



RASlow!

The IEEE Robotics and Automation Society (RAS)

@ the University of Texas at Austin



Overview

- Project Goals
- Design Strategy
- Hardware Design
 - Mechanical
 - Electrical
- Software Design
 - Autonomous Code
 - Simulator
- Conclusion



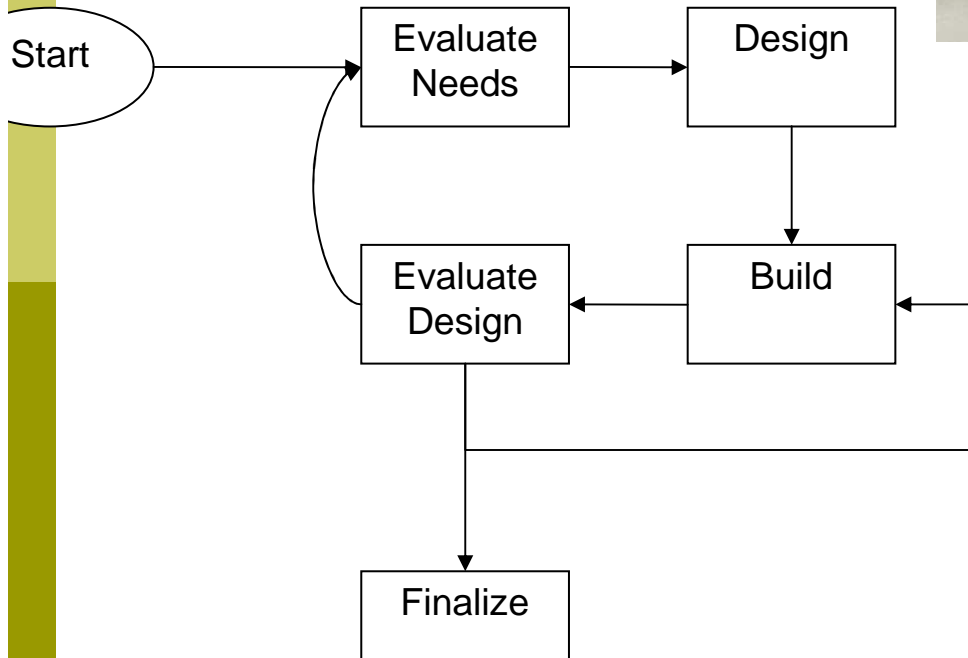
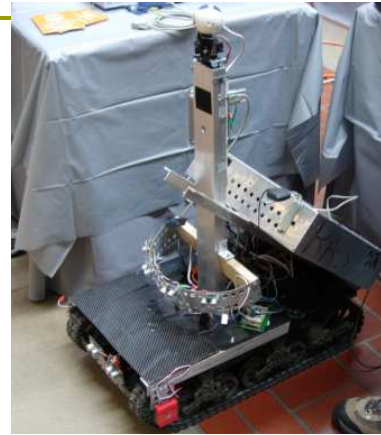
Project Goals

- ❑ Organizational Structure
- ❑ Working Robot
- ❑ Navigation Challenge
- ❑ Create framework for future years
- ❑ Low Cost



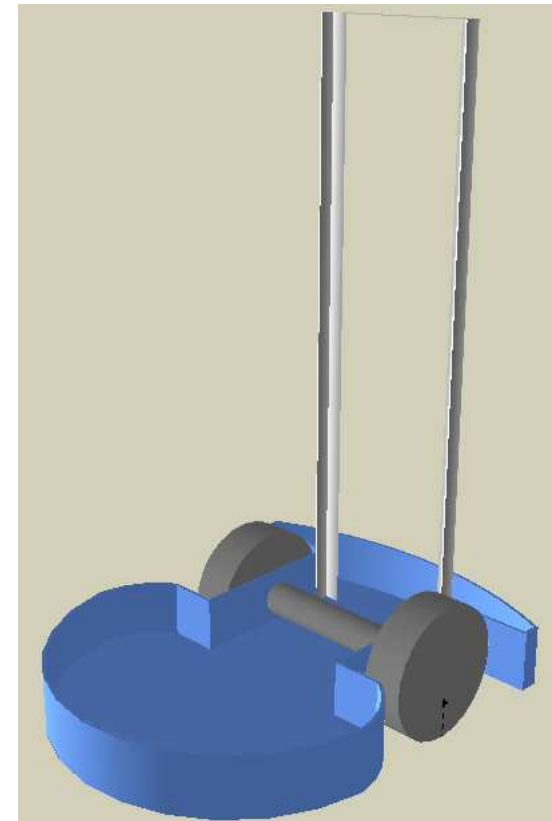
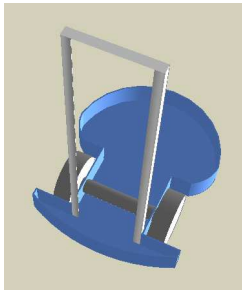
Design Strategy

- Iterative Design
- Facilitates Learning



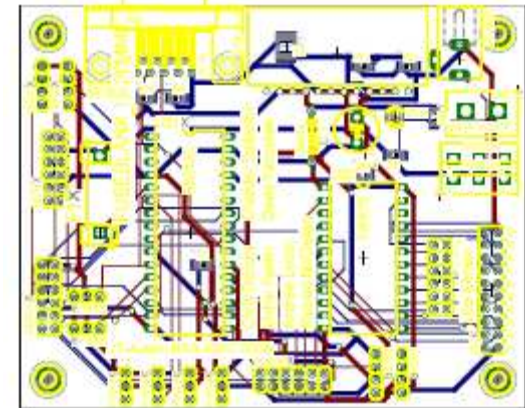
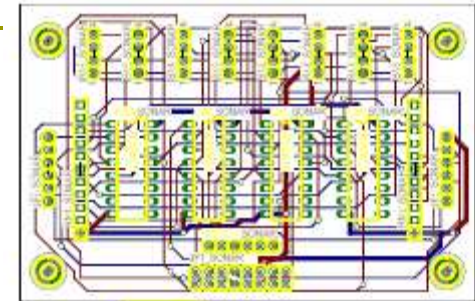
Mechanical Design

- ❑ Robomow Chassis
- ❑ Robomow Motors (**RASlow**)
- ❑ Stable and robust
- ❑ Hinged Payload Bay



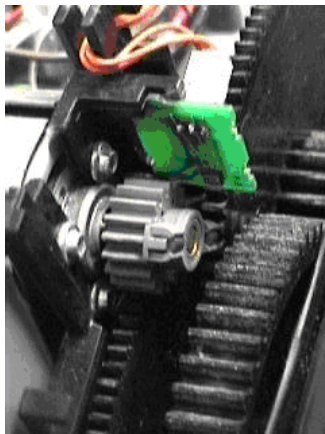
Electronics

- Power System
 - 24v Lead-Acid Battery
 - 5v Switching Regulator
 - Laptop Battery
 - Inverter
- Processors
 - Laptop – AMD Mobile Athlon XP
 - Freescale HC12 16 bit 24Mhz



Sensors

- ❑ Royaltek GPS
- ❑ Ultrasonic Rangefinders
- ❑ Optek Encoders
- ❑ Logitech Web Cam
- ❑ Mircostrain 3DMG IMU



Safety

- E-Stop
- Wireless
- Wiring

Big Red Button



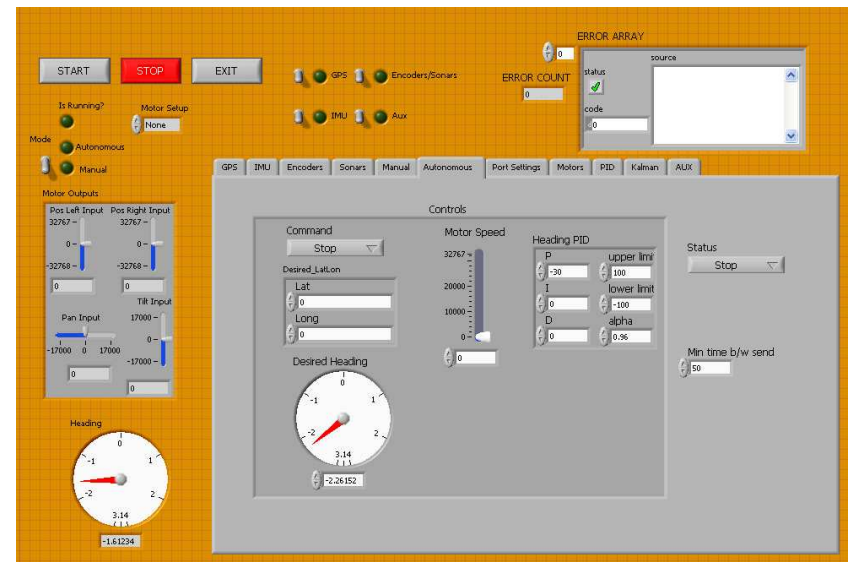
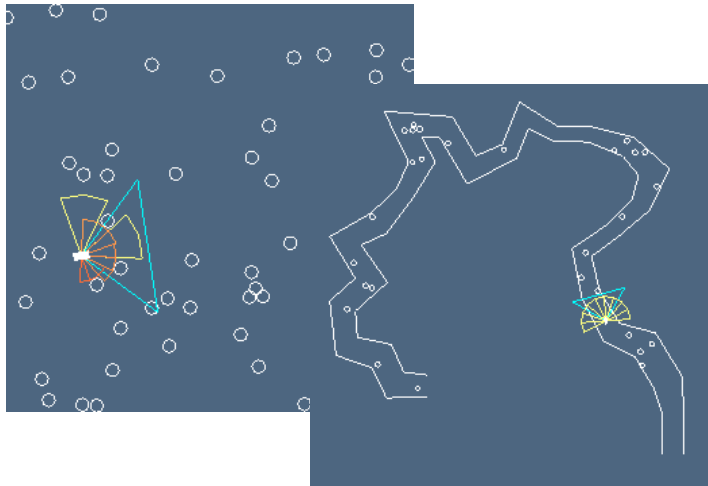
Wireless E-Stop



Wire Harness

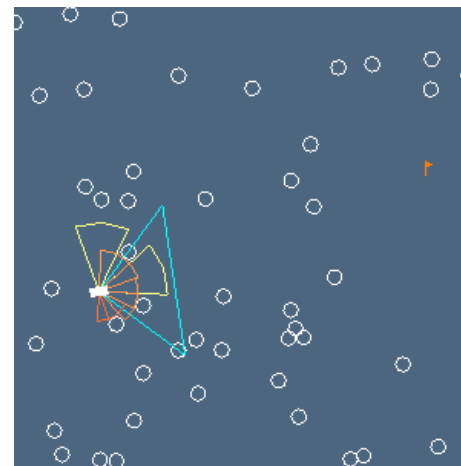
Software

- ❑ Labview front end and datapath
- ❑ C low level
- ❑ C Algorithm
- ❑ C Vision
- ❑ Python simulator



Simulator

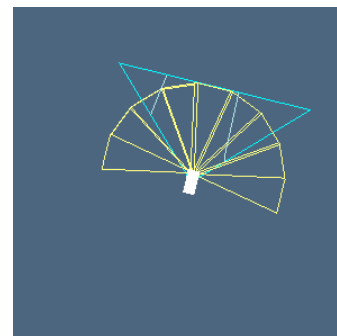
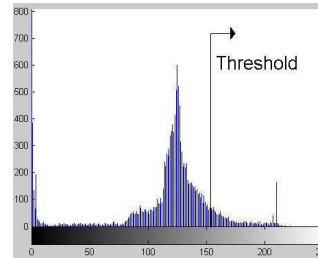
- ❑ Custom built, allows for rapid development and debugging
- ❑ Simulates sensors
 - Camera
 - GPS
 - Sonars
 - Encoders
- ❑ Connects to control algorithm over UDP





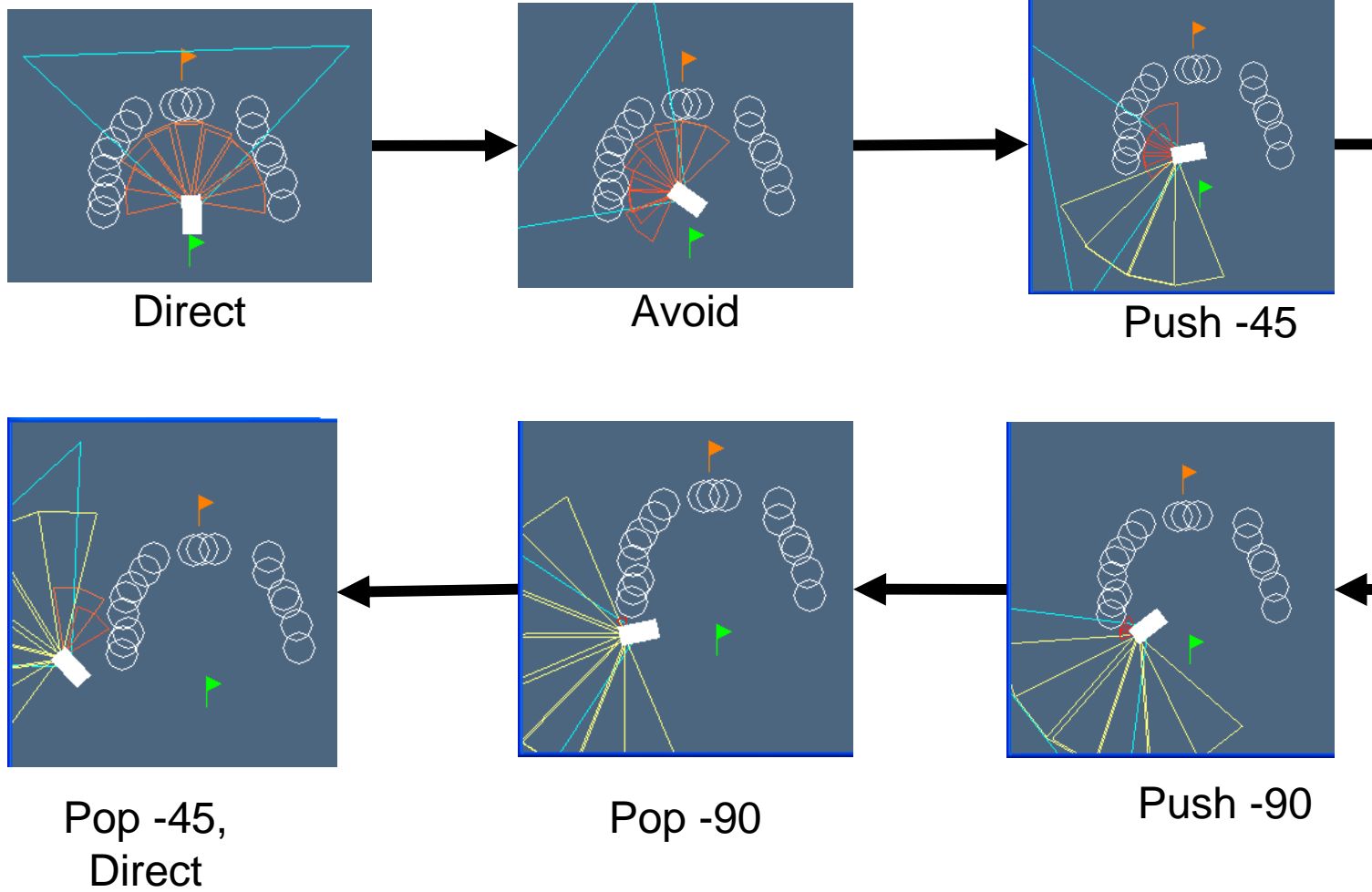
Algorithm

- ❑ OpenCV
- ❑ Acquire webcam video
- ❑ Grayscale
- ❑ Mask sky
- ❑ Threshold
- ❑ Binarize
- ❑ Perform Hough Transform
- ❑ Inverse perspective
- ❑ Debug using Labview



Algorithm

□ Heading Stack



Conclusion and Future Plans

- ❑ Expect complete Nav Challenge
- ❑ Low cost
- ❑ Vision challenge
- ❑ Better sensors
- ❑ Better motors





Questions?

Budget

Quantity	Part	Retail Price	Our Price
1	Friendly Robotics RL550 Robomow	\$1,000	\$400
1	Compaq Evo laptop	\$1,299	\$0
1	Motorola 68HC9S12 Microcontroller	\$50	\$0
1	Microstrain 3DM-G IMU	\$1,495	\$0
1	Logitech Webcam	\$40	\$25
1	Ublox GPS Unit	\$110	\$0
8	Ultrasonic SR04 Rangefinder	\$200	\$0
2	Optek OU090 Hall-effect Sensor	\$3	\$3
2	IFI Victor 884 Speed Controller	\$230	\$0
1	Custom PCB for Sonar and Microcontroller	\$66	\$66
Total		\$4,493	\$494