

Autonomous Detection and Assessment with Moving Sensors

Manager:

Jonathan Salton

6533

Project Mentor:

Stephen Buerger, Anup Parikh,
Steven Spencer, 6533

Justin Ngo
University of Utah
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ADAMS is developing foundational intrusion detection and assessment technology that autonomously optimizes the behaviors of dynamic / moving sensors to resolve most alarms without operator attention. This approach introduces dynamic sensing, in which physical properties of sensors are actively controlled, to the security environment.

Simulation

A robotic platform was purchased to mount a Light Detection and Ranging (LiDAR) sensor and a camera. Simulation was performed to be familiarized with the function of the robotic platform such as navigation packages and platform movement. Some functions include simultaneous localization and mapping (SLAM), way point and autonomous navigation. Installation, file parameters and instructions were documented for future use. Figure 1 shows the robotic platform within a simulated environment. Figure 2 shows the view of the laser scan where the robotic platform sees certain object to use with mapping and navigation.

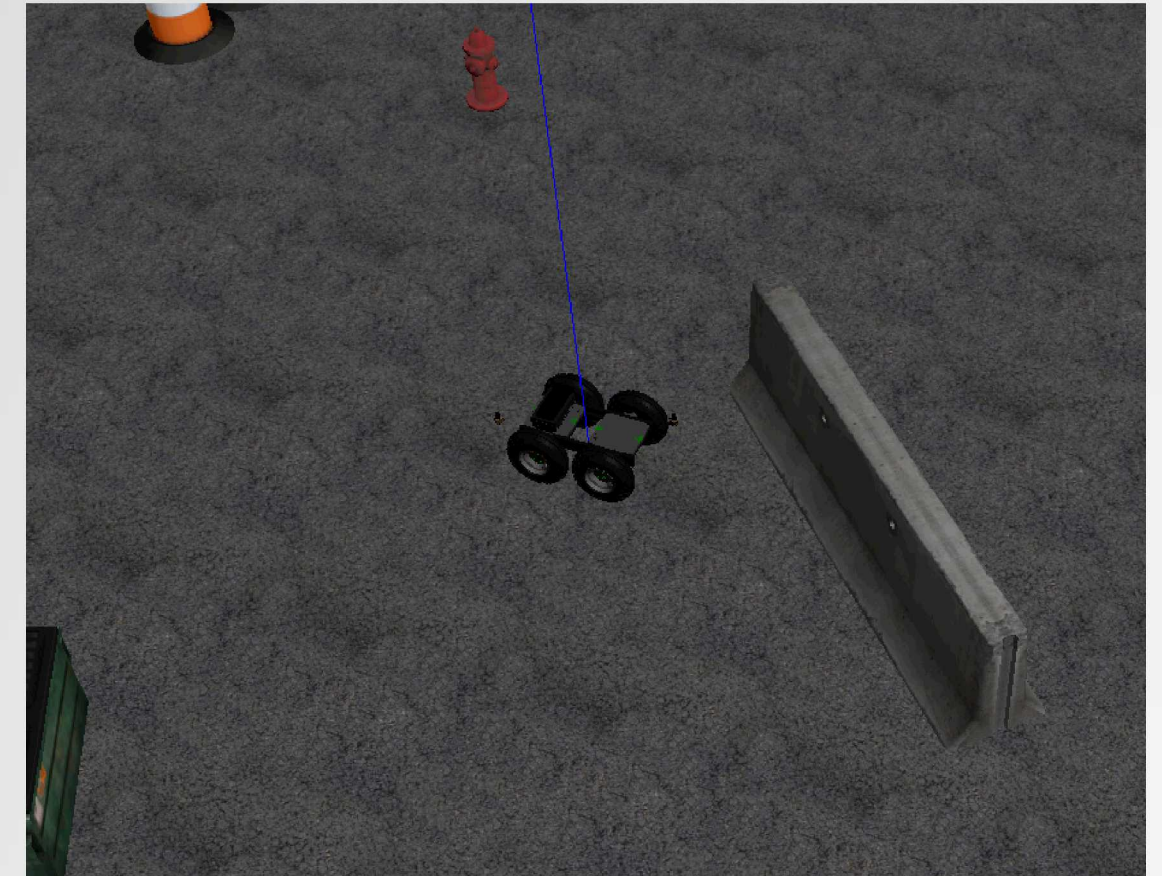


Figure 1: Gazebo environment

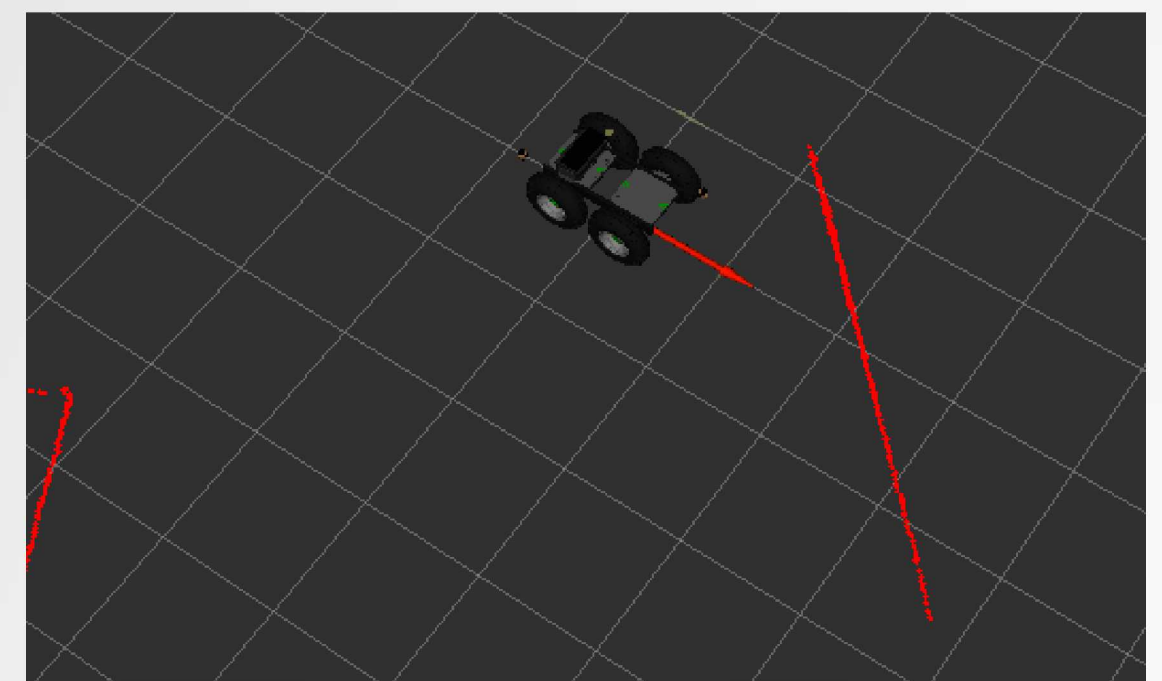


Figure 2: Rviz laser scan



Figure 3: Gimbal Encoder

Reverse Engineering

A portion of the dynamic sensing was accomplished by actively controlling the position of a camera using a gimbal. The position of the camera relative to the LiDAR is needed to create red, green, blue and depth image for object classification. A commercial gimbal's encoder (figure 3) was used to provide the absolute position of each joint.

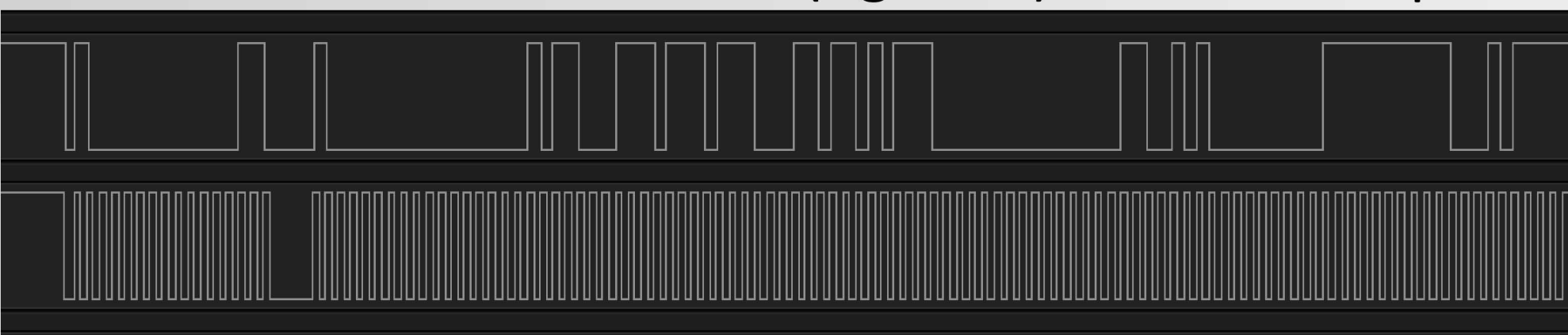


Figure 4: Example encoder data packet

Figure 4 shows the gimbal encoder data packet. The data was parsed to obtain the position.

Actively controlling the gimbal was accomplished by emulating the joystick via digital potentiometers. The position of the camera can then be controlled remotely or autonomously. Figure 5 shows the main board of the gimbal with the joystick, light green, attached.

Future Work

Integration of the robotic platform and sensors remains to be done. Sensor calibration with navigation packages such as depth monocular enhanced odometry will need to be modified to account for camera movement by the gimbal.

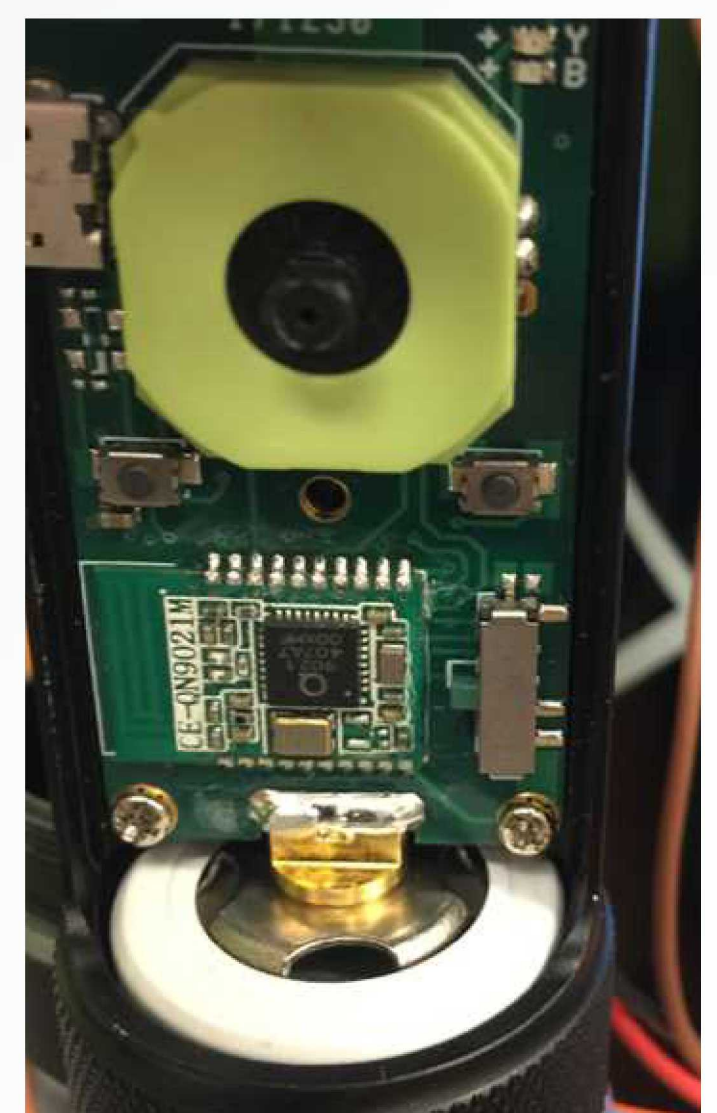


Figure 5: Main gimbal controller board