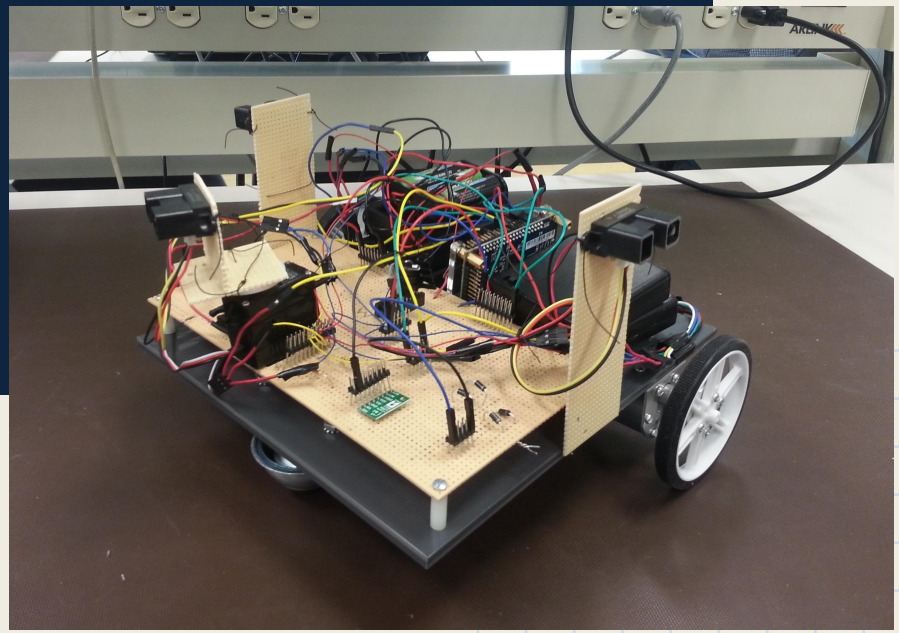
G14 Three-Wheel Rover

Obstacle Avoiding Robot

Mikael Rouhiainen
Peter Hu



Why we decided on a robot?

- Building a robot requires a general knowledge of software, electrical/hardware, and mechanics; good challenge
- We both have a great interest in robotics
- Builds on experience that could be beneficial in a digital world

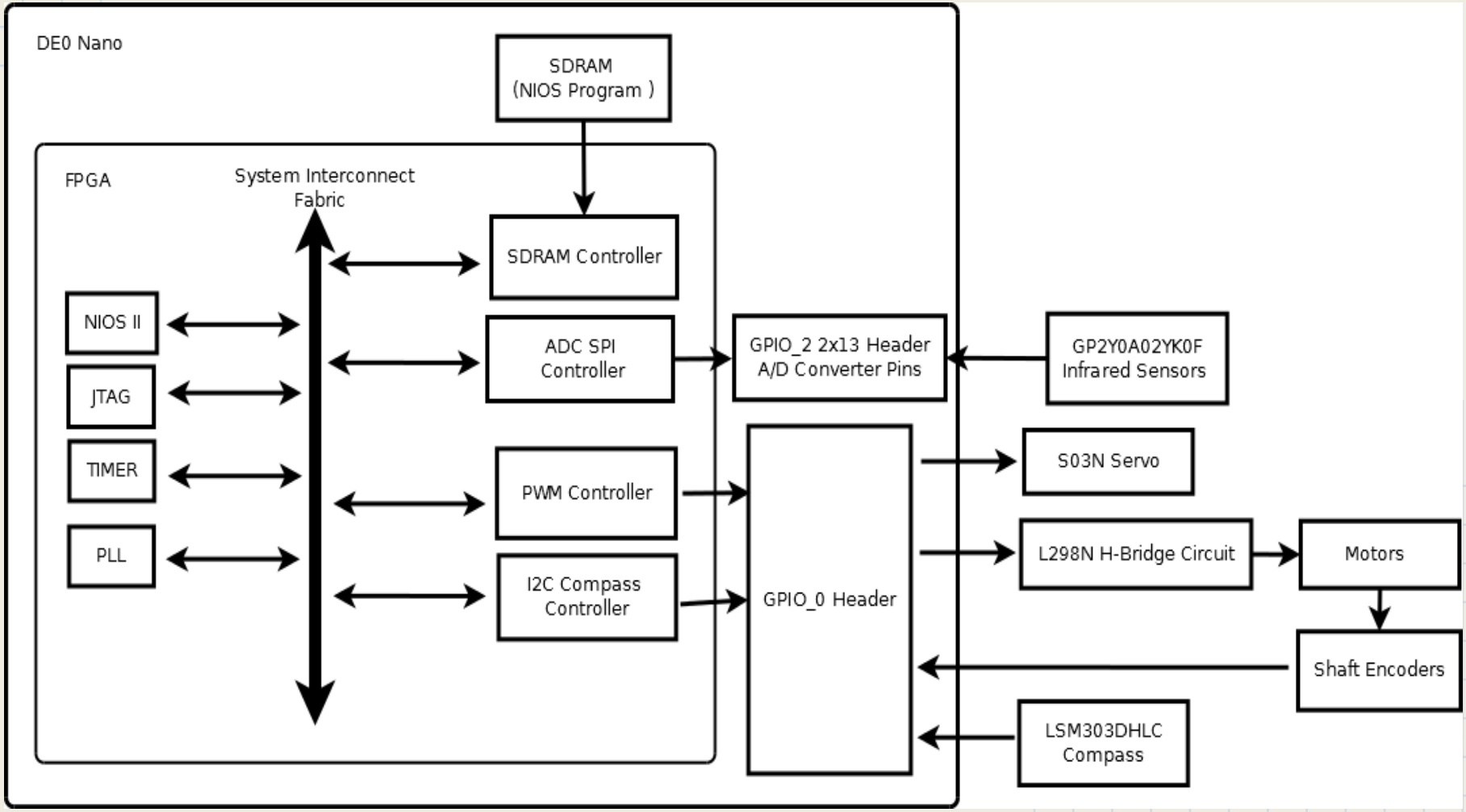
Functionality

- Three IR sensors to aid in navigation
- Servo attached to front sensor to increase efficiency
- Digital compass for rover direction awareness
- Two independent 12V motors to perform forward, reverse, and turning motions
- Two encoders attached to motors to calculate rover wheel's rpm, aiding in navigation

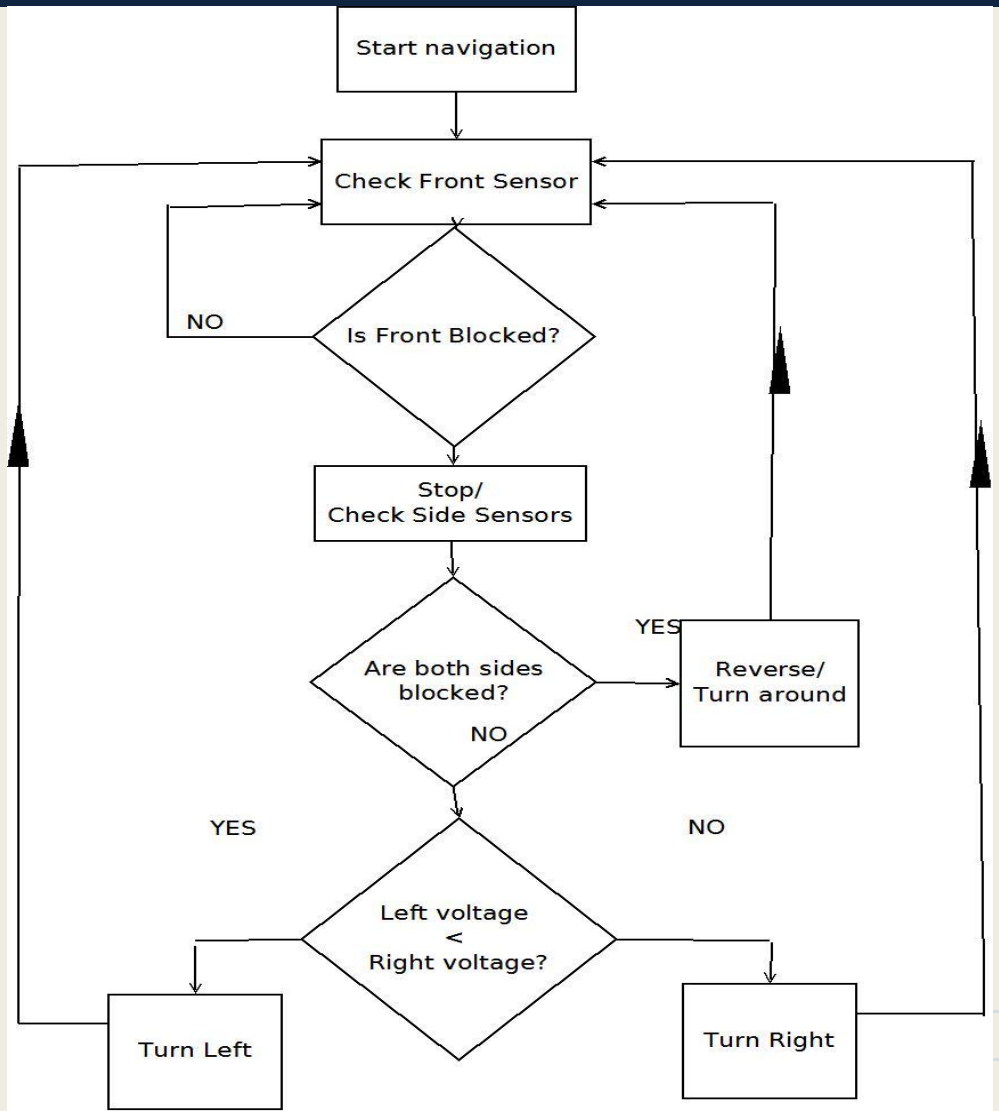
Overall Goal

Complete the obstacle course without making contact with any boxes

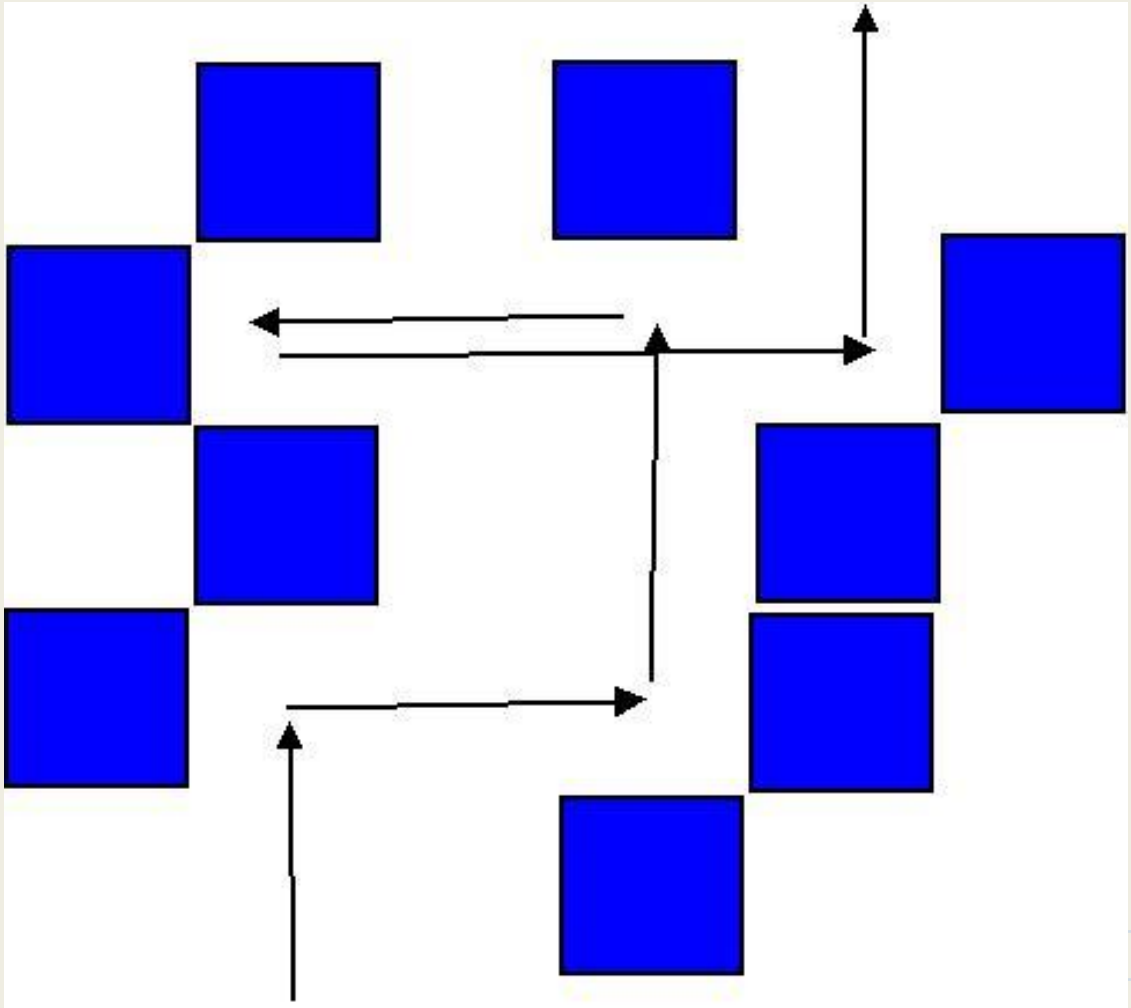
Hardware Block diagram



Navigation logic



Obstacle Course

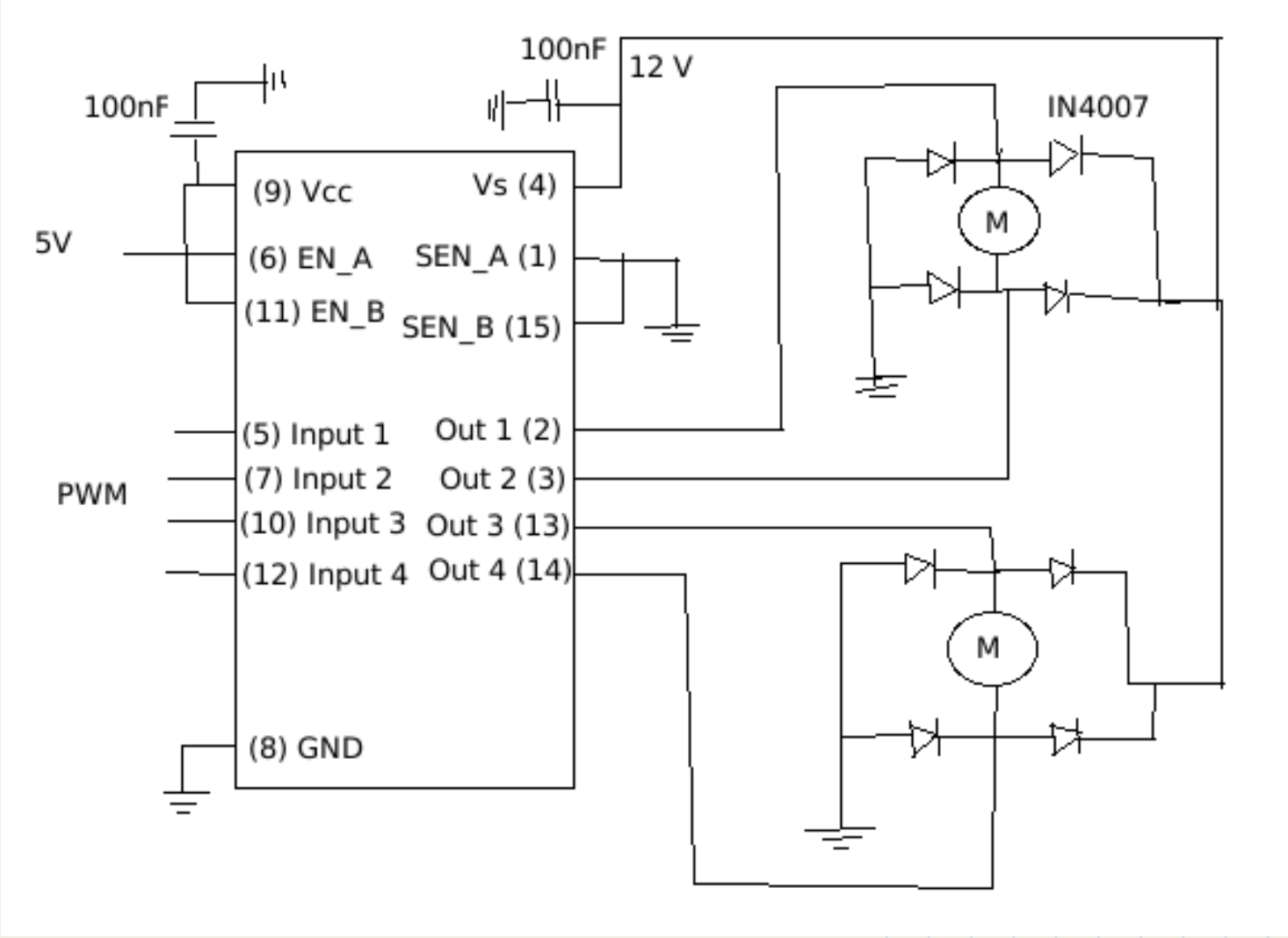


Motor Requirements

Estimated mass: m = (1.5 kg)/2 motors
Desired acceleration: a = 0.5 m/s^2
Wheel radius = 0.04m

T =0.044 Nm = **6.67 oz-in Rated Torque**
"Stall torque" should be > 2*Rated to prevent overheating and stalling on startup
Our motor has stall torque @12V: 250 oz-in, 80rpm
@6V: 125 oz-in, 40rpm

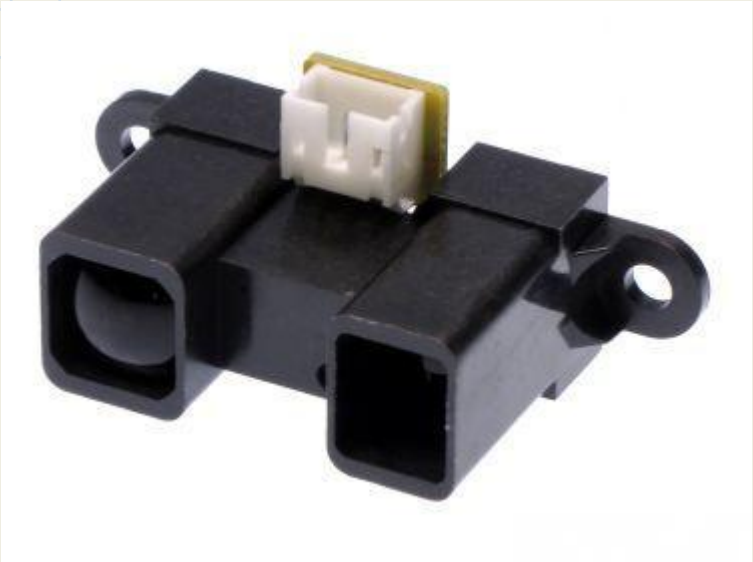
Motor Control Schematic



PWM signal logic table

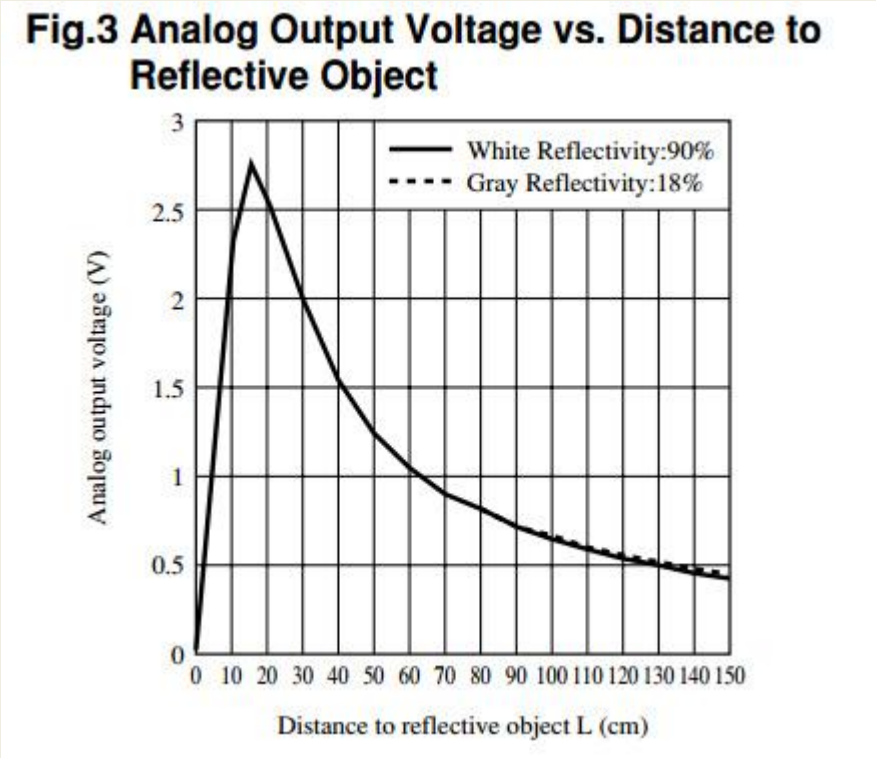
INPUT 1	INPUT 2	RESULT
1 ('High' PWM)	0 ('Low' PWM)	Clockwise Motion
0 ('Low' PWM)	1 ('High' PWM)	Counter-clockwise Motion
1 ('High' PWM)	1 ('High' PWM)	Fast Motor Stop
0 ('Low' PWM)	0 ('Low' PWM)	Coast/Free

Infrared Sensors



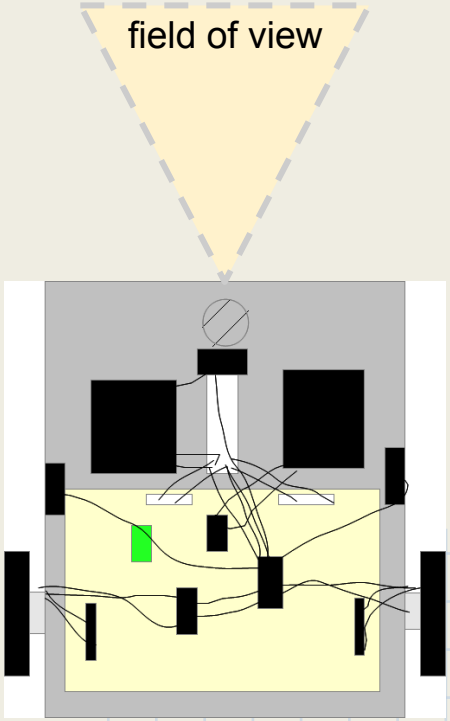
Sharp GP2Y0A02YK0F

Effective Range: 20-150cm



Servo

- Oscillating motor
- Rotates +/-30 degrees left and right
- Used in conjunction with the front IR sensor to create a wider "field of view"
- Covers blind spots in front detection

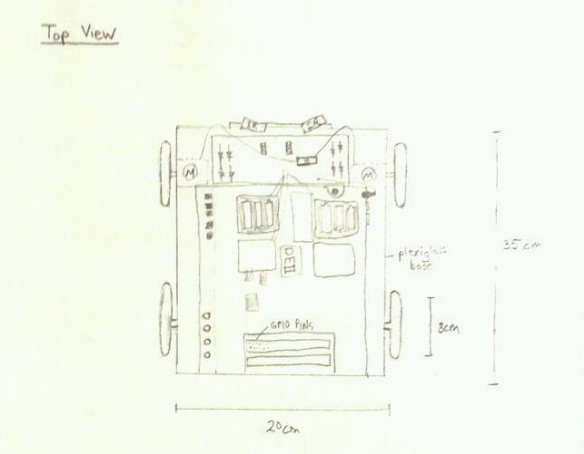


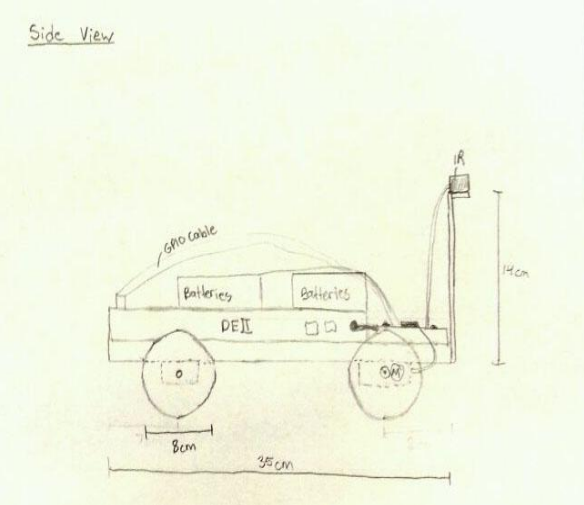
Power Supply

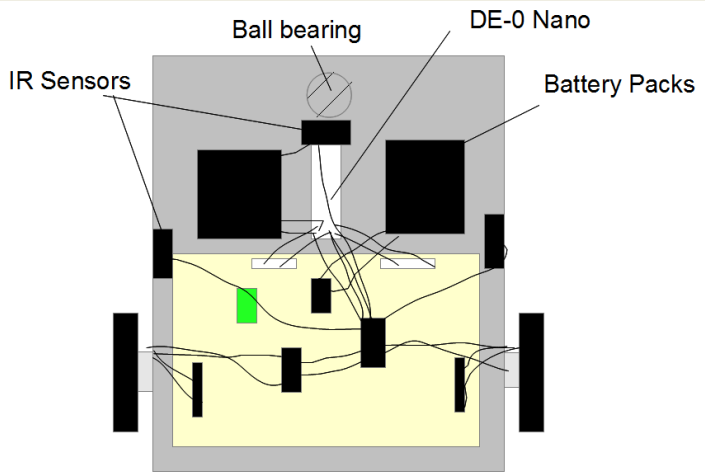
19 AA batteries are used for the power supply

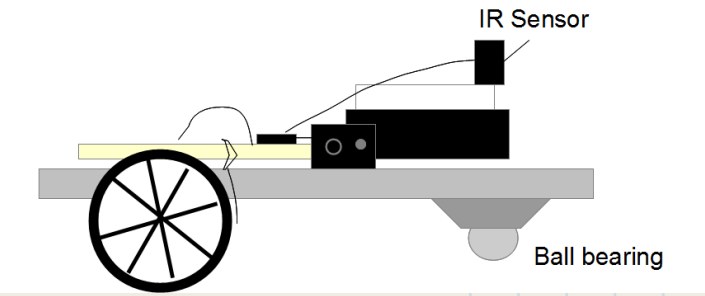
- each battery supplies ~1.2-1.4V
- 11 used for motors (13.2 - 15.4V)
- 4 used for sensors, motor logic, encoders and the servo
- 4 used to power the DE0-Nano

Diagrams

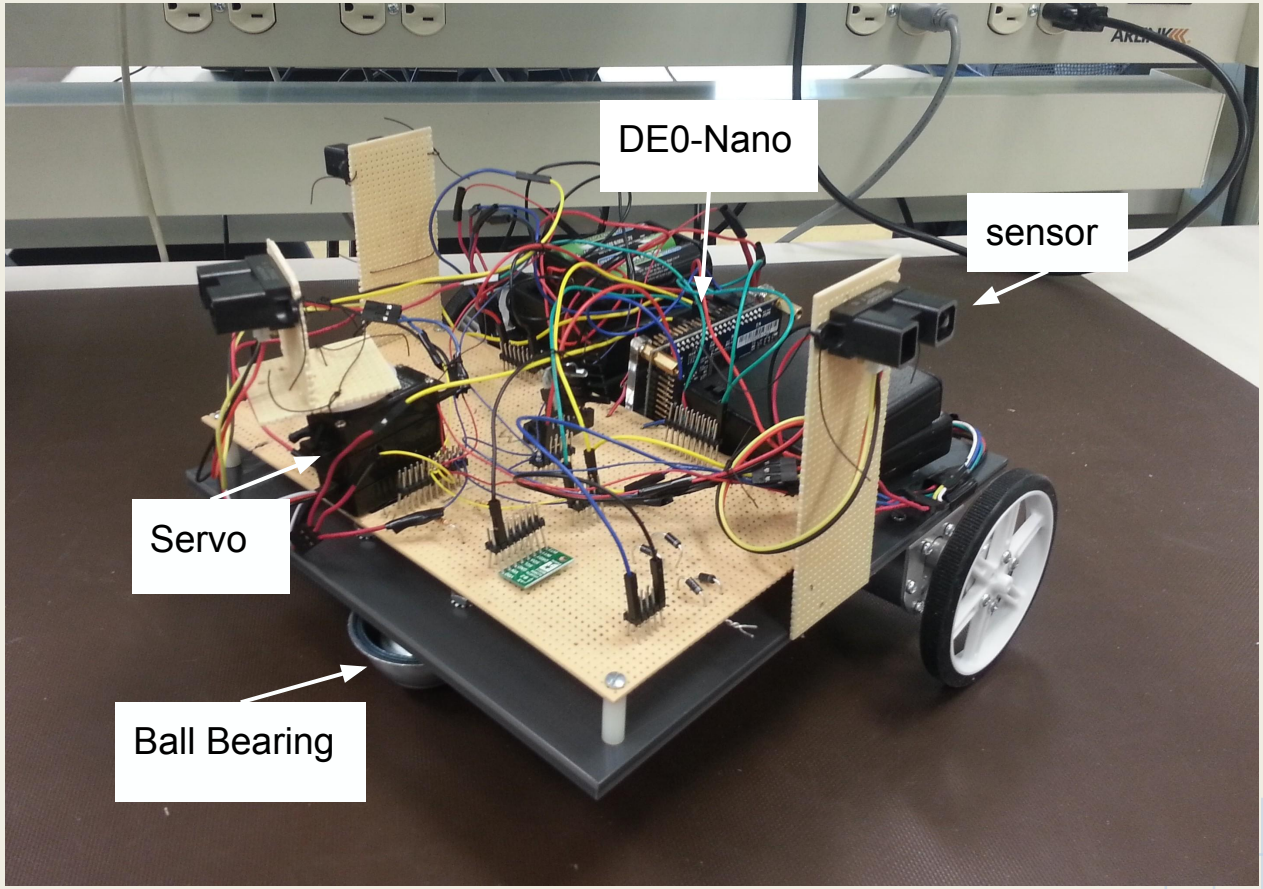

Top View
35cm
8cm
20cm


Side View
IR
GPIO cable
Batteries
Batteries
DEII
14cm
8cm
35cm


Ball bearing
DE-0 Nano
IR Sensors
Battery Packs


IR Sensor
Ball bearing

Final Design



Steps to completion &Testing

- Tested each module separately
- Sensor functionality
- Tested Motors/L298N
- PWM signals for motors
- Encoder testing
- Integration testing (sensors stopping motors, check encoders for turning)
- Servo calibration
- System testing

Design Challenges

- Power Supply
- H-Bridge voltage drop
- Calibration

Questions?