Real-Time Pothole detection and mapping using AI (RTPD-Map)

درب السلامة

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ABSTRACT

The objective of this project is to detect potholes by using an AI model. The system will be based on Raspberry Pi 4 Model B 8GB. Then the information that the system collects will be uploaded to a database and will be represented via a visual map. The stakeholders (for example – HOLY MAKKAH MUNICIPALITY) can use this information to decrease the amount of time taken to repair potholes.

INTRODUCTION

Our project aligns with objectives 08 and 09 of the Quality-of-Life Program under the Kingdom's vision, which explicitly state the goals of improving the urban landscape and the quality of services provided in Saudi cities. Our project aims to decrease the existence of potholes in the streets of our cities and make driving conditions safer for citizens and visitors.

METHODOLOGY

A car-mounted camera detects potholes and records footage, sending it to a Raspberry Pi. The Raspberry Pi is equipped with a GPS device to pinpoint the car's location. A machine learning model is employed to identify potholes in the stream video feed. The model associates each pothole with its specific geographic coordinates. Finally, a visual map is generated, plotting the identified potholes on the map for easy location tracking and road maintenance planning. This system provides a comprehensive solution for detecting and mapping potholes in real-time, aiding in safer and more efficient road navigation.

SYSTEM DESIGN

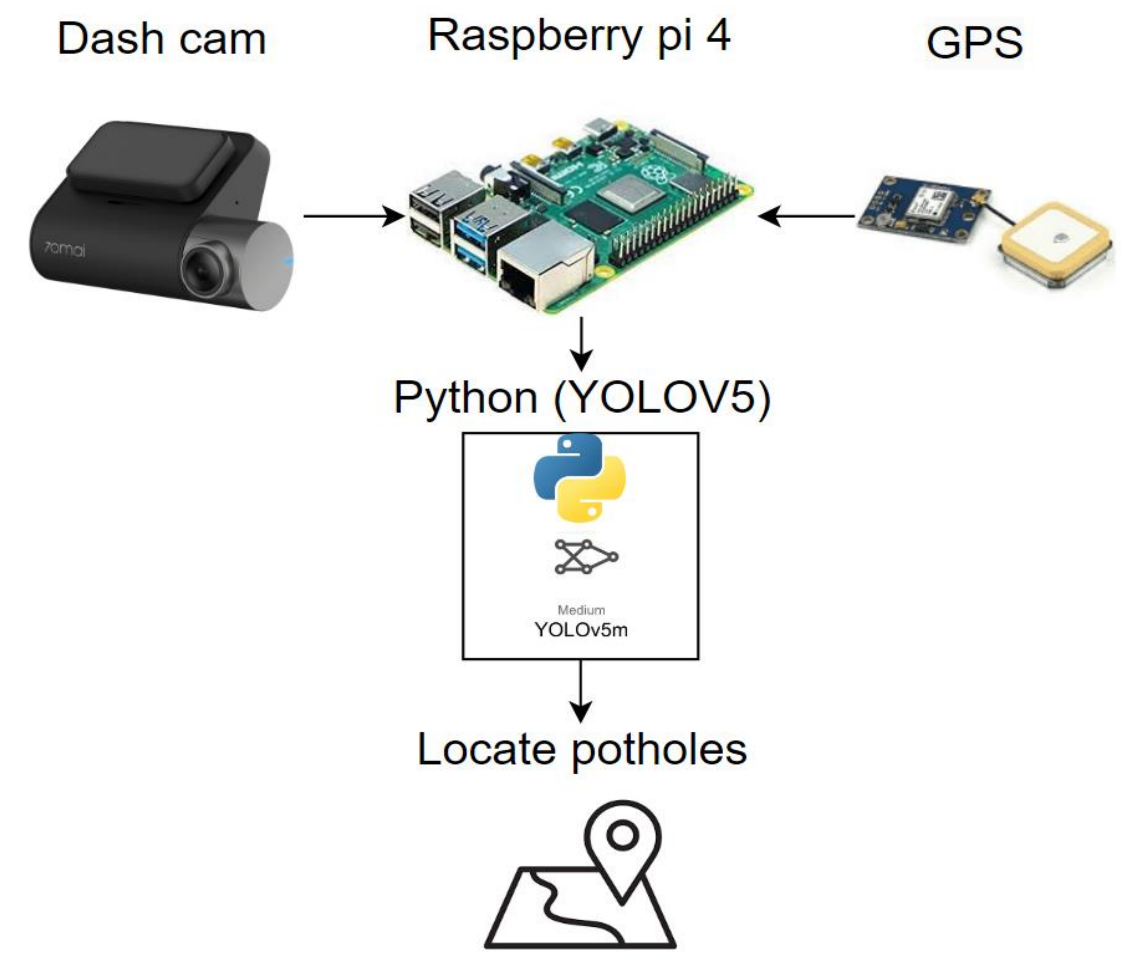
The project integrates three key inputs to effectively detect and map potholes.

The first input is the power source derived from the car's cigarette lighter, which provides a stable 12-volt supply. This power source ensures the continuous operation of the system, allowing it to function whenever the vehicle is in use.

The second input involves a GPS tracker, specifically the UART GPS NEO-6M. This tracker is responsible for determining the precise location of the vehicle. By establishing constant communication with satellites, it acquires real-time GPS coordinates, enabling accurate geolocation data. This is a critical component in pothole mapping, as it ensures that each identified pothole is associated with its exact geographical position.

The third input is derived from a dash camera that constantly streams live video footage. This camera operates whenever the car is in motion and the power supply is active. It captures the road surface in real-time, allowing the system to analyze the video feed for signs of potholes.

With these three inputs working in harmony, coupled with Real-Time Pothole Detection and Mapping (RTPDM) technology, the system processes the live video, identifies potholes, and associates them with their respective GPS coordinates. This enables the creation of a comprehensive map that visually displays the located potholes, providing a valuable tool for road maintenance and safety improvement.



FUTURE WORK

Our plan into future is enhancing our system performance so we can detect with more accuracy and cover more speeds, then creating a model that can calculate the size and the depth of a pothole .

CONCLUSIONS

Our project was born from a daily inconvenience we encountered. Leveraging YOLOv5 technology, our model has been meticulously trained on a comprehensive pothole dataset, ensuring remarkable accuracy in pothole detection. The project's core functionality involves real-time detection and precise geolocation of potholes, elegantly visualized on a user-friendly map for easy accessibility and use.