Team SimBot
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The Problem:

- In 2011, the Fukushima Daiichi nuclear power plant suffered a meltdown following an earthquake and tsunami. The site and surrounding area was evacuated for fear of radiation sickness.
- Unmanned robots can be used explore these hazardous environments to gain relevant information, collect materials or save remaining casualties.

Our Solution:

- A robot to navigate through an obstacle course using gesture teleoperation and autonomous movement while mapping its environment. The robot will recognize goal target and pick it up.

Hand gesture teleop model
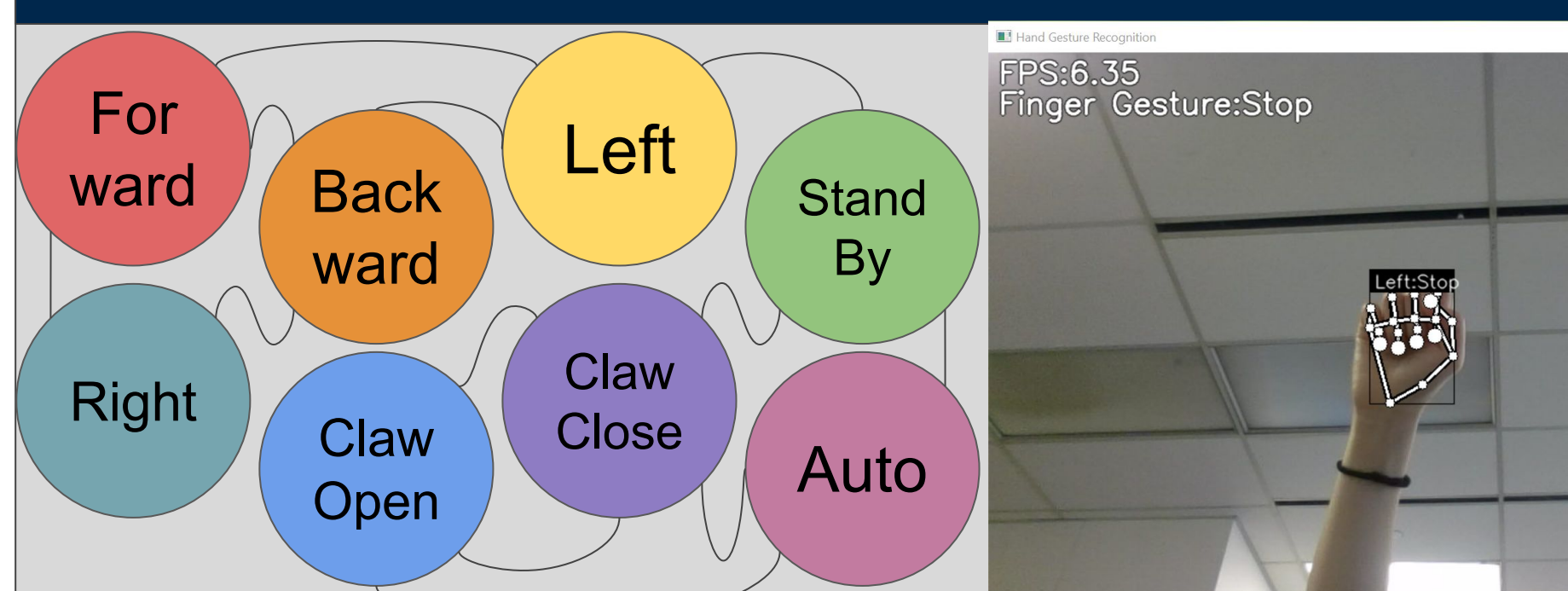
- Gestures are recognized through the laptop by a trained CV model
- A state machine keeps track of what the robot is doing depending on the gestures by receiving encoded data using sockets.

LIDAR and SLAM
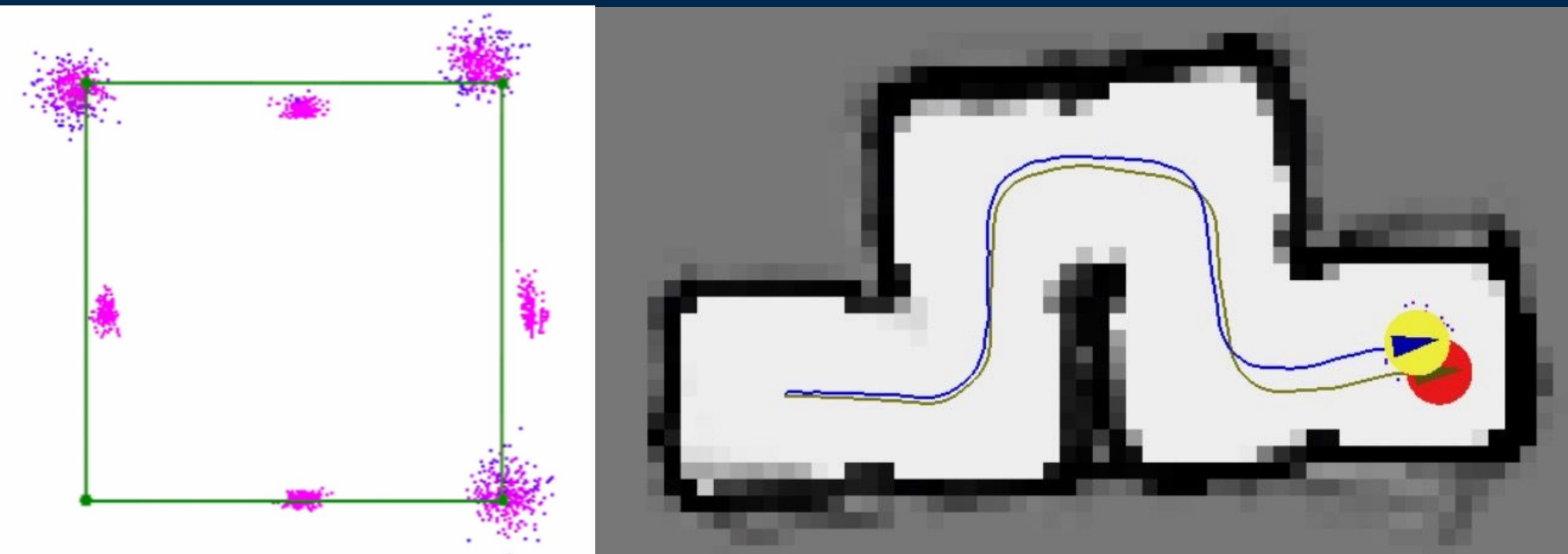
- Simultaneous and Localization Mapping maps the robot's environment using particles to measure the probability of a pixel being occupied
- Obstacles are displayed in our map by a double clicking on an april tag.

April tags
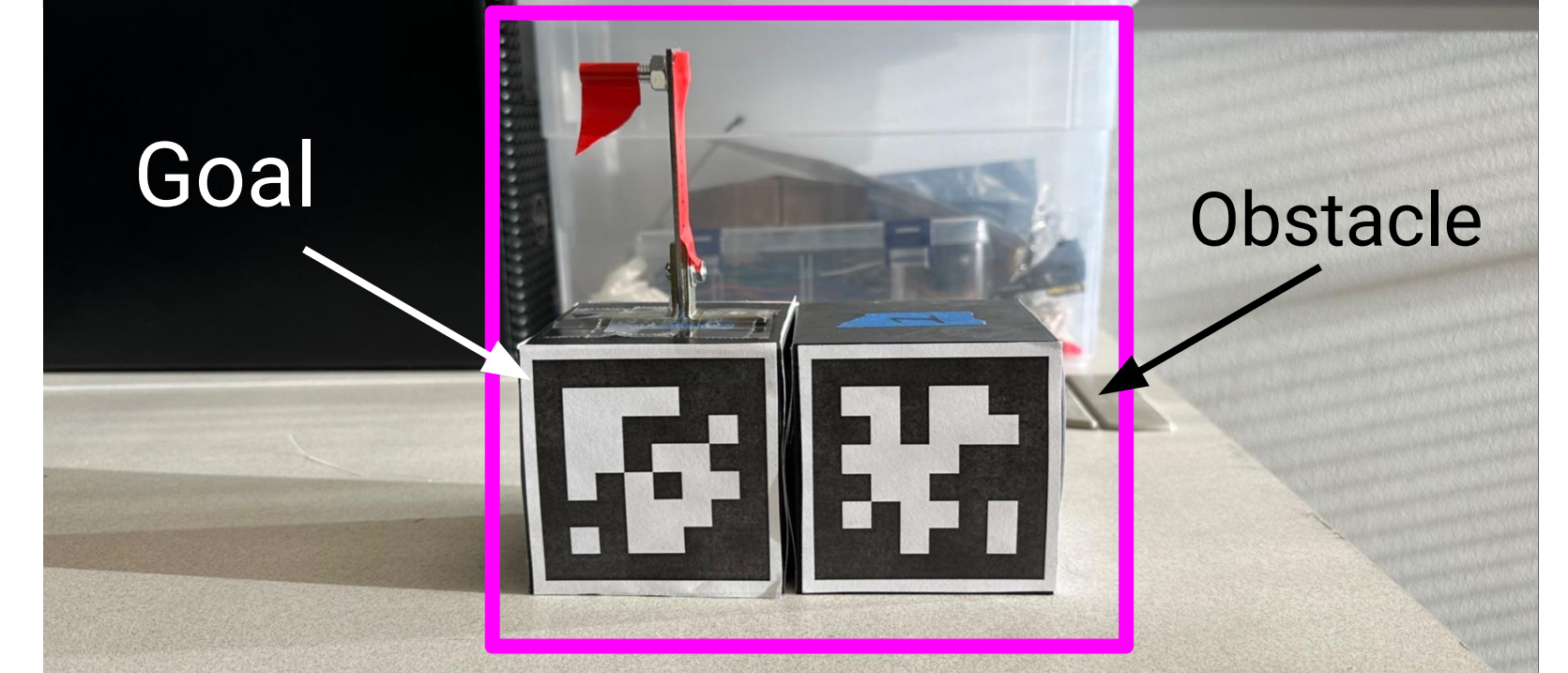
- Markers used for localization and object tracking
- The goal & obstacles use tags for the camera to detect and user to interact with.

Video Streaming

- To allow reliable video streaming, a wifi network is set up between the Mbot and Computer
- All the camera processing is on the computer and sent to the robot using IP protocols

Raspberry Pi

- The raspberry pi is the brains behind the robot.
- It connects to a Raspberry pi pico, camera, and LiDAR
- It is powered by a 12 V battery

Robotic Claw

- Custom 3D printed mount.
- Uses a 7.4 V servo motor to open and close.
- At 400 Hz, GPIO pin sends a duty cycle to the claw.

Camera

- We used a raspberry pi camera to allow the user to see the robots perspective in real time
- It detects the goal and obstacles to begin the autonomous pick up

Object detection and Pick up

User clicks on the april tag to pick up
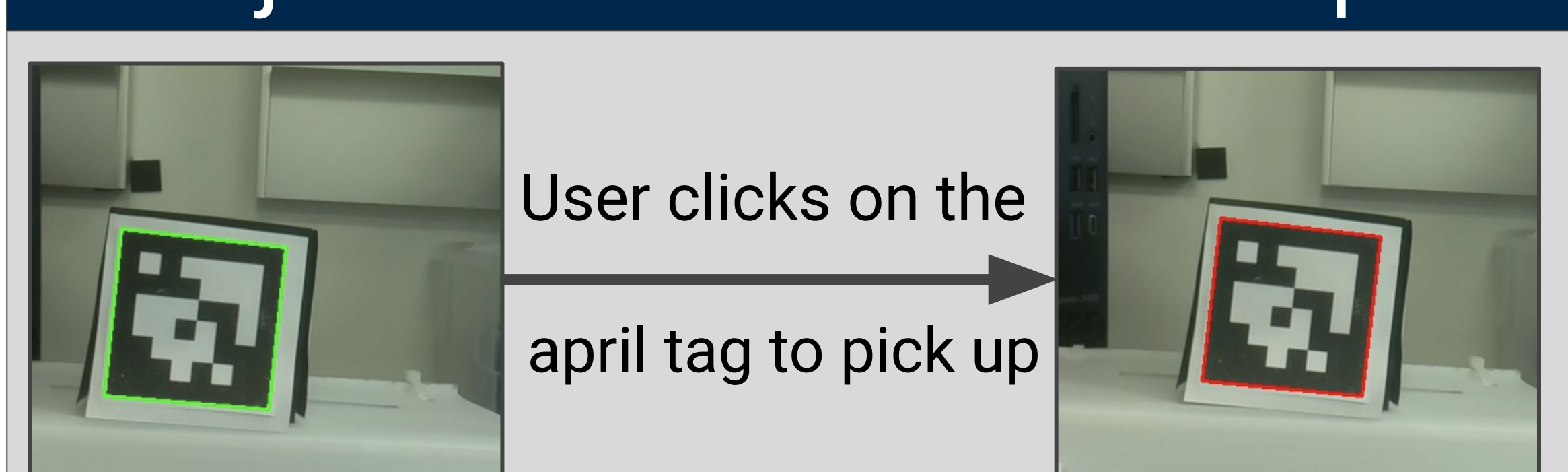
- User clicks on object through camera stream
- The robot will autonomously center the object and approach it
- It will pick up the object and then switch to teleop communication