McMaster University

Project Proposal

Vehicle mounted image acquisition device for infrastructure asset management.

Karan Patel (M.E.S.T) - 400136862

Parth Patel (M.E.S.T) - 400418754

Manmohit Chugh (M.E.M.E) - 400419901

1. PROJECT INTRODUCTION

The aim of this project is to develop a vehicle-mounted image acquisition device for infrastructure asset management. The device will utilize computer vision techniques to analyze images captured by a camera mounted on a vehicle. By deploying onboard processing, network connectivity, and cloud storage, we will create a system that can efficiently collect data, label the data for tagging sidewalk defects, and facilitate the understanding of infrastructure asset conditions.

2. PROJECT OBJECTIVES:

The primary objectives of this project are as follows:

a. Develop a hardware implementation for the vehicle-mounted image acquisition device.

b. Design and implement computer vision algorithms for fault detection, identification, and localization.

c. Integrate vibration sensors with the device to enhance fault detection capabilities.

d. Train a neural network model to accurately classify and tag sidewalk defects.

e. Establish a reliable network connectivity and cloud storage system for data transmission and storage.

3. Methodology and Approach

To achieve the project objectives, we will follow a systematic approach over the next four months. The steps involved in the process include:

May:

- Conduct a thorough literature review on existing methodologies for infrastructure asset management using computer vision and vehicle-mounted devices.

- Familiarize with the Raspberry Pi platform and its capabilities for onboard processing and network connectivity.

- Research and select a suitable camera module for image acquisition.

June:

- Procure the necessary hardware components, including Raspberry Pi, camera module, vibration sensors, and any additional required components.

- Set up the Raspberry Pi environment and configure it for development purposes.

- Develop a basic data acquisition system to capture images using the camera module.

July:

- Investigate and implement computer vision algorithms for fault detection in the captured images.

- Experiment with various image processing techniques such as edge detection, feature extraction, and anomaly detection to identify potential faults.

August:

- Integrate vibration sensors with the device to augment fault detection capabilities.

- Establish a reliable communication system between the Raspberry Pi and the vibration sensors.

- Implement data fusion techniques to combine image data and vibration sensor data for enhanced fault identification.

4.Hardware Requirements

The following hardware components are essential for the successful implementation of this project:

- Raspberry Pi 4 (or higher) for onboard processing and network connectivity.

- High-resolution camera module compatible with Raspberry Pi for image acquisition.

- Vibration sensors capable of detecting road defects and communicating with the Raspberry Pi.

- Storage device (e.g., microSD card) for data storage.

- Power supply and necessary cables for connecting the components.

5. Tentative Schedule with Objectives for the Next 4 Months

A Below is the schedule outlining the planned activities for the next four months:

Tentative schedule

Phase 1(2-3 weeks till 26th May)-By all the team members

- Conduct literature review and finalize the methodology.

- Procure the required hardware components.

Phase 2(27th May-20 June)-Manmohit, Parth

- Set up the Raspberry Pi environment and configure necessary software.

- Develop the initial data acquisition system with the camera module.

Objective-Develop hardware implementation for the vehicle-mounted image acquisition device.

Phase 3(20 June- 20 July)-Karan

- Implement computer vision algorithms for fault detection in the acquired images.

- Perform preliminary testing and refine the algorithms as needed.

Objective -Design and implement computer vision algorithms for fault detection, identification, and localization.
Objective-Train a neural network model to accurately classify and tag sidewalk defects.

Phase 4(20 July-15 August) Manmohit, Parth

- Integrate the vibration sensors with the device.

- Develop data fusion techniques for combining image and vibration data.

- Perform comprehensive testing and evaluate the performance of the system.

Objective-Integrate vibration sensors with the device to enhance fault detection capabilities.
Objective-Establish a reliable network connectivity and cloud storage system for

data transmission and storage

6. CONCLUSION

The proposed project aims to develop a image acquisition device for infrastructure asset management. By leveraging computer vision techniques, onboard processing, the system will enable efficient data collection, fault detection, identification, and localization. Through the scheduled activities and the utilization of appropriate hardware components, we will work towards the successful completion of this project.

NOTE: Please note that the timeline and activities provided are tentative and subject to adjustment based on the progress and challenges encountered during