Systems Engineering

TEAM HARP
HUMAN ASSISTIVE ROBOTIC PICKER
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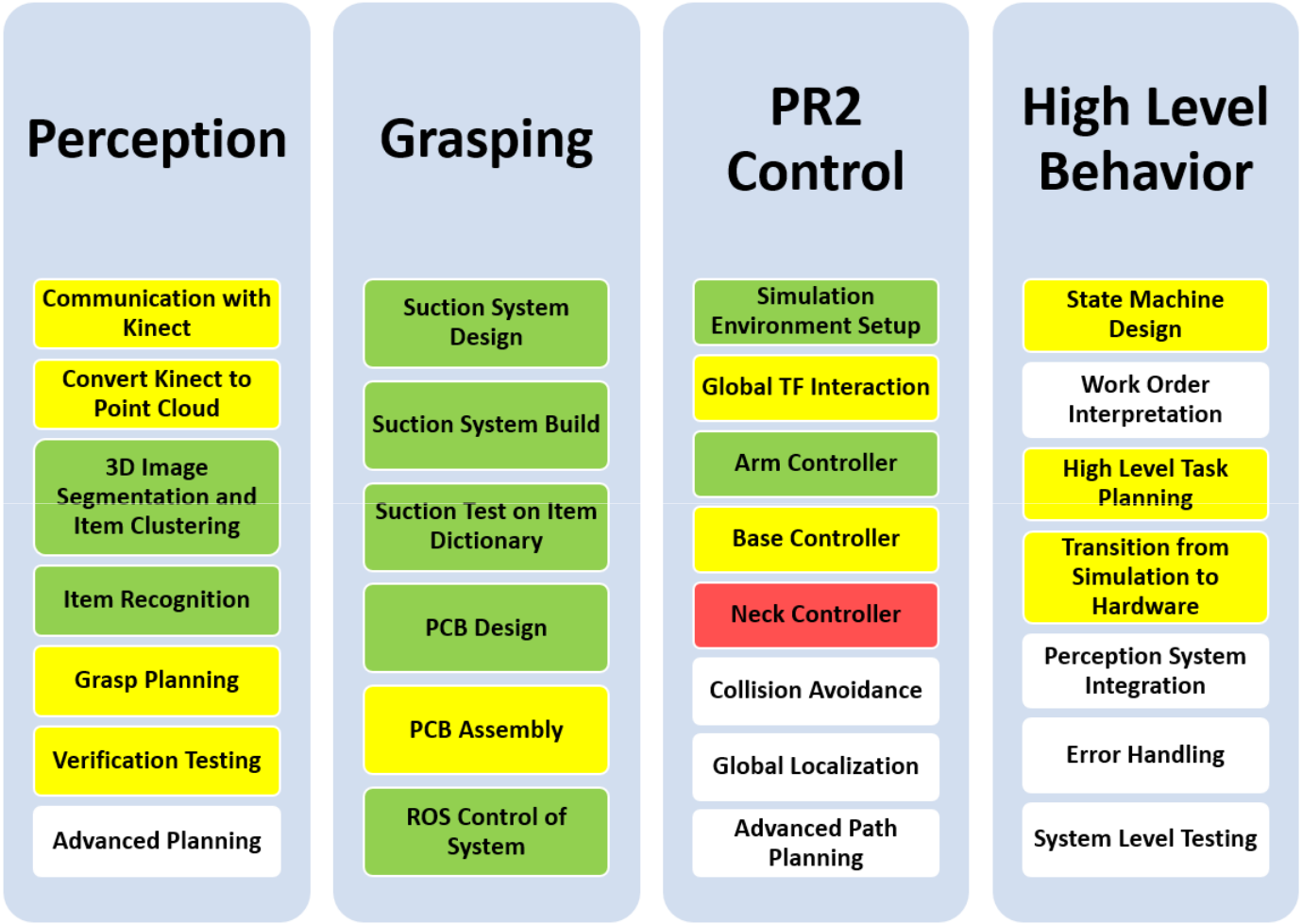
CARNEGIE MELLON UNIVERSITY

Work Breakdown



2015 Schedule

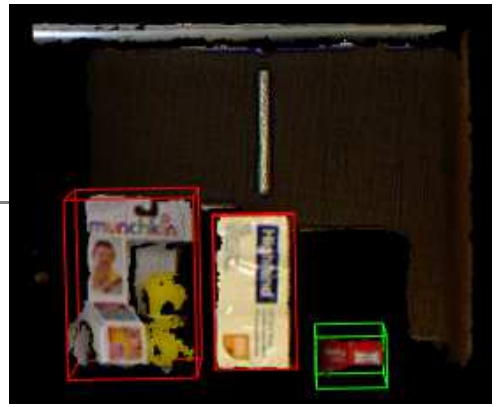
Week of…	Subsystem	Deliverable
November 16th	Platform	Develop base movement set point controller
	Perception	Integrate algorithms with live kinect2 stream
	Gripper	Finish electronics build, solder PCB
	Gripper	Modify TF to accomidate gripper
	System	Simulate arm and base movement with shelf model in state controller
November 23rd	Platform	Add neck, spine, and gripper control
	Perception	Improve algorithm performance to meet accuracy requirements
	Gripper	Test vacuum control and pressure feedback through ROS
	System	Develop full simulation of all PR2 actions
November 30th	System	Run full simulation with gripper hardware in the loop
	Perception	Integrate perception pipeline into ROS
	System	Fall validation experiment prep
December 7th	System	Improve FVE demo as necessary
	System	Begin testing state control integration on PR2
	Platform	Implement localization routine on PR2

Changes in Performance Requirements

PR3: Autonomously determine suction grasping surface on 50% of attempts (reduced from 75%)

PR4: Autonomously pick item of known pose from shelf bin on 70% of attempts (increased from 50%)

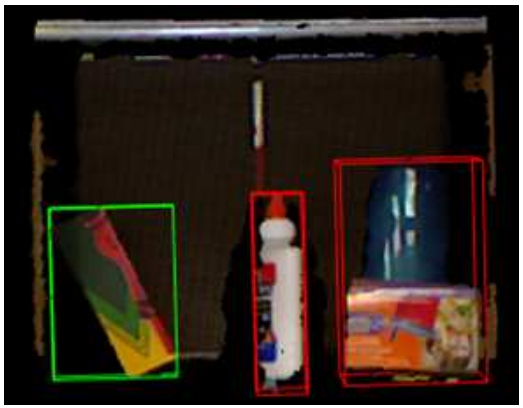
FVE 1: Perception Experiment



Objectives:

1. To show correct item identification
2. Ability to find grasping surface

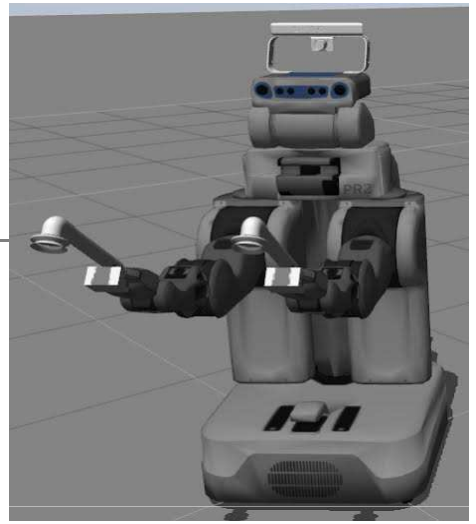
Description: A shelf will be set up with 1-3 items (no occlusions). The kinect will process the 3D scene. A graphical output will draw a bounding box around the item of interest



Requirements

F3: Autonomously determine positions and orientations of target items
NF4: Be robust to lighting between 320-500 lux
PF3: Autonomously determine suction grasping surface on 50% of attempts

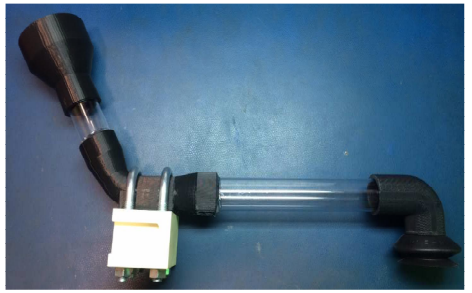
FVE 2: State Control, Hardware-in-Loop Grasping



Objectives:

1. Demonstrate command of motion controllers on PR2
2. Demonstrate ability to script high-level behaviors and adaptation based on real-time feedback
3. Demonstrate Strong, Robust suction gripper

Description: A shelf bin will be set up with random items. The gripper hardware will autonomously grasp and release items. The arm will move between shelf and order bin in simulation



Requirements

F4: Autonomously picks item from shelf
F5: Autonomously place item in order bin
PF3: Autonomously pick item of known pose from shelf bin on 70% of attempts
PF7: Be able to lift items up to .5kg mass

FVE Risk Mitigation

Risk	Likelihood	Consequence	Mitigation	Owner
Kinect2 live data is sparse relative to test image	2	4	1) Test Kinect1 in parallel 2) Research custom depth to PCD converter	Abhishek / Lekha
Algorithm accuracy ~ 50%	3	5	1) Evaluate other algoithms that could better fit application	Rick
Loss of communication with Arduino	2	5	1) Backup toggle line to reset Arduino from state controller	Alex
Unexpected issues with PCB	3	1	1) Prepare backup circuit on breadboard 2) Order backup components	Feroze
State controller hangs during demo	2	5	1) Extensive test and debug time before FVE, schedule margin	Alex

Questions?