Hide N Seek

Exploring an unknown world via a POMDP.

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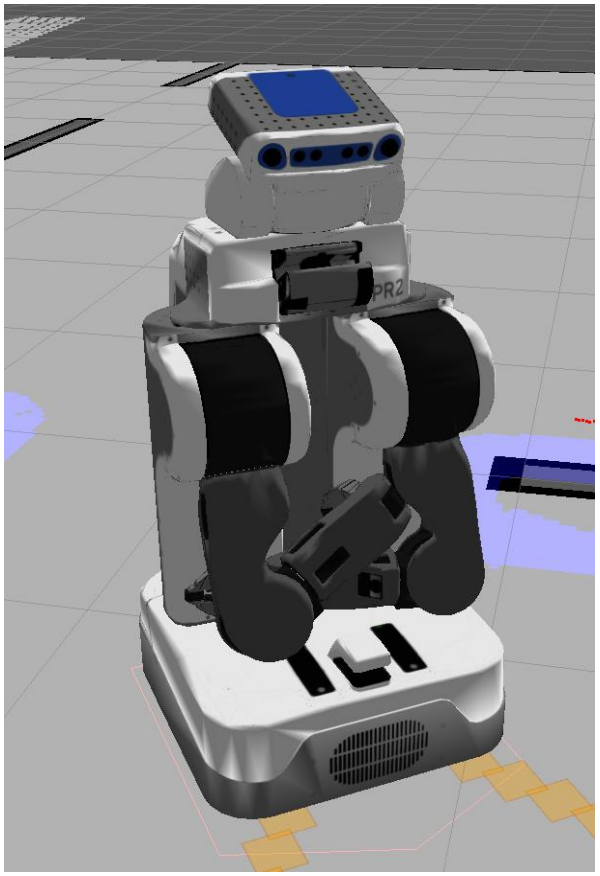
Agenda



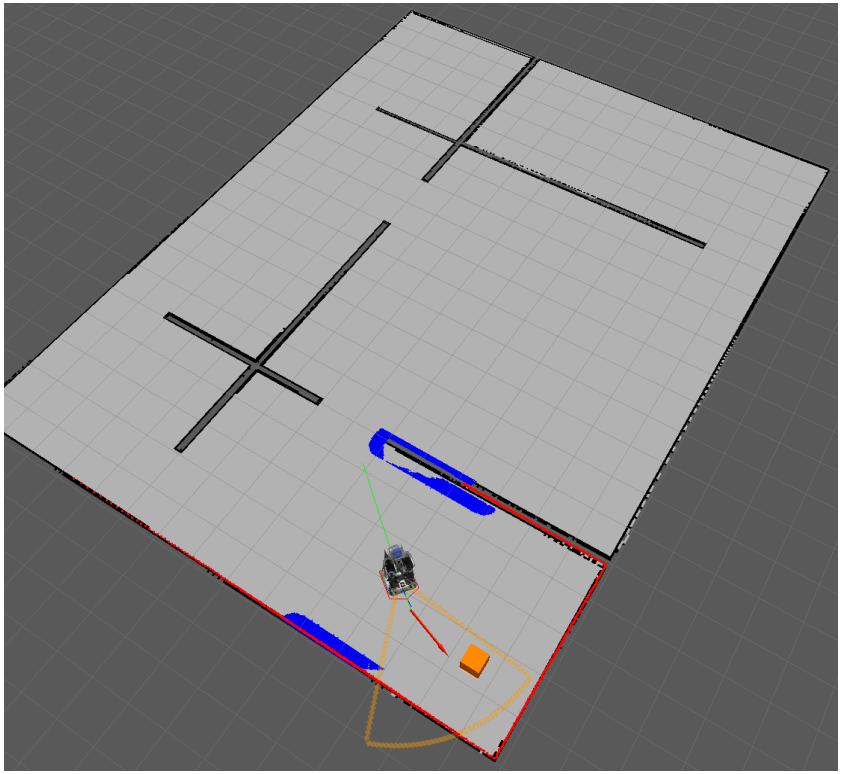
- Project Overview
- Navigation Stack
- People Finder
- Interaction Diagram
- Planning Task
- POMDP Planner
- Decision Model
- Future Tasks

Project Overview

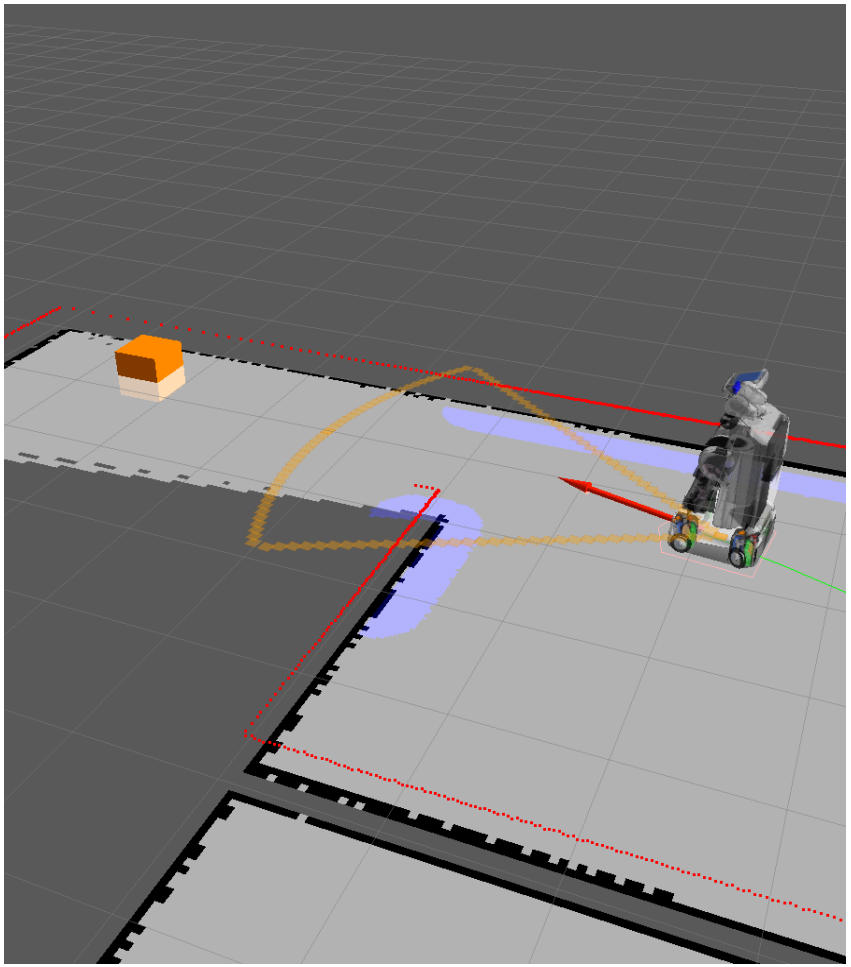
- Focusing on the “seek” part of Hide and Seek
- Problem is “how can we keep track of where we have been and decide where to go?”
- Simulating a Kinect in order to “find a person”

Navigation Stack

- Gazebo physics simulation with a custom map
- Online map generation with slam_gmapping
- Simple navigation goals sent to move_base
  - Handles obstacle avoidance
  - Translates goal in to low-level motor commands

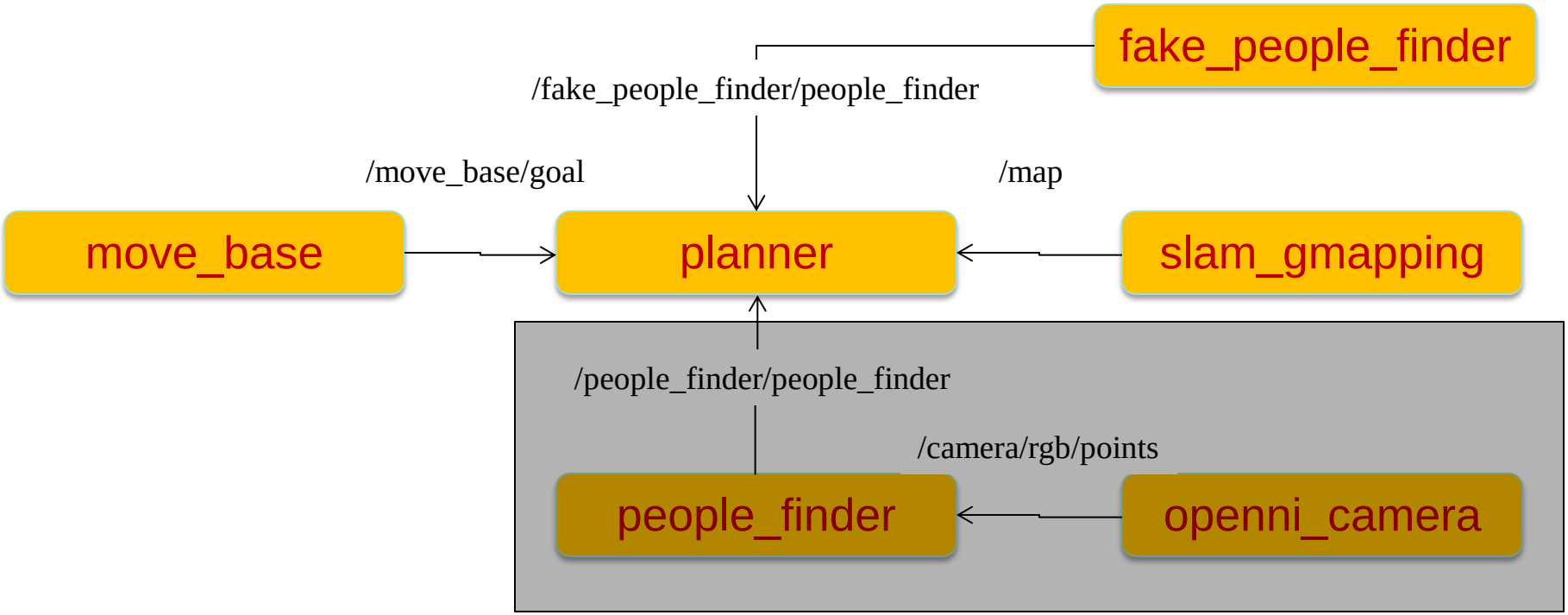


People Finder



- Use an interactive marker to place a fake person in the world
- Simulate Kinect range
  - Shown as orange outline
- Simulate Kinect reliability with noise
  - 5% false positives
  - 10% true negatives
- Since this is modular, it could easily be replaced by a real Kinect node

Interaction Diagram



msg: people_finder
float32 sensor_range
float32 sensor_fov
geometry_msgs/Pose[] people

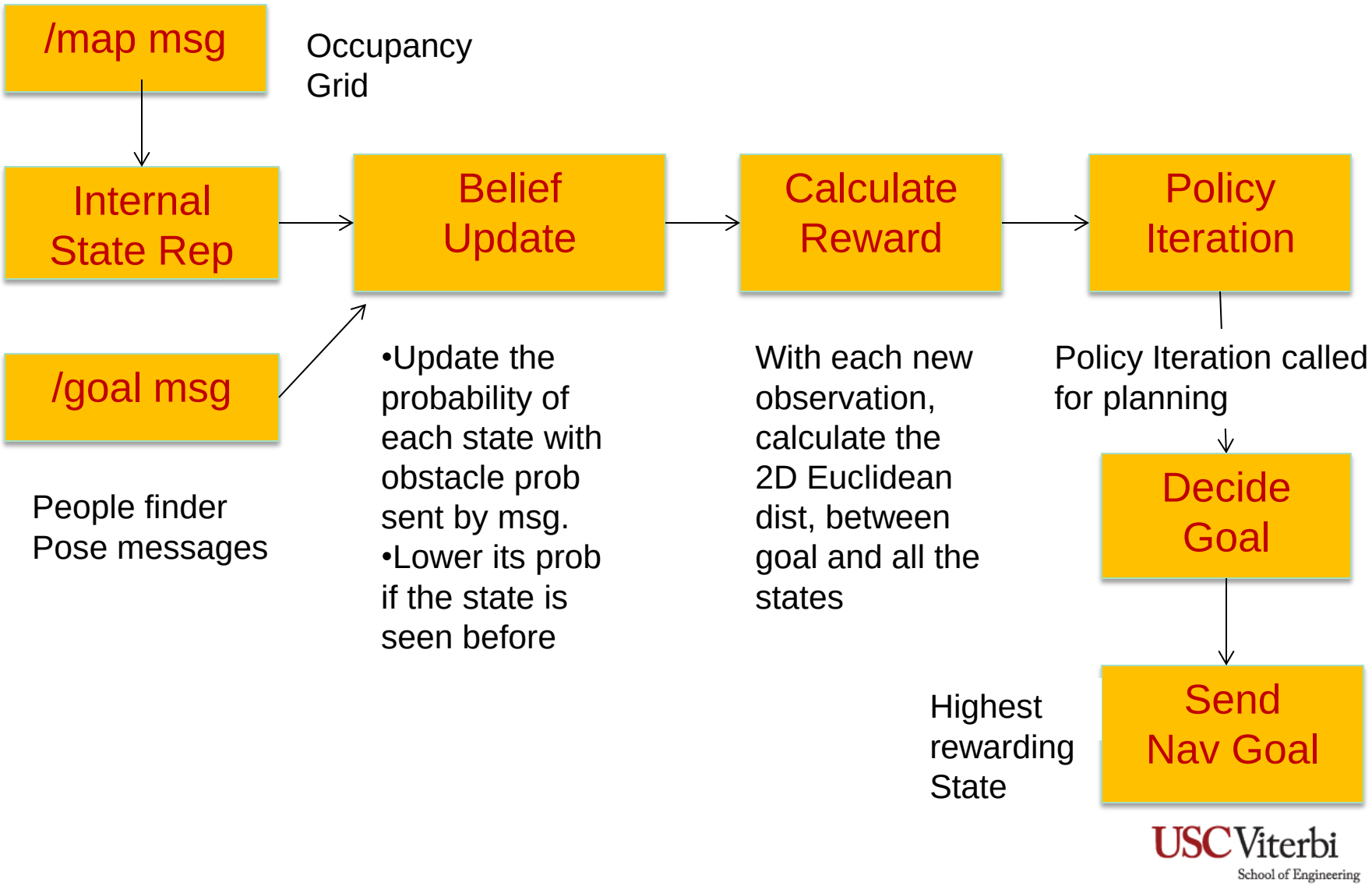
msg: move_base
geometry_msgs/Pose target_pose

msg: OccupancyGrid
MapMetaData info
int8[] data

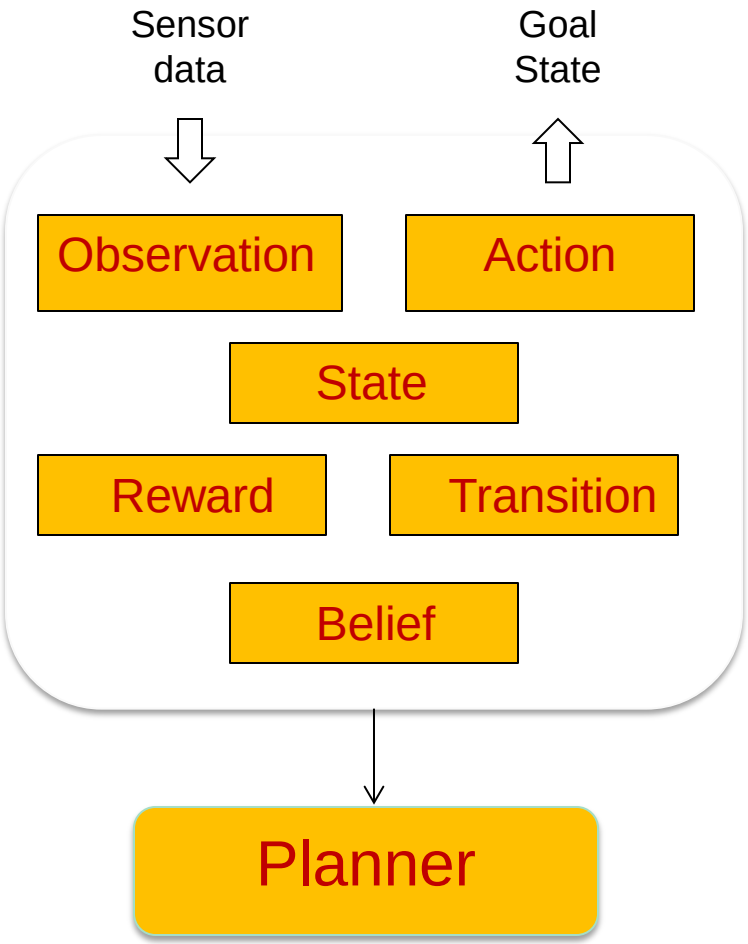
Planning

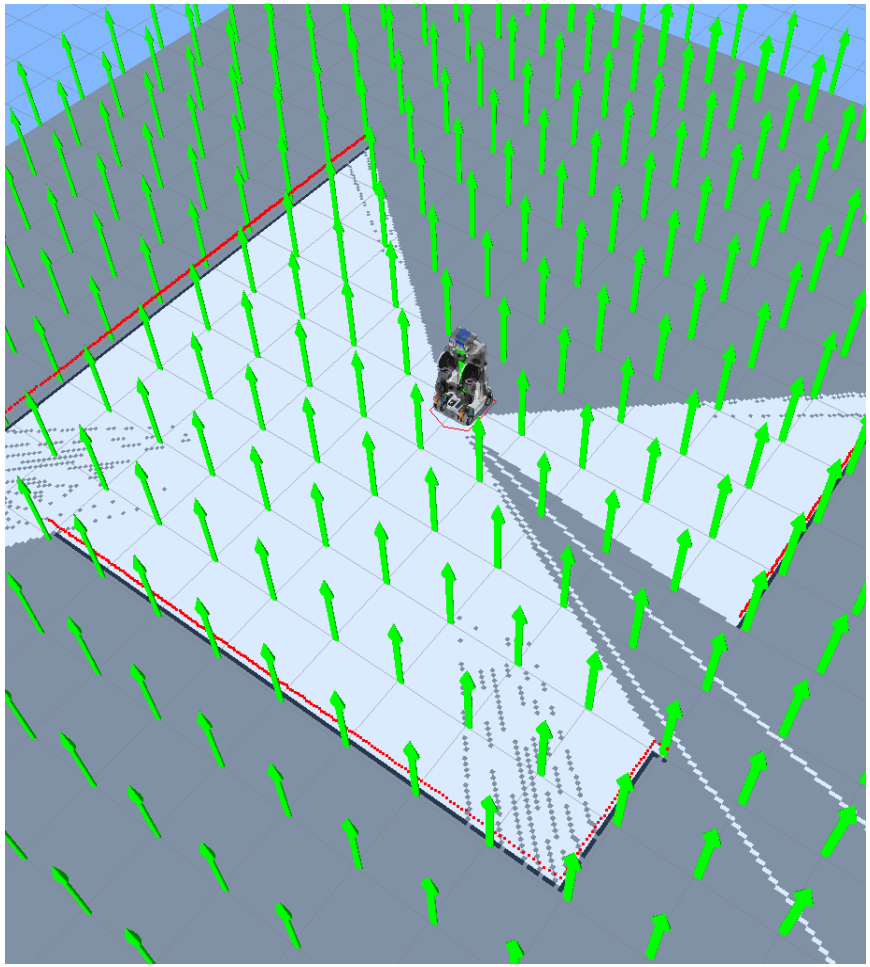
- How do we keep track of where we've been, and use that to figure out where we need to go?
- We need to keep an internal model of the world that we can then use to calculate where the next most likely hiding place, and consequently travel to it.

POMDP


/map msg
Occupancy Grid
Internal State Rep
Belief Update
Calculate Reward
Policy Iteration
/goal msg
People finder Pose messages
•Update the probability of each state with obstacle prob sent by msg.
•Lower its prob if the state is seen before
With each new observation, calculate the 2D Euclidean dist, between goal and all the states
Policy Iteration called for planning
Decide Goal
Highest rewarding State
Send Nav Goal

Decision Model





Future Tasks

- Optimize the down-sampling from real to state space.
- Fix sending of nav goals to unreachable states.
- Fix selection of next goal to not select the same goal multiple times (local maxima).