A3 Architectural Enhancement of Apollo

Cisc 322 Group 20

Youtube: https://youtu.be/qSVKQYytgaY

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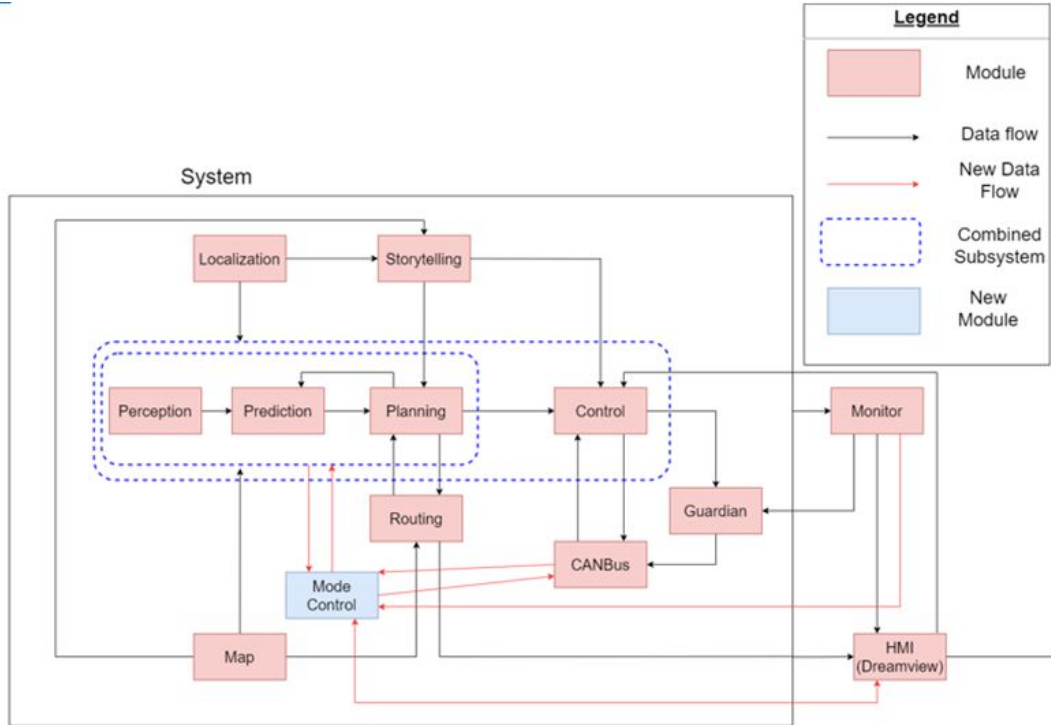Mukun Liu 19ml13@queensu.ca

Introduction

- Features
- Two Approaches
- SAAM Analysis
- Use Case
- Impacted Subsystems
- Limitation & Potential Risk
- Testing
- Lession Learned & Limitation

Feature

- Mode Control

- Maximize energy efficiency /reduce the energy consumption

- Automatically detected and take actions

Modified Conceptual Architecture

Enhancement module: Mode Control

Implementation 1

1. Mainly focus on the modification of Plannning module

2. Mode Control asks Planning to save energy

3. Routing —the paths to desination → Planning

4. Planning will choose the most energy-saving path. (wide and less cars)

Implementation 2

1. Reducing shifts.

2. Avoid unnecessary acceleration.

3. Engine shut down temporary.

4. Kinetic energy store.

SAAM Analysis

| Non-Functional Requirement	Implementation 1	Implementation 2
Maintainability	Easier to maintain by optimizing algorithm. **Stakeholders:** Development team, operation department.	Errors caused by different factors. Need to time to fully understand the causes. **Stakeholders:** Development team, operation department.
Evolvability	Better at evolvability. Improving by changing algorithm. **Stakeholders:** Development team.	Constrained to improve the software due to the limits of the hardwares. **Stakeholders:** Development team.

SAAM Analysis

| Non-Functional Requirement	Implementation 1	Implementation 2
Testability	Require substantial amount of testing. **Stakeholders:** Development teams.	Require a large amount of testing to check the stability. **Stakeholders:** Development teams.
Performance	Only perform route selecting. **Stakeholders:** Users, Development teams, operation departments.	Optimizing the vehicle in speed,gears and road conditions. **Stakeholders:** Users, Development teams, operation departments.

Use Case 1 (Energy-Saving Mode)
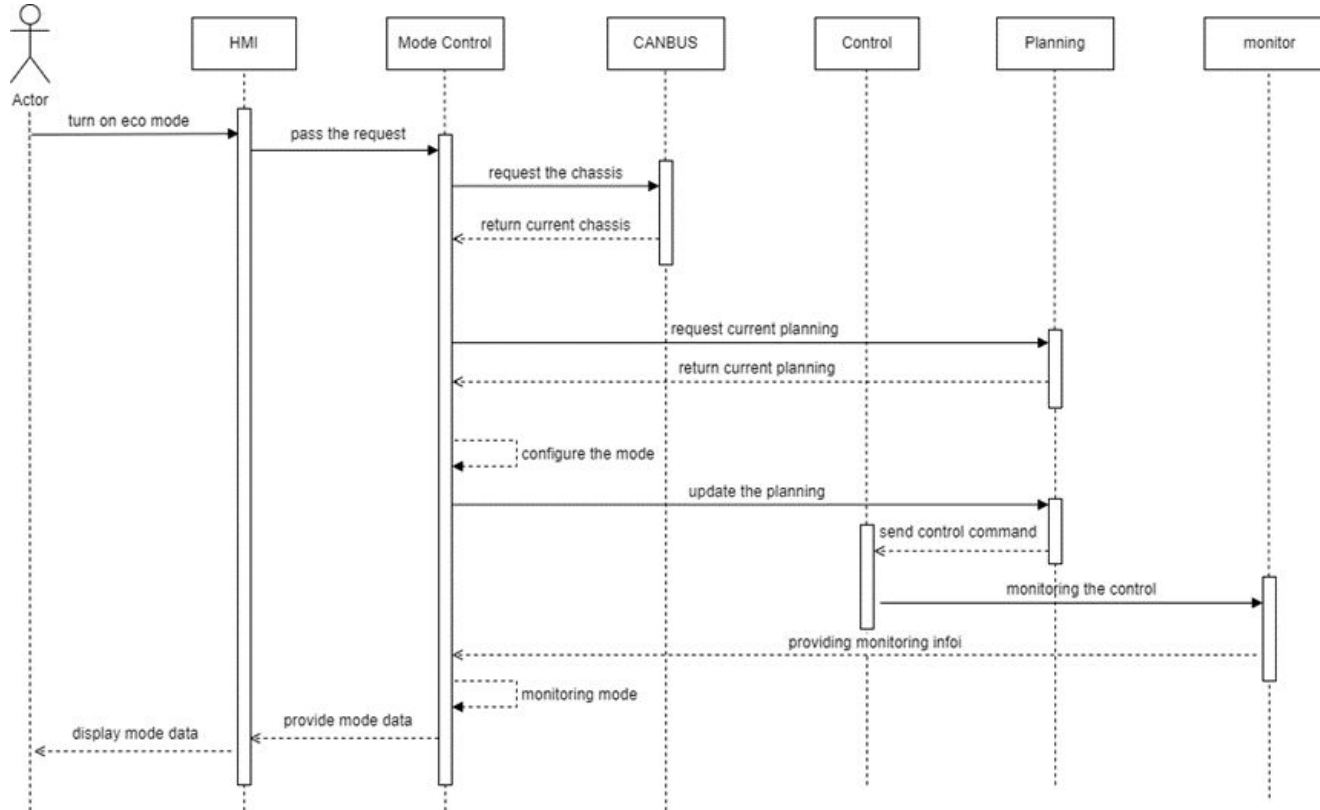
Use Case 2 (Time-Saving Mode)
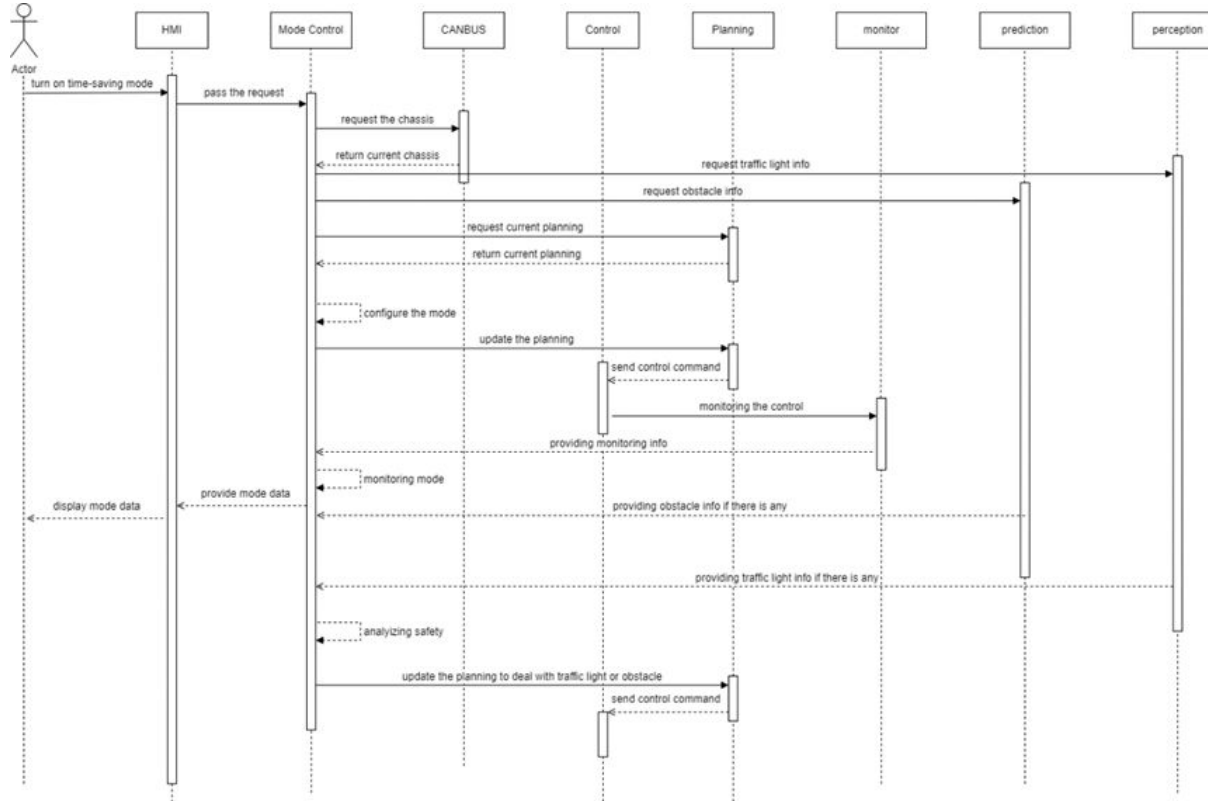
Impact Subsystems

- mode_control_command_topic
- Canbus

  chassis_topic & chassis_detail_topic

- Planning

  planning_trajectory_topic

- Perception

  traffic_light_detection_topic & obstacle

- Prediction

  prediction_topic

- Monitor & HMI

  mode_control_command_topic
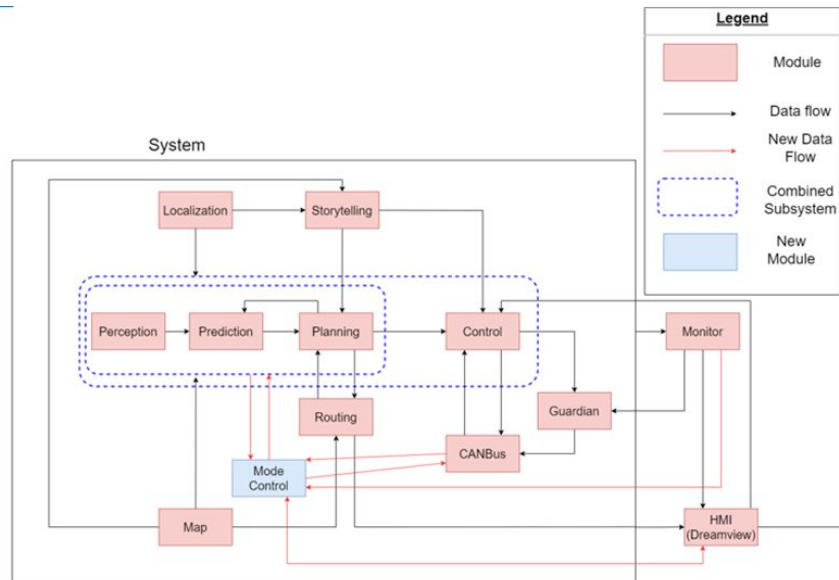
Testing

- Black box testing
  - input coverage
- White box testing
  - code coverage
  - method coverage
  - path coverage

Potential Risks and limitation

Potential Risks

- Reliability.

- User Experience

Limitations

- Topic

- Petrol or Electronic ?

- Hardware assistance

Lesson Learned

- Develop a stronger and deeper understanding of the interaction between original Apollo modules
- Diverse and interesting vehicle related features that were and will be applied into vehicles

Conclusion

- Driving Experience

- Pub-sub Architecture

- Efficiency

Reference

[1]*apollo developers's centre*. Apollo. (n.d.). Retrieved February 19, 2022, from https://apollo.auto/developer/index_cn.html#/

[2]https://github.com/ApolloAuto/apollo/blob/master/docs/cyber/CyberRT_Terms.md

Thanks for watching