# Senior Design Project - ParkSense

**Aaron Alden**
Martin, Tennessee, USA
aardalde@ut.utm.edu

**Spencer Karpati**
Martin, Tennessee, USA
spebkarp@ut.utm.edu

**Zachary Rose**
Martin, Tennessee, USA
zacerose@ut.utm.edu

## ABSTRACT

Our campus suffers from insufficient parking spaces. This has led to students parking farther away from campus, leading to longer-than-expected travel times to arrive to class. Consequentially, because some students arrive late, they disrupt the lecture and leave a mark on their attendance.

To address this issue, we would like to introduce you to our IoT approach to solving this problem by using OpenCV, YOLOv8, a Raspberry Pi, and a camera module. With OpenCV's real-time computer vision library and YOLOv8's deep learning capabilities, we will explain how we built our own object detection software that is trained on custom data to detect empty and taken parking spots.

The scope of this project is to use computer vision and a camera stream to detect in real time the availability of parking in a parking lot. The computer vision software will be trained on a custom data set for accuracy. A Raspberry Pi is used for collecting data, running calculations, and outputting the results of the pattern recognition. A user interface in the form of a website will be available for the user, which will update periodically and accurately communicate the availability of parking spots. Additional analysis will be available regarding the best and worst times to find open parking based on periodic samples taken.

### Author Keywords

Authors' choice; of terms; separated; by semicolons; include commas, within terms only; this section is required.

## 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.

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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