REVA UNIVERSITY
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REVA Academy for Corporate Excellence (RACE)

Smart Parking Solution for Multi Building Campus

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M.Tech in Artificial Intelligence

Capstone Project Presentation
Year: II

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Agenda

Introduction

- It is challenging to keep track of available car parking space inside a given building
- There are multiple buildings in main campus.
- Offices or buildings with separate entry and exit or single entry & exit.
- Post pandemic, employees prefer to use personal commute then public

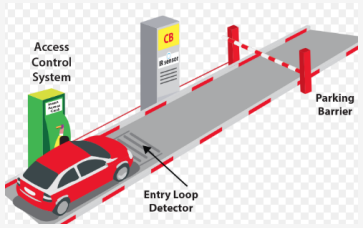
Without parking availability information, employees must shuttle around builds to find parking space during peak hours, and this will be a loss of time as well as frustration experience to the commuter.

Current status in office buildings

There are few options companies follow like:

- ✓ Physically counting cars at certain interval and update the dashboard

- ✓ Install badge reader at entry and exit and people must punch card at both the places



- ✓ Sensors have been installed in certain parking lots, allowing management to track when cars enter and exit

- ✓ Install Radio Frequency Identification (RFID) tag to each vehicle and reader at entry and exit in order to track the capacity

Literature Review

Paper title, Year	Key Insight
Intelligent Vehicle Counting Method Based on Blob Analysis in Traffic Surveillance, 2007	Uses blob analysis for Moving object segmentation, and tracking
Image Processing Based Vehicle Detection and Tracking Method, 2014	Proposed to develop an unique algorithm for vehicle data recognition and tracking using Gaussian mixture model and blob detection methods
Automatic Vehicle Detection and Counting Algorithm, 2014	Counting vehicles using GMM background modeling, object histogram and pyramidal Lucas Kanade method
Smart Parking: Parking Occupancy Monitoring and Visualization System for Smart Cities, 2016	Using a Wireless Sensor Network (WSN), parking spot statuses (occupied or idle) are detected and transmitted to a database
Vehicle Counting for Traffic Management System using YOLO and Correlation Filter, 2018	YOLO detection, tracking with correlation filter, and counting. correlation filters achieved greater accuracy and competitive speed in tracking
Review Paper on Smart Parking System, 2019	Smart parking system consists of an onsite deployment of a slot module that is used to monitor and signalize the state of availability of each single parking space.
A Simple Vehicle Counting System Using Deep Learning with YOLOv3 Model, 2020	This research aims to create a simple vehicle counting system to help human in classify and counting the vehicles that cross the street.

Problem Statement

All these current methods will bring in burden on

- Additional resource for monitoring
- High cost of installation of reader & necessary barricade systems respectively
- Added cost to regular maintenance of overall system.
- Employee experience will be at stake. Quality of lifestyle is most important to employees

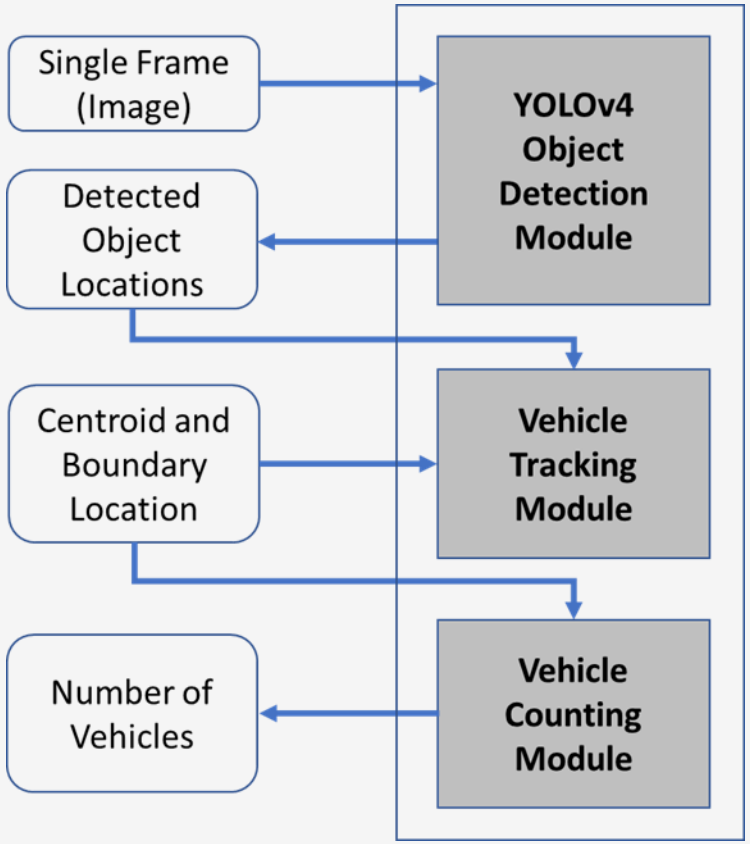
❖ Most importantly this is a practical problem in my current and most of the organization

Project Objectives

- ✓ The primary objective of this study is to implement the customized smart parking solution for multibuilding campus offices
- ✓ Detect entry and exit of the vehicles there by compute the available car parking number
- ✓ A dashboard at each building entrance encompassing overall occupancy and available status will greatly help the employee peacefully approach the building where parking is available

❖ Implement solution in my current organization which is motivating factor to join the course 👍

Project Methodology



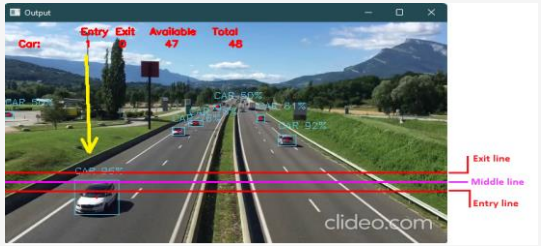
Project Methodology

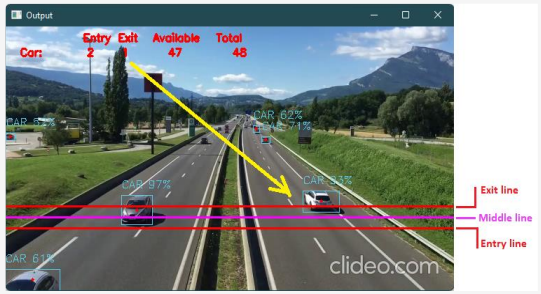
Conceptual Framework | Research Design

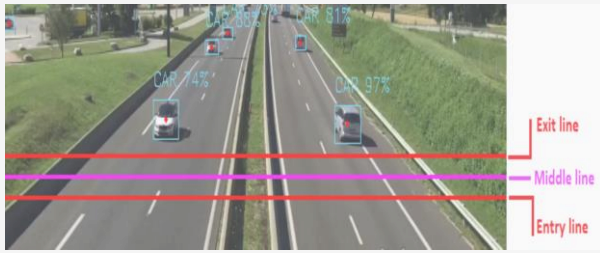
YOLOv4 Object Detection Module

Vehicle Tracking Module comparing the centroid b/w frames

Vehicle Counting Module







Resource Specifications

Data Resources

- ✓ 81 seconds video with with 1280 x 720-pixel resolution at 30 fps and 15 fps is used
- ✓ Video has two-way traffic by which both entry and exit of vehicle data can be detected
- ✓ In both the direction 48 cars will pass in enter and exit path each.

Technical Resources

- ✓ OPENCV 4.5.2, Yolov4 pretrained model and PYTHON 3.8.5 in a machine with Intel(R) Core i5-10210U, CPU of 2.10GHz processor with 16GB RAM

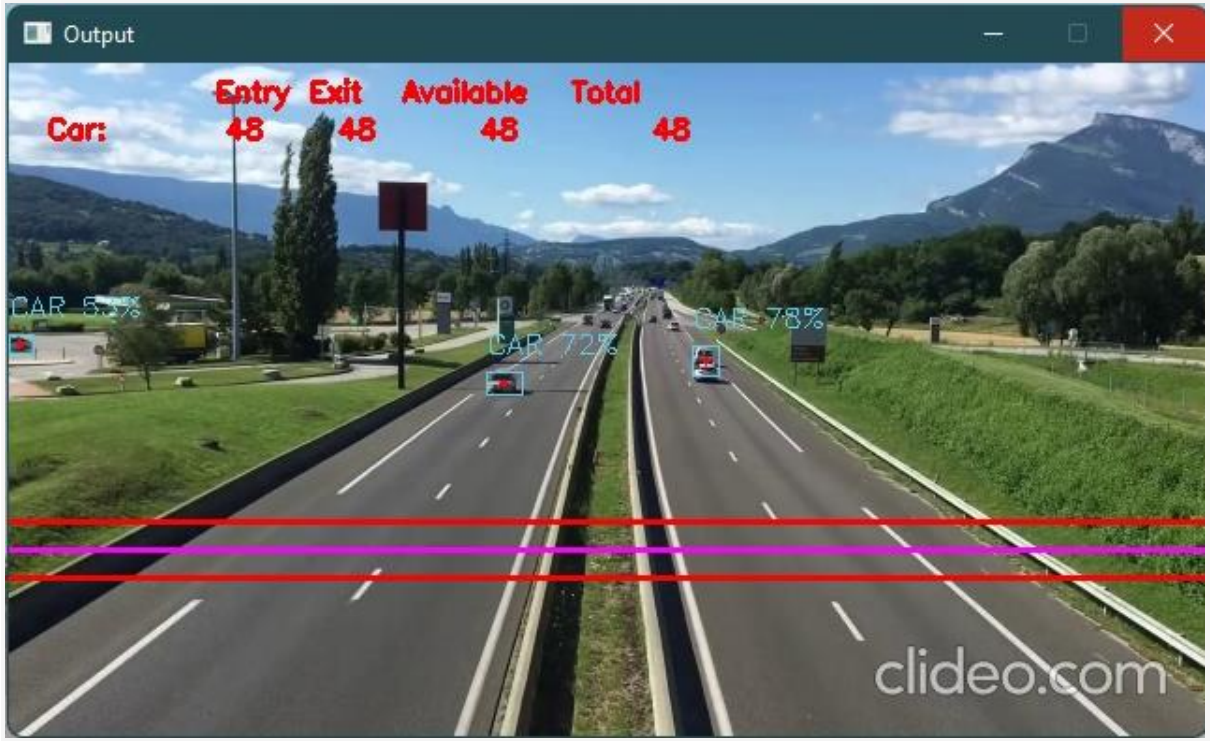
Implementation

Demo | Application | Use cases

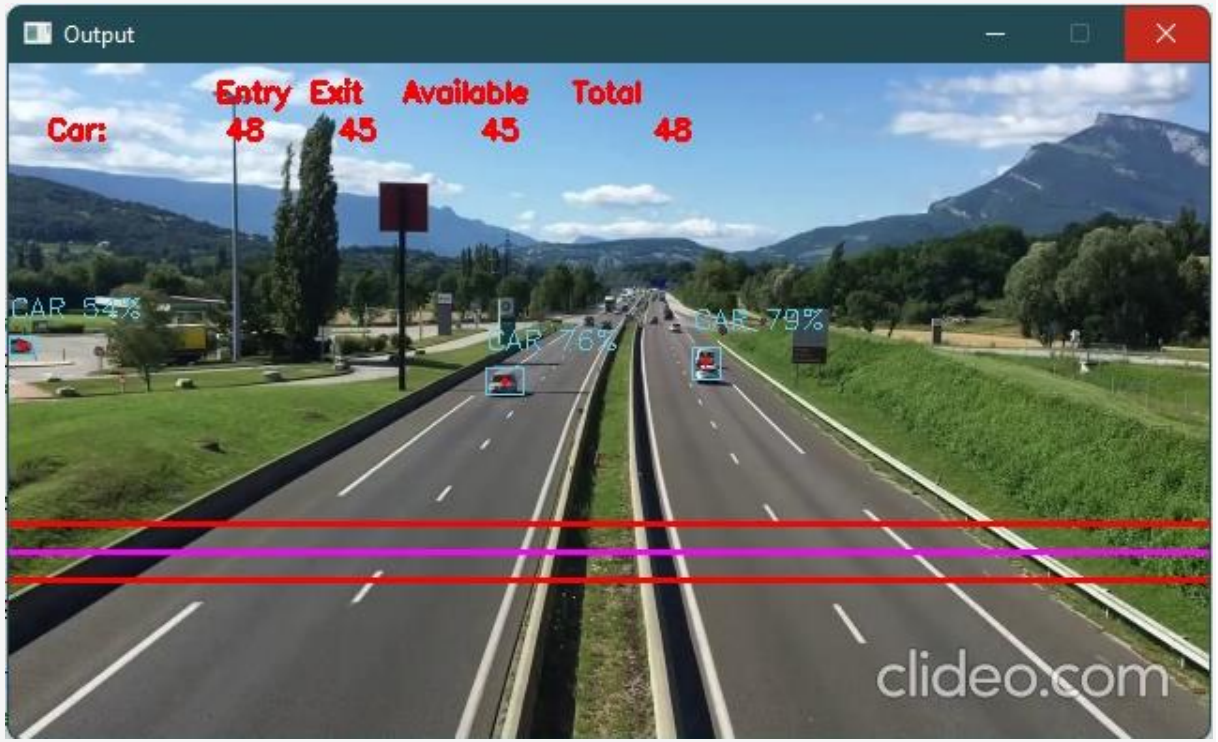
DEMO

Testing and Validation

Video mode at 30 fps



Video mode at 15 fps



Analysis and Results

	Entry		Exit		Entry Accuracy	Exit Accuracy	Overall Accuracy
	Actual	Predicted	Actual	Predicted			
Video with 30 fps	48	48	48	48	100%	100%	100%
Video with 15 fps	48	48	48	45	100%	93.8%	96.9%
					Average Accuracy		98.45%

Suggestions and Conclusion

Insights

- Video with 30fps achieved 100% accuracy.
- It is noted that more frame rate means more information that video carries which is integral information, vital for DL model to process, track, and count
- Hence recommended to use separate 30 fps direct live video feed non-storage camera apart from regular storage-based surveillance camera to avoid investing on huge onsite storage.

Future Scope

- The proposed solution can further be extended counter other objects like motorcycle, bicycle
- With a higher-resolution camera, the same method can be applied to extract license plate information as well
- Also, dashboard data can be made available to the employees over cloud or employee portal so that they can be well informed

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Annexure

Smart parking solution for multi building campus

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