Parking Pal Final Report

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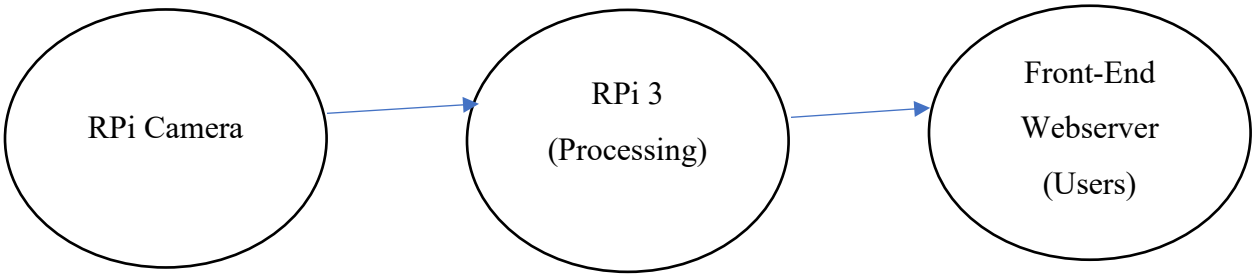
System Definition/Introduction

Parking Pal is a Raspberry Pi running a python script to process images taken by the Raspberry Pi camera and determine if there are available spots in a parking lot. It returns the data to a server for an external interface. The script running on the Raspberry Pi does most of the work, grabbing images from the camera's live feed and then running image processing using OpenCV to determine if a space is occupied or not. It takes that data and prints it out on the Raspberry Pi, and then sends an http POST request to the server to update the data there. The server then takes the received data and displays it.

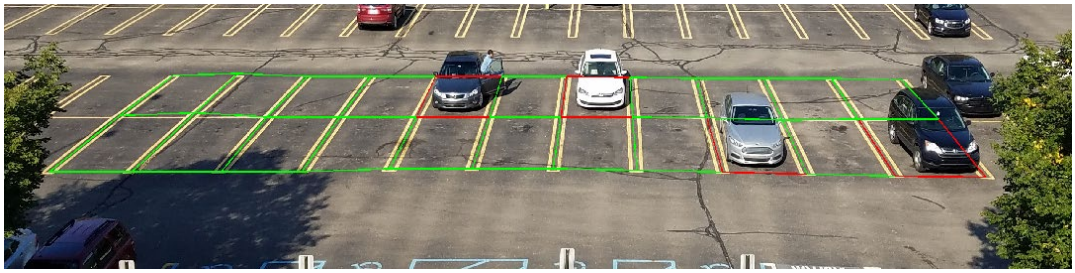
System Context Diagram



Functions/Features

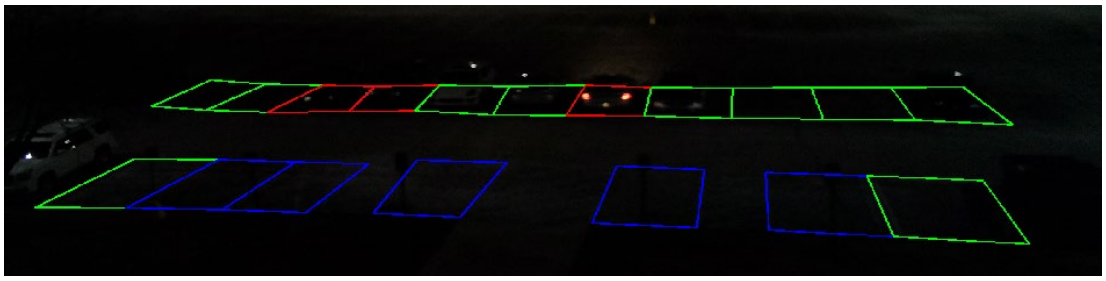
- Determines available and taken spaces in a parking lot
- Tells the difference between handicapped and non-handicapped spaces for reporting
- Sends data to web server for user interface
- Updates regularly to catch changes in availability of spaces

Testing with regular spaces during the day:



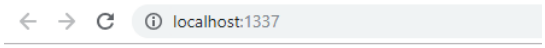
```
E:\VSCode\Python\ParkingPal>python ParkingPal.py
Total Spots: 22
Open: 18
Occupied: 4
```

Testing with handicapped spaces at night:



```
E:\VSCode\Python\ParkingPal\RPI Files>python ParkingPalOld.py
Total Spots: 18
Open: 10
Open Handicapped: 5
Occupied: 3
Occupied Handicapped: 0
```

Server output:



Parking Pal

Total Spaces: 18

Open: 10

Open Handicapped: 5

Occupied: 3

Occupied Handicapped: 0

Test Cases

- Time of Day: Morning, Noon, Evening, Night
- Lot Availability: Empty, Partially Full, Full
- Moving Cars: Exiting, Entering
- Handicapped Spaces: Determining handicapped versus non-handicapped

Test Case Results

- Time of Day: Results were best during midday, and nearly as good in the morning and late afternoon but were tenuous at night and less reliable.
- At any availability amount, the availability calculated was nearly always correct, only a few times on edge cases were there misprocessed.
- Due to the regular updating of the images being processed, cars exiting or entering spaces do not cause any meaningful disruption.
- Handicapped spaces are separated from regular spaces to prevent the confusion of open and occupied handicapped spaces with regular open and occupied spaces.

References

OpenCV documentation: https://docs.opencv.org/3.0-beta/index.html

picamera library documentation: https://picamera.readthedocs.io/en/release-1.13/

Requests library documentation: http://docs.python-requests.org/en/latest/