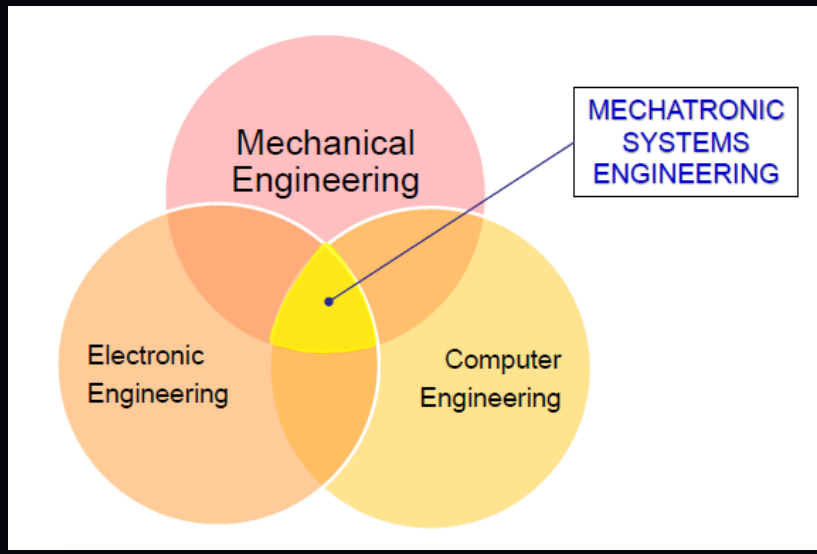
Team 11 - Mo

David Vasko
Jonathan Hsu
Chareena Sarabian
Tri Phan
Stephen Sundin

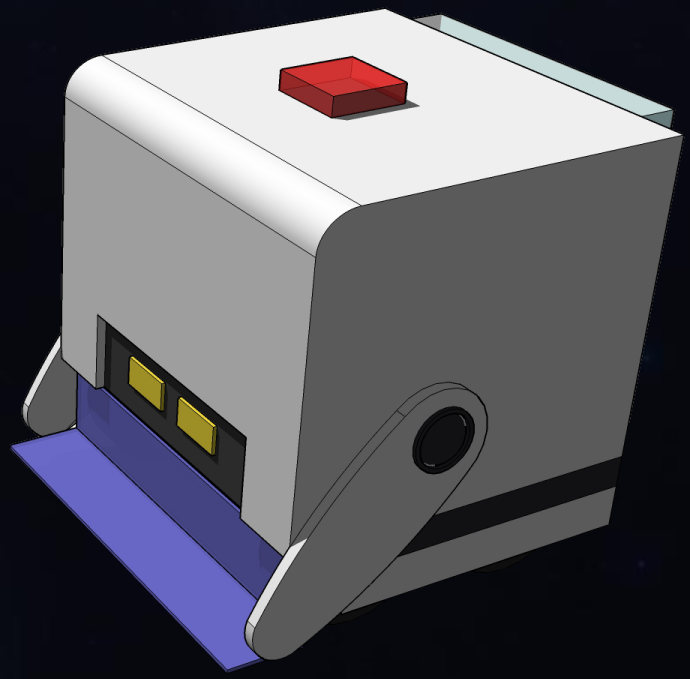
Themes

- Simplicity
- Integrating Other Fields
  - Hard to be just a mechanical engineer, need to be cognizant of other disciplines
- Reliability
- Design Iteration
- Team Trust



Outline

- Motivation
  - Problem Statement
  - Design Requirements
- Design Concepts and Design Selection
- Important Design Choices
  - Push Tab and Rack and Pinion
- Finalized CAD
- Fabrication
- CAD vs Product
- Programming Basics
- Problems and Solutions
- Conclusion



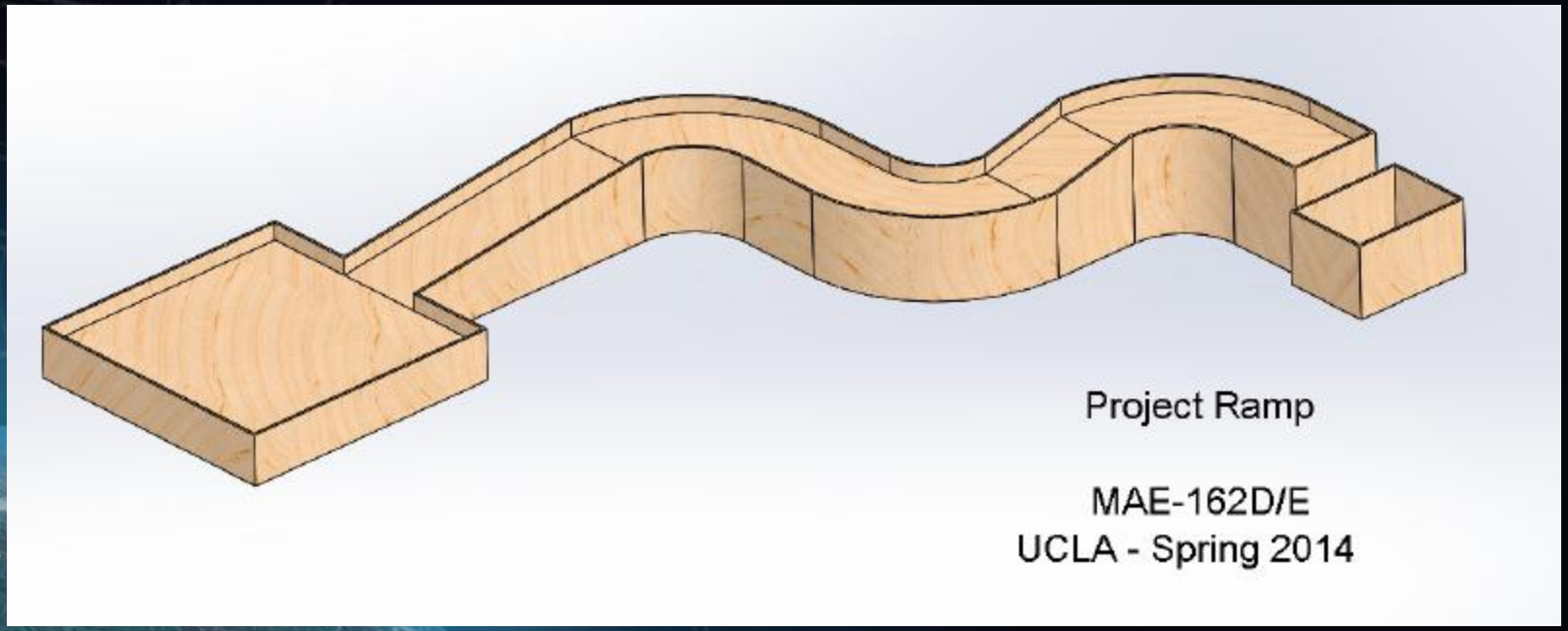
Motivation

- Autonomous Systems are of growing importance
- Incorporating other disciplines is essential for a successful mechanical engineer

Problem Statement

" A device is needed that can collect, transfer and deliver a billiard ball to a collection bin"

- Objective is to deliver the largest number of billiard balls in the allotted time



Design Requirements

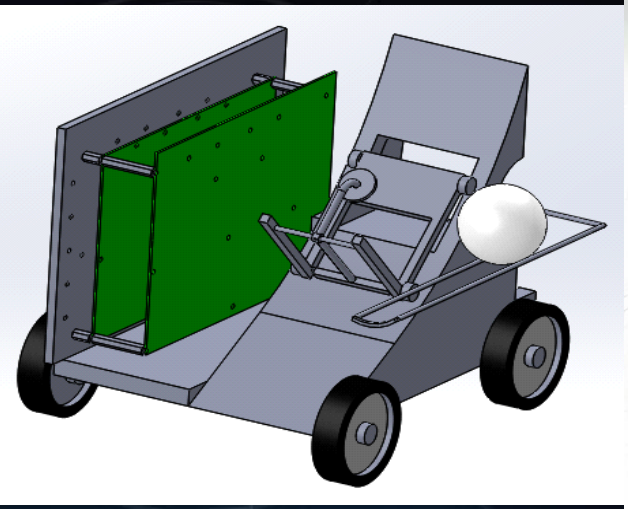
High Level

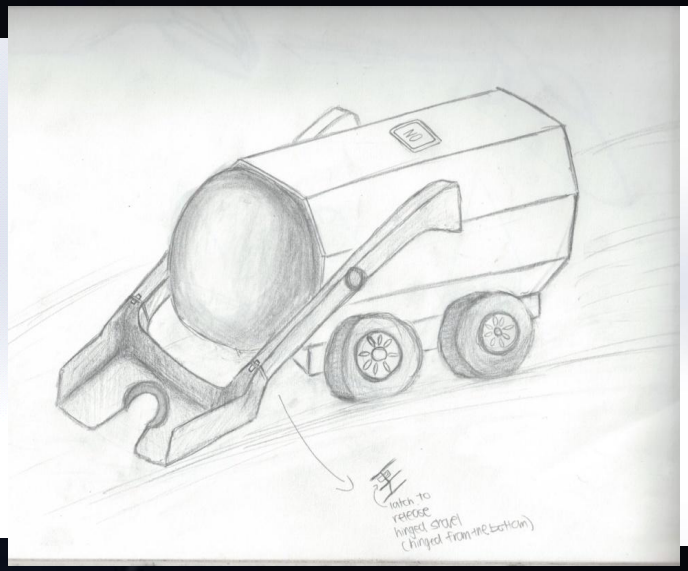
- Safety
- Cost
- Size
- Power

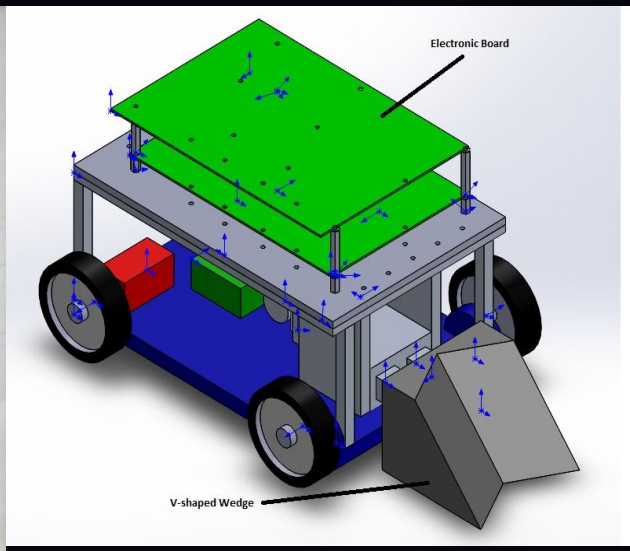
Low Level

- Four Wheels
- FWD
- Accessible Rio Board
- Space for Wiring
- 3 total motors
- 5 total sensors

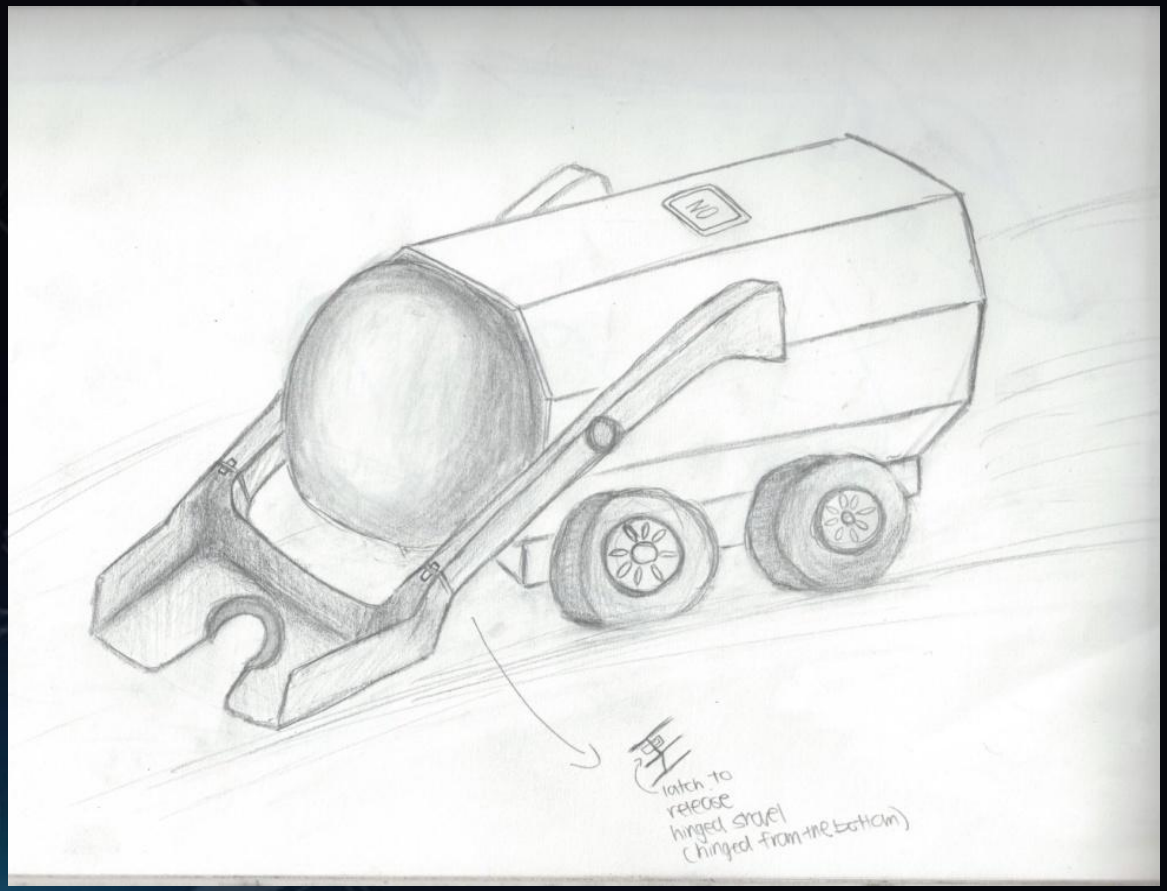
Design Concepts





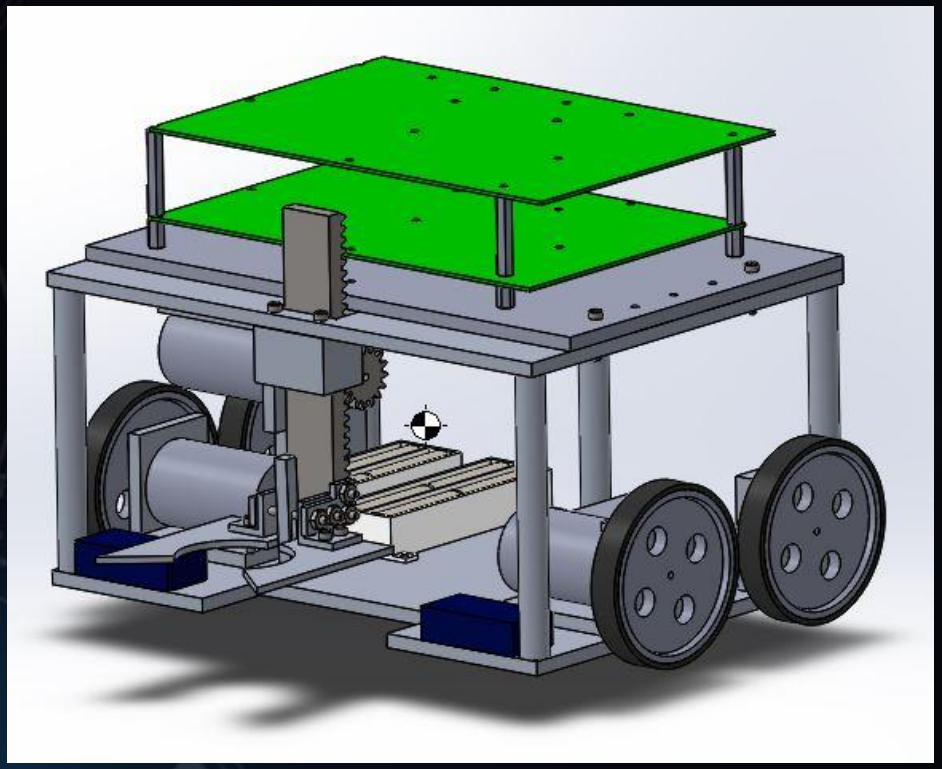


Chosen Design



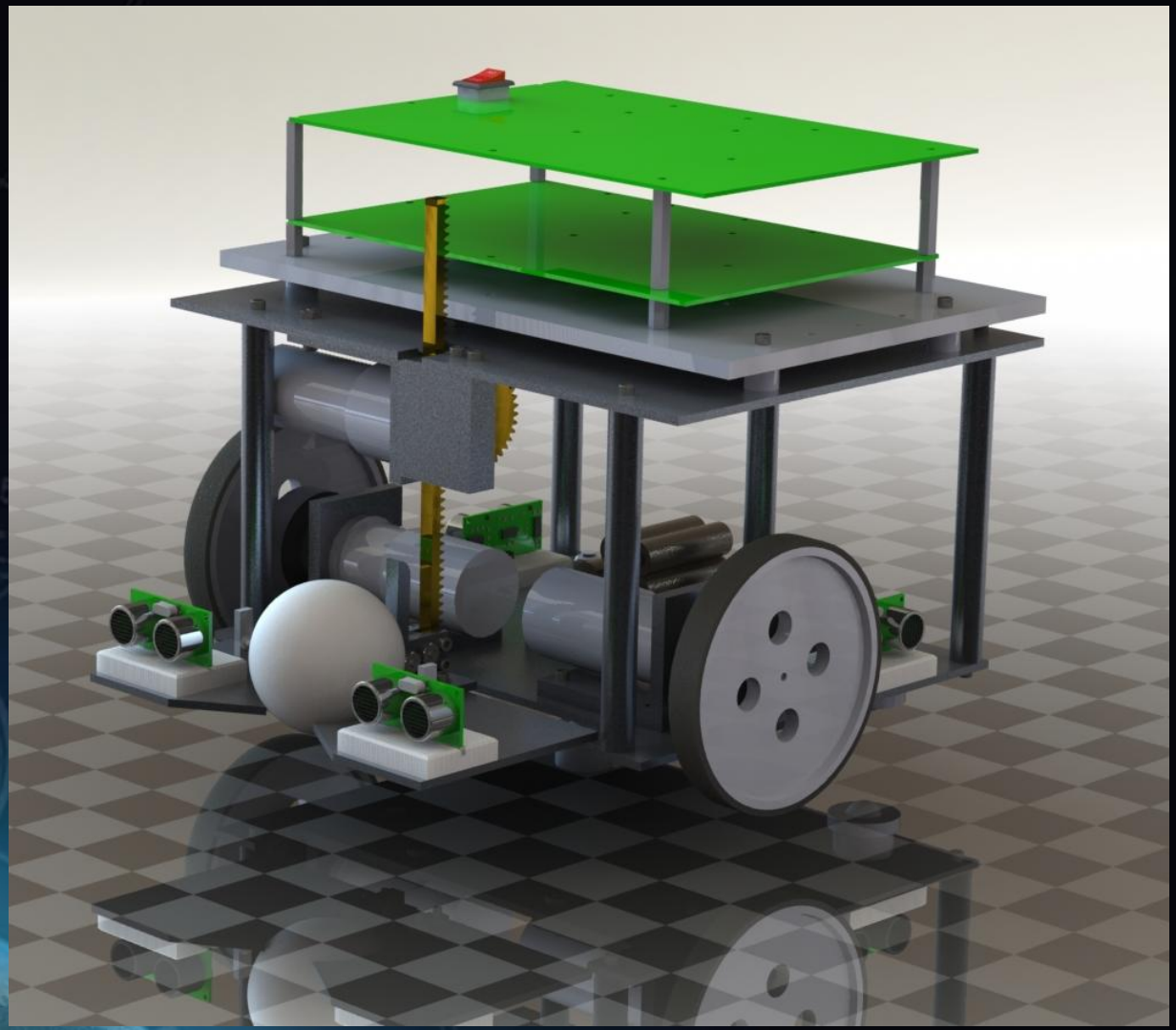
- First Concept
- Simple scoop design

Intermediate Design



- Optimized for simplicity and to use the environment
- Scoop modified to use a rack-and-pinion

Finalized CAD



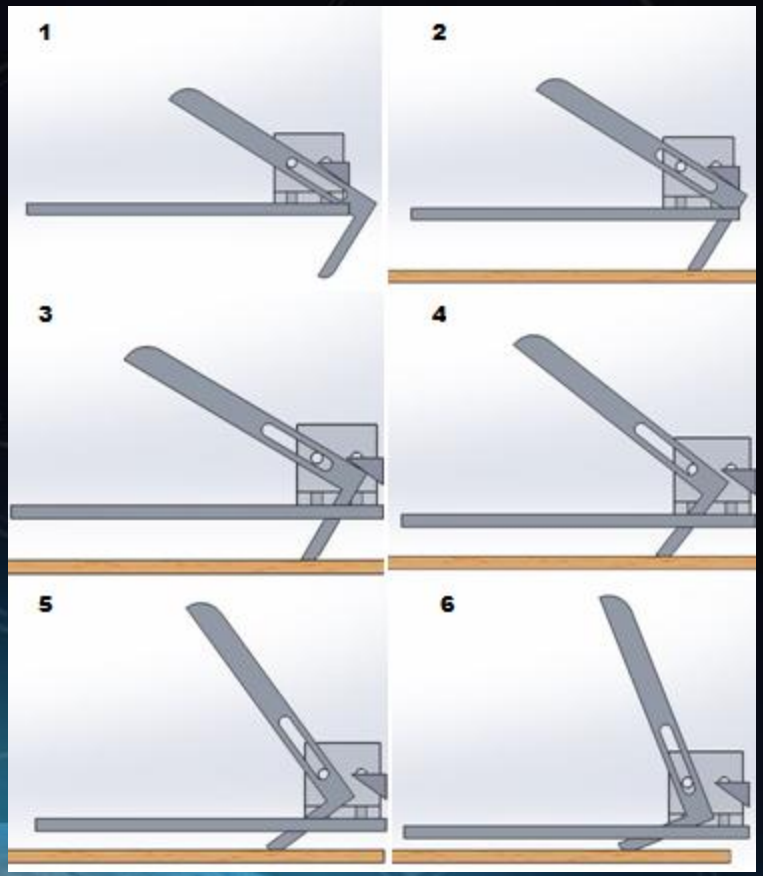
Important Design Choices

- Push Tab
  - Turn delivery into a simple mechanical interaction with the wall. NO MOTORS NEEDED

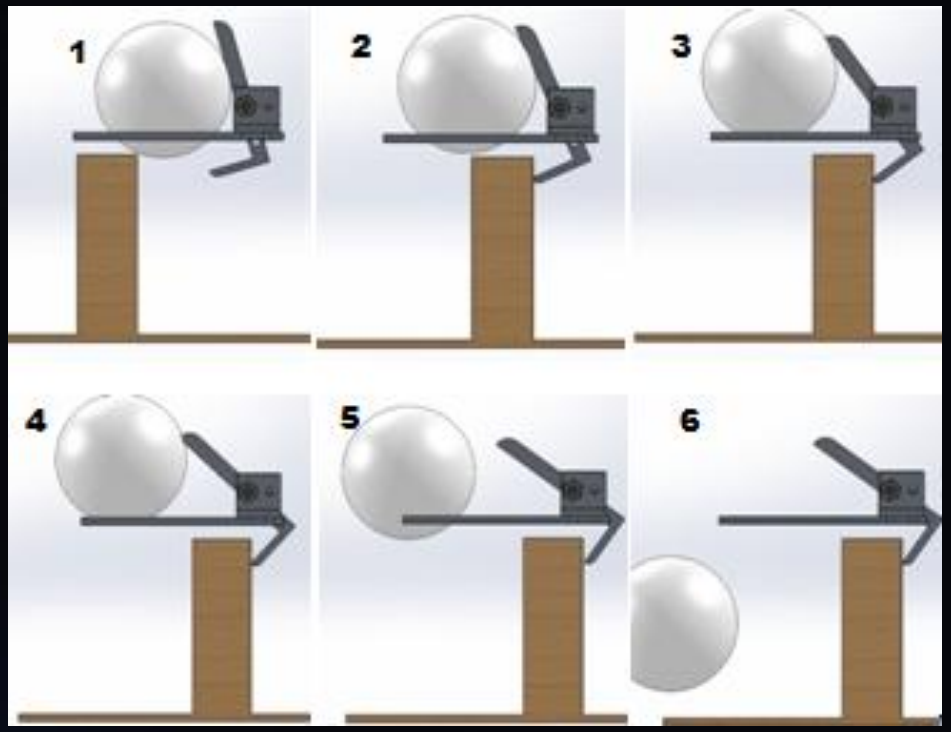
- Rack and Pinion
  - Motor can be perpendicular to motion of Rack
  - Loads are low so do not have to worry about high torque on lever arm

Push Tab Design

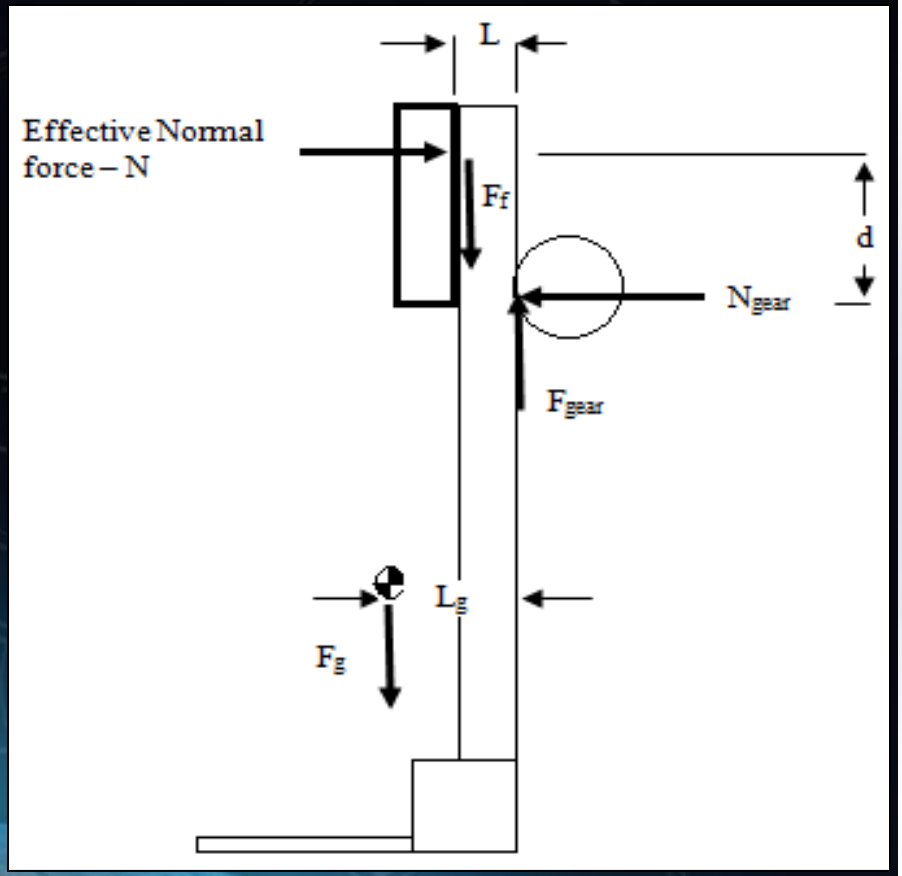
Ground Interaction

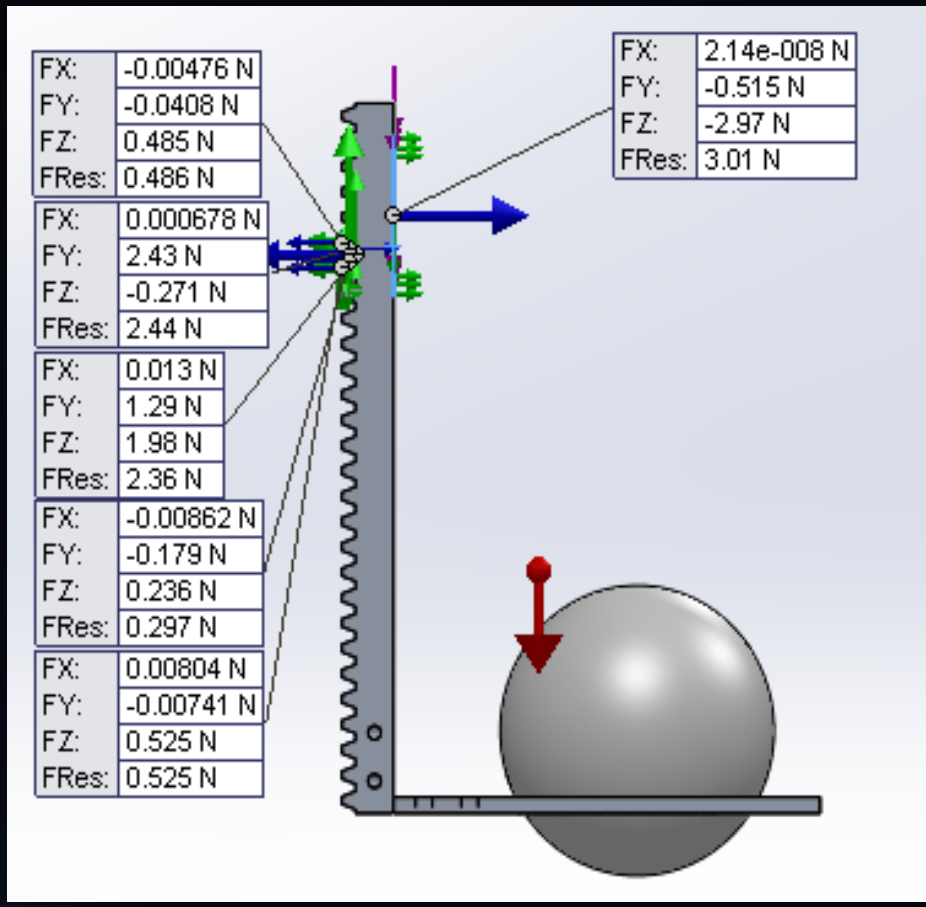


Wall Powered Delivery

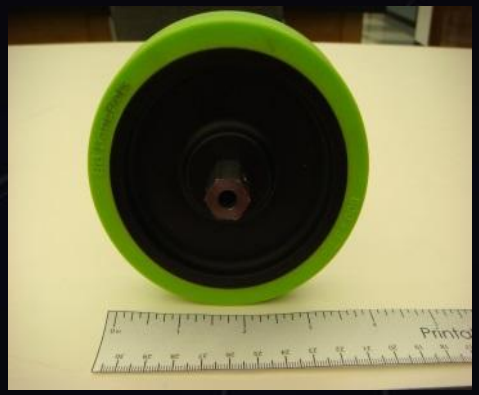


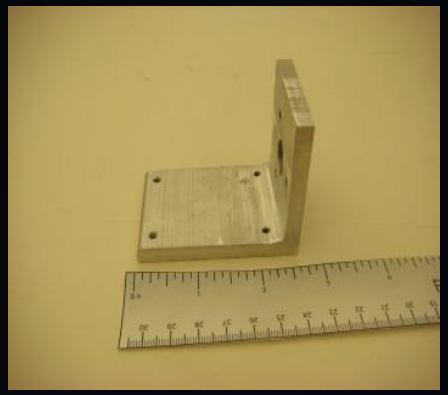
Rack and Pinion

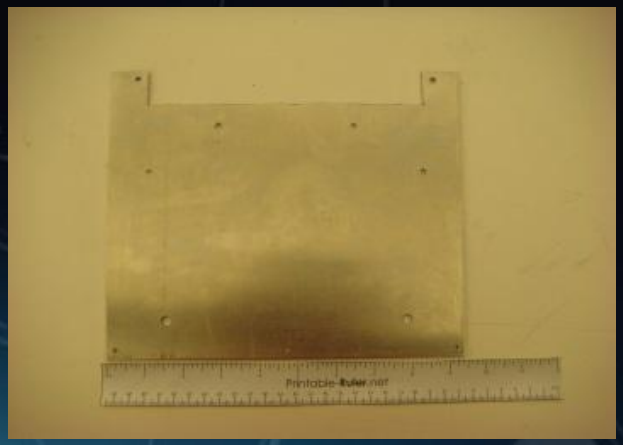


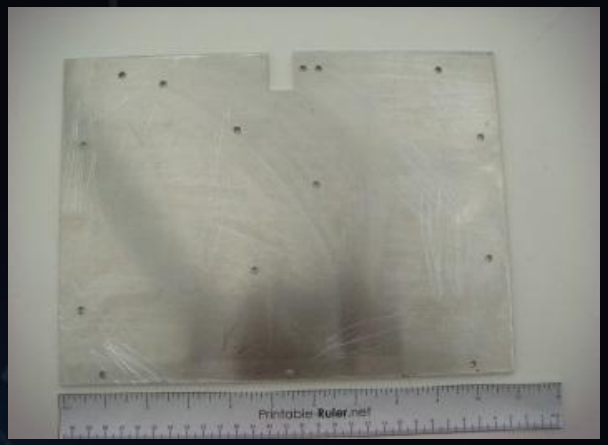


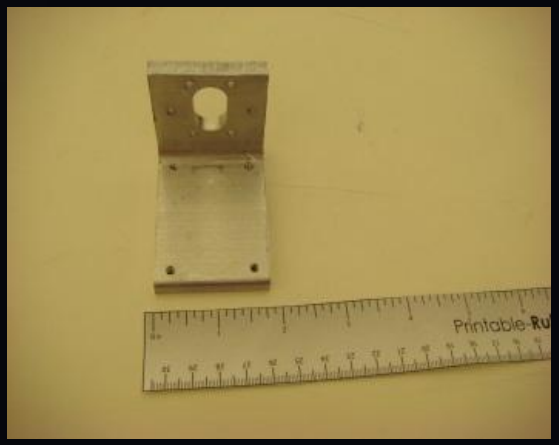
Fabrication

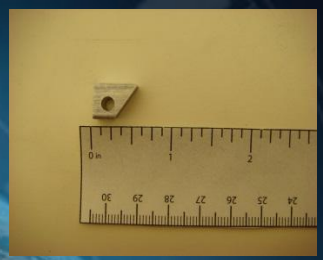
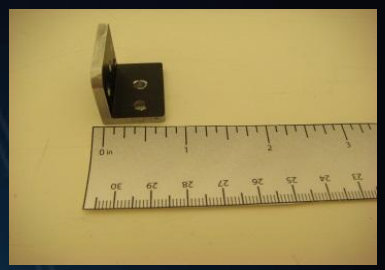


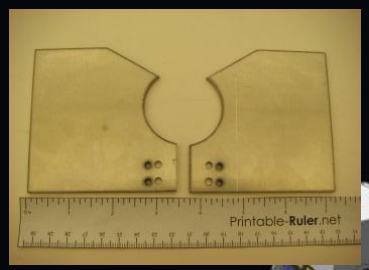


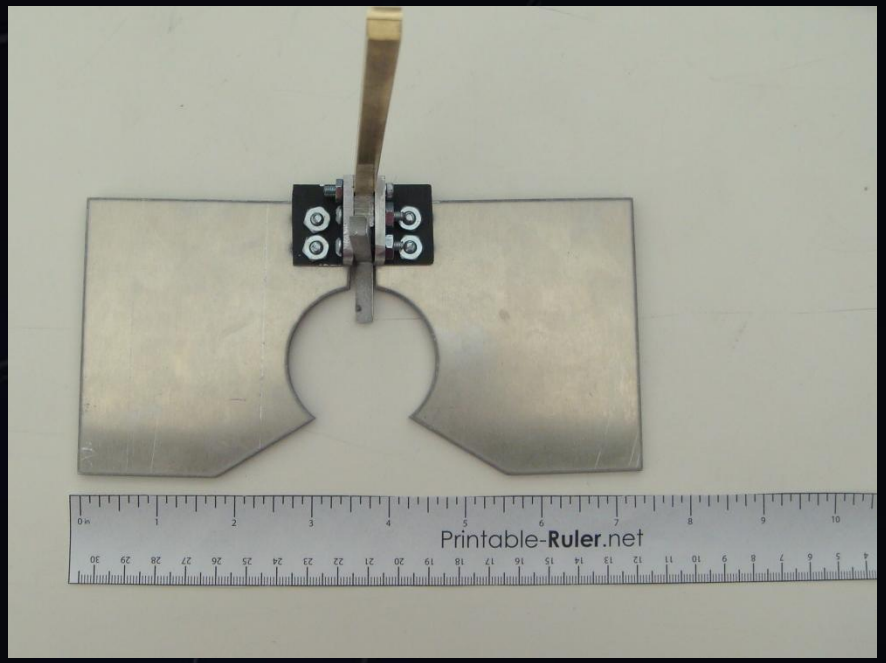







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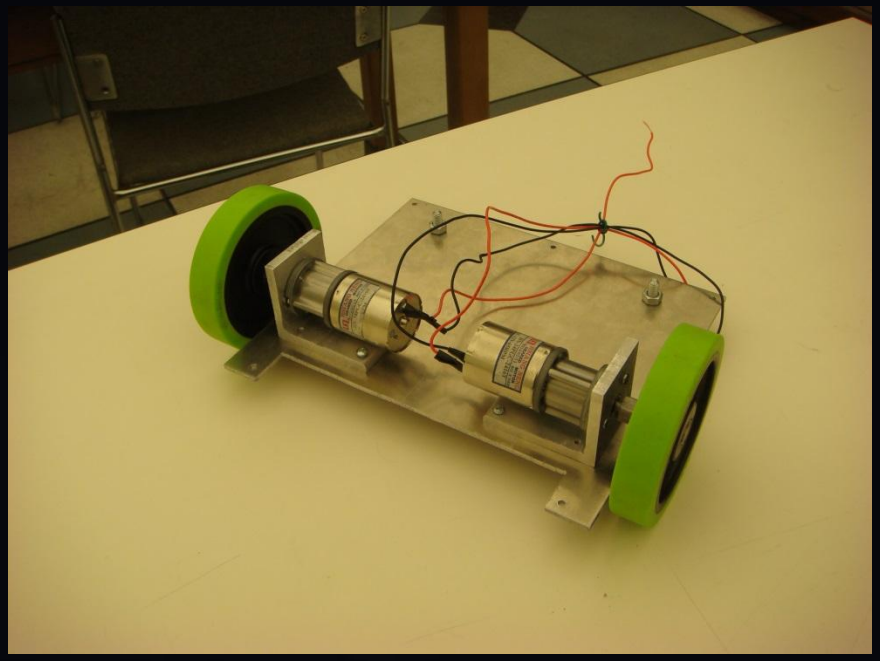
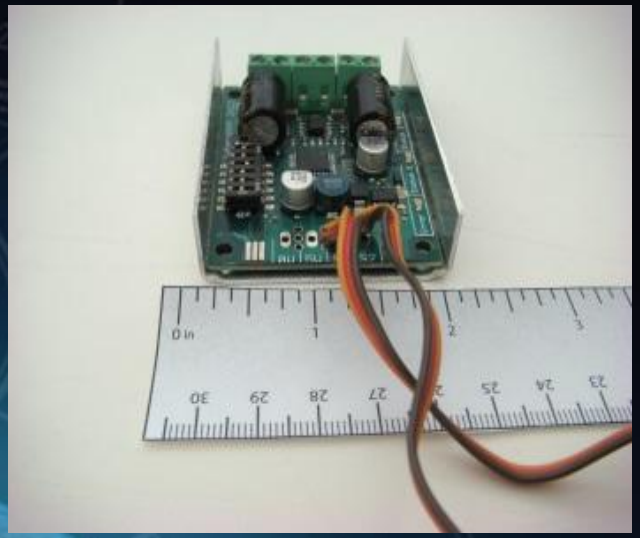
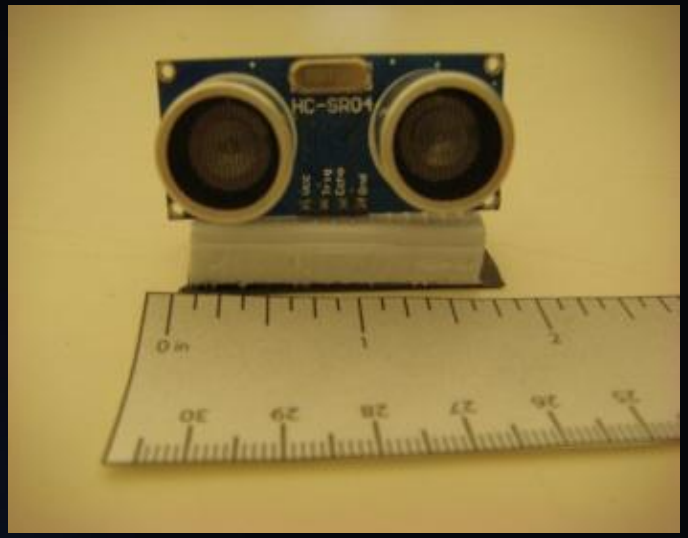
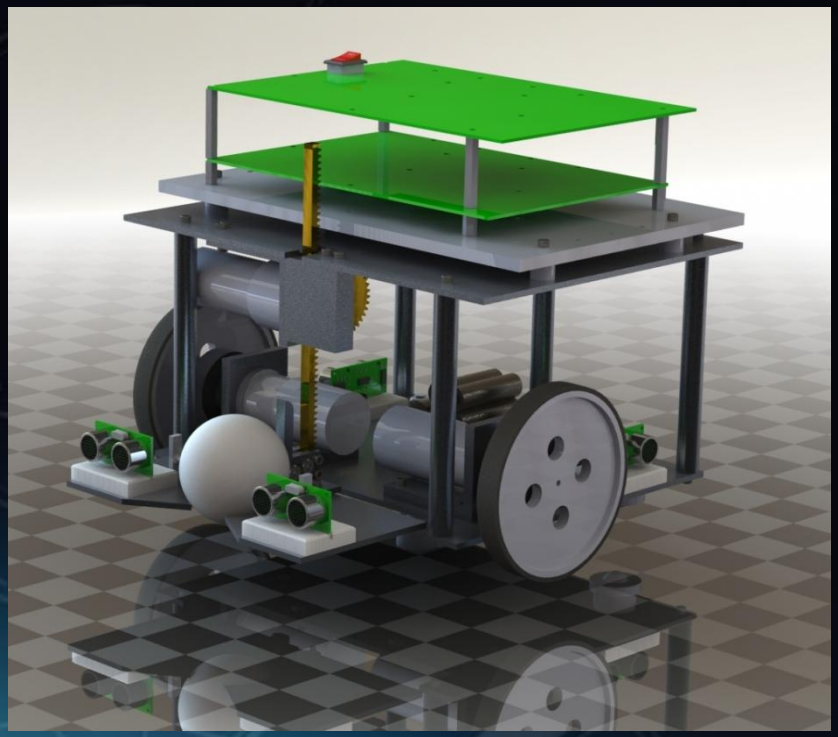
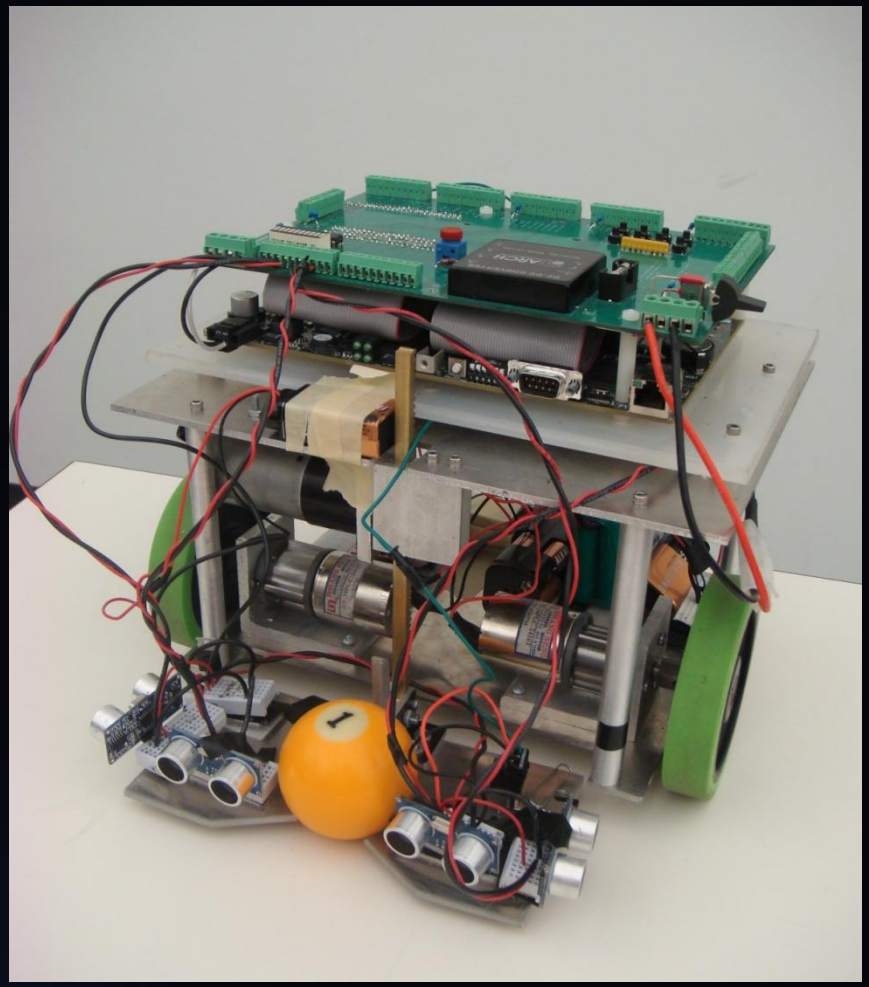





HC-SR04

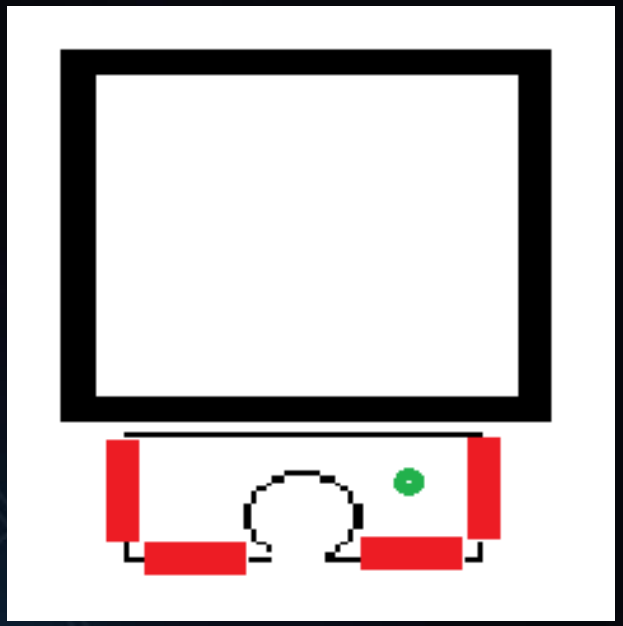
CAD vs. Fabricated Part





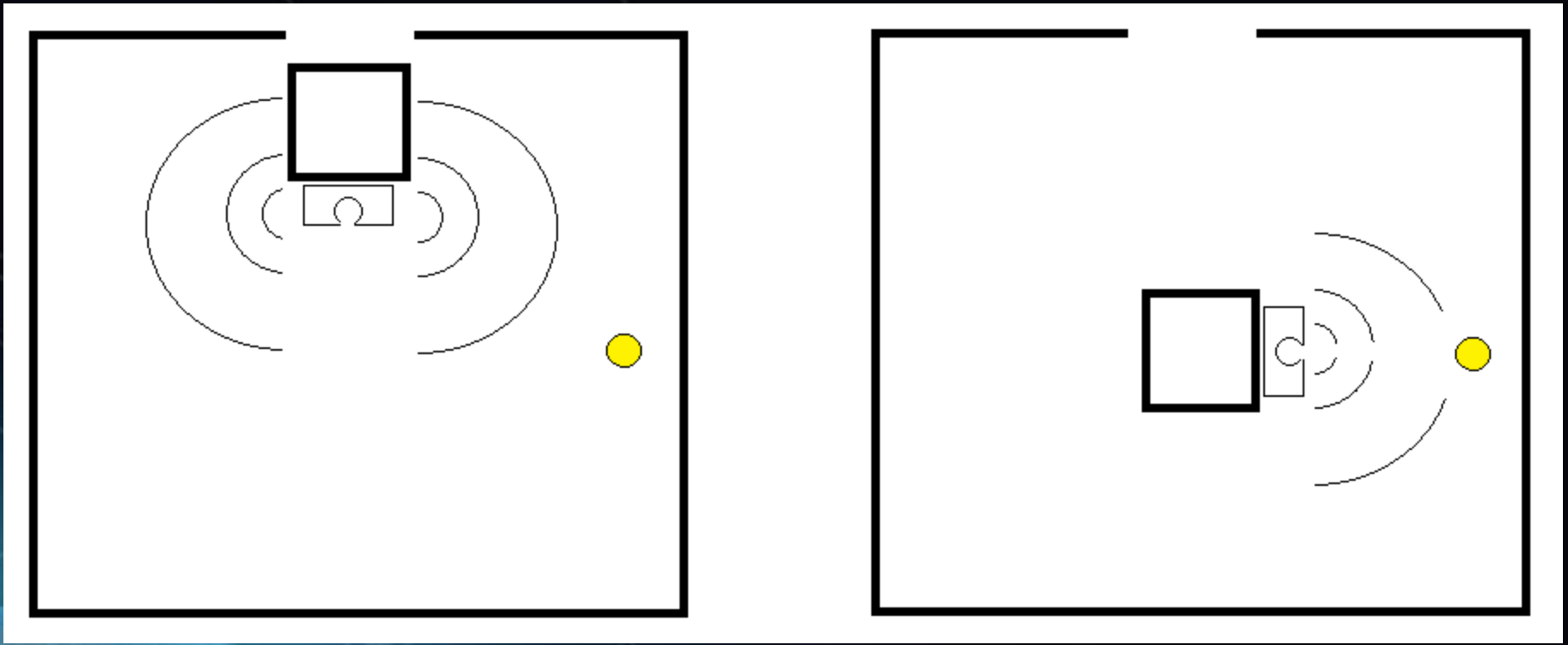
Programming Basics

- Sensor Placement
  - Initial vs. Final



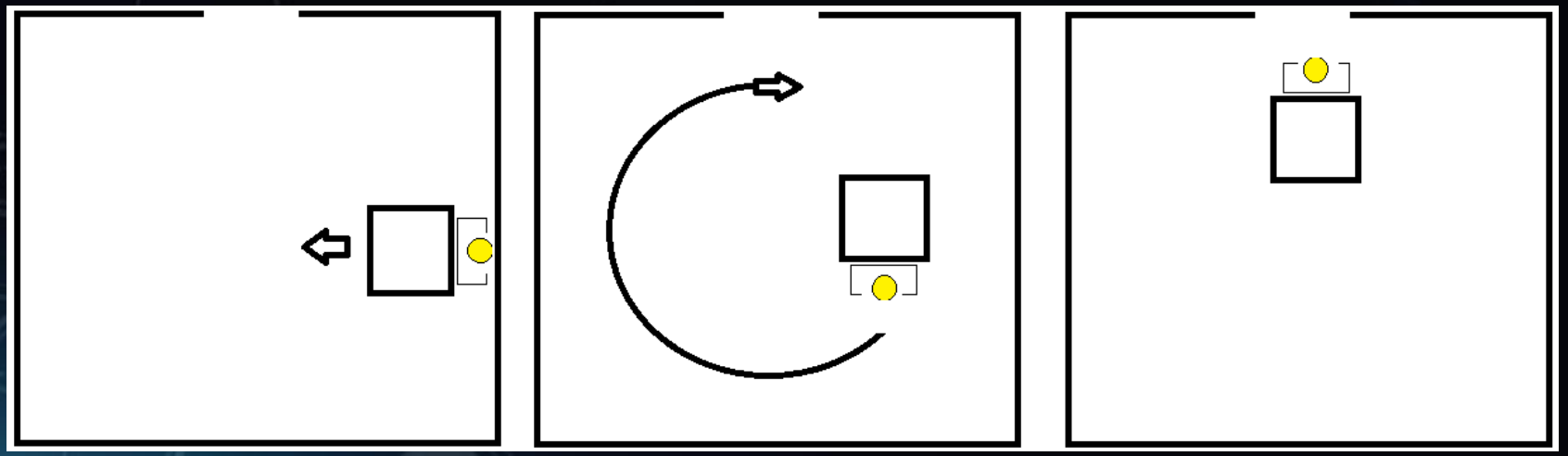
Programming Basics

- Locate the ball



Programming Basics

- Find the Ramp
- Lift height



Problems and Solutions

PROBLEM: Wall Tracking with Sensors behind the Steering Wheels
SOLUTION: Move the Sensors in front of steering wheels

PROBLEM: Making rack motor stop in desired positions
SOLUTION: Physical limiter and timed loops

PROBLEM: Do not have encoders how to make robot make predefined turns
SOLUTION: Timed loops

PROBLEM: Too front heavy, tipped when going down the ramp
SOLUTION: Slow robot and shift weight to the back

Conclusions

- Foreseeing problems BEFORE they happen is what makes a truly good engineer
- Integrating and understanding other disciplines
- Trust

Thank you for your time!

David Vasko – david@vaskos.com

Tri Phan – triphan92@ucla.edu

Chareena Sarabian – charhye@comcast.net

Johnathan Hsu – jonhsuucla@gmail.com

Stephen Sundin – ssundin@ucla.edu

Any Questions?