

# Introduction to robocup

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[Rfcbots.com](http://Rfcbots.com)



# The plan

- Robocup Overview
- Mechanical
- Electrical
- Computer Science
- Last notes
- Pizza and questions!



# Gameplay – Small Size League

- Five robots/team
- 18cm diameter, 15cm height
- Play soccer with an orange golf ball
- Two overhead cameras connected to an off-field computer
  - Cameras send bots' info to computers
  - Teams send commands



# RFC-Cambridge

- First competed in 2005
- Harvard-MIT effort
- International competitions in Istanbul, Singapore, Germany, Austria



# What to expect

- No background experience necessary
- **Weekly** subteam meetings
- **Semesterly** all-team meetings
- **Spring Semester** North American competition???
- **Summer** international competition

# Mechanical subteam

- What we do
- How we do it
- How we're organized
- What you'll get out of it
- Why RFC-ME?
- What to expect
- 2012-2013 projects

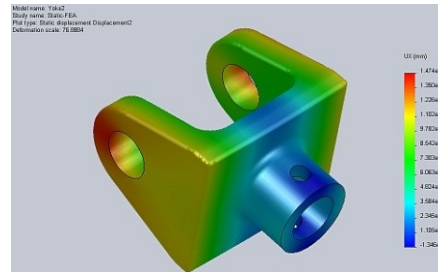


**Robocup ME**



# How we do it

- Weekly meetings
- Tools of the trade
  - ▢ CNC mills, lathes
  - ▢ Rapid prototyping
  - ▢ Solidworks CAD
  - ▢ Finite Element Analysis (FEA)
  - ▢ MATLAB, MathCAD



# How we're organized

- Constantly evolving
- Lots of experience levels
  - Freshman-graduate
- Older students mentor young'uns

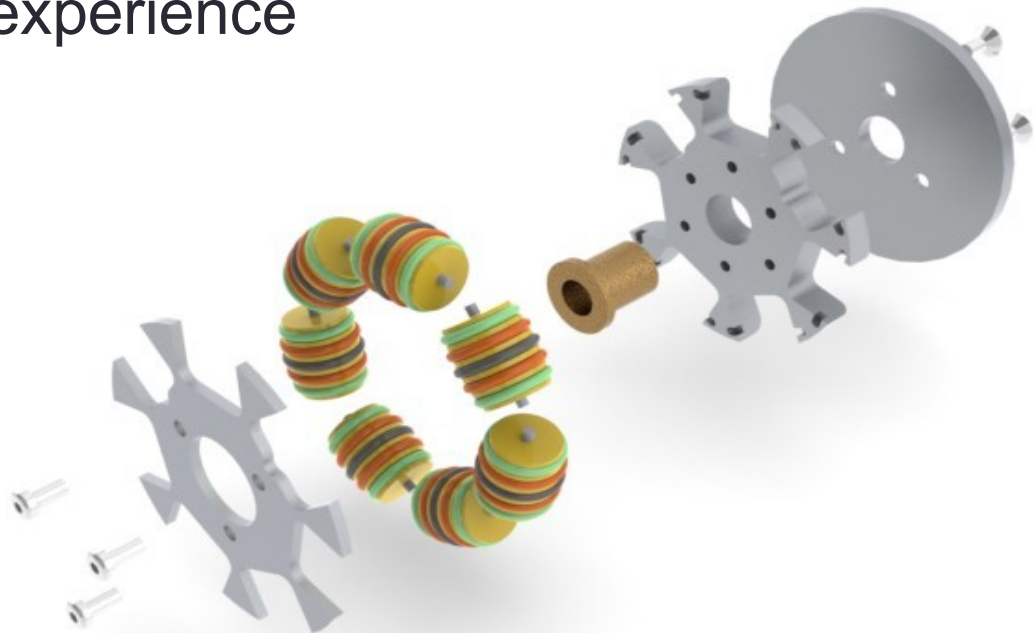


- *2011 Robot rendering*



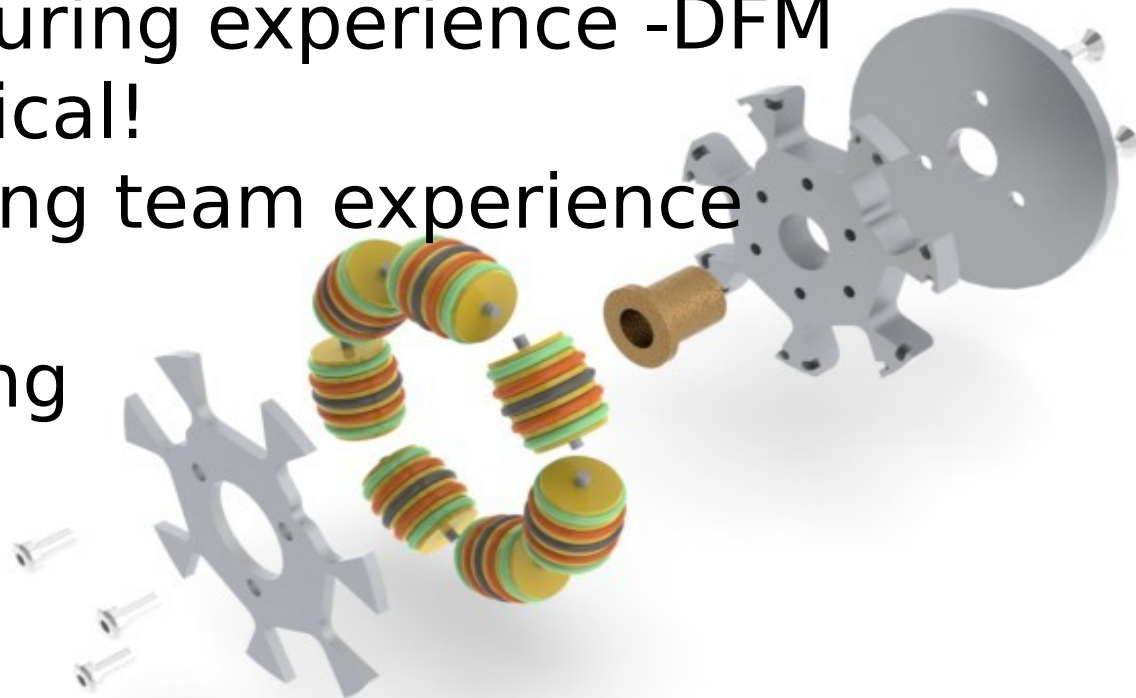
# What you'll get out of RFC-ME

- Design experience: *Mens et Manus*
  - Critical! Only way to learn it is to do it
- Manufacturing experience
  - Also critical!
- Engineering team experience
  - Subtle, but critical!
- Networking



# Why RFC ME?

- Design experience: *Mens et Manus*
  - Critical! Only way to learn it is to do it
- Manufacturing experience -DFM
  - Also critical!
- Engineering team experience
  - critical!
- Networking



# What to expect

- Fluctuating time commitment
  - Weekly meetings typically 1.5 hr
  - Spikes before important milestones
  - Feb, June
- Comfortable pacing
  - Take on as much work as you like
  - Freshman year will likely be an apprenticeship period
  - When ready, tackle design projects
- Focus on learning
  - Ok to mess up! Failures are a source of insight, learning



# 2011-2012 season ME projects

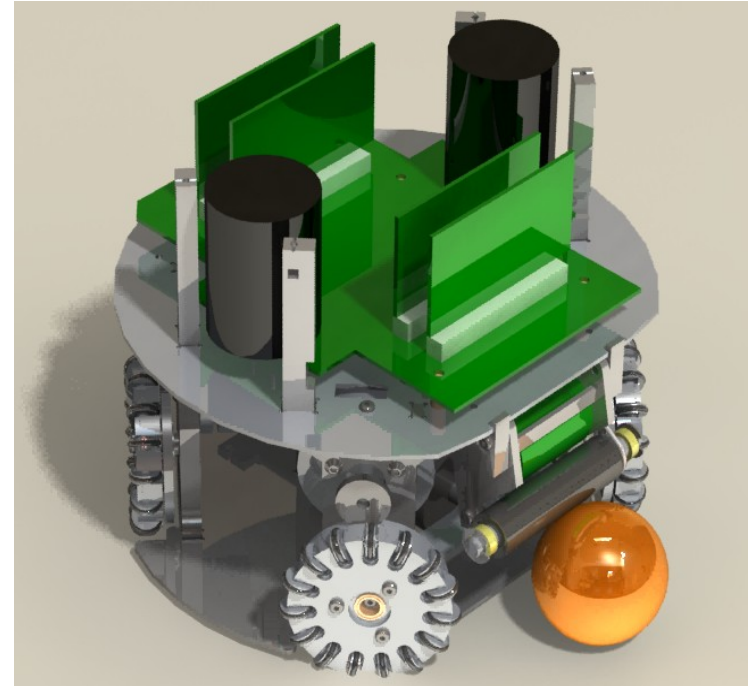
- Hit the books – hard
  - Read other teams' papers, journal articles
  - Assess state of the art
- Benchmark
  - Run experiments; where do we stand?
- Redesign -> prototype
- Maintain current gen (*Firefly* squad) for other subteams

# EE Subteam



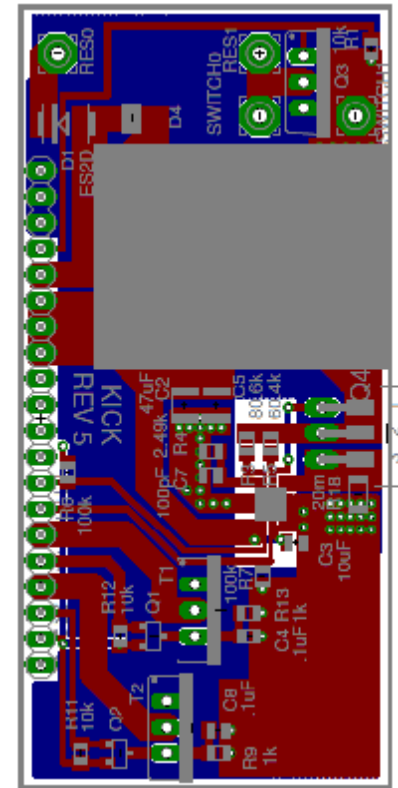
# EE in the robot

- Each robot function is controlled by a distinct circuit board – modularity
- **Driving:** motor controller boards (4)
- **Kicking:** kicker board; 450 volts!
- **Dribbling the ball:** auxiliary kicker board
- **Communication:** motherboard



# What can you learn?

- EE skills about circuits, control, communication
- Hands on lab experience
  - Soldering
  - oscilloscopes
  - etc.
- Design experience – design and implement your own circuit board





# How you can help!

- No skills needed
- Design circuit boards to validate critical components (motors, kicker, dribbler, etc.)
- Interface with MechE and CS teams to optimize robot

# Where to find us

- We meet once a week on Sunday afternoons behind the MIT Museum (N51)
- Next Meeting: watch your e-mails!

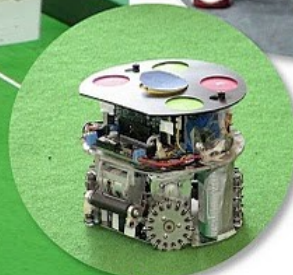
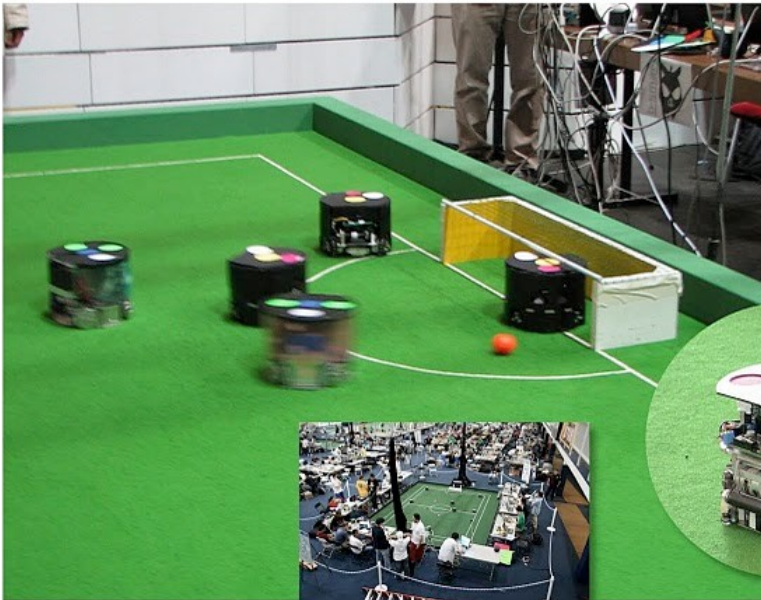


# Computer Science Subteam

- We write the code
- ... and make the bots do cool stuff



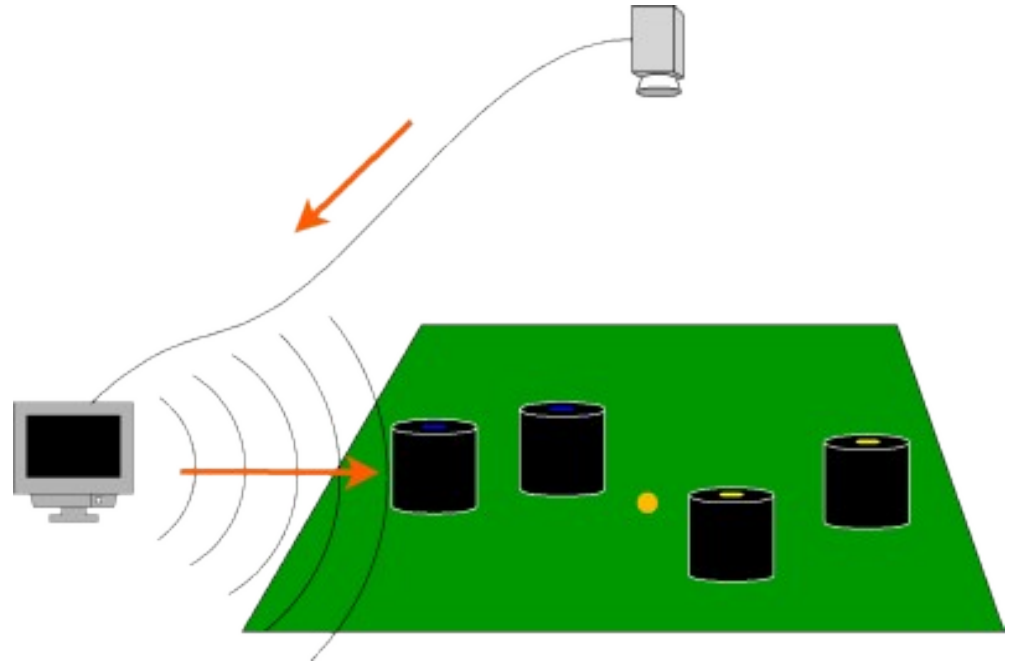
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# Overall System

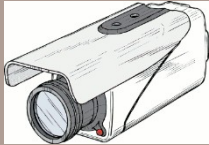
- Code runs on a PC
- We use C# under Visual Studio 2010
- 10,000+ lines of code
- 1-20 people involved every year



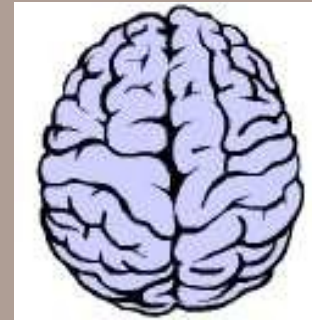
(Some) documentation on <http://wiki.rfccambridge.com/>

# System Architecture

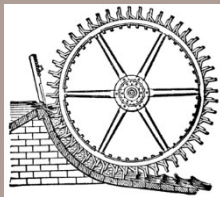
Vision



AI

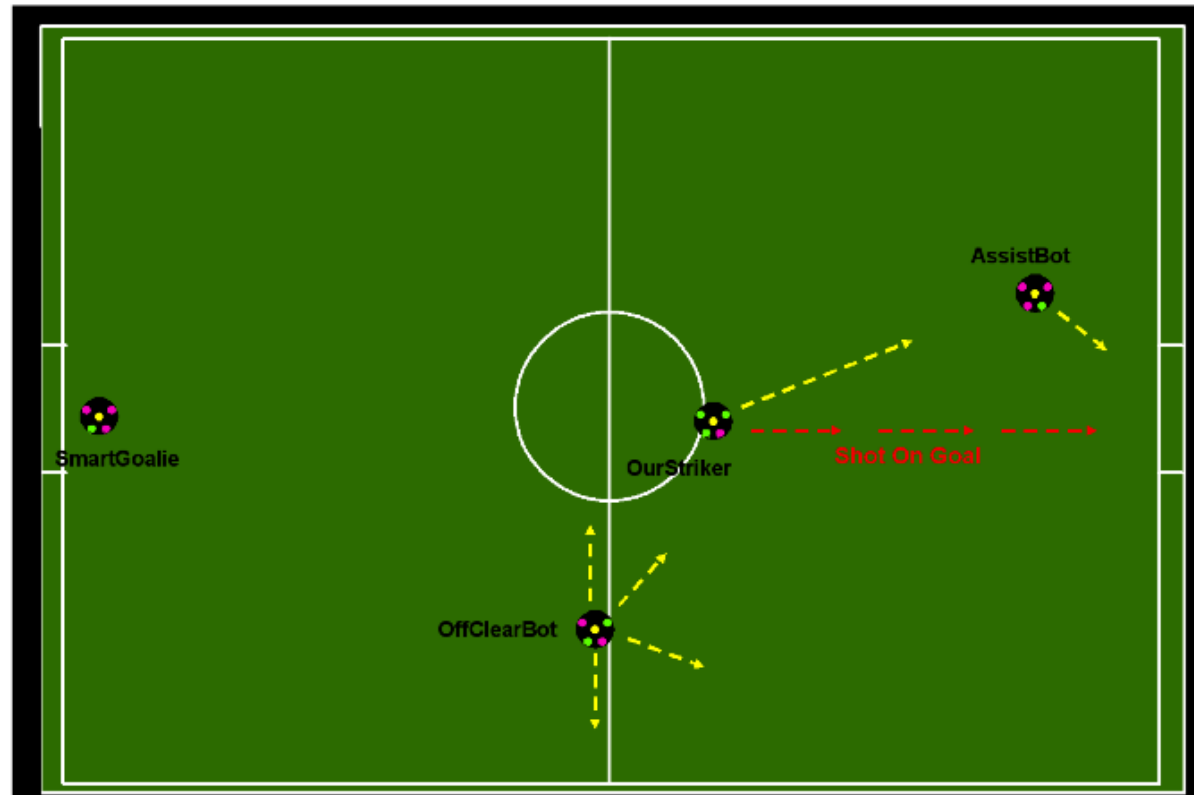


Control



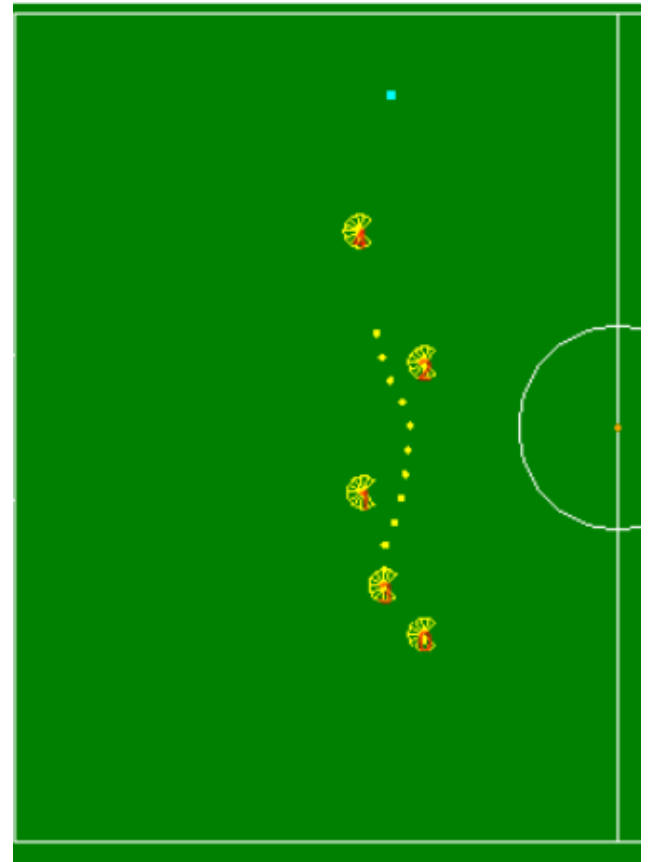
# AI Strategy

- Skills, tactics, plays
  - Play-language
- Long-term vs. Short-term goals
- All changes with opponent



# Motion Planning

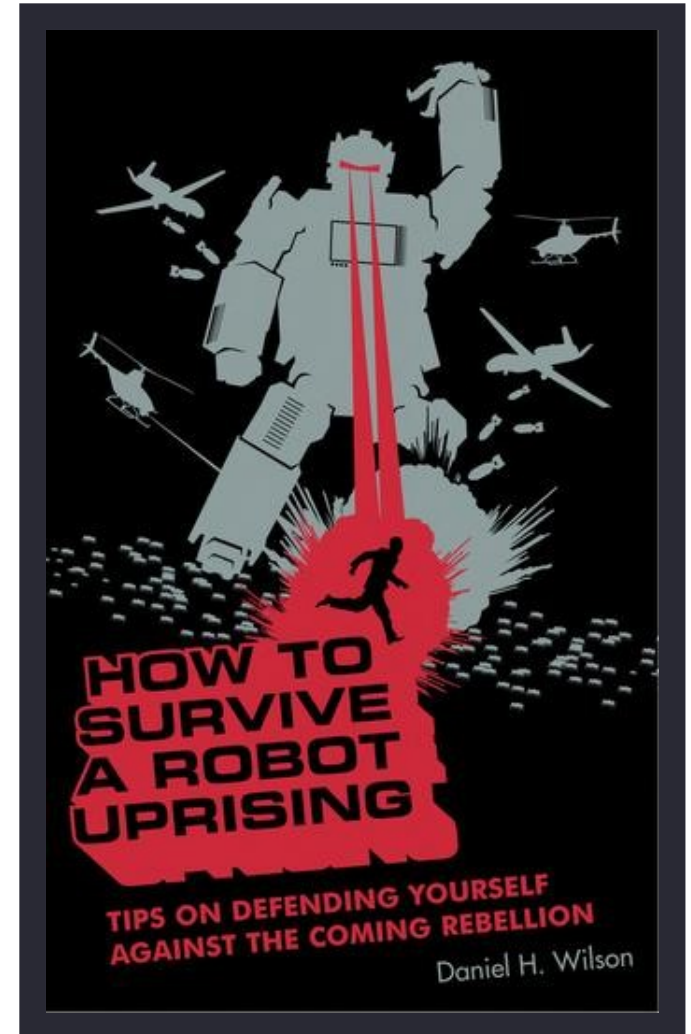
- Get from point A to point B
  - Avoid obstacles
  - Be fast
- Cool algorithms involved





# Why CS?

- You love hacking!
  - ... and want to learn how to write good code
- It's a real team and a real system
  - Very different from psets
  - Companies love that
- Possible projects:
  - different playbooks, more strategies
  - dribbling, chip kicking?
  - passing, deflection shots
  - replay system



# Why join Robocup?

- Help from upperclassmen

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- International experiences



# Mission from 1997:

able of beating the human world



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- Help from upperclassmen
- Experience
- Cross-university (get off campus every once in a while)
- International experiences
- Robots are cool