

AutoSense: Road Condition Monitoring Network

Theme: Road Conditions

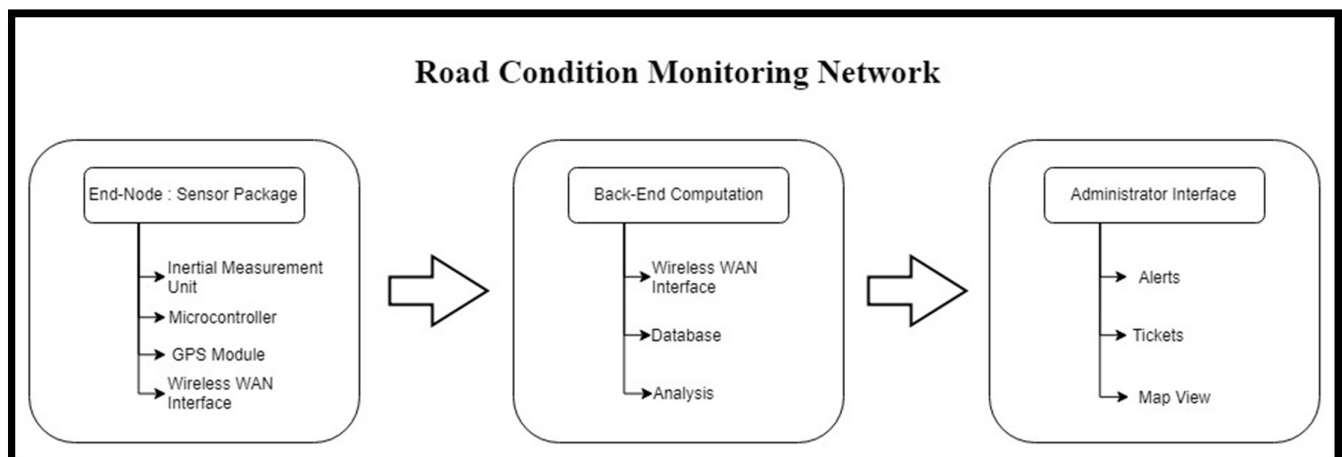
Executive Summary:

Monitoring and maintenance of roads are still a pain-point for Governments and the Public Works Department. AutoSense is an **end-to-end integrated solution** for monitoring the condition of roads and **bringing critical failures to the notice** of the responsible personnel. The system automatically **raises tickets for unkempt roads** passes the raised ticket to higher authorities to ensure that the condition is maintained. This is particularly useful to **monitor roads** that are paved on tendered contracts **by private contractors**. Furthermore, such a system **ensures regular upkeep** and helps **prevent accidents** caused by unsafe road conditions. It is also a justified investment as the system merely **adds functionality** to the infrastructure that is already in place, since we use the **public transport system** and the state owned vehicles to survey the roads.

Objective:

Our objective is to develop a prototype that best demonstrates our idea such that we can showcase the potential of such a system. We aim to create a prototype that is able to **detect** potholes, **relay** the information back to a base-station and **analyse** the data to detect potholes and other faults in the road condition. Upon detection of the faults, tickets will be assigned to the task of repairing them and the status will be monitored by the system in a similar manner.

Execution:



As shown in the block diagram, the project has three major aspects that we intend to demonstrate with our prototype.

- i) **The End-Node Sensor Package:** This unit comprises of an Inertial Measurement Unit (IMU) to detect the changes in acceleration as well as the orientation of the vehicle. For our prototype, we will be using the MPU6050 IMU which comprises of an accelerometer and a gyroscope. The raw data from the IMU will be monitored by the Microcontroller to detect Pot-holes. When the microcontroller detects a pattern in the data-stream that is indicative of a pot-hole, it relays the trigger data along with the GPS coordinates to the base station over a Wide Area Network (WAN).
- ii) **Back-End Computation:** The Base station is tasked with the job of handling the triggers from all Sensor Nodes spread throughout the city. Once a trigger is received, the listener script pushes the data to the Database. The Data received is analysed for triggers that are concentrated around particular spots. This 'heat-map' will essentially reveal the areas with poor road condition, filtering out the false triggers. Tickets are raised for the identified potholes and alerts are sent to the administrators. The contractor responsible for that particular stretch of road may also be notified to expedite the process.
- iii) **Administrator Interface:** A Web-app will serve as the Front end interface of the system to display the alerts, triggers and raised tickets. It will also display the heat-map generated from the triggers received using the OpenStreetMaps API. This will enable the administrative officials to keep a check on the execution of the system as well as be aware of the road conditions at a city-wide level

Future Plans:

Being a project that caters perfectly to the demands of a **smart city**, we certainly intend to take this project as far as possible. With our country being in a stage where several smart city ecosystems are under design and **proposals for implementation are underway**, we believe the government will be interested in a project like this to be able to **automate** such a relatable and **omnipresent issue** that is often overlooked. Furthermore, Owing to the blame that governments receive of improper maintenance of roads, this serves as a solution to create a **transparent system** that even the public can access. The implementation of this system will **not be resource intensive** as we are **taking advantage of existing infrastructure** by using public transport and state-owned vehicles for surveillance. A survey suggests that over **50% of road accidents have bad road conditions as a contributing factor**. Weighing in the importance of proper road condition monitoring and the constraints of implementing a city wide system, our system offers a cost effective solution that is a must-have for the infrastructure of a city. Good roads are **quintessential for the safe and effective function of a city** and our system is a good bet at ensuring that. We intend to take this further by using our prototype to demonstrate the capability of the system.