ELEG 498 - Project Proposal

Project Title: Building Mapping with 'Street View'

Project Name: Wall - E

Group Members:

Objectives:

Use an iRobot Create platform to roam a building and map it with panoramic images. The robot would create estimates of position and images would be collected and stored and then later processed. Depending on accuracy of position measurements, the pictures could then be programmatically put into a database corresponding to map points. A bonus would be to have an android app that would give a basic interface to the pictures.

Success would be measured by an accurate 2D map with precise 'Street View' areas of a building. Panoramic images and their calculated position should correspond closely to the actual building.

Possible customers include government, emergency services (i.e. Firefighters), Armed Services, and institutions (i.e. University of Delaware).

Design Constraints:

Our design will take advantage of the iRobot create platform. Size will be limited to what can fit upon the robot platform and total weight of equipment will not exceed 15lbs. We plan to use a web camera to obtain high quality images. We will need to interface an Arduino board with a 25 pin connector to control and read sensors on the robot.

Goals:

Fall Goals:

- Successfully test camera and image stitching.
    - Test with human holding camera and turning while taking pictures.
- Experiment with taking 'spherical pictures'
- Create a mechanism to turn the camera.
- Be able to control and read sensor data from robot.
- Test sensors and how they work.
- Create program to autonomously go around building using sensors.
- Research image recognition
    - Goal is to recognize door plates and possibly room numbers.

Spring Goals:

- Begin to combine all elements.
- Perfect autonomous mode of robot.
- Rough mapping of a floor of a building.
- Implement image recognition if time allows.
- Implement android app if time allows.
- Map a floor of a building.

Approach:

- Individually test components and sensors.
- Build method to take panoramic pictures
  - Image stitching
  - Rotation of camera
  - Activation of camera
  - Storage of pictures for post processing
- Control robot to go around a building while knowing its location.
- Combine robot and camera system to take pictures and link with location.
- Map a building floor.
- See if image recognition is feasible.
- Create basic application to view images.

Equipment Needed:

For Robot:

- iRobot Create platform
- Arduino (to control robot)
  - Arduino Ethernet
    - 14 digital i/o, 6 analog inputs, RJ45 to connect to Raspberry Pi
- 25 pin solder connector (male)

For Camera mount:

- Web Camera
- Lazy Susan
- Tripod
- Motor to spin lazy susan
- LED detector to 'read' markings on bottom of lazy susan and detect when proper angle is reached.
- Image stitching program.
- Raspberry Pi to interface with camera and store image and location data

Budget:

- iRobot Create platform $129.99
- Arduino Ethernet ~$60.00
- 25 pin solder connector (male) ~$1.25
- Adesso CyberTrack H1 HD Desktop Webcam ~$29.95
- 18" turntable ~$20.00
- 3 foot speaker stand / tripod ~$19.99
- LED detector ?
- Stepper motor $7.00
- Image Stitching Program (courtesy of Microsoft)

- Raspberry Pi ~$35

Total without Robot: ~$173.19
with iRobot: ~$303.18

Challenges:

Autonomously controlling the robot.
Creating a system to spin the Lazy Susan to desired angles.
Interfacing Raspberry Pi, Arduino and webcam.
Creating app to display ‘street view’ images

Equipment -not fully understood:

- Arduino
- Raspberry Pi
- iRobot Create platform
- Image processing

Skills:

- Programming (logic and hardware)
- Hardware (constructing circuits and wiring)

Schedule:

	Week Starting	Week	Activity	Milestones
Fall	9/9/2012	3	Finish Proposal Rough Draft and Submit	
	9/16/2012	4	Correct proposal and submit final draft	
	9/23/2012	5	Order parts and begin to do research	Order Parts and Understand all components
	9/30/2012	6	Test components that we have in and experiment with processes	
	10/7/2012	7	Split into two teams: One robot control, other camera control	
	10/14/2012	8	Program robot, control camera	Interface Arduino with robot and camera with raspberry pi
	10/21/2012	9	Preparation for midterm status report and presentation	
	10/28/2012	10	Program robot, control camera	
	11/4/2012	11	Program robot, control camera	
	11/11/2012	12	Program robot, control camera	Robot moving on its own, and camera taking pictures and rotating via program
	11/18/2012	13	Thanksgiving	
	11/25/2012	14	Final Presentation preparation	
	12/2/2012	15	Final Presentation preparation	
	12/9/2012	16	Final Report	
	Winter Break			
Spring	2/3/2013	1	Contingency: Program robot, control camera / Revised Proposal	
	2/10/2013	2	Contingency: Program robot, control camera / get back up to speed	
	2/17/2013	3	Contingency: Program robot, control camera / get back up to speed	
	2/24/2013	4	Integrate Systems together	
	3/3/2013	5	Integrate Systems together	
	3/10/2013	6	Begin Running full system	Have robot move and camera rotate all autonomously
	3/17/2013	7	Mid-Term Status Report and Presentation	
	3/24/2013	8	Spring Break	
	3/31/2013	9	Trial/Error and modify // Begin working on application	View map on application
	4/7/2013	10	Trial/Error and modify	Map a floor of a building
	4/14/2013	11	Trial/Error and modify	
	4/21/2013	12	Contingency Time	
	4/28/2013	13	Contingency Time	
	5/5/2013	14	Final Presentation preparation // Contingency Time	
	5/12/2013	15	Final Presentation preparation // Contingency Time	
	5/19/2013	16	Final Report	