

Overview of APA3

Software Engineering CSE435

Michigan State University

Fall 2022

Team members:

Project Manager: Adam Sloan

Facilitator: Nicholas Aaltonen

Customer Liaison: Daniel Wylie

Configuration Manager: Stanley Duru

Security Engineer: Amar Taj

Customer: Ms. Eileen Davidson

Instructor: Dr. Betty H.C. Cheng*

*Please direct all inquiries to the instructor.

Project Overview

- System enables the vehicle to automatically park in a desired location
- Motivation for project
 - Park vehicle without assistance of the driver
 - Facilitates a safe and easy way for people to park their vehicles

Overview of Features

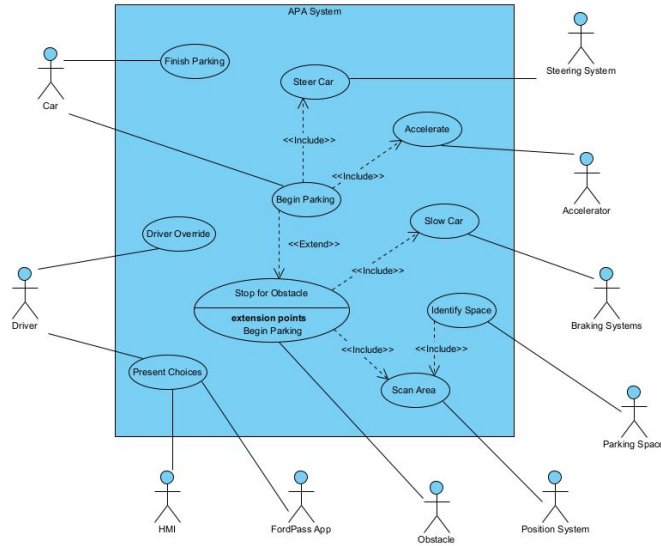
- Scan area for valid parking locations
- Move vehicle to safely park in desired location
- Avoid collisions and prevent any form of injuries

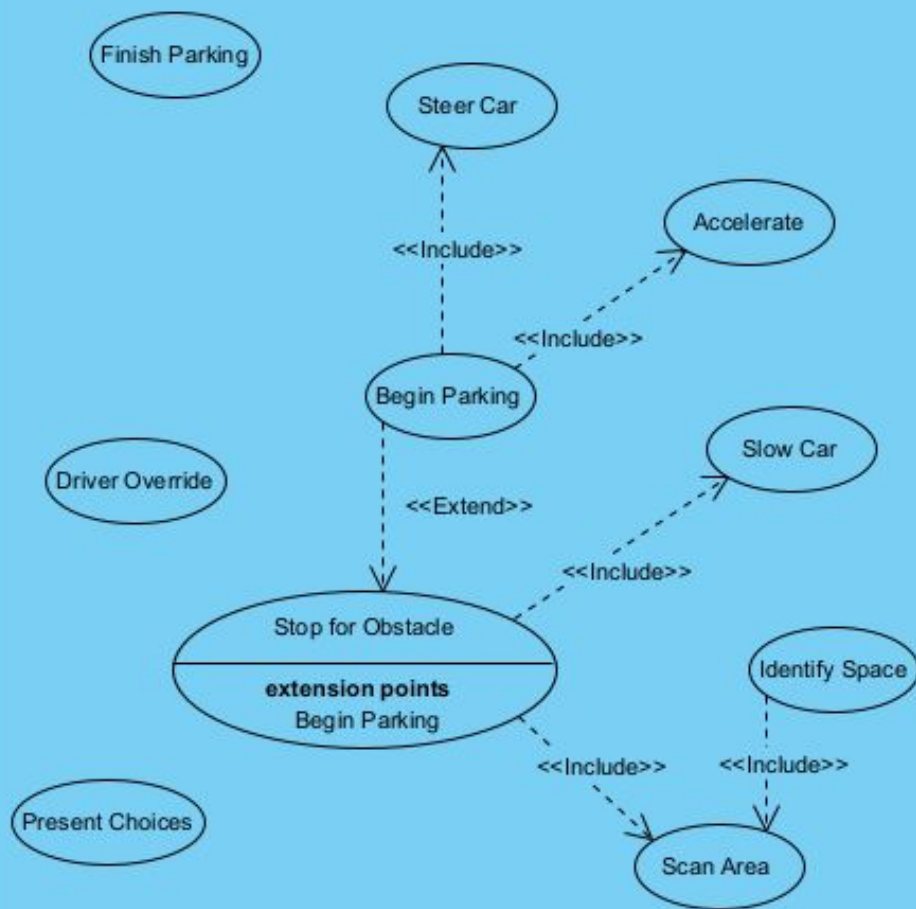
Domain Research

- Investigated Car sensor systems
- Needed to apply domain knowledge on building prototype
- Project Constraints
 - Max speed of 5mph
 - Never simultaneously accelerate and brake
 - Only park in valid locations

Part II: Model-based View of System

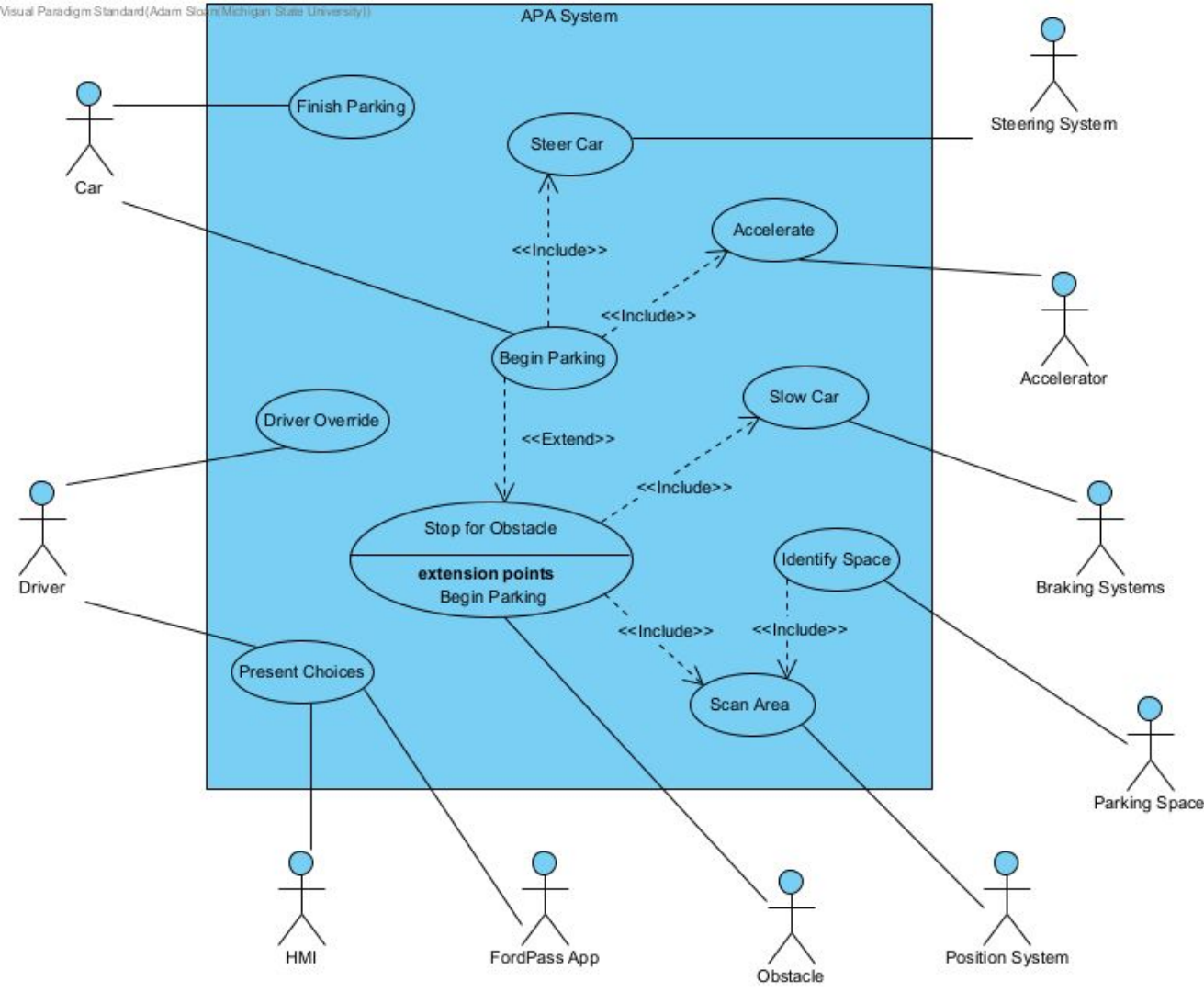
Our APA system design is best represented through a use case diagram





Use Cases

- These detail all the use cases required for the APA system to operate
- “Begin Parking” is the pivotal use case
- “Stop for Obstacle” is the one exception for “Begin Parking”



Actors

- This details the actors necessary for our use case diagram
- Primary actors are the driver and the car itself
- Secondary actors are subsystems and outside elements

Part III: Demonstration

- Can be interfaced by HMI or the currently available FordPass app

Scenario 1

Obstacle moves in parking path

- Stop vehicle to avoid any type of collision
- Wait for obstacle to move or offer driver other valid locations to park
- Periodically rescan the area to determine if there are still obstacles in the way of the parking location
- Continue parking once area is safe

Scenario 2

Car next to parking location begins moving

- Scan to make sure moving car isn't in parking path
- Slow down the vehicle substantially as it get closer to the moving vehicle
- Continue parking as normal but at a slower speed to ensure no collisions will occur

Scenario 3

APA system is overridden by driver

- At any point while the APA system has control, the driver may override this
- If the driver applies the brakes fully, bringing the car to a stop, the system will automatically abort and return full control to the driver
- Otherwise the driver can take control through use of the steering wheel

Scenario 4

No valid parking locations

- Vehicle will offer a rescan to ensure there are no valid locations to be able to park
- If there still isn't a place to park the vehicle will not go into parking mode
- Vehicle will advise you move to another location and scan again

Scenario 5

Normal Parking Scenario

- The driver will select Parallel or perpendicular parking on startup
- Any available spaces will be presented to the driver through the HMI
- The driver will select the space and the car will begin the parking maneuver as necessary

Acknowledgements

- We gratefully acknowledge and appreciate the participation of our customer, Ms. Davidson, an independent consultant formerly of Ford Motor Company