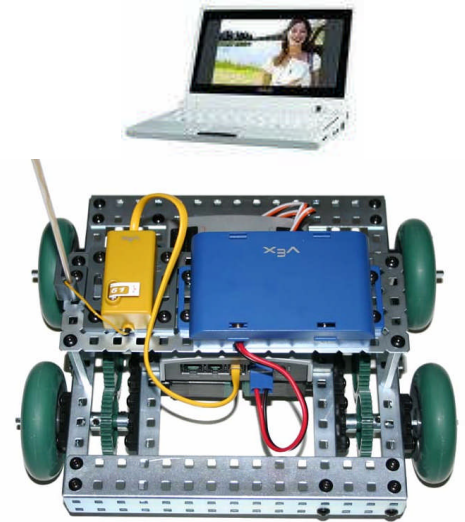


RSSC October 11, 2008

**Class: Steven Gentner: [RoboRealm](#)**

Visual Obstacle Avoidance and Navigation

A low cost Laptop based robot. A Vex Square bot base with the wheels re-gear. The large gear in the traditional squarebot is replaced with a small gear to provide additional torque to allow the robot to navigate on carpet. The computer is an Asus EEE PC with a built in camera.



1. Finding Edges Detect object

Edges and fill upwards until a significant edge is detected. Horizontal erode to remove noise and small pathways. Finds edges straight up. IE Detect edges from bottom of the screen up and fill upward from the edge. Then erode to remove small pathways. Then find the top most point that is left. Aim the robot at this point.

Canny

Sidefill (Bottom to Top)

Erode

Smooth Hull

Point\_Location (Highest)

Math Source Current (Blend in original image with processed image)

2.Floor Blob

Segment objects based on colors. Detect largest “blob” which is assumed to be the floor.

First do a flood fill. “Implement gravity of Jupiter on largest blob”

Segment colors (much faster then flood fill)

Blob size cut

Erode

Blob size cut

Collapse (bring pixels down to the bottom so they stack up from the bottom)

Erode (to find path that robot can fit through)

3.Finding floors

Problem with previous two techniques is that it doesn't work on floor that has any pattern. (IE Persian carpet!)

Assume that the space in front of us is empty. Sample a triangle at the bottom of the image. Using these colors extrapolate to the rest of the image. Take those colors and flood them out to the rest of the picture. Collapse again.

Floor Finder (Define the triangle and threshold out pixels that don't look like pixels in square area)

Erode (Erodes and image by reducing the border of the blob one pixel at a time.)

Collapse

Smooth hull

## Point Location

Polarizer do a great job of blocking out reflection. (A vertically oriented polarizer will block the horizontally polarized light reflected from surfaces.)

## 4.Laser Detection

Project a laser line onto the environment. Use laser and camera triangulation to determine the distance of object (Objects that are lower on the frame are closer.)

Demonstration of EEE based laser obstacle detection.

A nice laser line generator is available from <http://www.instapark.com/>. (Editors Note: I purchased three laser modules from them and they arrived the next day. They also sell on Ebay for even less then their website!)

## **Business Meeting:**

Next meeting will be 2008 ROBOExpo at Mt. San Antonio College in conjunction with the Vex Technical Robotics State Qualifier Competition.

The ROBOExpo will include the annual Talent Contest which will be judged by both the audience and a panel of distinguished judges(To be determined):

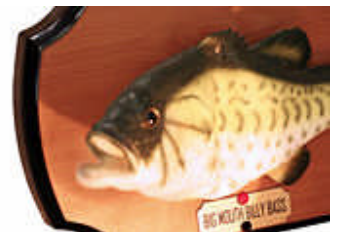
Criteria for Judging includes:

- Software
- Hardware
- Mechanical

In October, Steven Gentner will continue to talk about Advanced Obstacle Avoidance.

## **Show and Tell**

Martin Mason: Robot Fish: An animatronic fish tells jokes. It uses a version of the Leaf software to drive a Billy Bass Fish. The fish lipsyncs based on the audio output from the leaf software. The Billy bass has three separate motors, one to control mouth movement, one for head orientation and a third for tailing flapping.



Jim: Showed an Asimo Video shot at Disneyworld. [Asimo](#) is a remarkable biped.

Martin: Alien microfly is a tiny one rotor flyer. However its size make it much more flyable in doors then the traditional one rotor flyers. It is controlled with an IR remote. Using a USB-UIRT the flyer can be roughly controlled from a PC. Software was demonstrated to show computer control of the microfly.  
<http://profmason.com/?p=652>



Ron: 99cent flasher and rotational unit. Available at 99 cent store.

Marty: Robomagellan Truck mini computer. PC104 format posideon computers. There appear to be difficulties in getting Linux to run on this computer.

Jim U: A question about sourcing an optically transparent foam. Folks suggested bubble wrap and other ideas, but there were concerns that since it is foam and has lots of small bubbles that repeated refractions would tend to make it difficult to make foams transparent.

Martin: TOMY I-Sobot. Demonstrated computer control of the world's smallest biped. Using a USB-UIRT to deliver codes to the I-Sobot allows complete computer control of either individual limb motions or replaying programmed moves. <http://profmason.com/?p=640>

I-Sobot is currently on sale for \$149



### **Steven Gentner continued the class:**

Depth from Focus:

Determine distance to object based on in-focus texture. If you can detect the focus of an image, you can tell the depth of an object.

Apply an edge detector. Image that is in focus will have more edges. Blur and threshold edge detection. Step through focus of camera to get depth map of image. It is possible to use focus changes to "scan" in a crude depth map.

Can't use just eduges as background black/white edges are still strong.

Prewit Edge

Optical Flow:

Tracking an object. Can display a vector that shows the amount and direction of movement in the frame.

Optical Flow module

Understanding how objects move tells you which objects are closer than others. Insects navigate by balancing optical flow on either side and generate a turning vector to avoid nearby objects.

Flow balance module

Visual Odometry

Tracking path traveled by pointing camera at ground and measuring how the image translates and rotates.