ParkSense

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ABSTRACT

Insufficient parking spaces on our campus, exacerbated by a new building occupying a large section of a previous lot, have forced students to park farther away. Consequently, this has led to increased travel times to classes, resulting in disruptions and attendance issues.

To address this challenge, we present an IoT solution utilizing OpenCV, YOLOv8, a Raspberry Pi, and a camera module. Our custom-built object detection software, leveraging OpenCV's real-time computer vision and YOLOv8's deep learning capabilities, focuses on identifying available and occupied parking spots.

The project's scope involves real-time parking availability detection using computer vision and a camera stream. The software, trained on a tailored dataset for precision, runs on a Raspberry Pi, handling data collection, calculations, and pattern recognition results.

Users can access a website interface for accurate, periodic updates on parking spot availability. While the technology's implementation is the primary focus, future iterations may explore additional features, such as insights into optimal parking times.

However, we acknowledge the speculative nature of this aspect and emphasize delivering the core functionality of real-time parking detection.

1. INTRODUCTION

The purpose of developing ParkSense is to detect and deliver relevant information about parking to Students and Faculty in real-time. Using the design philosophy *The Internet of Things*, we intend to show how it's possible to use machine learning and computer vision technologies to make things more convenient in a cost-effective manner. By training a new model, this technology can be applied to many different aspects of life.

The technologies in use are primarily software-based. A camera feed is used for data input, and a Raspberry Pi can be used for data processing and delivery. We intend to show how to build a data set for training a model, how to train said model using the data set, and how you can use the model to generate a useful set of data to feed to a user interface. We want to show how to do all of this with the selected modules that we will use for this project: OpenCV, YOLOv8, and RoboFlow.

2. TECHNOLOGY

Parksense makes use of several technologies for monitoring the lot and presenting data. A Raspberry Pi and its associated camera module were chosen for its practicality. They are portable and inexpensive, allowing for quick deployment wherever needed.
Several open license Python packages were used for building and training the model, and for real time video processing. OpenCV will provide computer vision for real-time processing for our video feed while YOLOv8 will provide a deep learning algorithm for training on our dataset and producing weights for our model once training is complete. RoboFlow will help with labelling each image of our mock-up with taken and empty instances as it provides extensive image annotation tools needed to produce a training data-set that is accurate and efficient. We will record mean average confidence, recalls, and object loss across different epoch values to show how the algorithm produces more accurate results with more training.

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