Carleton UNIVERSITY

Canada's Capital University

Integrated Autonomous Vehicle (IAV)



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Integrated Autonomous Vehicle (IAV)

Two Main Goals:

- Design and build a fully automated vehicle capable of transporting an individual to improve accessibility on campus.
- Design and build fully integrated and self powered infrastructure to assist the vehicle in navigating the Carleton Campus.

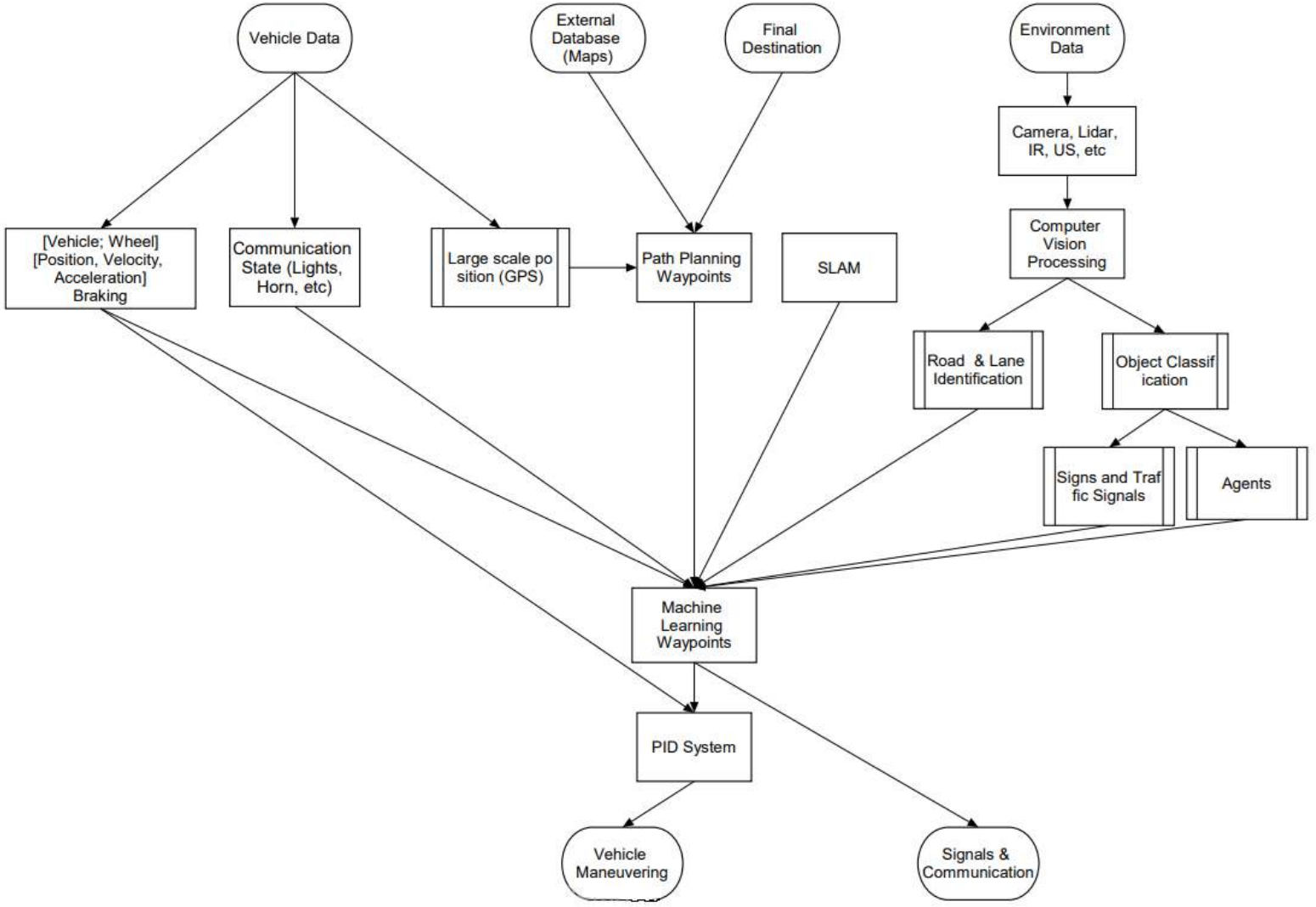
Main development areas

- Developing machine learning navigational and visual recognition systems
- Integrating control systems based on input from navigational and visual systems
- Designing and implementing systems for assisted entry and safety
- Developing beacon systems to assist with navigation
- Developing energy harvesting system to power the beacons



3D render of a proposed design for the vehicle

Integrated Autonomous Vehicle (IAV)



Vehicle Sensors

- Stereo Cameras
- LIDAR
- Radar
- Ultrasonic ranging
- GPS
- Bluetooth

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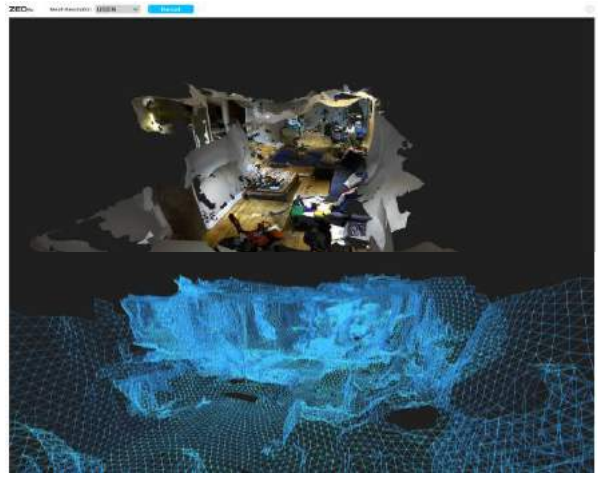
Machine Learning and Neural Networks

2020-2021 Areas of work

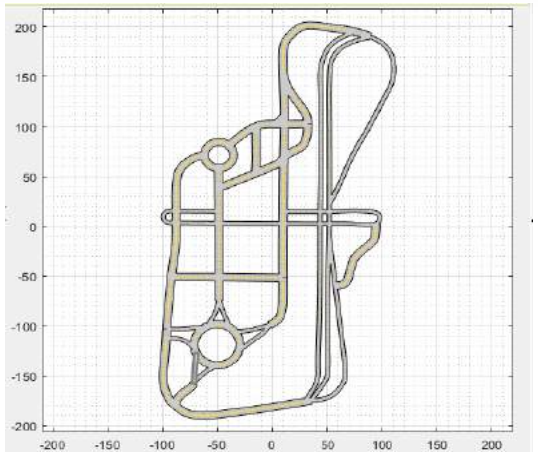
- Camera vision
- Vehicle localization and mapping
- Dynamic route planning
- Lane detection
- Vehicle dynamics simulation
- Test vehicle prototyping



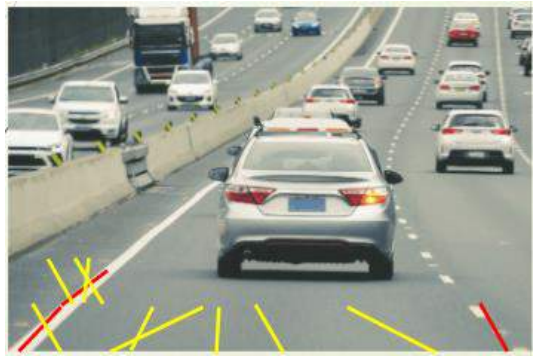
Real time object detection using YOLO (You Only Look Once)



Environmental Mapping using SLAM (Simultaneous localization and mapping)

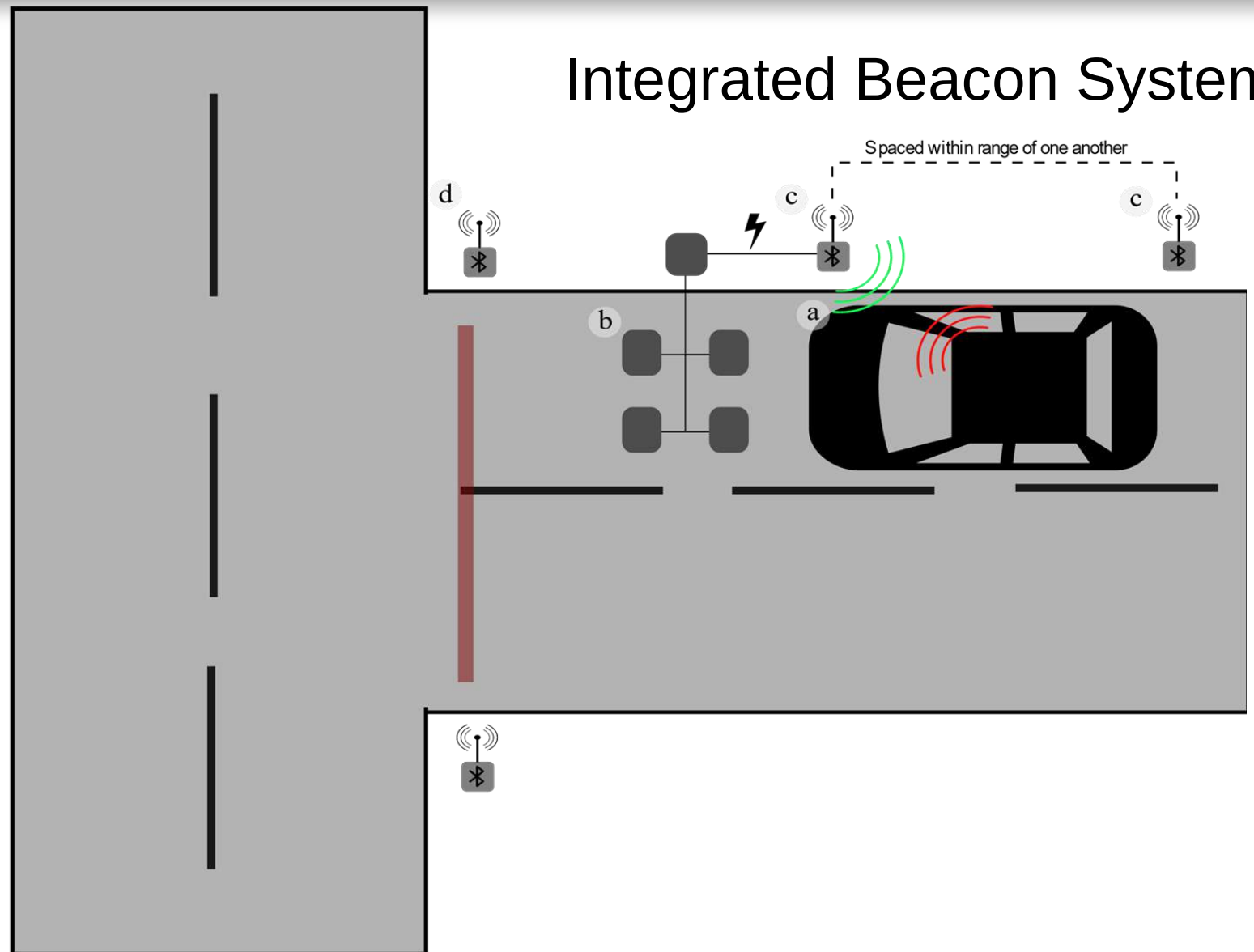


Vehicle route planning



Lane line detection

Integrated Beacon System Design



a) Autonomous Vehicle

b) Energy Harvesting Unit

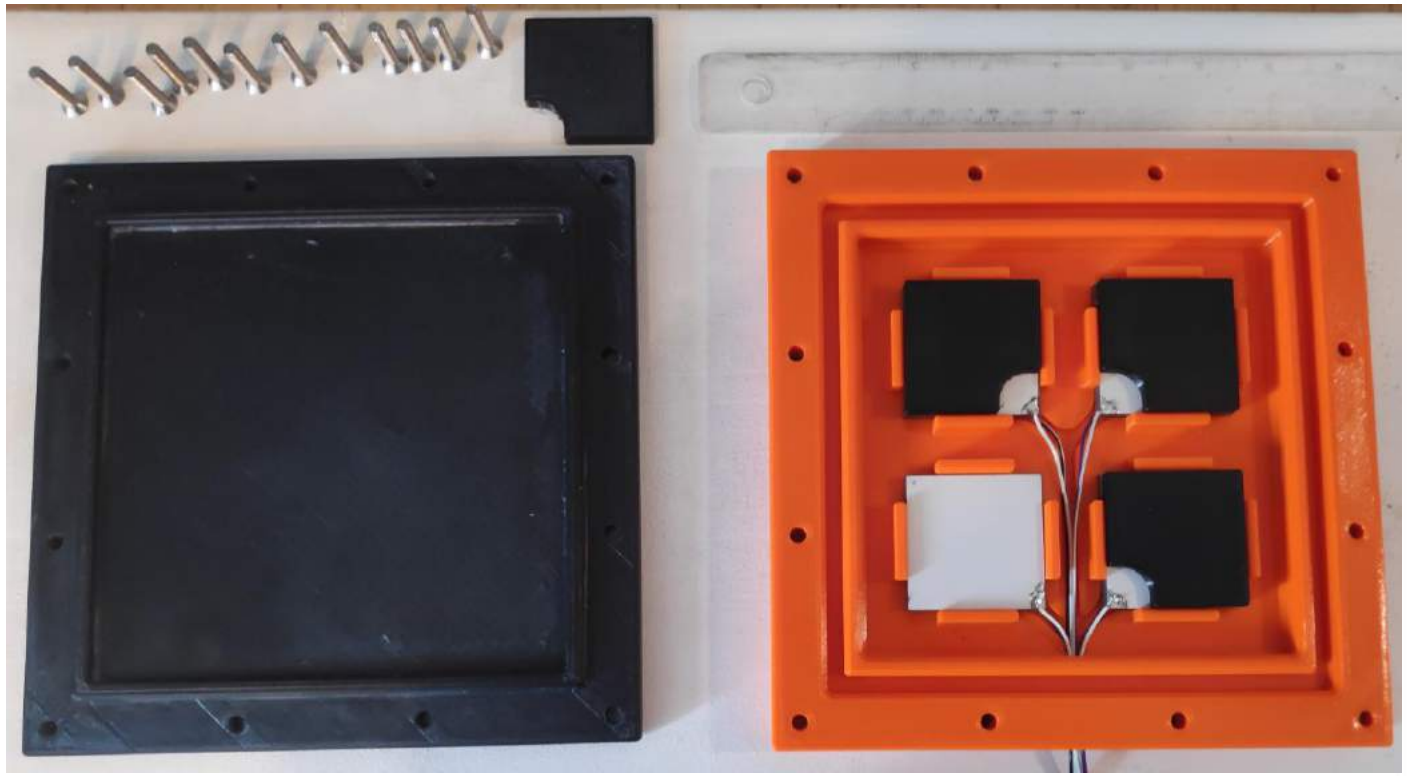
c) Integrated Beacon Network (currently Bluetooth)

d) Example of Beacon Implementation (virtual stop line)

Currently designed systems



Arduino based system utilizing Bluetooth Low Energy



Energy harvesting system utilizing piezoelectrics

Beacon System

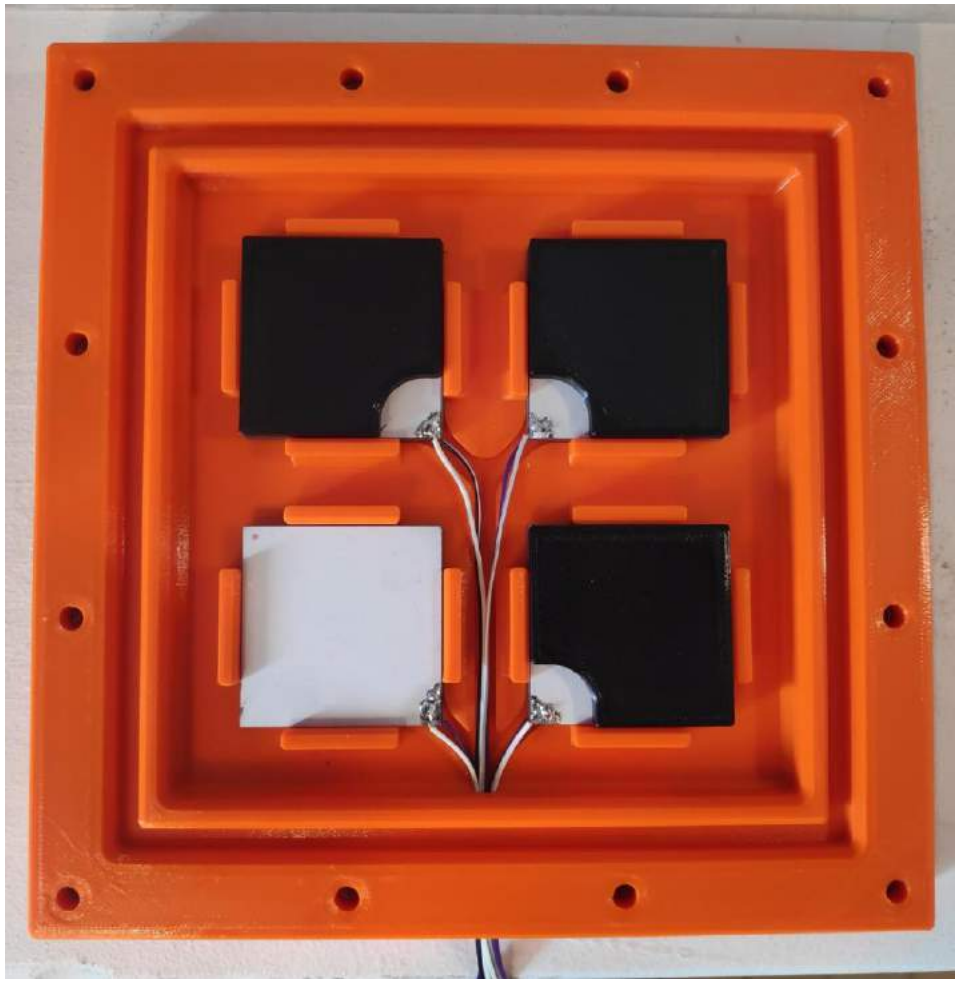


Arduino based system utilizing Bluetooth Low Energy

Future Work

- Continued development of communication systems. Both beacon to beacon, and beacon to vehicle.
- Continued testing of beacon range under various conditions
- Development of information processing systems
- Local network integration

Piezoelectric Energy Harvester



Future Work

- Further design and manufacture of future units
- In-service testing
- Continued development of FEA simulation model
- Optimization of power conditioning circuits
- Integration with Beacon System

Vehicle System Integration



Current FSAE vehicle available for modification

- Designed control systems will need to be integrated into the vehicle (i.e. steering, braking, etc.)
- Accessibility features will need to designed and implemented
- New and/or existing safety features will need to be integrated
- Non-Contact charging

Team Composition

Looking for students with background or interest in:

- Machine Learning
- Control systems and mechatronics
- Communication systems
- Electronics
- Mechanical design
- Structural analysis
- And more

If you have any questions, feel free to send an email to any of the following emails:

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