PARKING AVAILABILITY SYSTEM

BETA PRESENTATION MILESTONE

The ParKings

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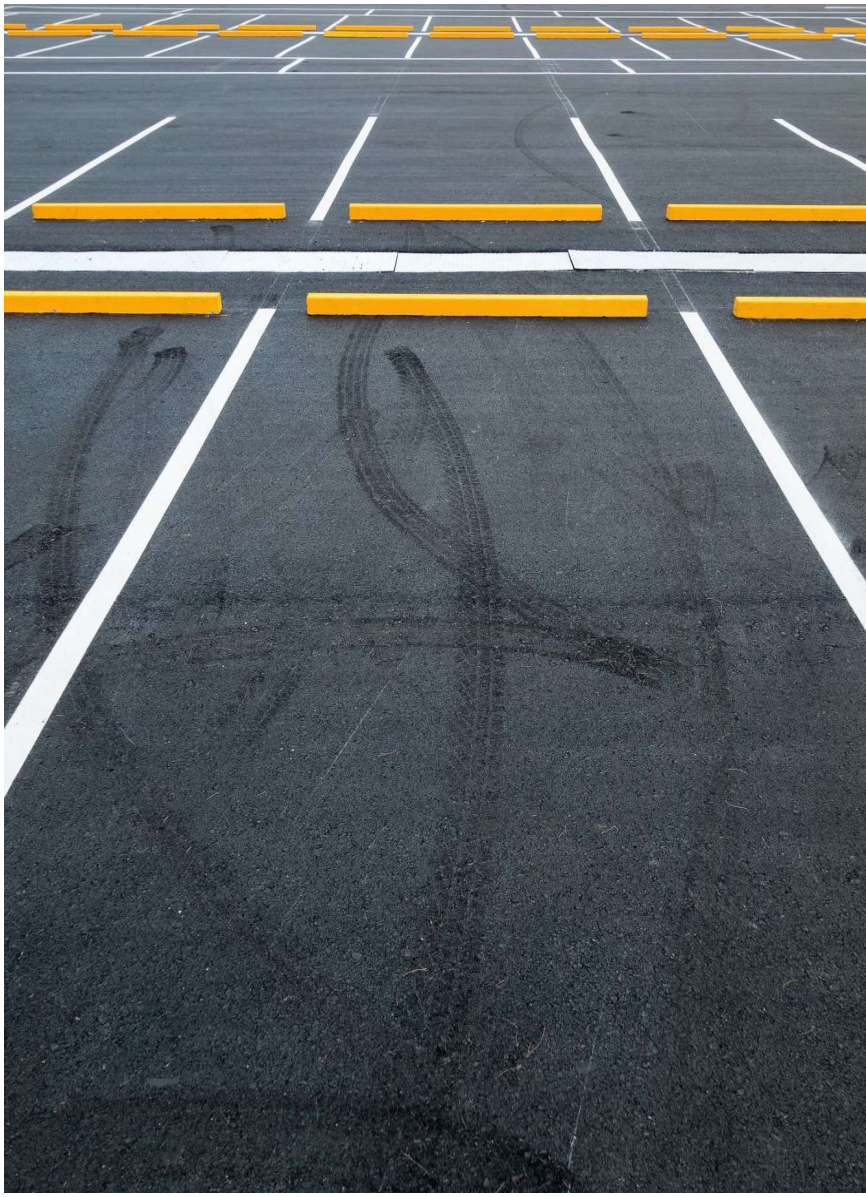
CEN4908C – Computer Engineering Design 2



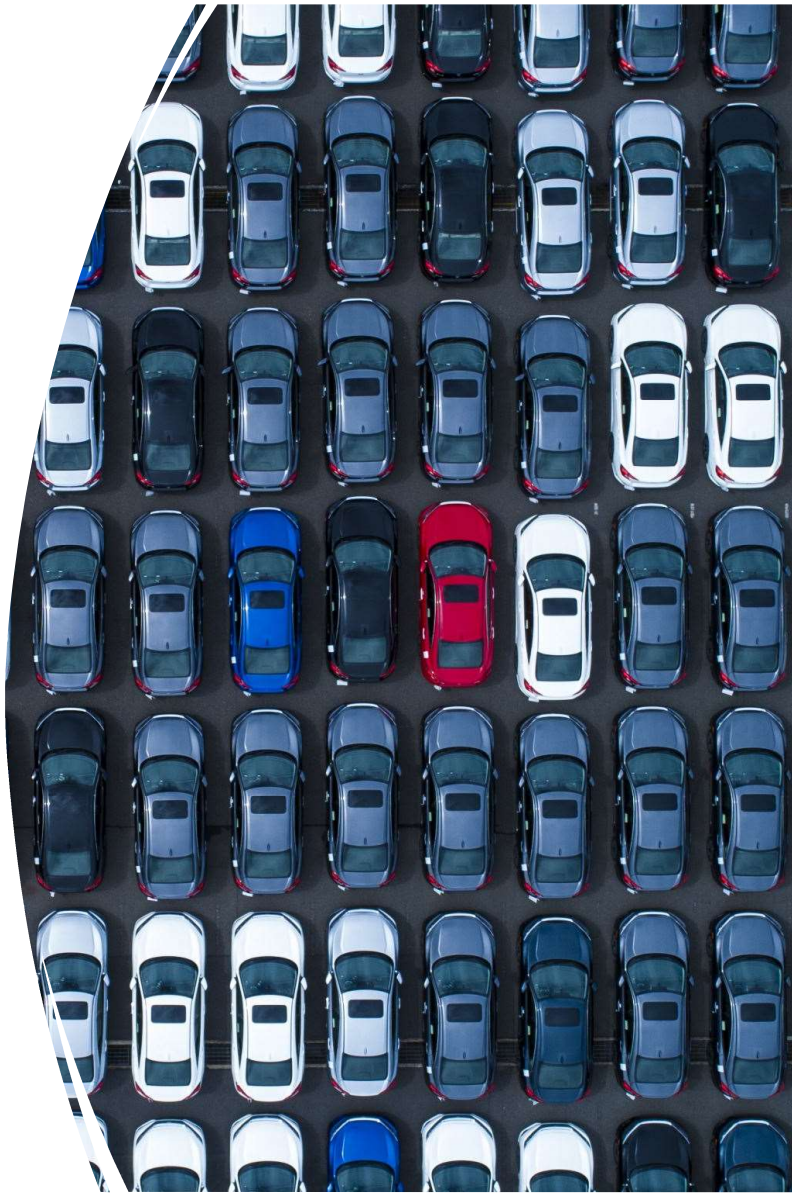
Context

UF lacks easily available parking resources

Parking difficulties cause drivers stress and frustration, wastes time, and creates traffic congestion.

Parking Availability System (PAS)
A low-cost, hardware/software system for parking information for facilities on campus

Features:
- Vehicle Detection
- License Plate Recognition
- Database with Lot and Car Information
- Real-time Parking Information on Mobile App



Alpha Completed Work

Alpha Build (01/10/2025 - 01/28/2025)

Researching, planning and deciding on a solution to resolve WiFi dead zone in pilot garage:

- ESP32 repeater
- USB WiFi modem for Raspberry Pi

Implemented YOLOv11n license plate detection model on Raspberry Pi

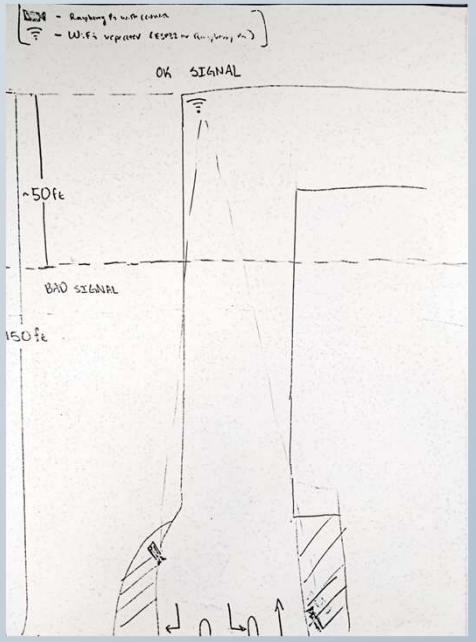
Implemented API communication between Raspberry Pi and AWS

Preliminary configuration script implementation for Raspberry Pi set up:

- System packages
- Python virtual environment

Developed test plan for testing license plate recognition, backend API functionality, mobile app functionality, hardware performance, network connectivity

lotid [UUID]	latitude [NUMERIC]	longitude [NUMERIC]	name [VARCHAR]	address [VARCHAR]	open [TIME]	close [TIME]	days [_VARCHAR]	decals [_VARCHAR]
0210feeb-cf1d-42a7-95(	29.647502	-82.359249	Fraternity Row 2		08:30:00	15:30:00	{M,T,W,R,F}	{parkAndRide,red1,disabl
0226350f-5dc0-433e-a(	0.407479	0.345672	test name	5678 Elm St	12:35:22	12:35:22	{M,T}	{Red,Green}
02bf2c6a-1810-4fe2-90	29.645655	-82.337330	Parking Garage 8		08:30:00	15:30:00	{M,T,W,R,F}	{orange,red1,red3,disabl
0405bdde-778a-4de7-9	29.639044	-82.346679	Parking Garage 2		07:30:00	17:30:00	{M,T,W,R,F}	{gold,silver,visitor,disable
060dc221-bd70-408a-a(	29.649438	-82.339431	Tigert Hall/13th Street M		07:30:00	16:30:00	{M,T,W,R,F}	{motorcycleScooter}
06fa4bf0-3ecb-4ef7-a0	29.645198	-82.348377	UF Bookstore & Welcome		07:30:00	16:30:00	{M,T,W,R,F}	{gold,silver,disabledEmpl
09549251-14f3-44ab-9:	29.645754	-82.352848	Flavet Field		08:30:00	15:30:00	{M,T,W,R,F}	{green}
1114af86-d158-4b14-b4:	29.640779	-82.341599	Parking Garage 10		08:30:00	15:30:00	{M,T,W,R,F}	{visitor,motorcycleScoot
11945155-ac9e-45c7-8(	29.647512	-82.342973	Inner Road Motorcycle		07:30:00	16:30:00	{M,T,W,R,F}	{motorcycleScooter}
1284e0bd-fe3f-4156-84	0.083723	0.871200	test name	1234 Main St	12:38:42	12:38:42	{M,T}	{Red,Green}
128ce783-ff24-4a47-be:	29.639699	-82.356552	IFAS Parking 3		08:30:00	15:30:00	{M,T,W,R,F}	{orange,motorcycleScoo
1429020c-9ba3-4662-a	29.646837	-82.350160	East Hall		08:30:00	15:30:00	{M,T,W,R,F}	{orange,motorcycleScoo
18a4bda1-b294-47a9-af	29.634154	-82.351701	Veterinary Medicine Wes		08:30:00	15:30:00	{M,T,W,R,F}	{parkAndRide,green}
18a9b8f3-7f9c-41bc-act	29.637907	-82.367623	Southwest Rec Center		08:30:00	15:30:00	{M,T,W,R,F}	{parkAndRide,disabledSt



Beta Completed Work

Beta Build (02/02/2025 - 02/21/2025)

Designing and printing of the second Raspberry Pi housing iteration

- Smaller size, better ventilation, persistent power (no battery, wall wart power supply)

Work on ESP32 network repeater access point

Completion of Raspberry Pi configuration script:

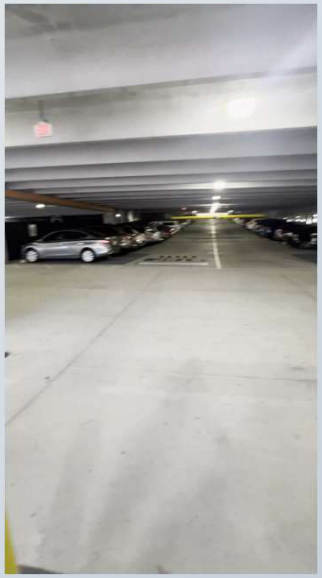
- Documentation, eduroam network onboarding, system packages, WiFi modem drivers, system settings, virtual environment, script error control

Preliminary car detection algorithm direction configuration

Testing USB WiFi modem, on-board modem, and network connectivity

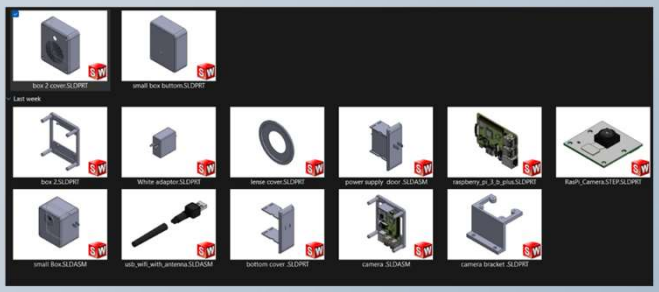
Testing license plate detection inference speed and real-world functionality on Raspberry Pi

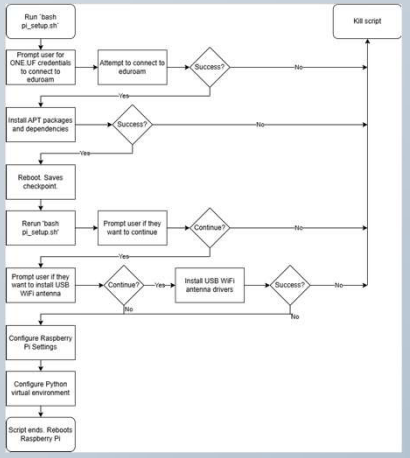
Adjustments to testing plan

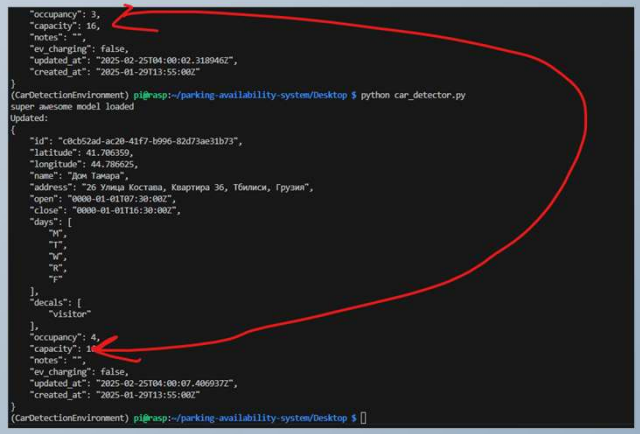


Input Size	MinTime	MeanTime	MaxTime	MaxFPS	MeanFPS	MinFPS
640x384	203.4	271.14	373.4	4.916	3.688	2.678

Modem Type	Average Bit Rate (Mb/s)	Average Link Quality	Average Received Signal Strength (dBm)
On-board (5 GHz)	54.53333	79%	-55
Antenna (5 GHz)	115.175	91%	-46.3333





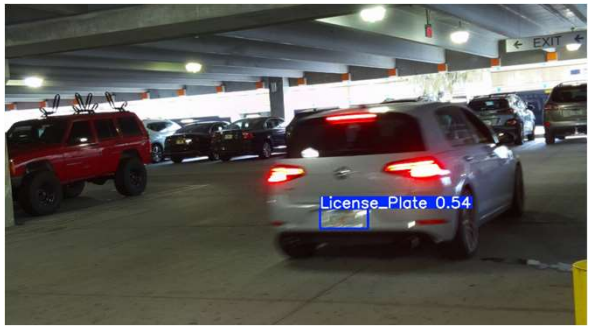


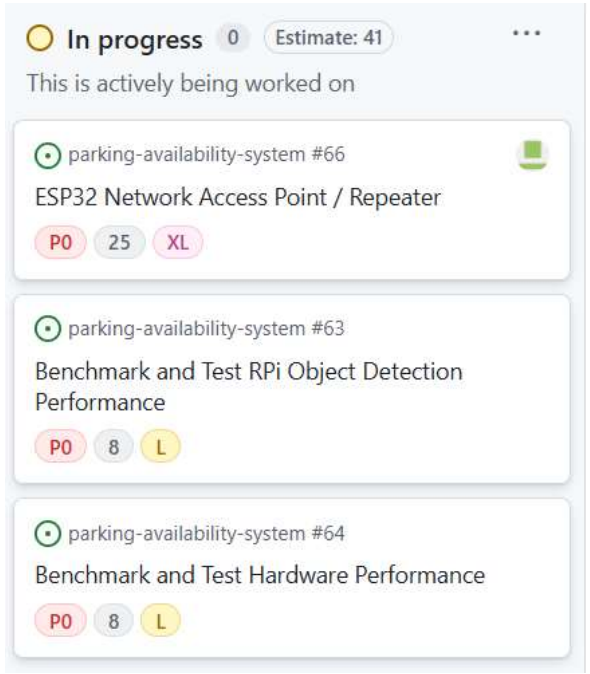
In-Progress Work

Continued Testing

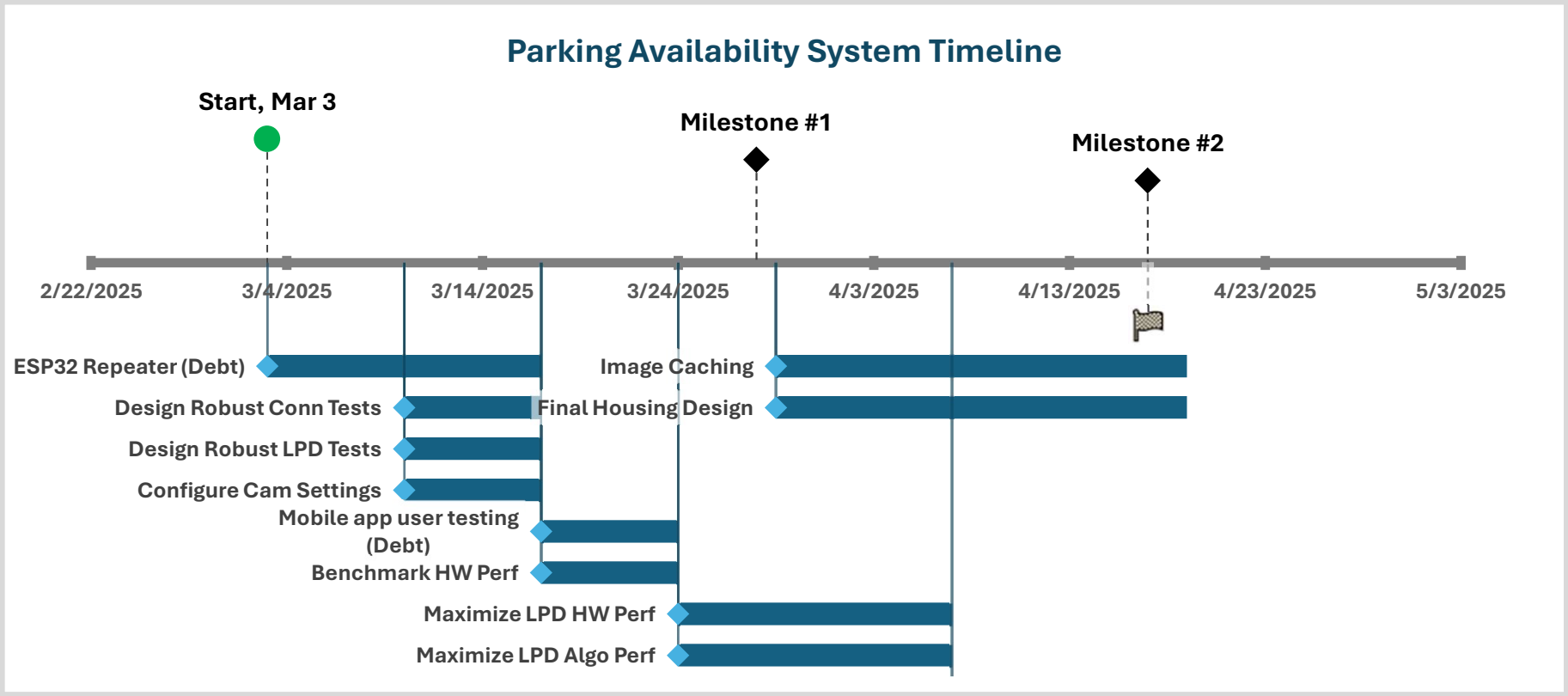
- More robust connectivity tests for modem(s), ESP32 repeater, and stability at pilot garage
- More robust license plate detection performance tests
  - Logging
  - Inference speed and accuracy scores
  - Augmenting camera configuration to enhance functionality
- Mobile app user testing

ESP32 Repeater





Future Work


Parking Availability System Timeline
Start, Mar 3
Milestone #1
Milestone #2
2/22/2025
3/4/2025
3/14/2025
3/24/2025
4/3/2025
4/13/2025
4/23/2025
5/3/2025
ESP32 Repeater (Debt)
Design Robust Conn Tests
Design Robust LPD Tests
Configure Cam Settings
Mobile app user testing (Debt)
Benchmark HW Perf
Maximize LPD HW Perf
Maximize LPD Algo Perf
Image Caching
Final Housing Design

Deliverable Plan

Demonstration

Questions?