SOSCON 2018 Hackathon

17-18, Oct. 2018

SAMSUNG POWERbot Path Planning Hackathon

Introduction

- A.I. technologies & Low-price, high-precision sensors → Smart behaviors of POWERbot
- POWERbot must clean indoor efficiently with maximum coverage
- POWERbot must move smartly

- This hackathon expects highly efficient path planning algorithms and novel software architecture

Path Planning Hackathon

- Objectives
  - Achieve maximum coverage within limited time
  - Recognize objects and design appropriate path or motions to maximize efficiency
  - Propose novel software architecture

- Virtual Environments
  - (1) empty space → (2) with furniture → (3) with objects/people → (4) developing env. → (5) scoring env.

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Empty space

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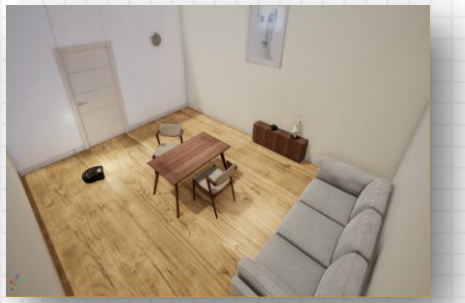

With furniture

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?

With objects/people

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?

Developing environment

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?

Scoring environment

Sensors & Processed Data

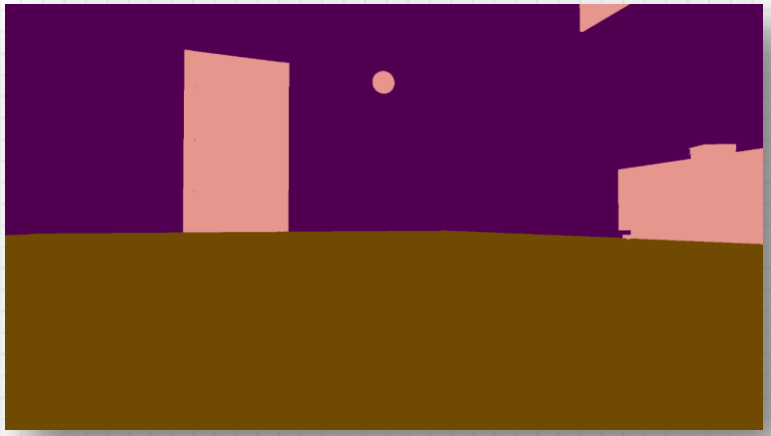
- 5 sensor data and processing data will be provided

RGB Camera

Lidar

IR depth

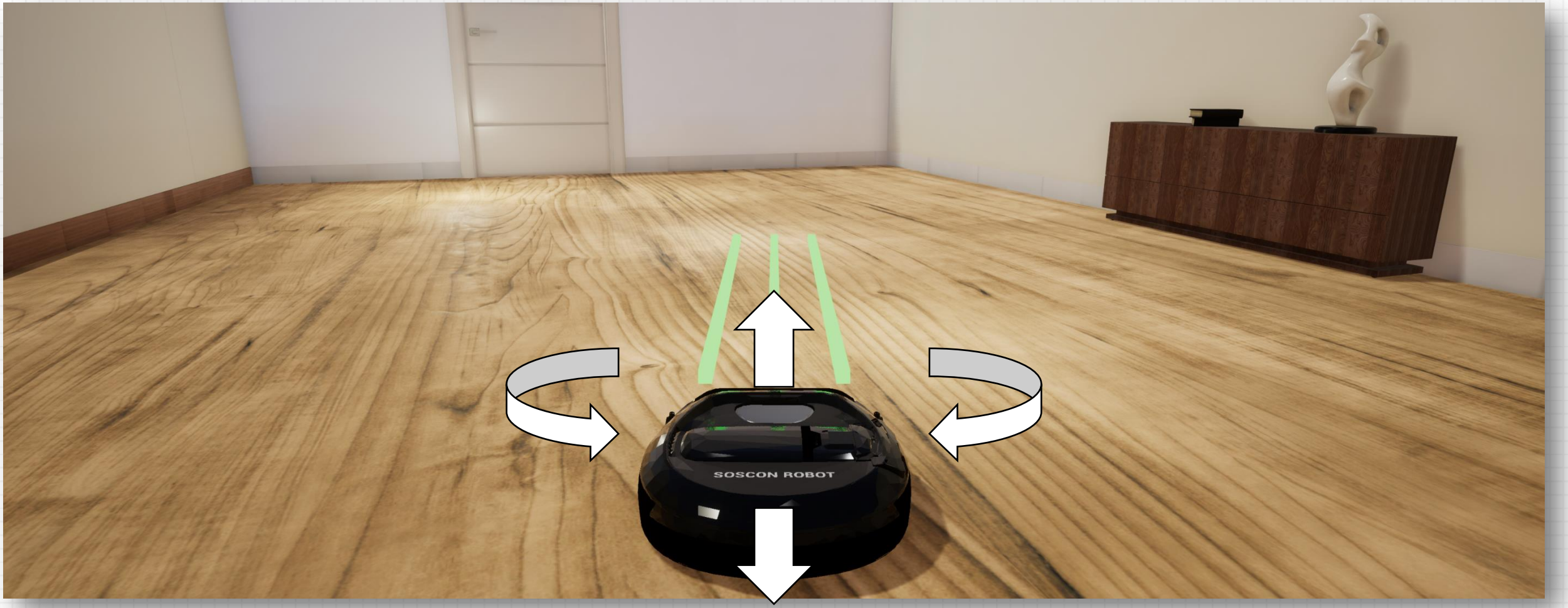
Bounding box



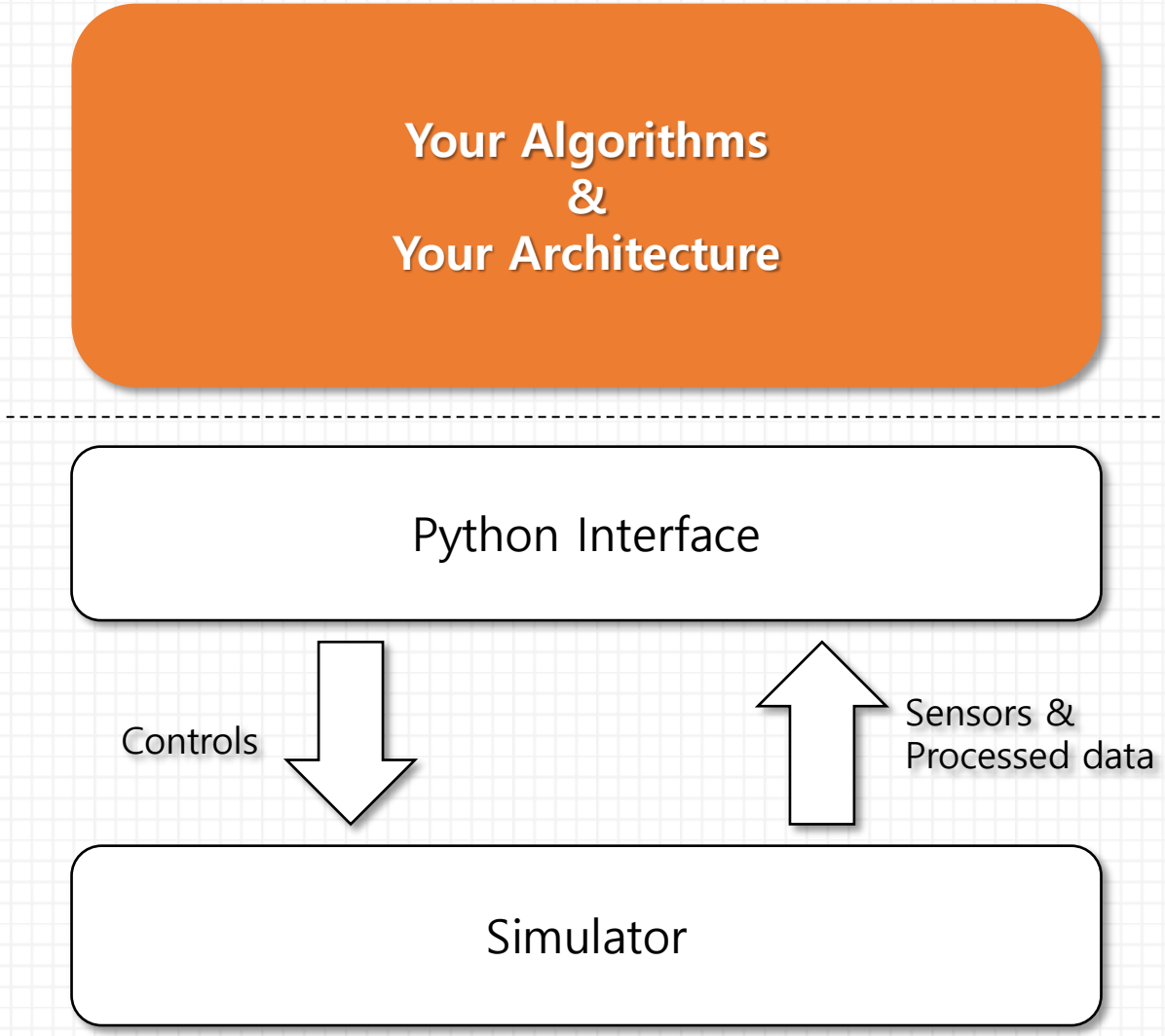
Semantic segmentation

Controls

- Forward, Backward
- Left Rotation, Right Rotation



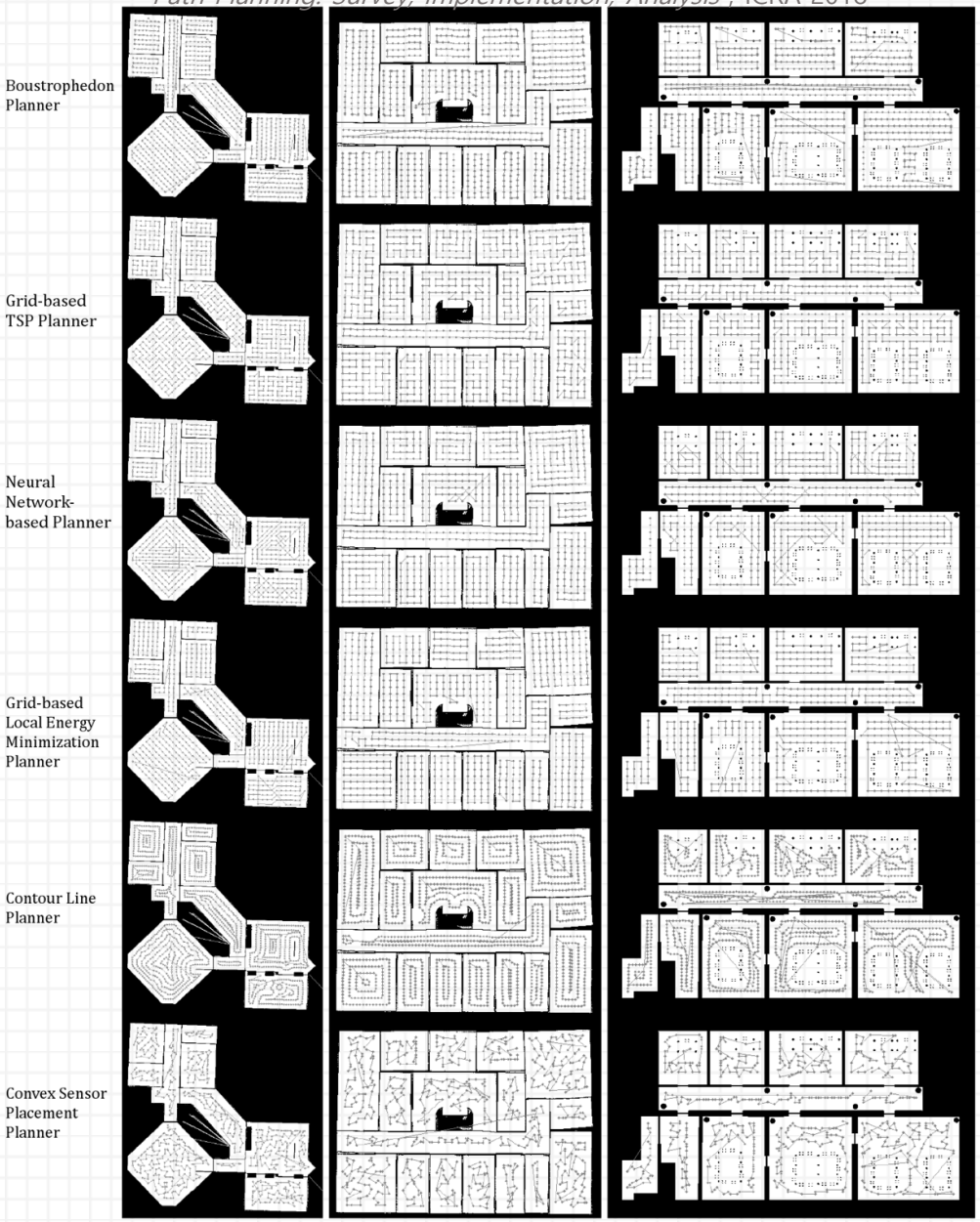
Developing Scope



Coverage Path Planning (CPP)

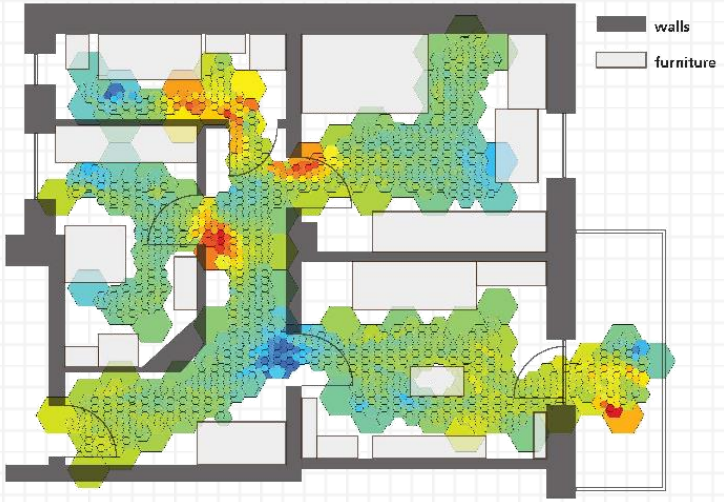
- CPP describes the process of generating robot trajectories that fully cover an area or volume.
- Indoor cleaning robots, lawn mowing robots or harvest machines are applications.
- CPP is Related to graph traverse algorithms.
- Reference
  - http://wiki.ros.org/ipa_room_exploration
  - http://robots.engin.umich.edu/~egalcera/papers/galceran_ras2013.pdf
  - https://pdfs.semanticscholar.org/d4de/a9fdc67aa058eec7b0994f3abe8b9b4c9e7a.pdf

R. Bormann, F. Jordan, J. Hampp and H. Hagele, "*Indoor Coverage Path Planning: Survey, Implementation, Analysis*", ICRA 2018

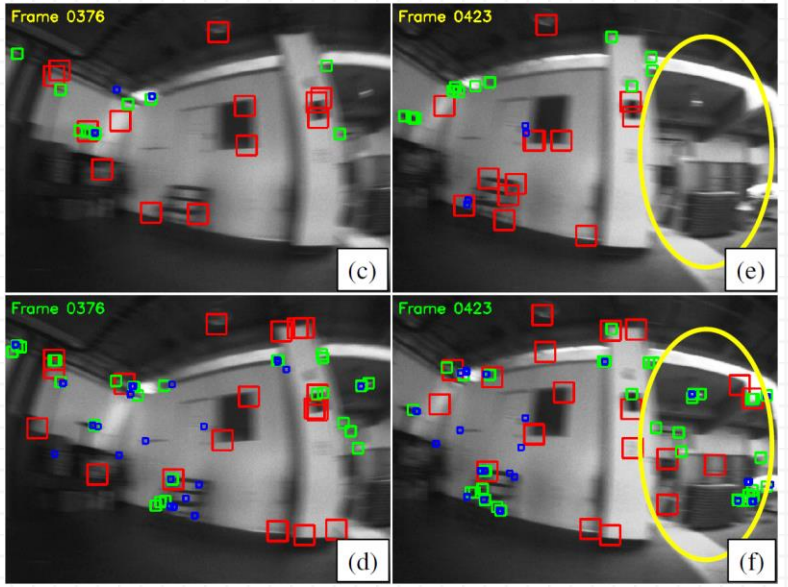


Simultaneous Localization And Mapping (SLAM)

- SLAM is the computational problem of constructing or updating a map of an unknown environment while simultaneously keeping track of an agent's location within it.

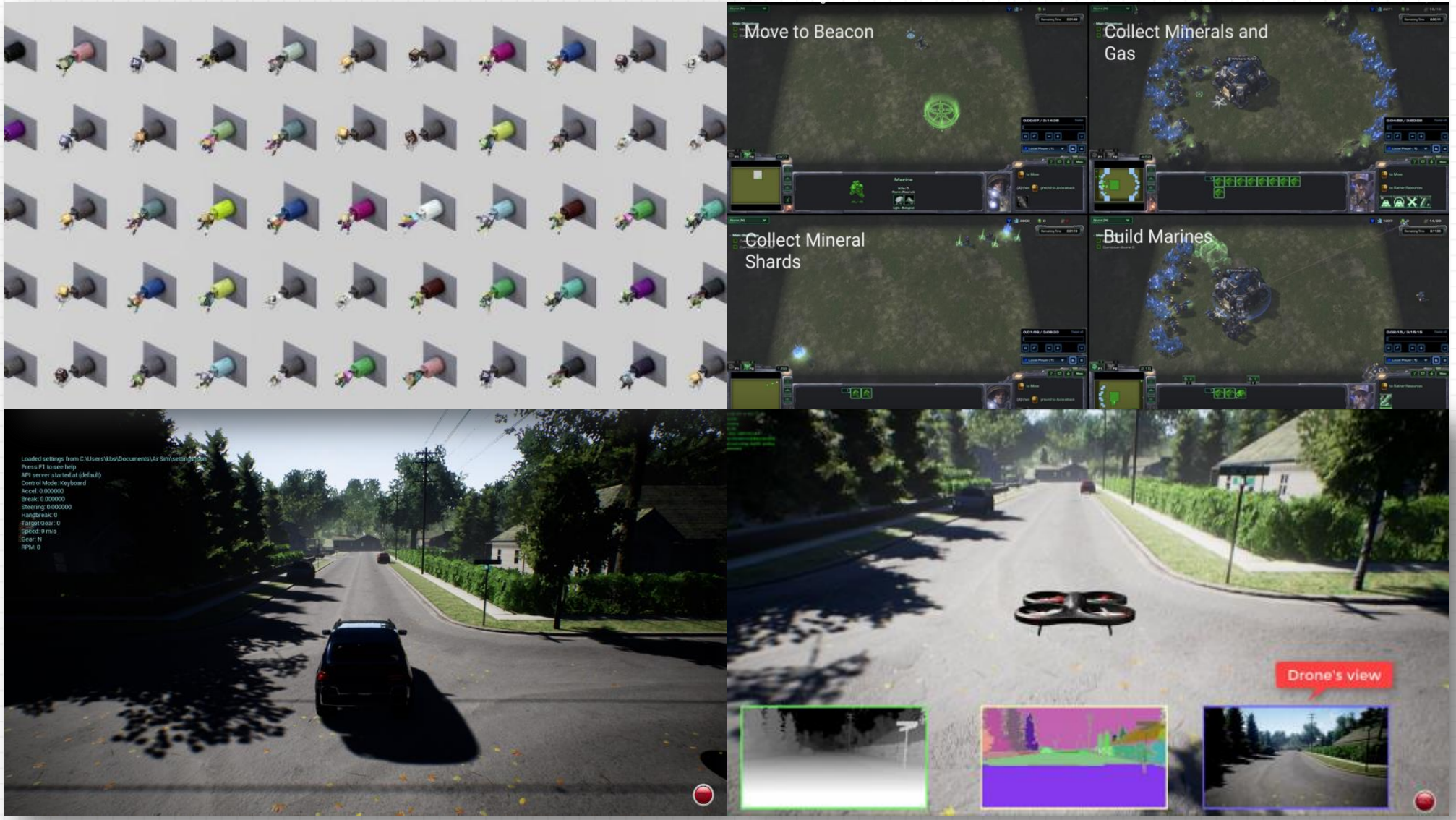


- Keywords
  - Bayes filter
  - Motion & observation model
  - Kalman filter and EKF
  - Occupancy grid map
  - Particle filter



- Reference
  - https://github.com/googlecartographer
  - https://openslam-org.github.io/
  - http://jinyongjeong.github.io/tag/SLAM/

Simulators for Developing and Testing



ROS or ROS2

- The Robot Operating System is a set of software libraries and tools that help you build robot applications
- From drivers to state-of-the-art algorithms, and with powerful development tools, ROS has what you need for your next robotics project.
- Open source

- There are many useful libraries, find and integrate to your algorithms!

- Reference
  - http://www.ros.org/
  - https://github.com/ros2/ros2/wiki

Q&A