Group C0:
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Occupancy Monitoring System

Application Area

- We want to design an Occupancy Monitoring System that tracks wait times and current table occupancy for fast casual restaurants.

WHY?

- Currently not that much information on how busy a location is.
- Lets users make a more educated decision on where to eat.

Solution Approach

Person Re-Identification

- **Two cameras aimed at the front and back of a line**
- **Facial Recognition algorithm re-identifying person to calculate average wait time**

Table Sensing

- **Sense hat**
  - **Gyroscope**
  - **Humidity**
  - **Temperature**
  - **Threshold values**
  - **Zemorui paper**
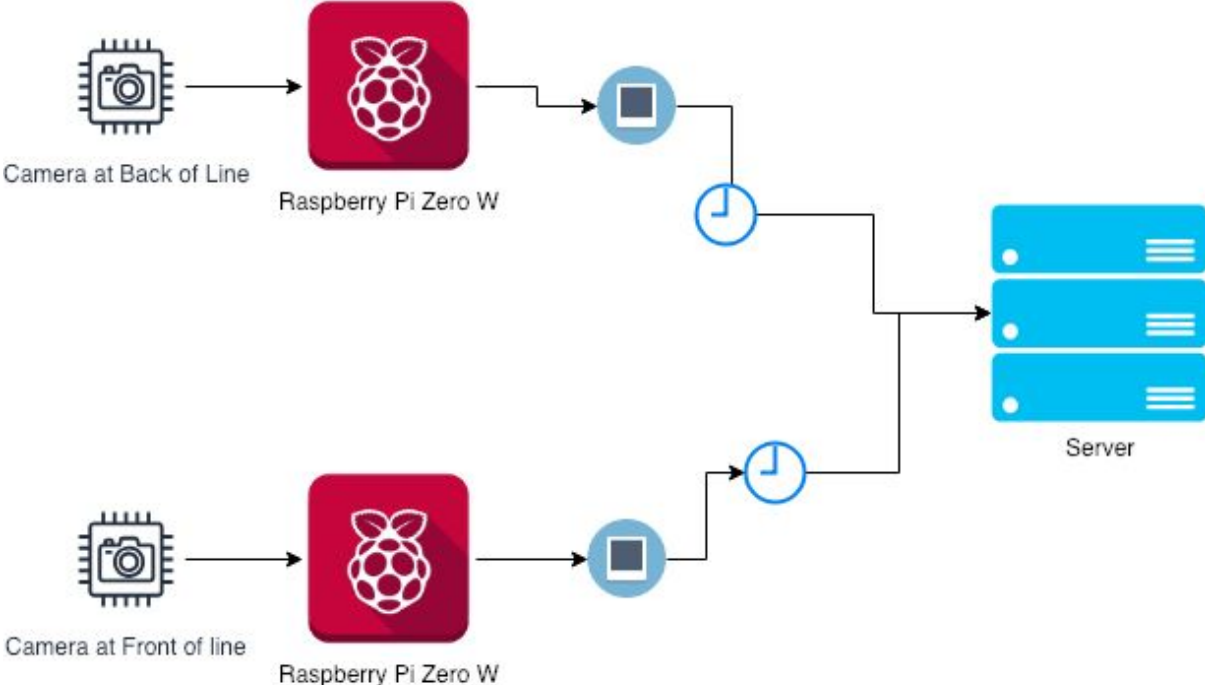- **MPR121(Capacitance sensing)**

Web-Application

- **Raspberry Pi Connection to Servers + SQL for data transfer + storage**
- **Sticky front end features displaying wait times, occupancy heat maps, and predictions**

System Specification - Table Sensing

Sense Hat

Capacitance Sensing

Raspberry Pi

Server
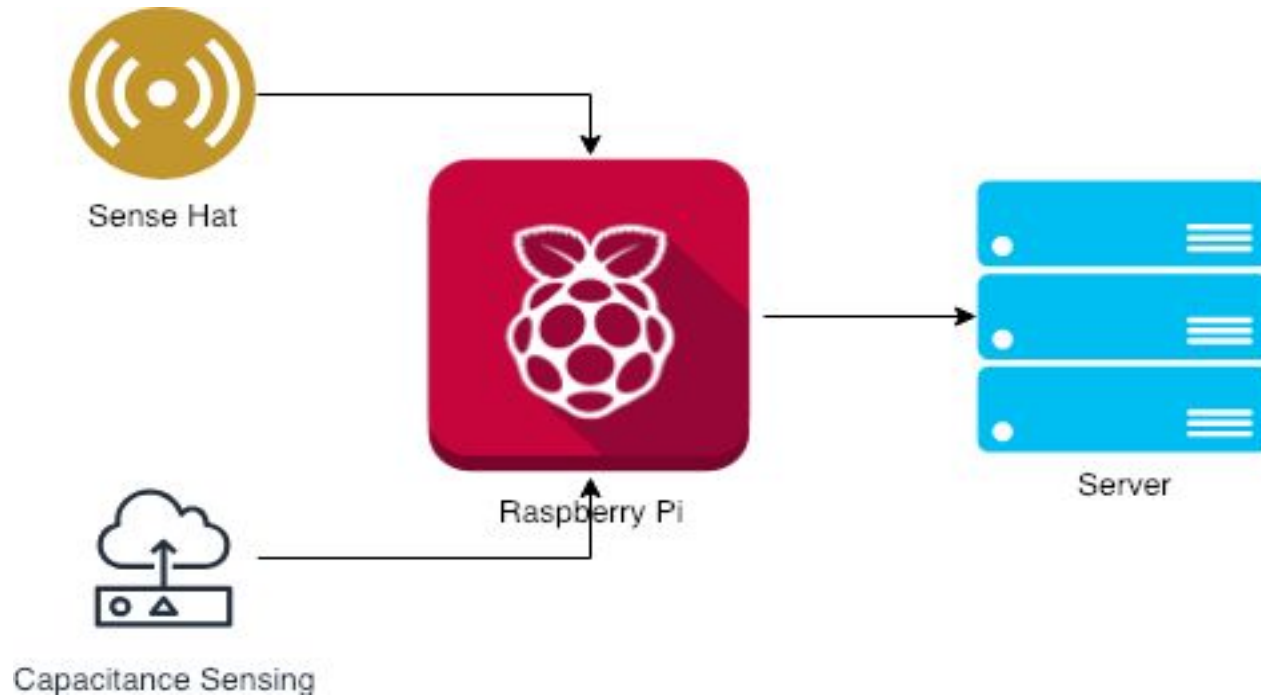
System Specs - ReID

Implementation - ReID

- YOLO Object Detection
- Dominant Color Region
- Cross Camera Calibration
- Matching - Classifier or Feature similarity
- Market1501 Dataset
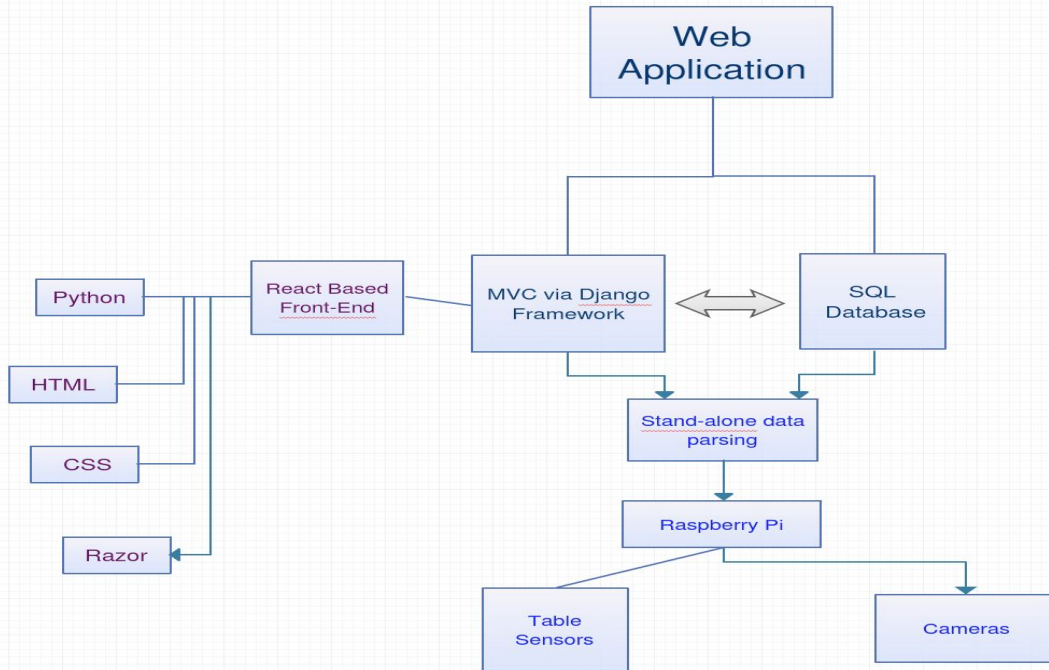- Database for features
- Wait Time Algorithm

Implementation - Table Sensing

- Sense Hat - (Humidity, Temperature, Threshold values)
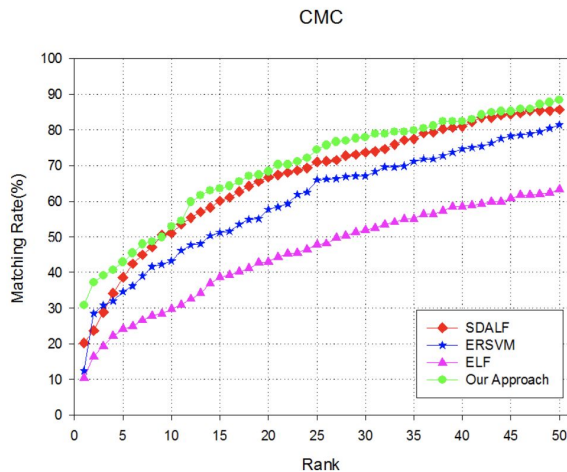- MPR121 Capacitance sensing
- Raspberry Pi zero W
- Wireless Charger
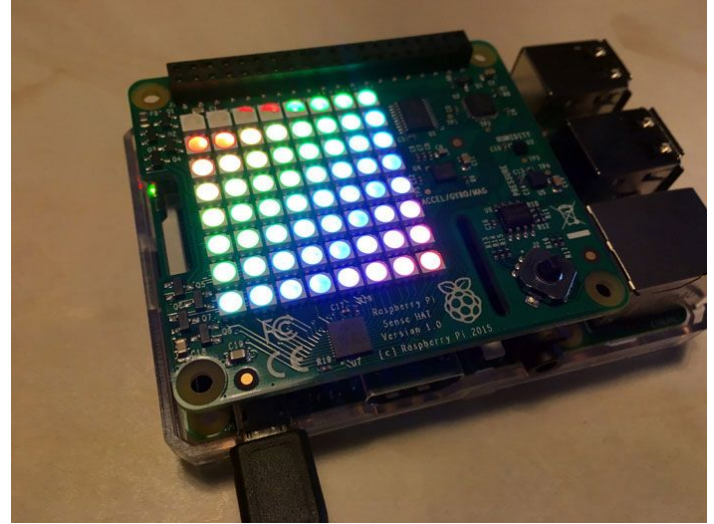
Web Application Implementation

Metrics
Validation ReID

- ❏ Mean Average Precision of 50% for Object Detection
- ❏ Measure Cumulative Matching Characteristic(CMC)
- ❏ Beat ELF model

Metrics Validation Table Sensing

❏ Achieve 90% Human Sensing(Real time Detection Paper)

Table 1: Detection performance of capacitive sensor

States	Precision	Recall
Unoccupied	100 %	100 %
Object Occupied	97 %	100 %
Laptop Occupied	66 %	97 %
People Occupied	97 %	95 %

Table 2: Occupancy states confusion matrix

States	Unoccupied	Object	Laptop	People
Unoccupied	629	0	0	0
Object	0	360	0	0
Laptop	0	0	247	66
People	0	11	129	2546

Web-App Metrics Validation
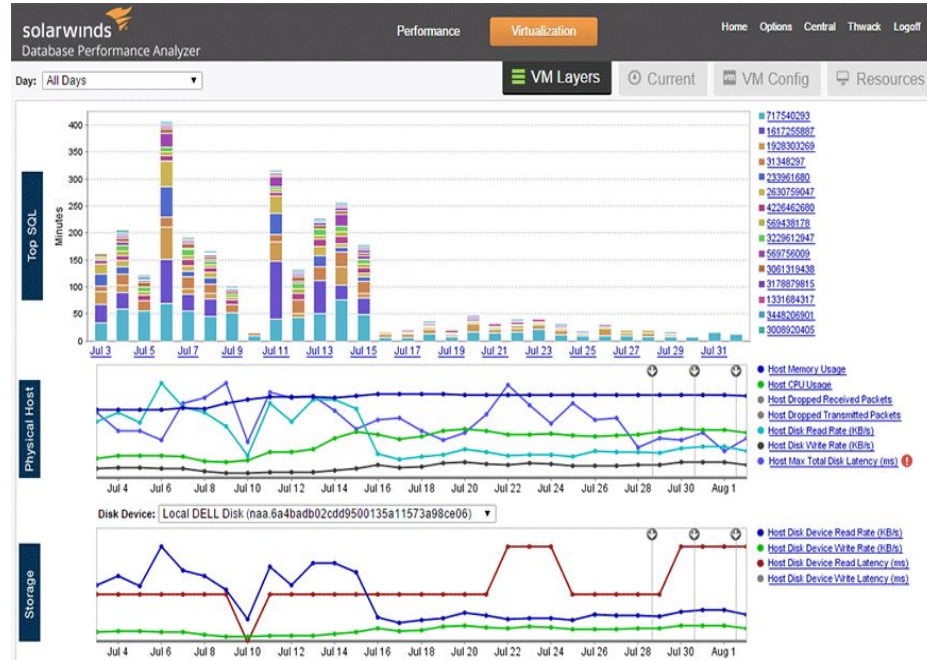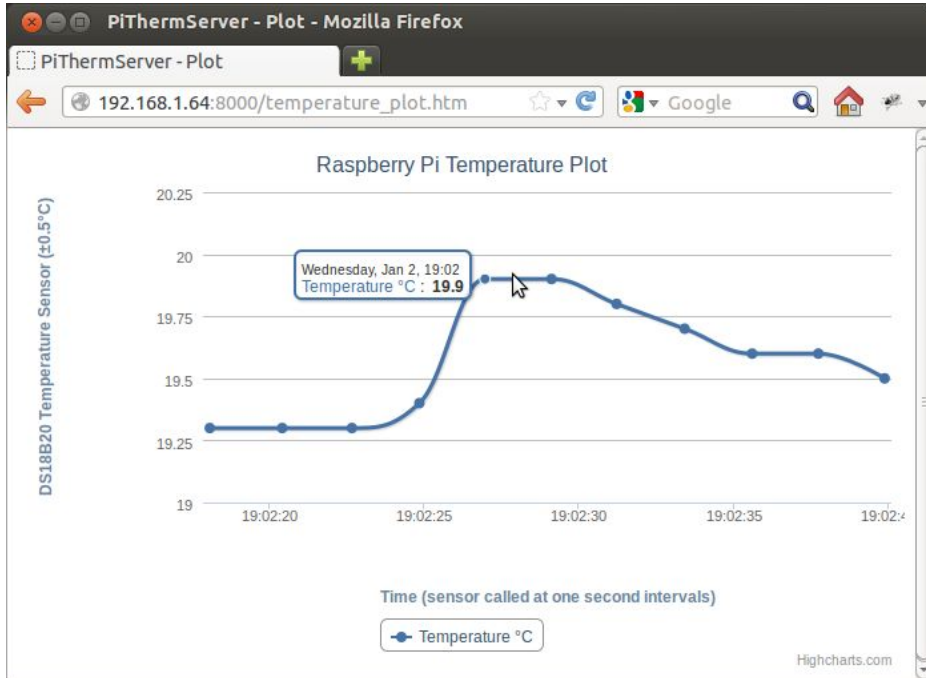
Schedule and Progress

Schedule

Start Day ■ Duration

Peter - Vayum - Ajay

Detect Human From Camera F...
Extract Human Features from...
Write matching algorithm
Develop method of transmittin...
Slack
Figure out way to store data, d...
Design Wait time Algorithm
Write Wait time algorithm
Write Endpoints for current wa...
Connect Endpoints to Fronten...
Slack
Slack
Design requirements
Decide overal data formatting
Decide database
Write Socket interface
Build Layout of Home page
Build individual restaurant page
Create fake data to test website
Connect with table sensing en...
Connect with facial recognitio...
User testing for layout
Slack
Slack
Decide which sensor we can u...
Connect sensors with raspber...
Determine thresholds for hum...
Determine thresholds for any f...
Send data to central server
Explore Wireless Charger desi...
Integrate wireless charger into...
Send the charging data to the...
Design a housing for the sensor
Fabricate the housing
Slack
Slack

0   25   50   75   100