Data Flow* **Vehicle Side:** The Micro:bit accelerometer continuously monitors vehicle movement. When a sudden impact (indicative of a pothole) is detected, the Micro:bit records the timestamp and triggers the GPS module. The GPS module captures the current location (latitude and longitude). The Micro:bit sends this data to a central server via Bluetooth or cellular network. **Central Server Side:** A central server receives data from multiple vehicles. The server processes incoming data: Identifies potholes based on accelerometer readings. Aggregates GPS coordinates and timestamps. The server maintains a real-time database of pothole incidents.

c. *Pothole Mapping and Visualization* **Map Interface:** Develop a web-based map interface (using technologies like Google Maps API or Leaflet) hosted on the central server. Display a map with markers representing pothole locations. Update the map in real-time as new data arrives. **Data Storage and Analysis:** Store pothole data (location, timestamp, severity) in a database. Analyze patterns to identify high-risk areas. Generate reports for maintenance teams.

Implementation Steps

Micro:bit Programming: Write Micro:bit firmware to detect accelerometer events. Integrate GPS data retrieval. Establish Bluetooth communication with the central server.

Central Server Development: Set up a server (cloud-based or local). Design APIs for data ingestion. Implement data processing and storage logic.

Map Visualization: Create a web-based map interface. Plot pothole locations dynamically. Ensure real-time updates.

Testing and Deployment: Test the system with a fleet of vehicles. Optimize accuracy and reliability. Deploy the solution to a wider audience.

Benefits

Timely Maintenance: Authorities can address potholes promptly. **Safer Roads:** Reduced risks for drivers. **Data-Driven Insights:** Identify trouble spots for targeted repairs.

Conclusion

Our proposed system combines Micro:bit technology, GPS sensors, and centralized data processing to create an efficient and real-time pothole detection and mapping solution. By collaborating with local authorities and road maintenance teams, we can improve road safety and infrastructure maintenance.