COIMBATORE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

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DEPARTMENT : MSc SOFTWARE SYSTEMS

BATCH : 2021 – 2026

COURSE CODE : 20MSS84

COURSE NAME : INTERNET OF THINGS LABORATORY

SMART ROAD SAFETY MONITORING SYSTEM

Problem Statement:

Create an Arduino-based system to detect and map pavement distresses (IRC : 82) like

- Potholes
- slippage
- cracks etc.., and Unmarked Speed Brakers.

The system updates a central map to highlights the distresses and improve road maintenance and safety.

Objective:

- Develop an Arduino-based embedded system for detecting pavement distresses, such as potholes, slippage and cracks.[Model Distance UpTo = 10 Meter]
- Detection of Unmarked Speed Brakers during night for Vehicles.
- **Integrate a vibration sensor** to measure vehicle vibrations caused by rough road conditions and speed breakers.
- Design and build a centralized map to update with detected pavement distresses.
- Enhance road maintenance efficiency and safety by providing real-time distress information to maintenance teams.
- Ensure the system is energy-efficient for continuous operation and minimal maintenance.
- Develop a user-friendly interface for maintenance teams to easily access, interpret, and act on the distress data.
- Ensure the need of establishment without affecting the IRC: 37 flexible pavement designs.

Methodology

- **Sensor Calibration** – Adjust ultrasonic sensors using known distances for accurate readings [ultra sonic sensor] .
- **Vibration Sensor Integration** – Use a vibration sensor to detect abnormal vehicle vibrations due to road conditions, such as potholes and unmarked speed breakers.
- **Data Collection** – Mount sensors on a vehicle, measure road surface distance, and record data with GPS coordinates.
- **Data Processing** – Detect issues like potholes, cracks, and unmarked speed breakers. Set thresholds to flag irregularities.

- **Data Integration** – Use mapping software (e.g., Google Maps API) to plot distress locations using GPS data.
- **Visualization & Reporting** – Develop a user-friendly interface to display mapped issues and allow reporting.
- **Maintenance Planning** – Use collected data to prioritize and schedule road repairs

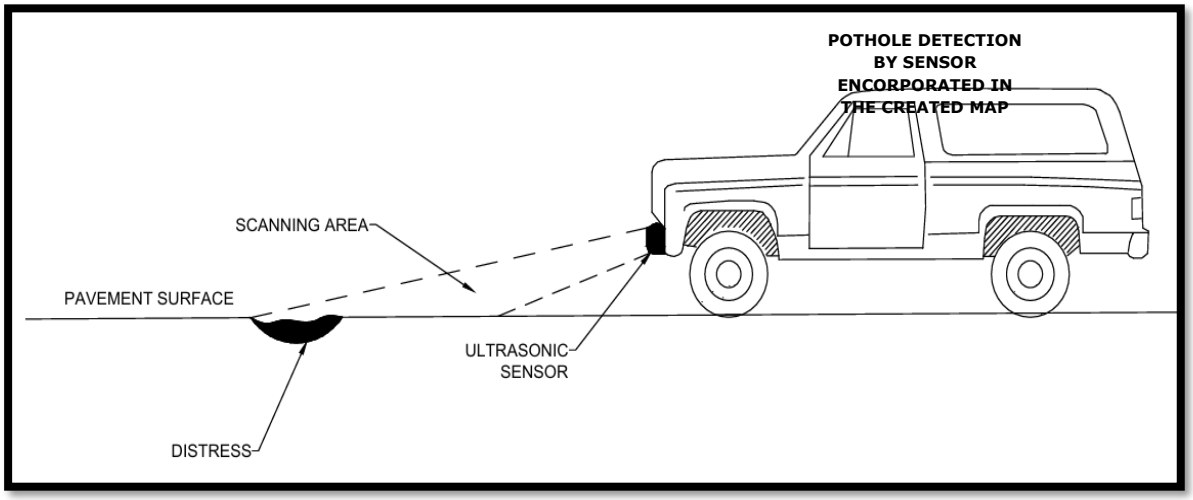
Expected Outcome:

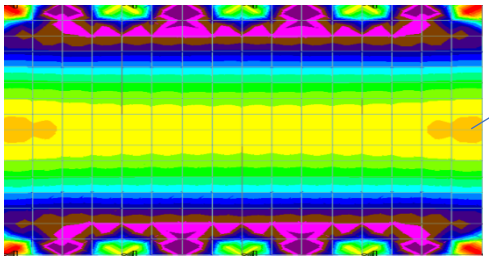
- **High Detection Accuracy**: The system will accurately identify pavement distress like potholes, cracks etc.., and Unmarked Speed Breakers achieving a high detection rate and minimizing false positives.
- **Map Integration**: The detected data will be integrated with mapping software to visualize the locations of pavement distress on a map, enabling easy identification and analysis.
- **Improved Maintenance Planning**: Data collection will enhance road maintenance strategies by providing up-to-date information, allowing for efficient prioritization and planning of repair activities.
- **Reduce Fatal Accidents**
- **Minimize Road Difficulties**

Execution Difficulties:

- **Data Transmission**: Ensuring reliable data transmission from the sensors to the central system, particularly in areas with limited connectivity, can pose significant challenges and may require robust communication solutions.

Architecture Diagram:





POTHOLE DETECTION BY SENSOR ENCORPORATED IN THE CREATED MAP

Approximate Estimate of the Cost (If implemented).

- **Ultrasonic Sensors** : Quantity: 2–4 sensors Cost per Sensor: ₹150 – ₹200 Total: ₹300 – ₹700.
- **Arduino Board**: Cost: ₹1,200 – ₹1,700.
- **Miscellaneous Components**: Wires, breadboards, connectors, etc.: ₹500 – ₹1,000.
- **Total Estimated Cost**: Approximately: ₹2,600 – ₹4000.

(NOTE:FOR SINGLE MINIATURE PROTOTYPE)

Key Benefits:

- **Enhanced Road Safety**: Early detection of pavement issues prevents accidents and vehicle damage.
- **Efficient Maintenance:** Data ensures timely, targeted repairs.
- **Improved Public Satisfaction:** Leads to smoother roads and better user experiences.
- **Data-Driven Decisions**: Enables informed, strategic maintenance planning