A Realtime Robotic Inventory System for Retail

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Goals Specified in Proposal

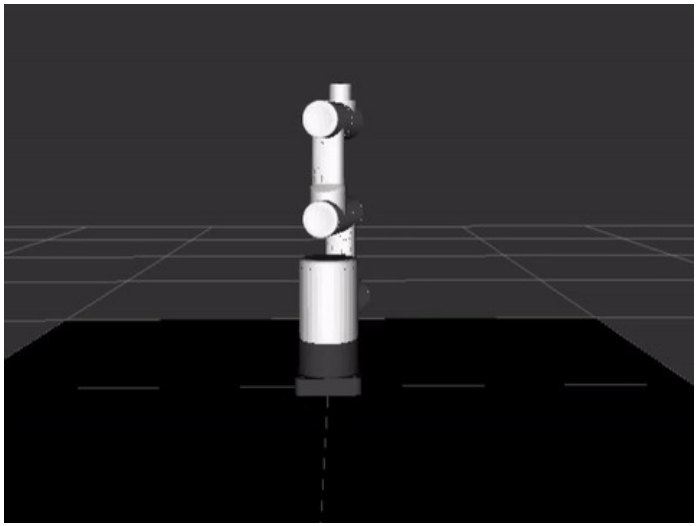
- A new prototype for retail robots
- Mobile robot equipped with RealSense camera
- Manipulator arm with RFID reader
- Automatic generation of planograms
- Pricepoint $10~15K (**competitors** > $50K)
- Especially robot arms have been expensive in the past...

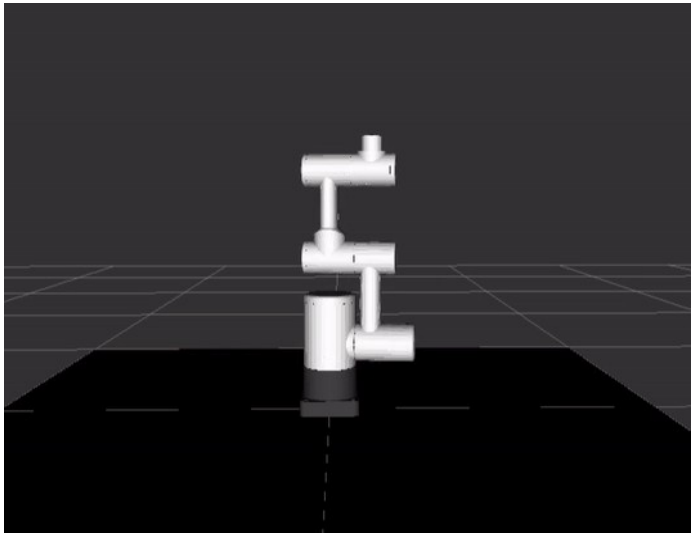
First Development Steps [Jul – Sep '18]

- PI Ben Amor spent summer at ElementaryRobotics
- Specifications for robot arm
  - Reach: 80cm
  - Payload: 1.5Kg
  - Degrees of Freedom: 6
- Implemented robot control algorithms
- Fully functioning control stack

Control Stack

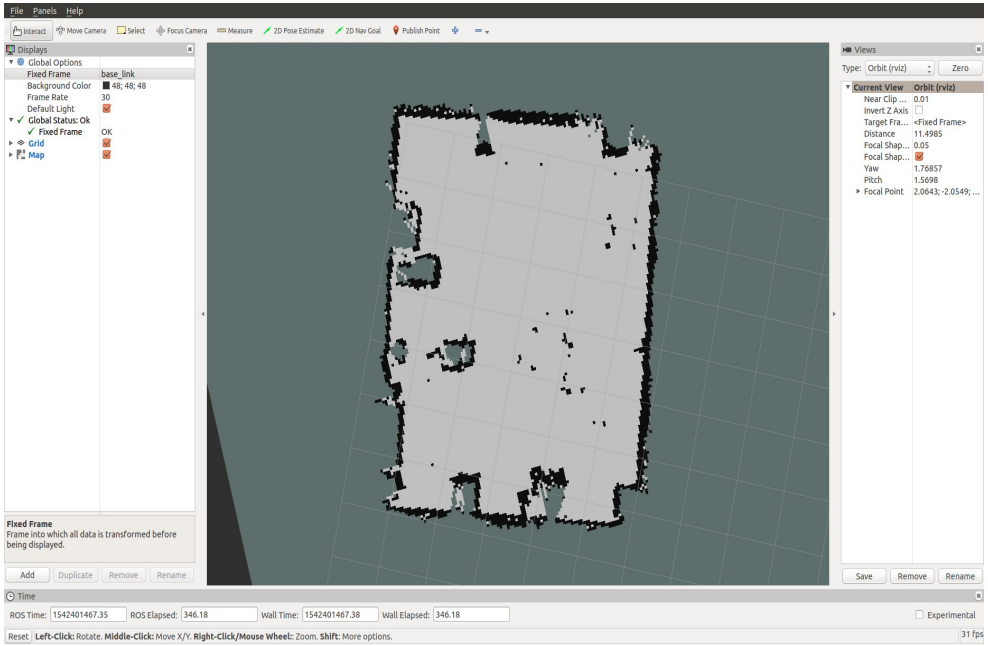
- Simulation in ROS/RViz
- Simulation in Gazebo
- Forward Kinematics
- Inverse Kinematics
- Machine Learning Techniques:
  - Dynamic Motor Primitives
  - Model Parameters





SLAM Stack

- Simultaneous Localization and Mapping
- Incorporates LiDAR and RealSense
- Includes robot odometry
- Generates 2D Map
- 3D Map in progress



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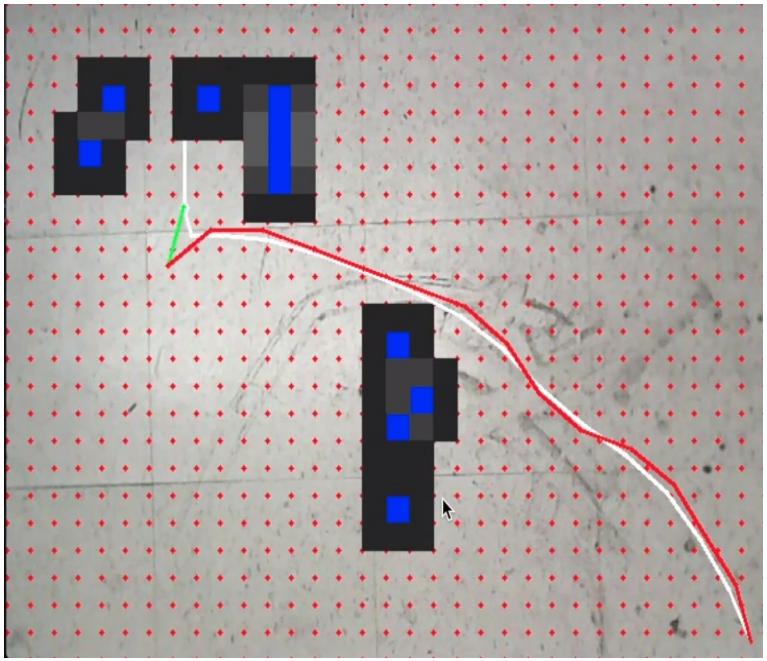
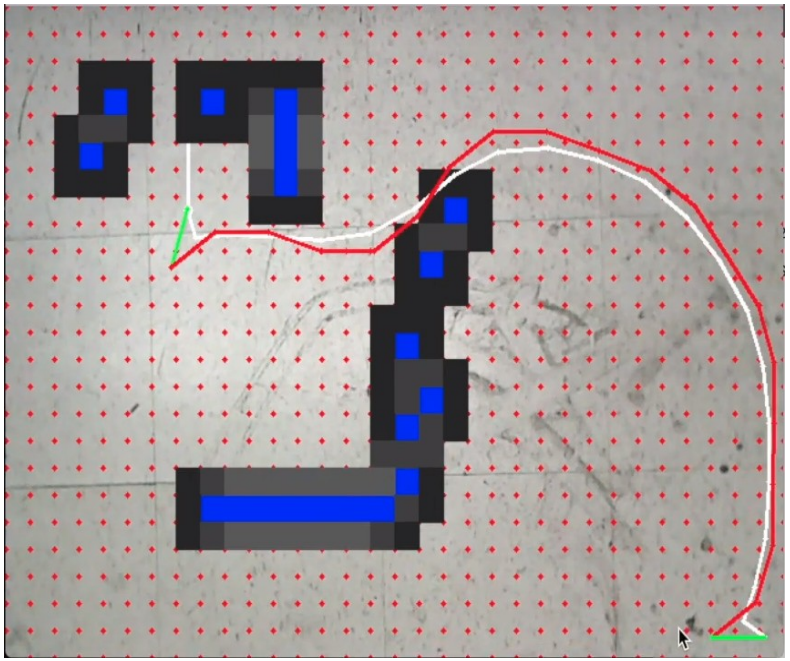
Path Planning using Generated Maps

- Path Planning algorithms implemented
- Generated maps are used for avoidance
- Artificial obstacles and no-go areas can be defined



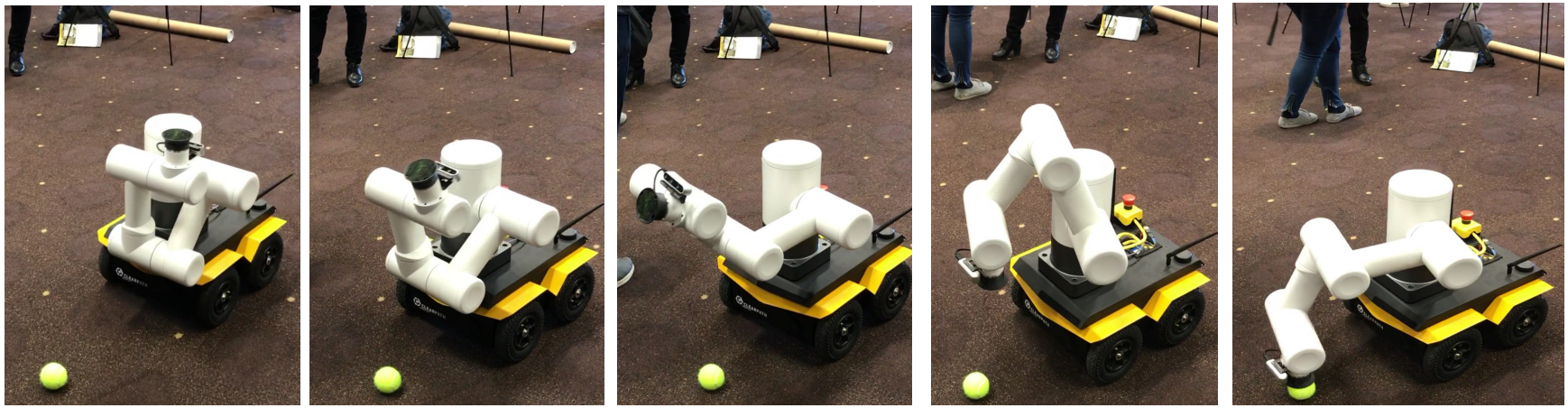


Milestones

- According to Proposal Milestone 2 [March '19]:
  - Full implementation of behavior-based control stack for semantic robot navigation. ✓
  - Videos of first real-world examples of robot navigation and object scanning performance. ✓

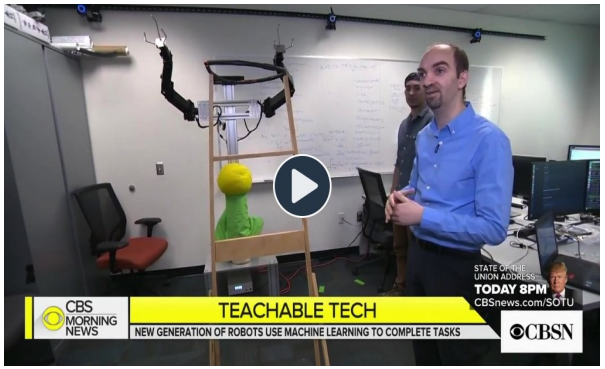
Demo

- Autonomous detection and picking of tennisball
- Pictures from realtime demos at Southwest Robotics Symposium:



National Attention

- The robot was featured in a CBS report and interview with PI Ben Amor
- The report was broadcast nationally on “CBS This Morning”. The report was also broadcast on 192 local CBS affiliates
- After the State of the Union it was the most repeated and watched clip by CBS



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