Cooperative UAV Exploration

A group project in course introduction to ROS

Team Ɛ:

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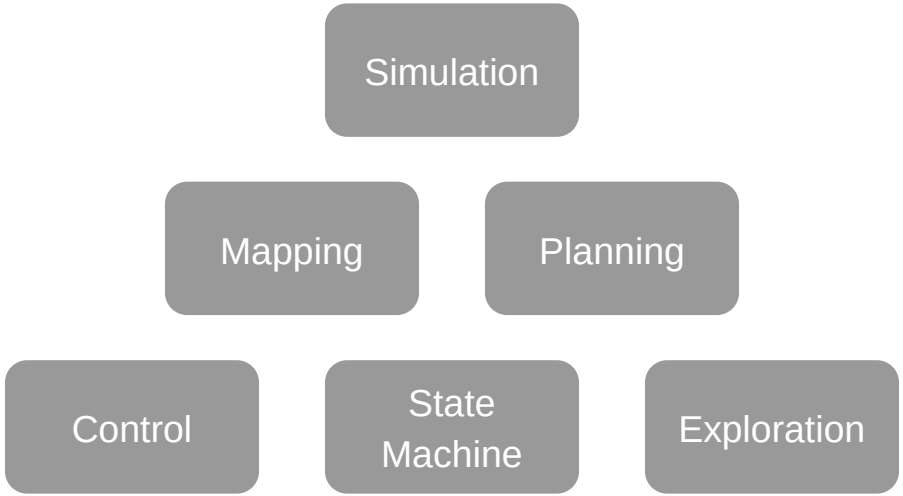
- Tao Zhou
- Xuhui Li
- Yinghan Huang

Garching, 2. August 2022

Structure of our Approach



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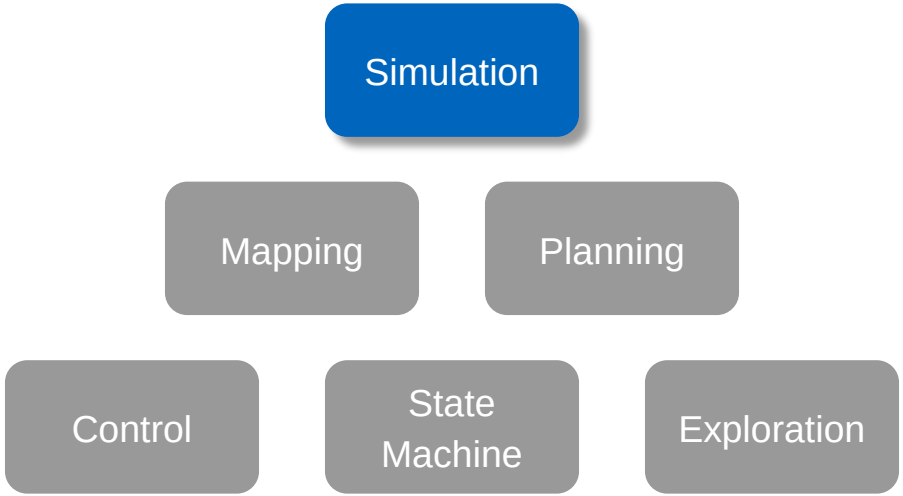
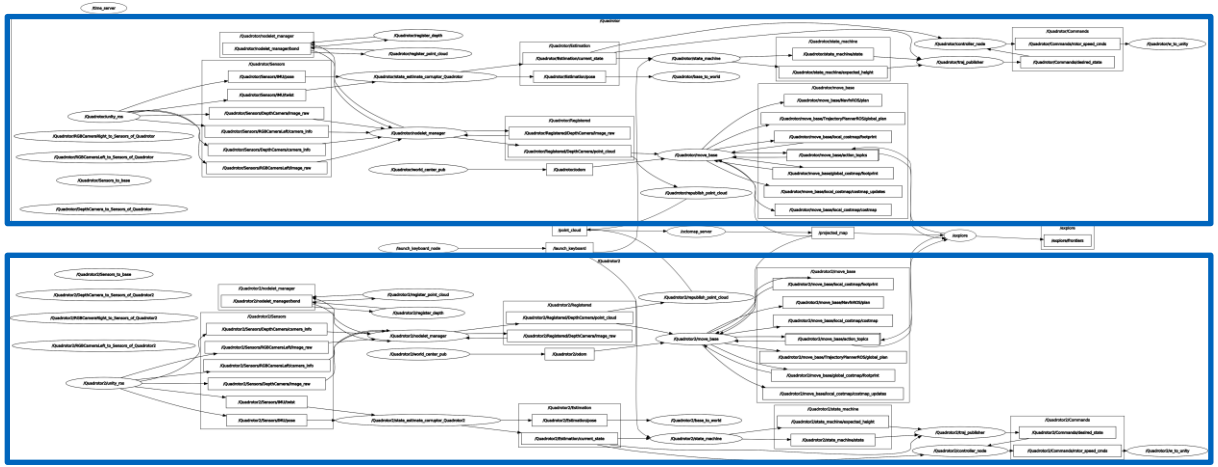


Unity

Simulation

Simulation

- Namespace standard
- Provide ROS clock
- Encode depthimages
- Dynamic tf publisher
- Add network support



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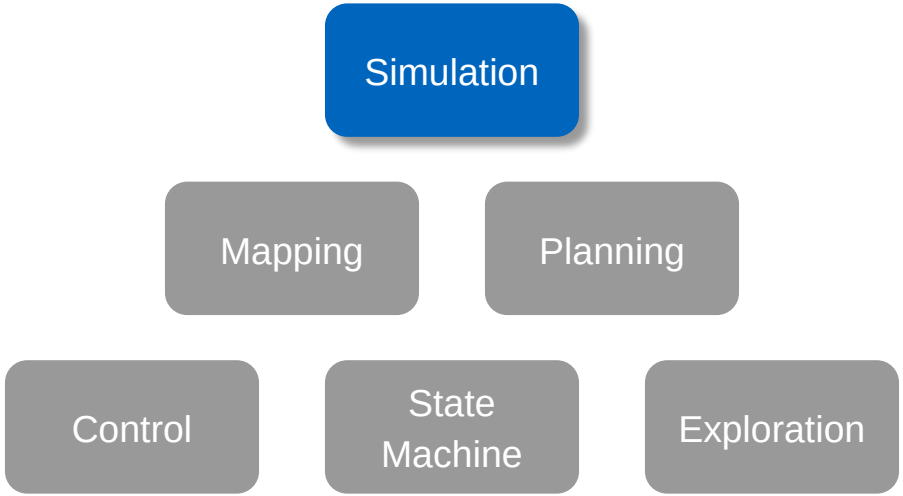

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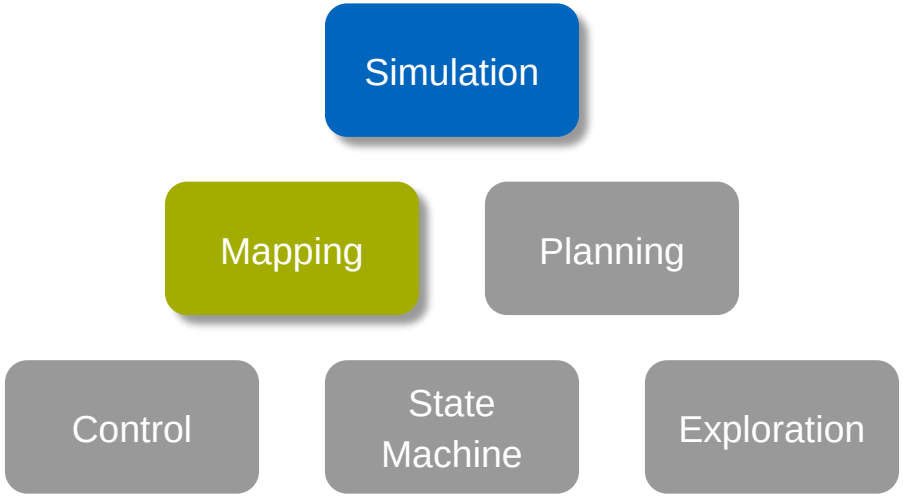

Mapping

Simulation

Mapping

- Reproject depth image to RGBCamera frame
- Generate rgb point cloud
- Generate color octomap
- Generate projected 2d map

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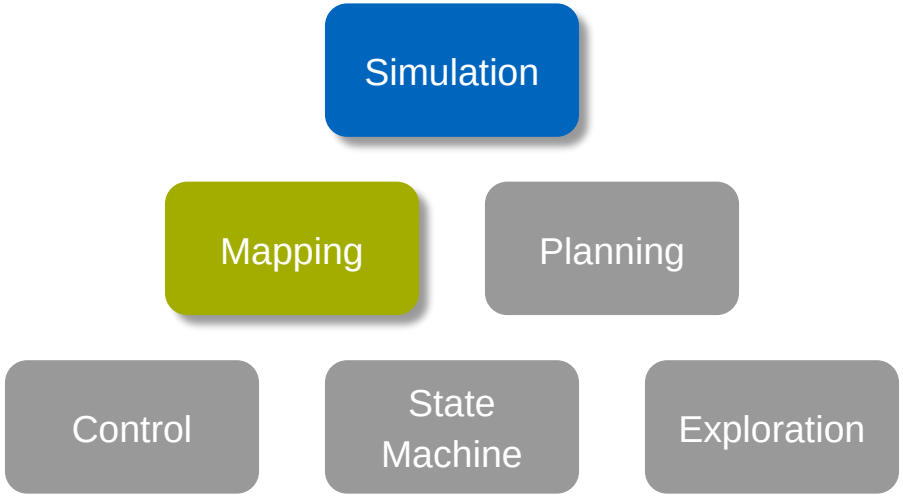

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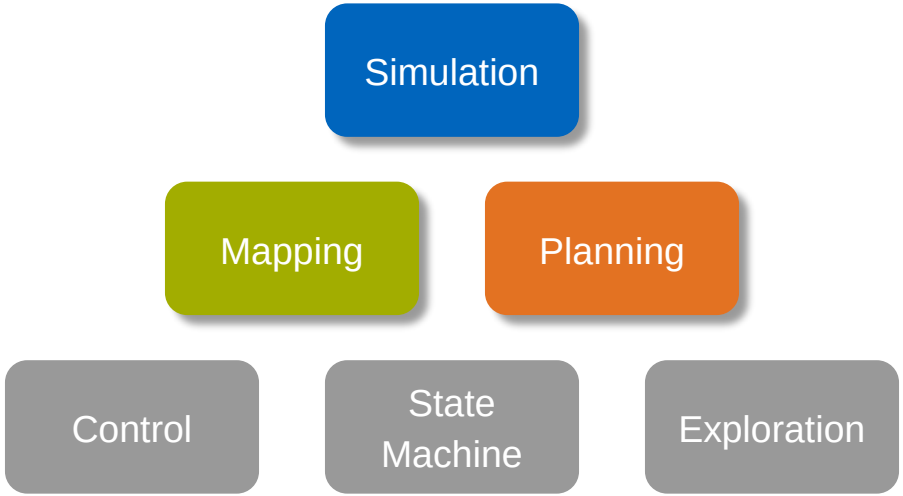
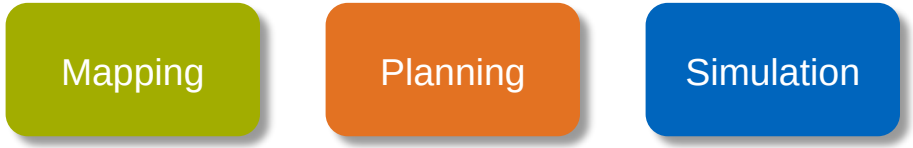


Planning



- Move base package
- Use global planner to generate path
- Use local planner to crop local path from global path

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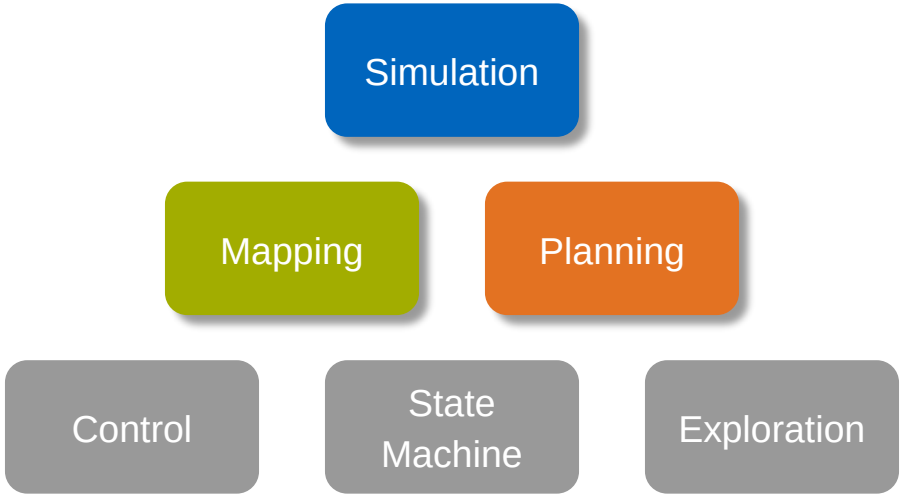

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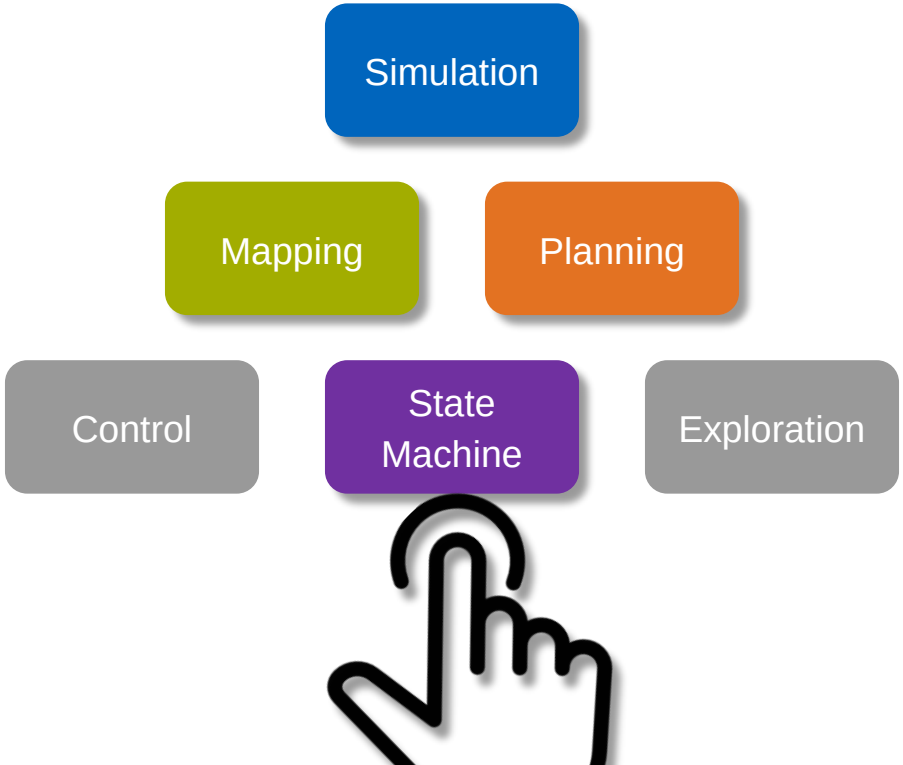

State Machine

Simulation

State Machine

Adjust the state machine and controller, such that:

- Switch the stop/start service in explore automatically
- Generate different desired poses and velocity in different states
- Different heights, two explore modes possible (explore with rotation or with poses depends on the trajectory)

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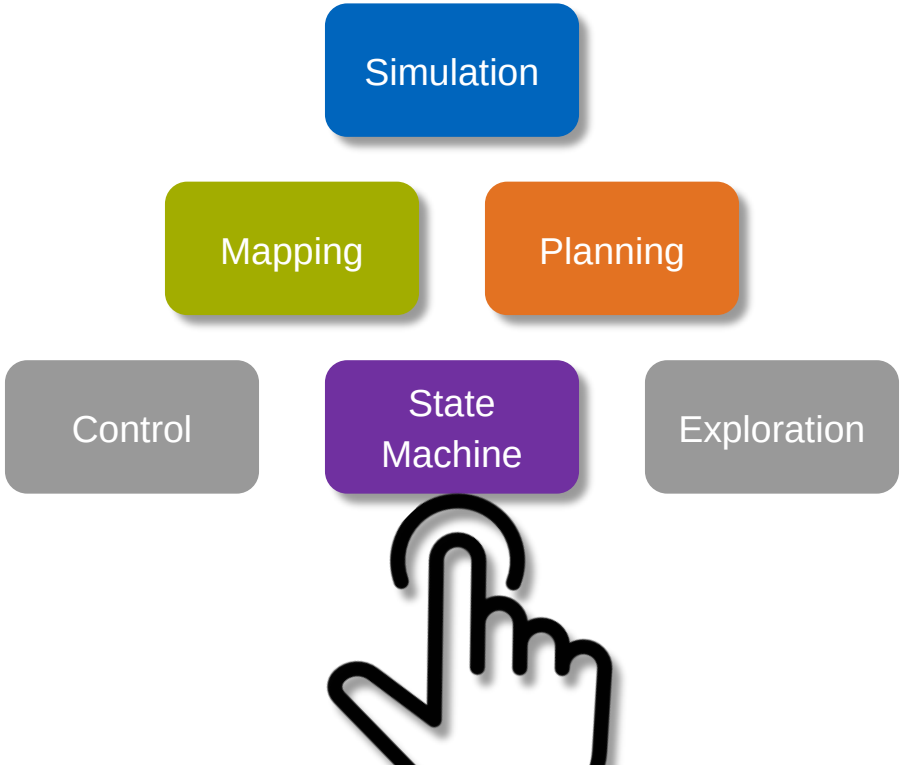

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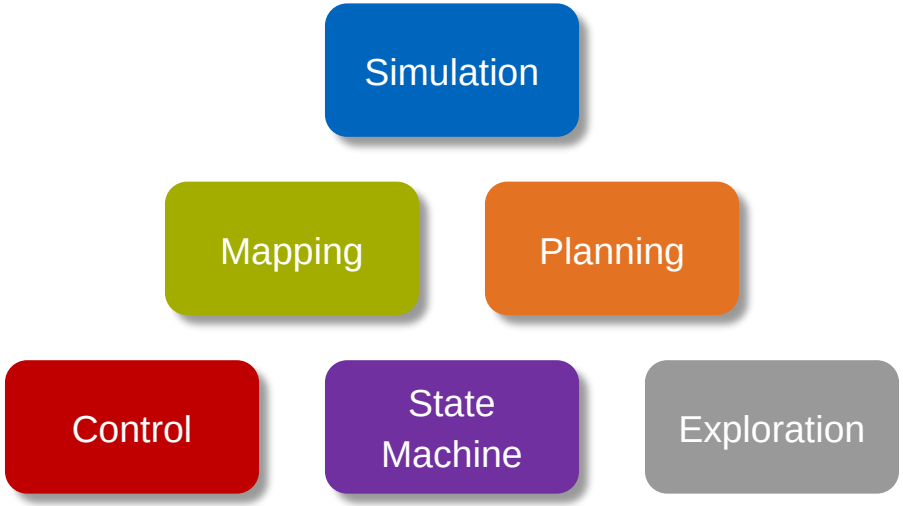
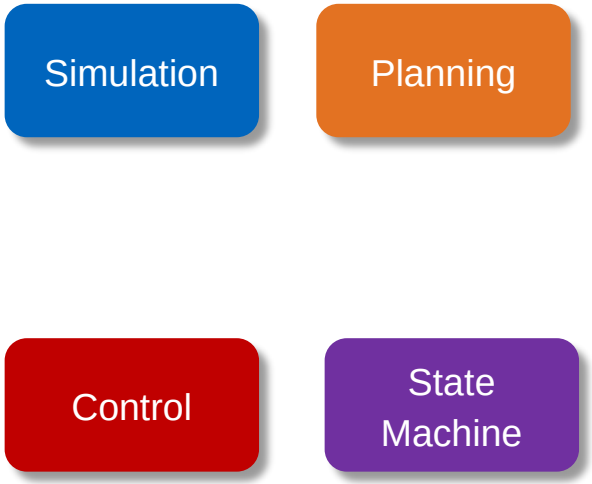


Control



- Triggered by the state machine
- Subscribe the planned path and the current poses
- Cascade PID controller
  - Generate desired poses and desired velocities
  - Based on that, generate propeller speeds
  - Parameter tuned in order to generate smooth flying and reduce oscillation
- Pure path following mode & rotate while path following mode

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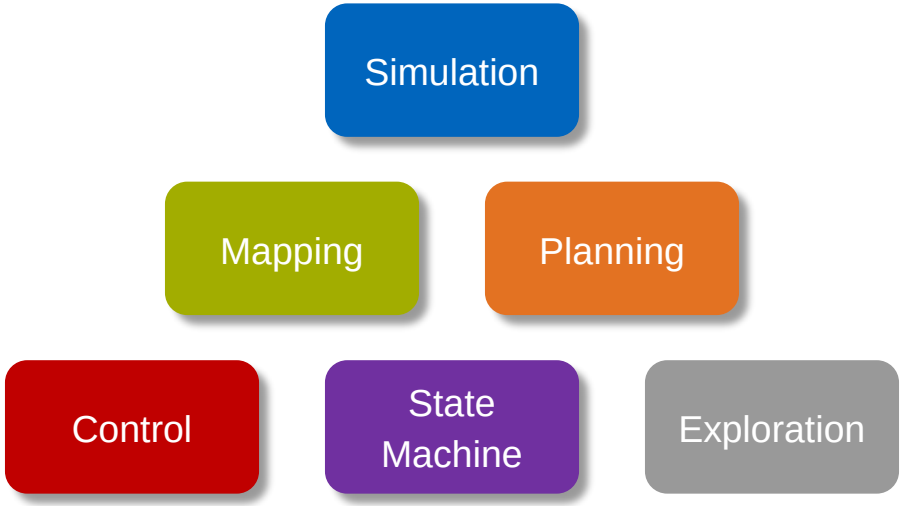

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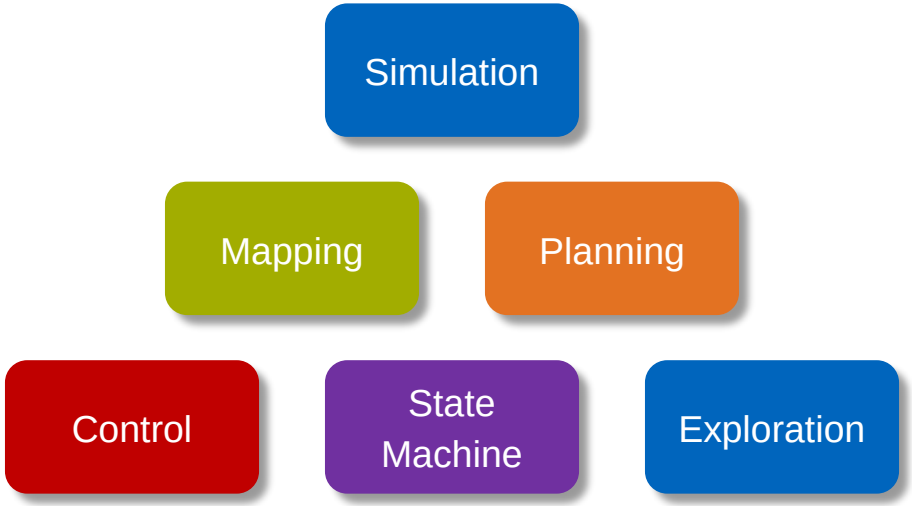
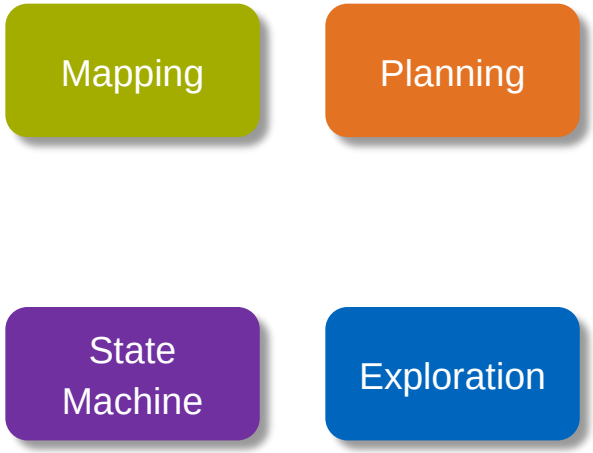


Exploration

- Inflected 2d map for frontier exploration
- Modify explore_lite so that:
  - Support multi-robot cooperation
  - Communicate with state machine
  - Explore range limit
  - Optional explore strategy



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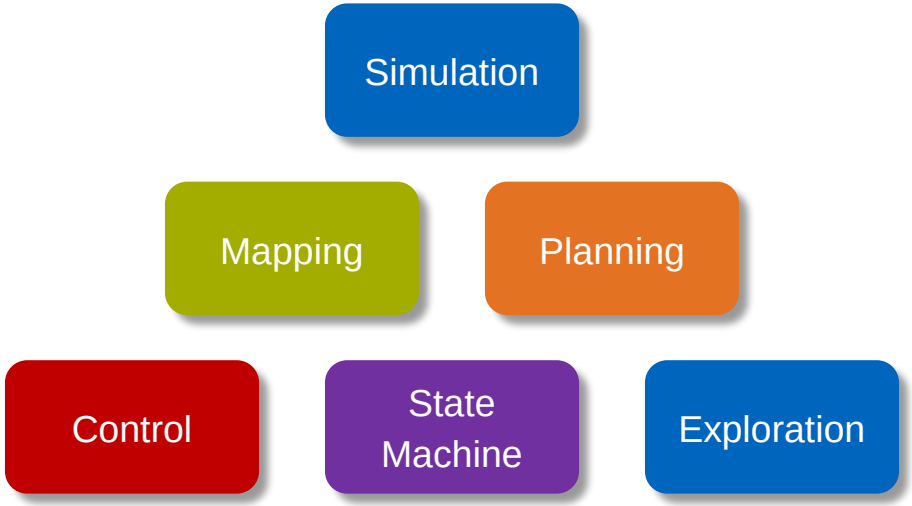

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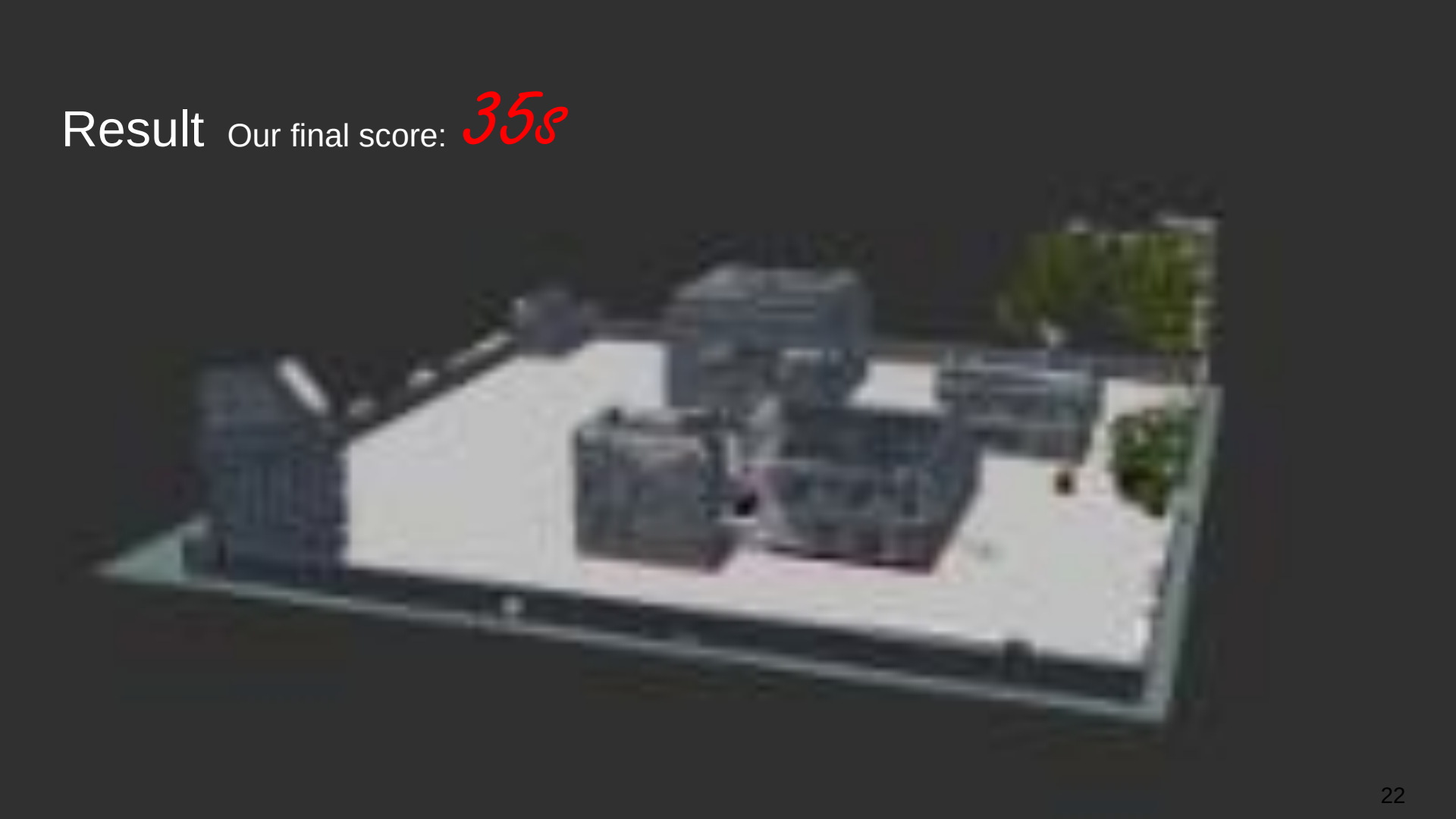
Result

- Use the original unity build
- Use provided noised drone state
- Time starts when exploration finishes initialization
- Time ends when exploration triggers landing
- Test on i5 12400f and 3070 Ti

Result Our final score: 35s



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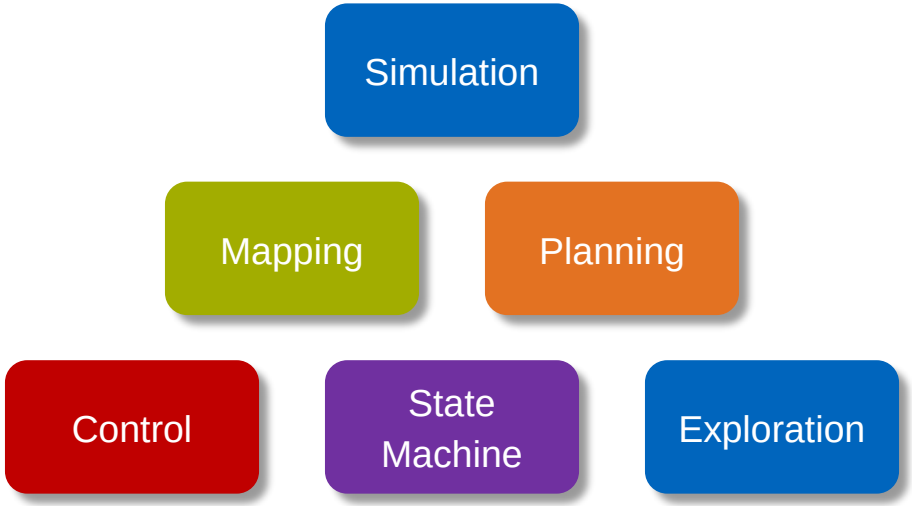

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Link to gitlab_repo