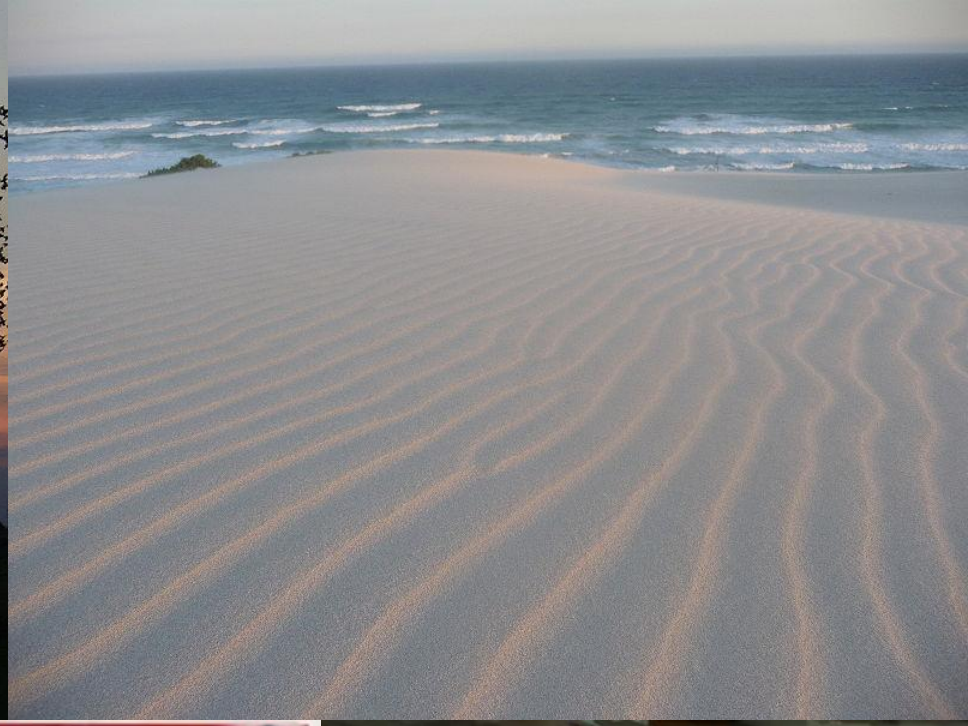


Emergent Behavior Robot

Bradley University - Senior Capstone Project
Fall Presentation

By: Andrew Elliott & Nick Hanauer

Advisor: Joel Schipper

December 8, 2009

Overview

- Introduction
- Functional Description
- Block Diagrams
- Functional Requirements
- Preliminary Work
- Parts List
- Proposed Schedule

Introduction

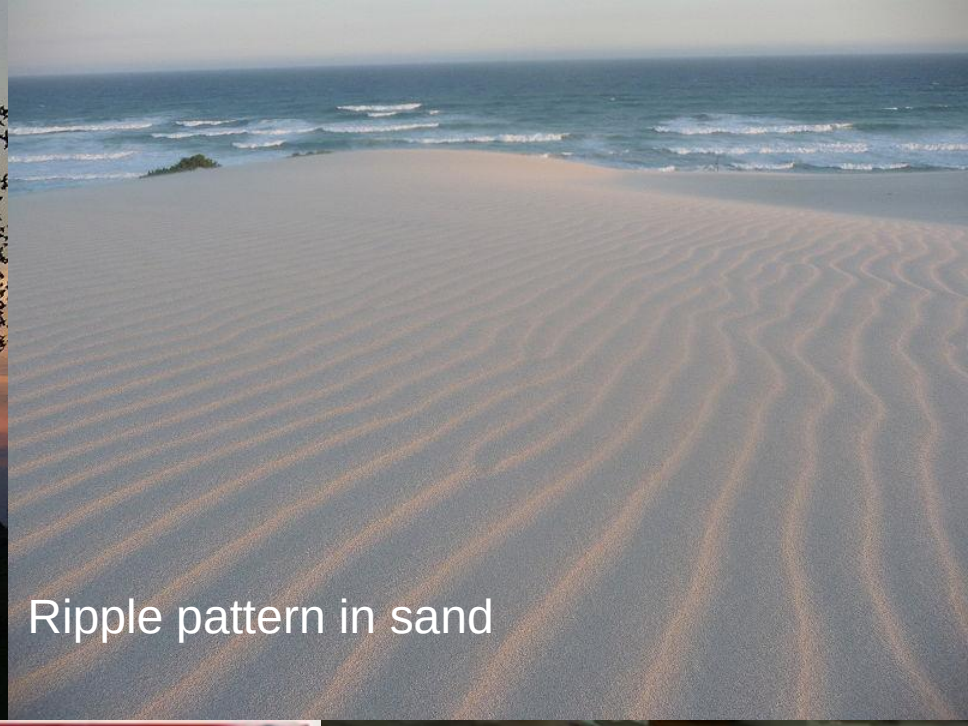
- Create a robot that:
  - Avoids obstacles
  - Seeks and finds beacon
  - Flees from loud sounds
  - Favors darker environments
  - Displays emergent behavior

Functional Description

- Construct a robot from the ground up
  - Less complexity
  - More experience
- Interact with the environment
  - Sensors
  - Locomotion
- Display emergent behavior
  - Multiple simple behavior modules combine to create a sophisticated, intelligent response [1]

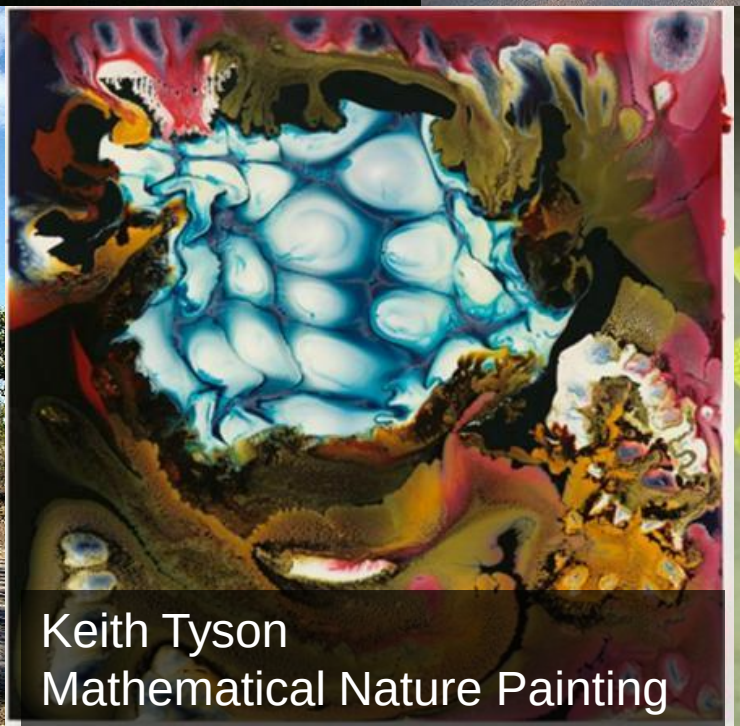
[1] R. Cioarga, B. Ciubotaru, D. Chiciudean, M. Micea, V. Cretu, and V. Groza, "Emergent Behavioral Modeling Language in Obstacle Avoidance", Warsaw, Poland, May 2007.

Flock of birds

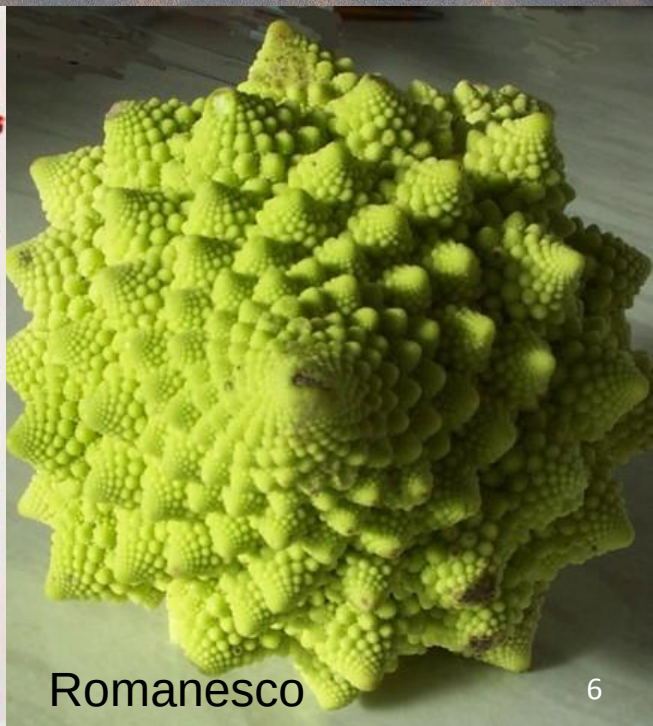


Ripple pattern in sand

Termite mound



Keith Tyson
Mathematical Nature Painting



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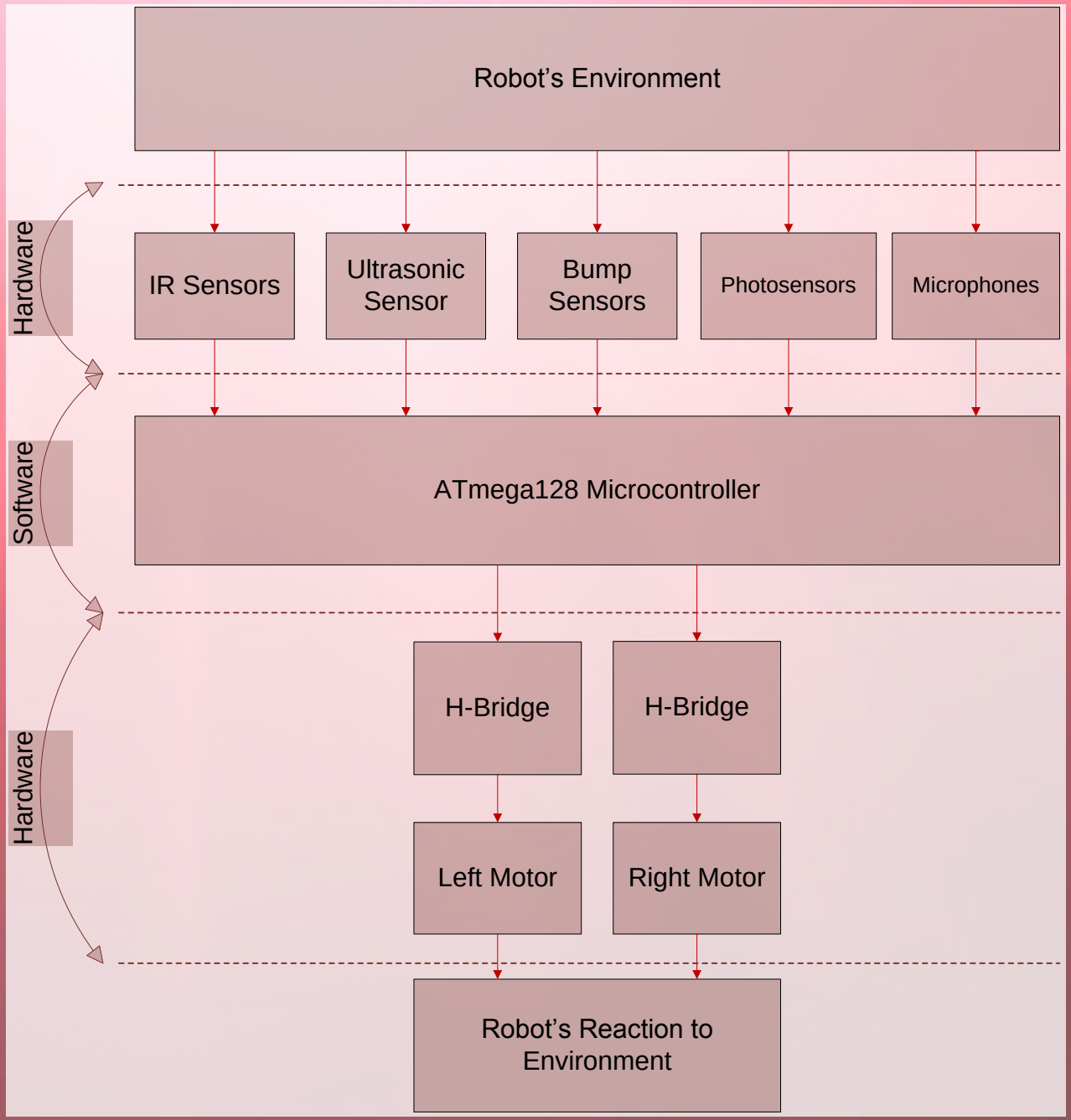
High-Level System Overview

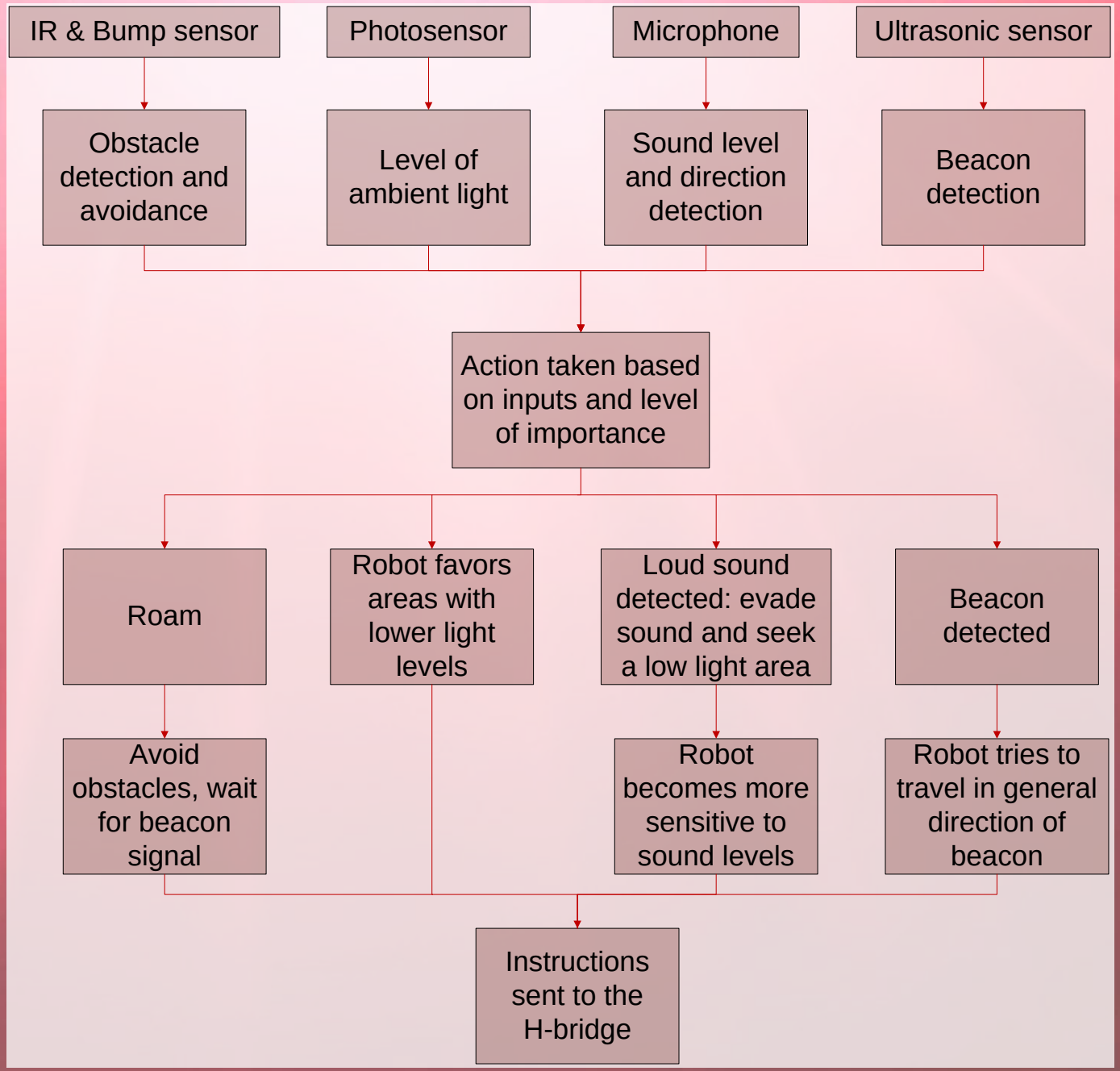


Software - Modes and Task Priority

- Modes (all modes include obstacle avoidance)
  - Roam mode
    - Search for beacon
  - Evade mode
    - Travel quickly away from source of sound
    - Find shelter (low light area)
  - Pursuit mode
    - Travel toward beacon
- Priority (1 is the highest)

Task	Roam	Travel in low light	Beacon found	Detection of a loud sound
Priority	5	4 (2 if in Evade mode)	3	1

High-Level Software Block Diagram



Functional Requirements

Our Robot Shall:

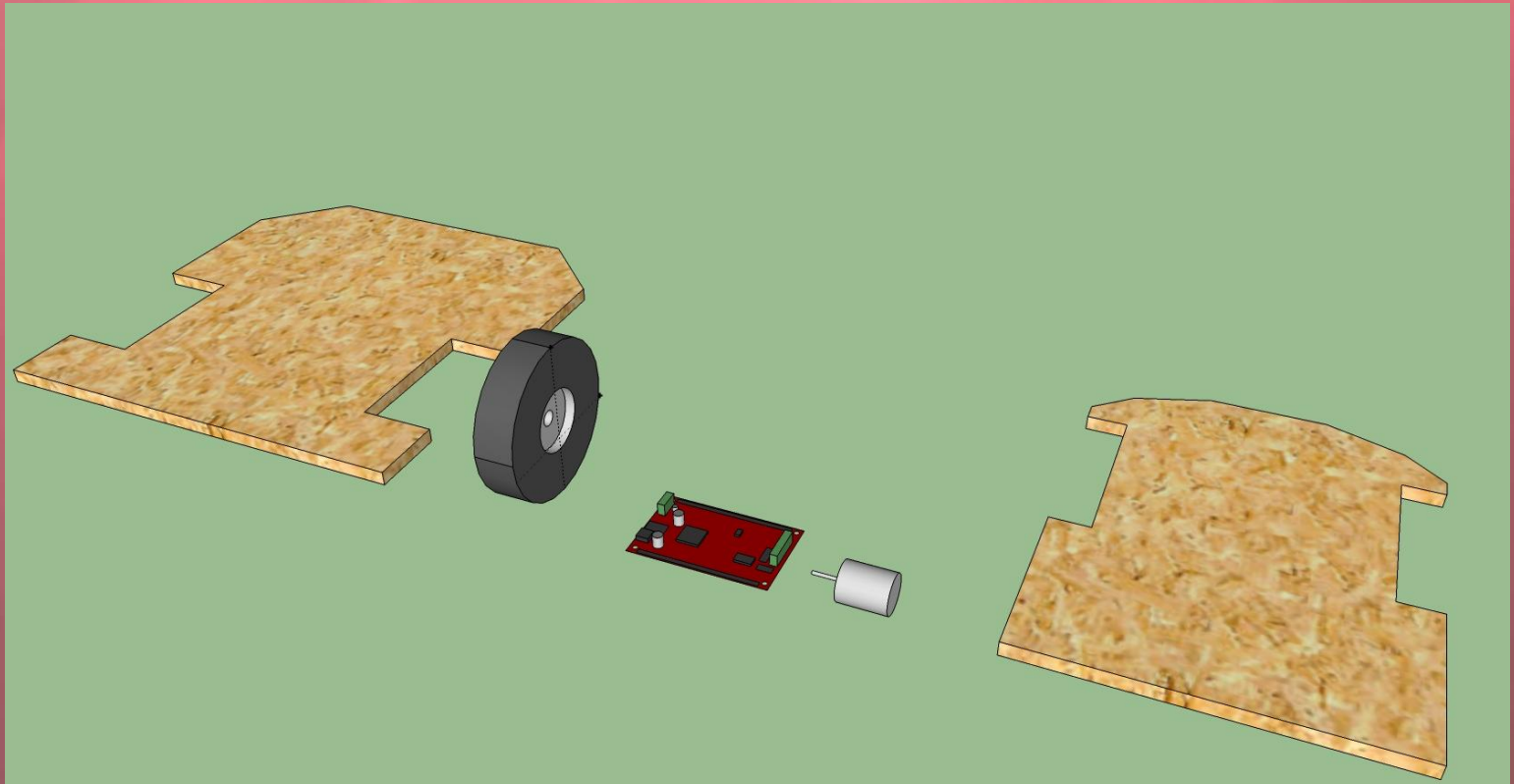
- Avoid all obstacles within 6 inches
- Detect a loud noise (above 80dB) and determine the direction of origination
- Reach an ultrasonic beacon within a 2 feet radius
- Determine which areas in its path are darker
- Travel at a speed of 2 feet per second normally
- Travel at a speed of 4 feet per second when evading

Preliminary Work (1)

- MAVRIC-IIB Microcontroller Board
  - Adapting to the development software
  - Writing test programs
- Testing IR Sensor and Photosensor capabilities
  - IR Sensor results are unreliable at close range
  - Photosensors are not good for directional sensing
- Selected parts to meet specifications
  - Parts have been ordered

Preliminary Work (2)

- Chassis Design
  - Using Google SketchUp



Parts List

Component	Vendor	Part Number	Crucial Spec	Unit Cost	#	Ordering Cost
MAVRIC-IIB	BDMICRO	MAV2BPH16		$99.00	1	$99.00
Motor	Robot Marketplace	0-BHG31	Torque & RPM	$23.99	2	$47.98
IR Sensor	Acroname	Sharp GP2Y0A21YK	Distance (Min & Max)	$12.50	4	$50.00
H-Bridge	Bradley University	LMD18200	Max Current	$0.00	2	$0.00
Wheels	Robot Marketplace	0-DAV5540	Diameter	$8.99/pair	2	$17.98
Hub	Robot Marketplace	0-MHUB04	Bore size	$8.49/pair	1	$8.49
Microphone	Digi Key	CMB-6544PF		$0.72	5	$3.60
Photosensor						

Proposed Schedule

Week	Andrew Elliott	Nick Hanauer
1-3	Research & Website Development	Parts Research
4	Learn ATmega128	Parts Testing & Research
5	Interface with the Digital I/O	Parts Testing & Finalizing Parts List
6	ADC Setup	Parts Testing & Order Remaining Parts
Winter Break	Construct Chassis	
7	Interface IR Sensors & Photosensor	Motor & H-Bridge Circuitry/Testing
8	Interface Microphones	Microphone & Photosensor Circuitry/Testing
9	Interface Motors & H-Bridge	Ultrasonic Circuitry/Testing
10-11	Integrating All Sensors	Circuitry Clean-Up & Wire Wrapping
12	Final Software/Hardware Testing	
13-14	Final Documentation and Presentation Preparation	

Questions?

Emergent Behavior Robot

Andrew Elliott & Nick Hanauer

Joel Schipper