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Master programme: System, Control and Mechatronics

Perception and decision making for intelligent robots

Research areas:
- **Localization and mapping**
- **Object detection**
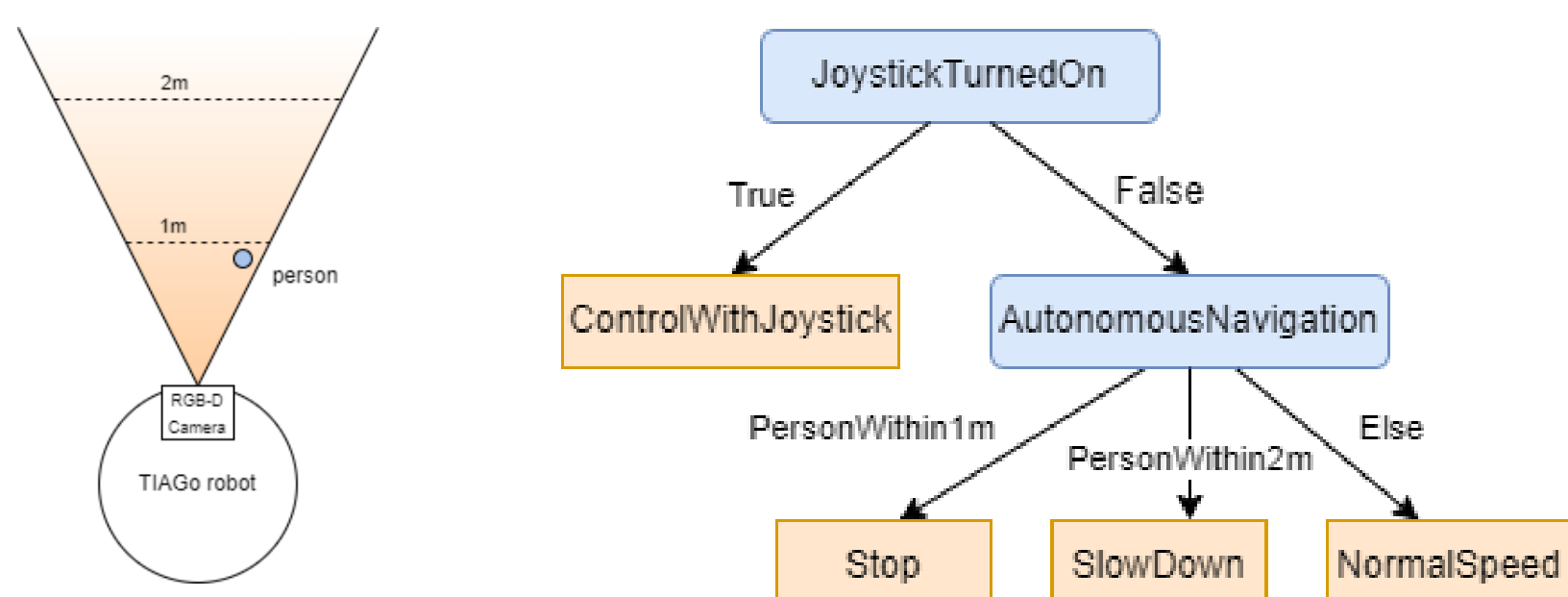- **Autonomous navigation**
- **Decision Making**

ROS architecture:
- Created custom ROS nodes and messages to control TIAGo
- Decision making solely based on camera feed (object + depth data)
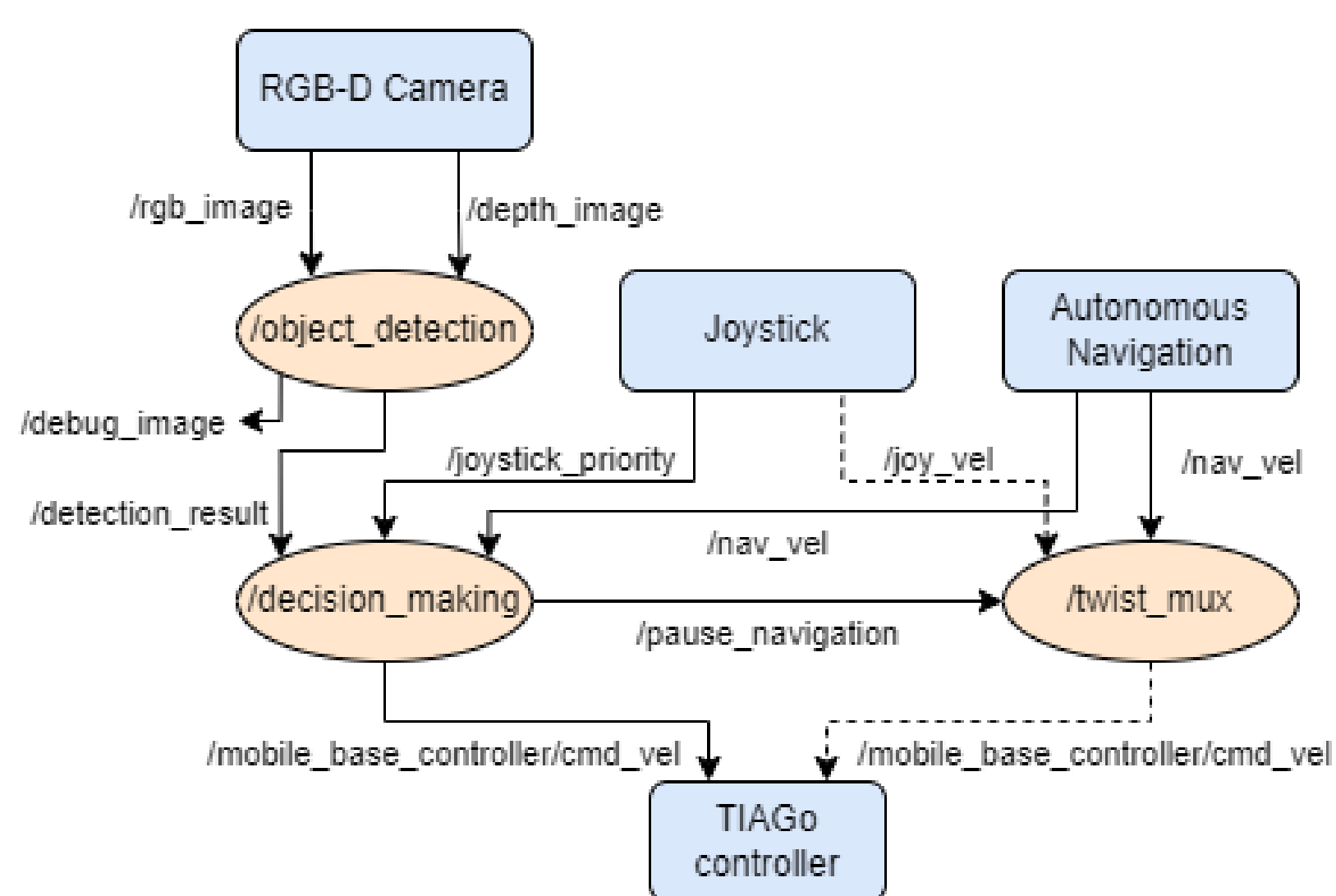
Decision making
- Robot slows down/stops if person is detected within a given threshold
- Based on a state machine of closest person.
- Possible to interfere with joystick

Localization & Autonomous navigation
- Implemented an off-the-shelf localization and navigation system from PAL-Robotics, utilizing AMCL
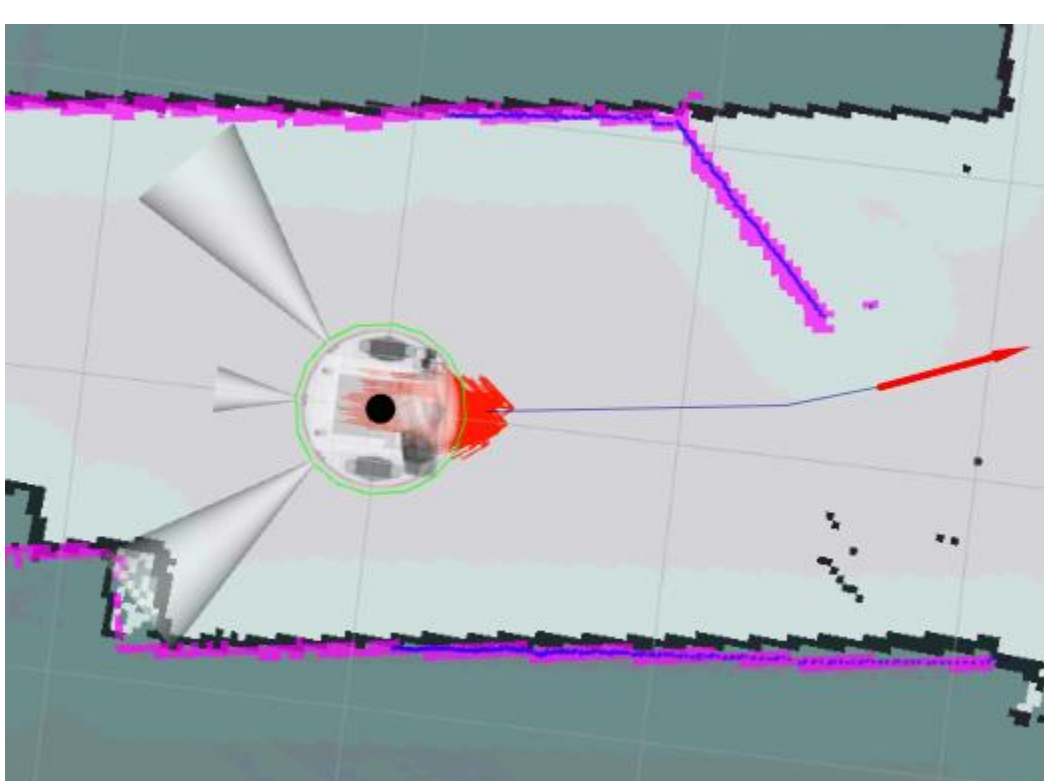
Object detection:
- Utilized YOLOv8 to identify objects
- Computed average depth from object masks and RGB-D image

Experiments:
- Checked accuracy of depth measurements. (Image and object estimates)
- Brake test – TIAGo driving autonomously with a person blocking its path

Test Results:
- Depth in the entire field of view are transformed to be the same with $\sigma = 0.2$mm. (Wall 0.65m from camera)
- Depth estimation of person ± 30mm with $\sigma = 4$mm.
- Robot slows down and stops as expected when person is within threshold.