

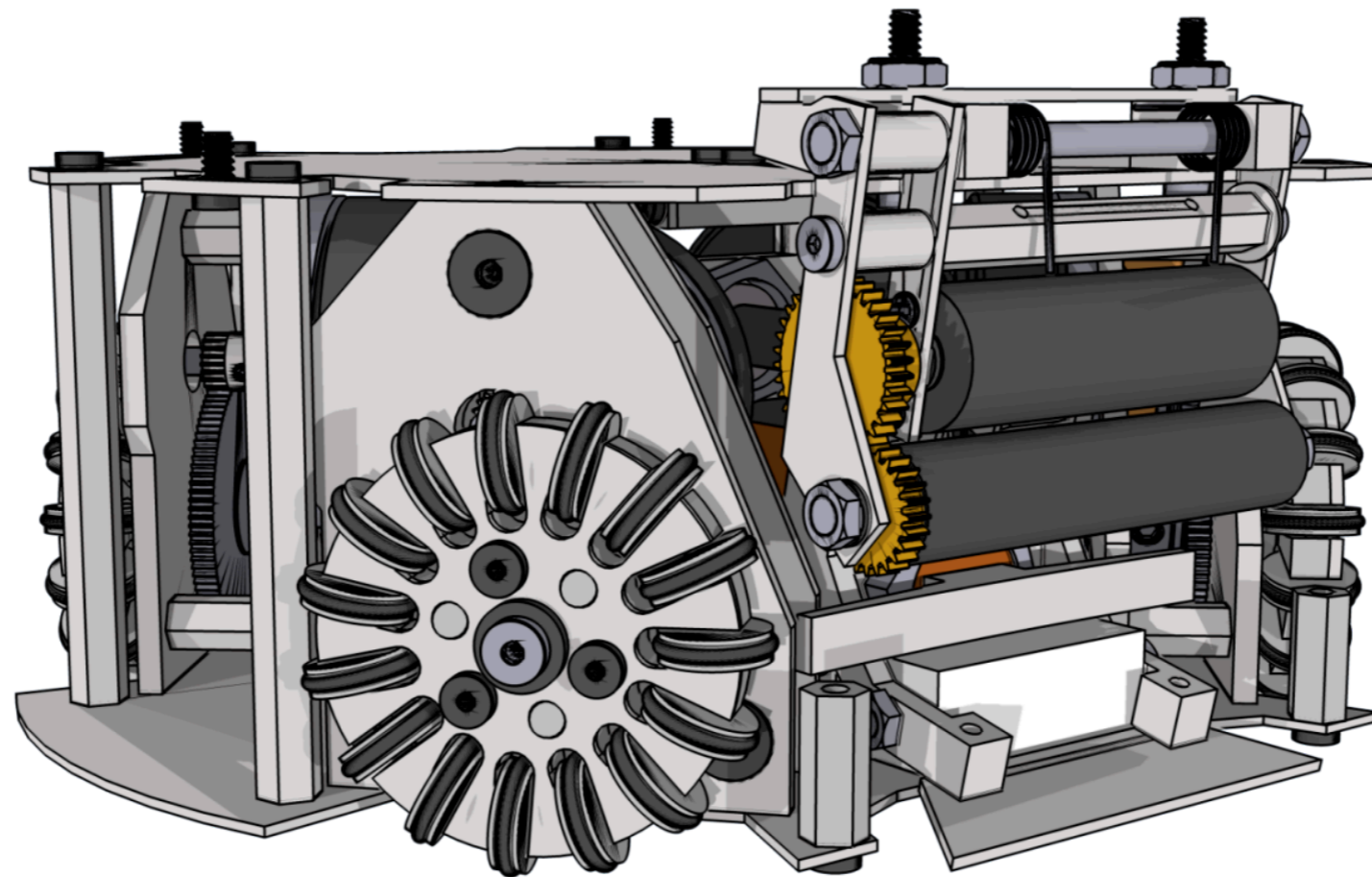
Georgia
Tech



RoboJackets

FIRST - IGVC - BATTLEBOTS - ROBOCUP

RoboCup: Robot Soccer!



Andy Bardagjy

URK Feb 9, 2009



What is RoboCup?

By mid-21st century, a team of fully autonomous humanoid robot soccer players shall win the soccer game, comply with the official rule of the FIFA, against the winner of the most recent World Cup.



What is RoboCup SmallSize?

Autonomous robot soccer

- **Rules:** FIFA
- **Speed:** Robots: 3.5 m/s = 8 mph!
Ball: 10+ m/s = 22mph!
- **Size:** 180mm dia, 150 mm tall
- **Field:** 6 x 4 meters
- **Time:** Two 15 min halves



Time left:
0:00

Plasma Z
0

CMDragons
0

Video time:
5:55.1

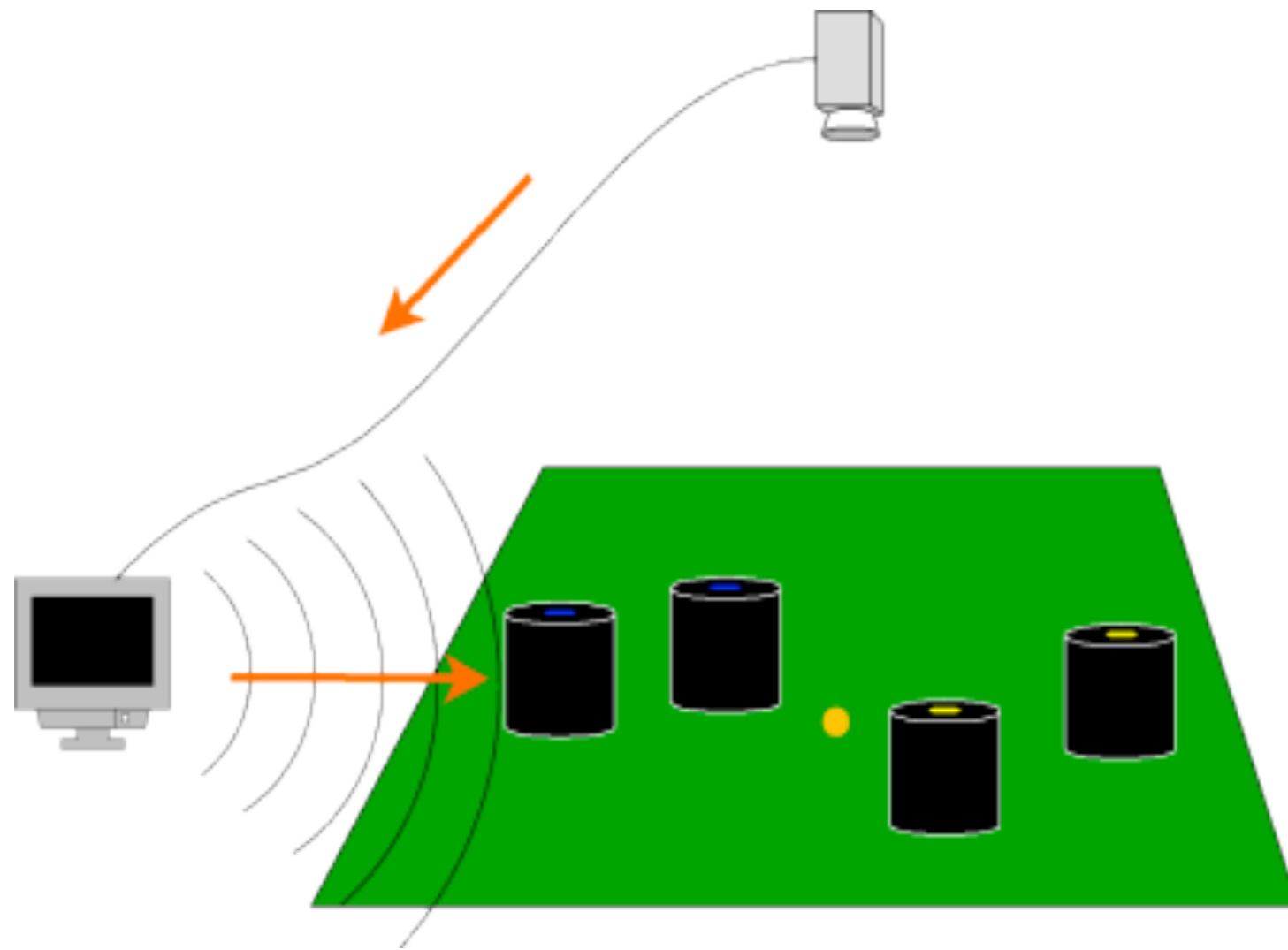
Kickoff for blue

video by:
www.robojackets.org





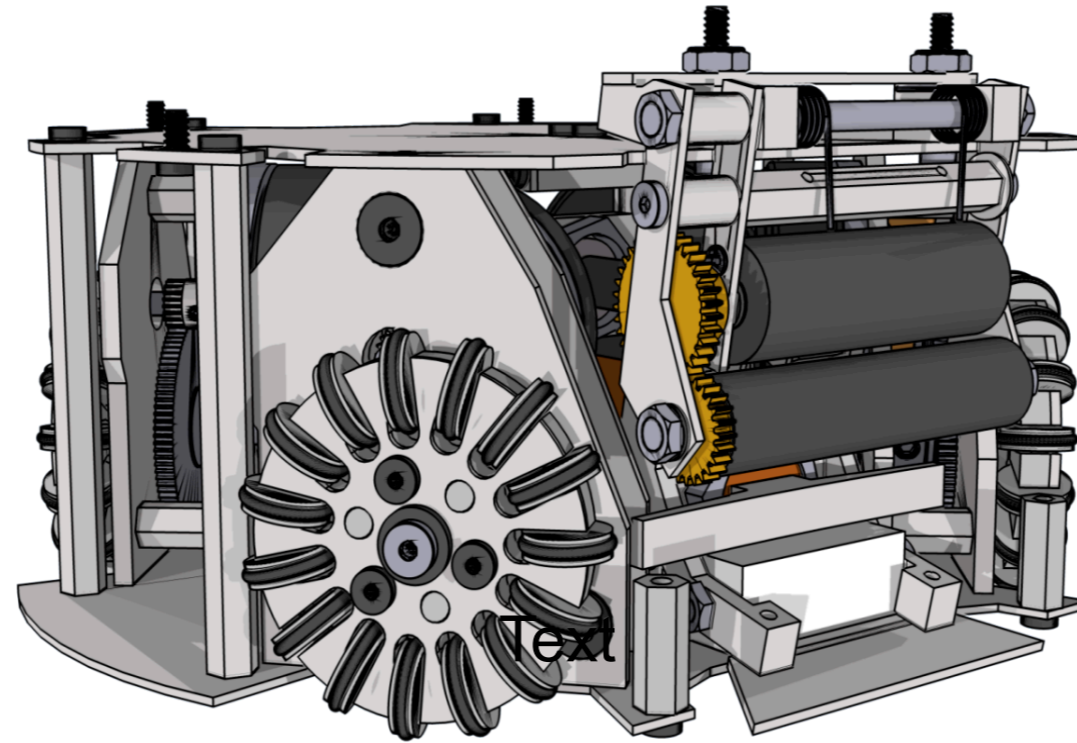
System Overview



- **Mechanical**
 - Drivetrain
 - Ball Control
- **Software**
 - Vision
 - Gameplay
- **Electrical**
 - Controller
 - Ball Control



Drivetrain

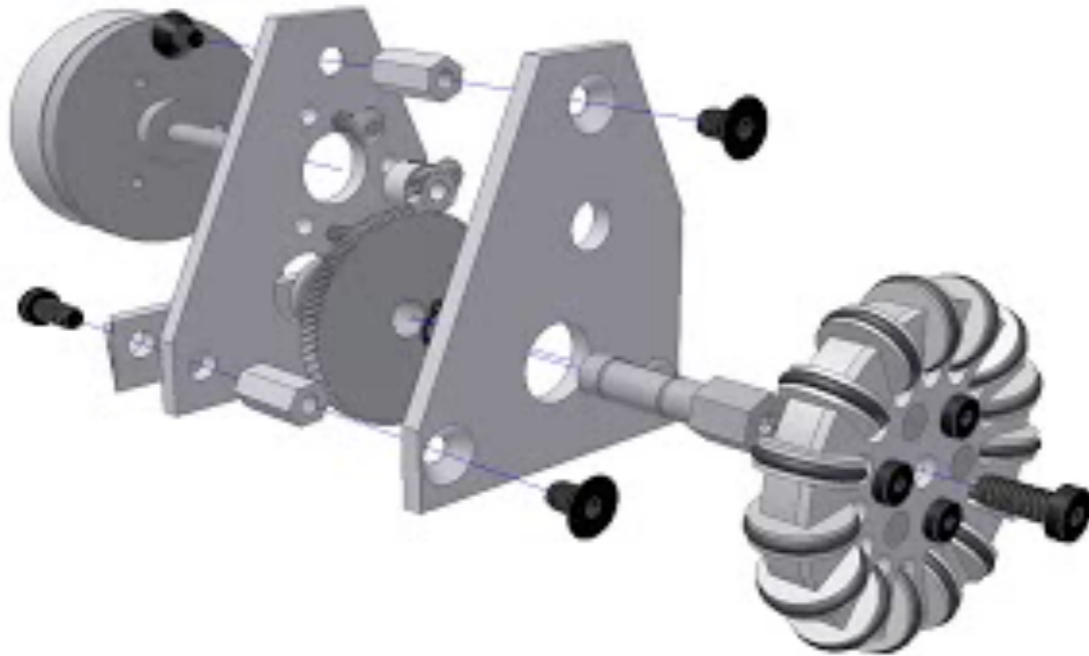


- Over 3 m/s in any direction
- Four 35 watt brushless motors
- Holonomic drive configuration

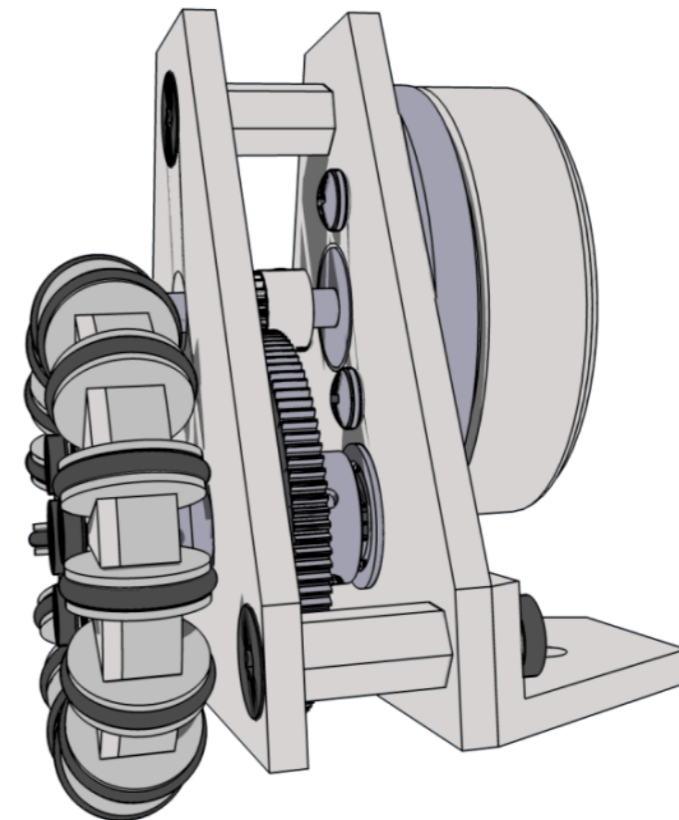


Drivetrain

- **Optimized** for cost effective manufacturing
- Fabricated as far away as **China**

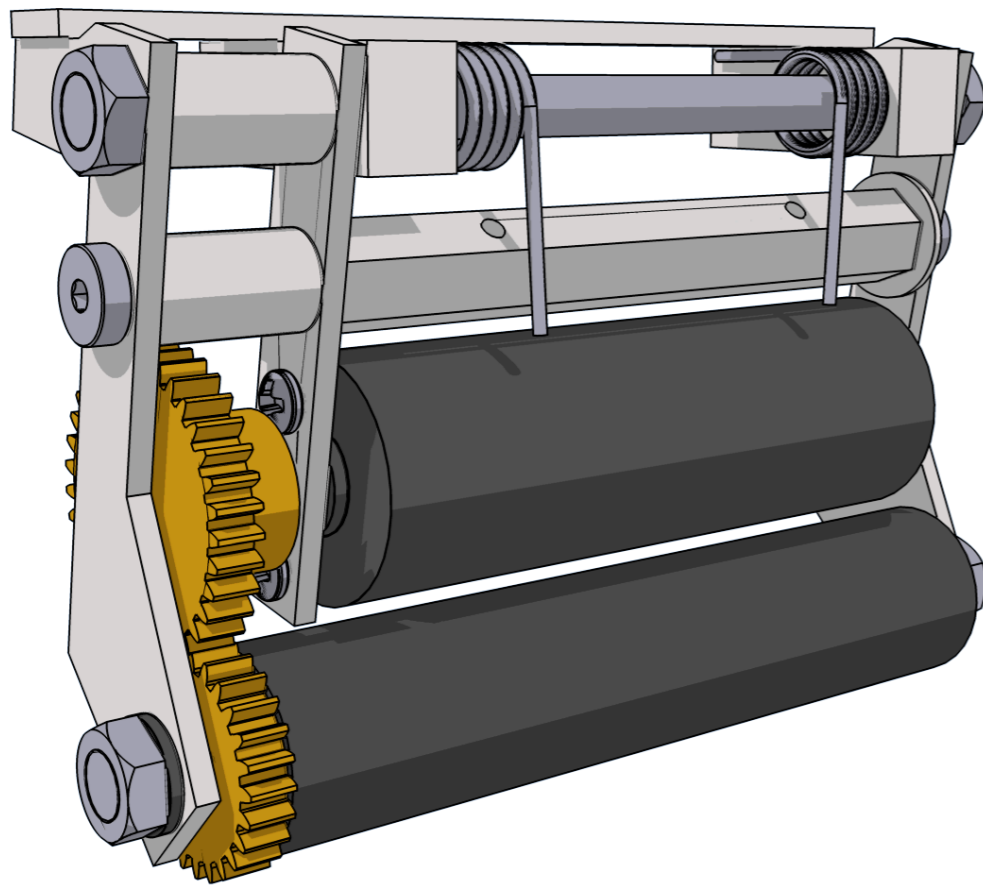


- **38 parts** per wheel
- **62 parts** per module





Ball Control

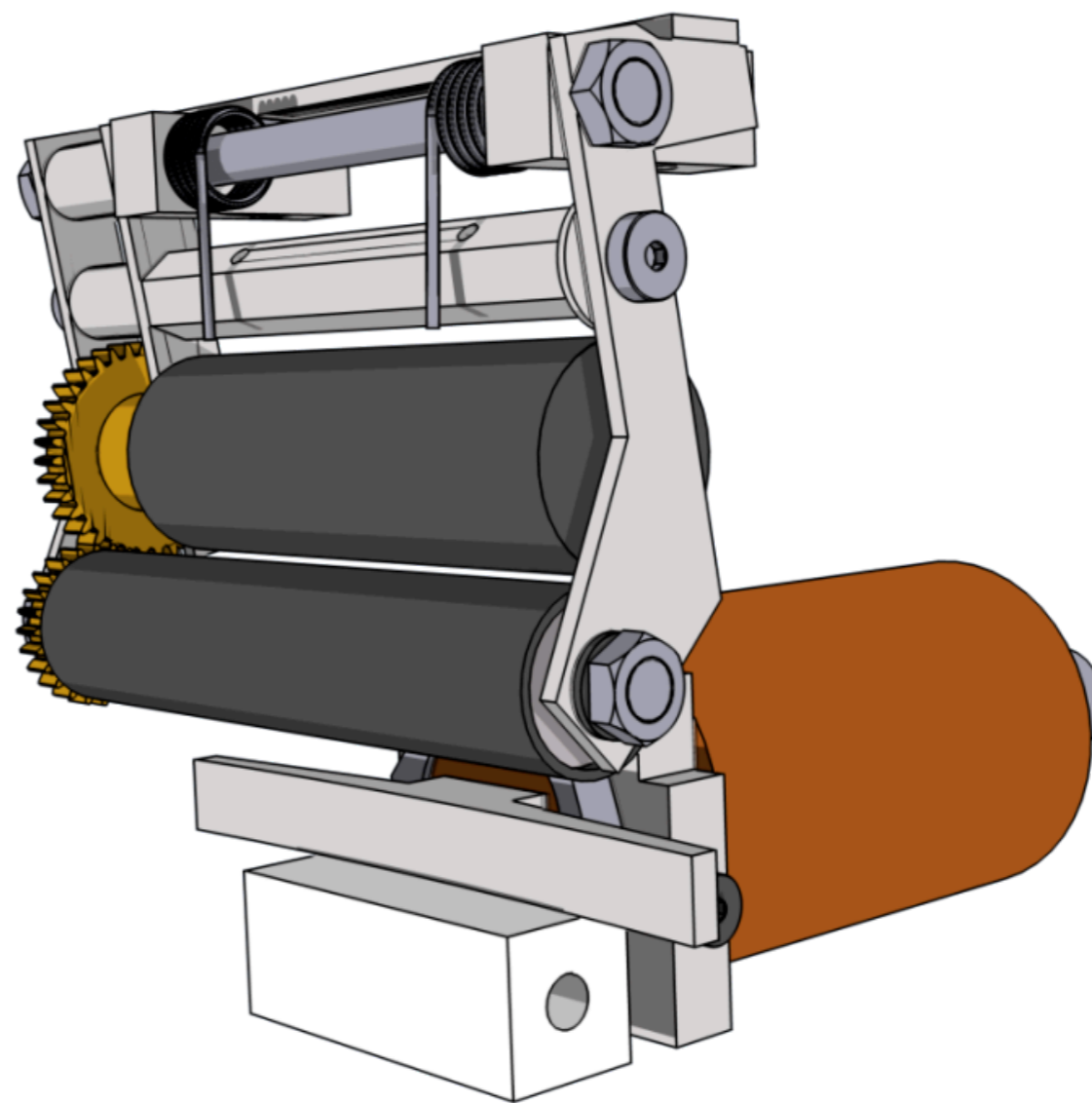
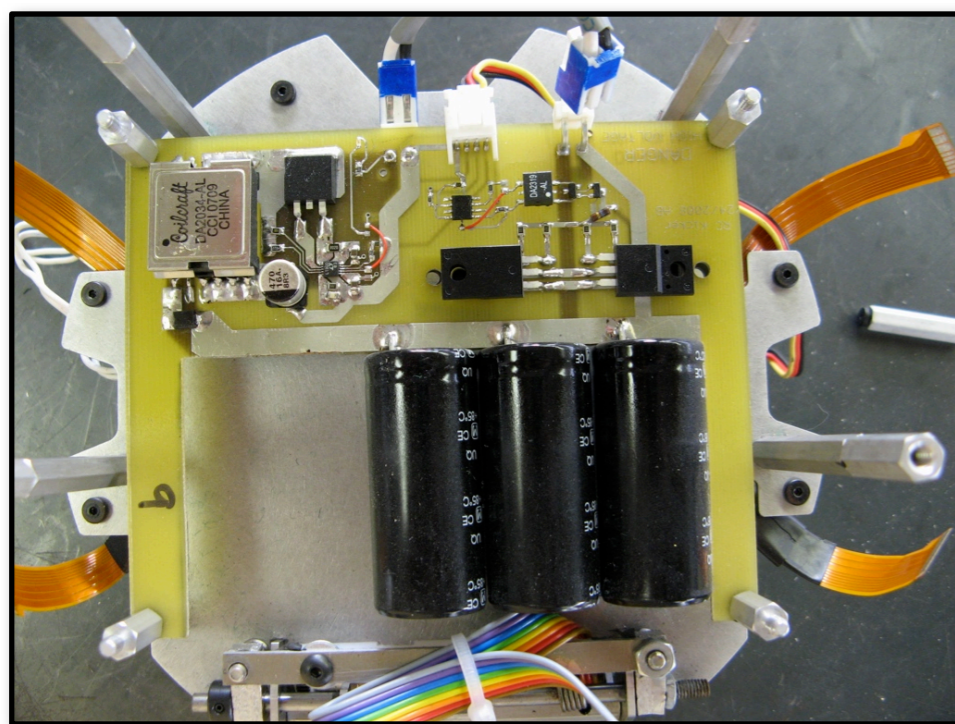


- Compact **design**
- High torque **brushless motor**
- **Silicon rubber** roller for added traction
- **Torsion springs** absorb ball energy
- Wide **ball contact surface**



Kicker

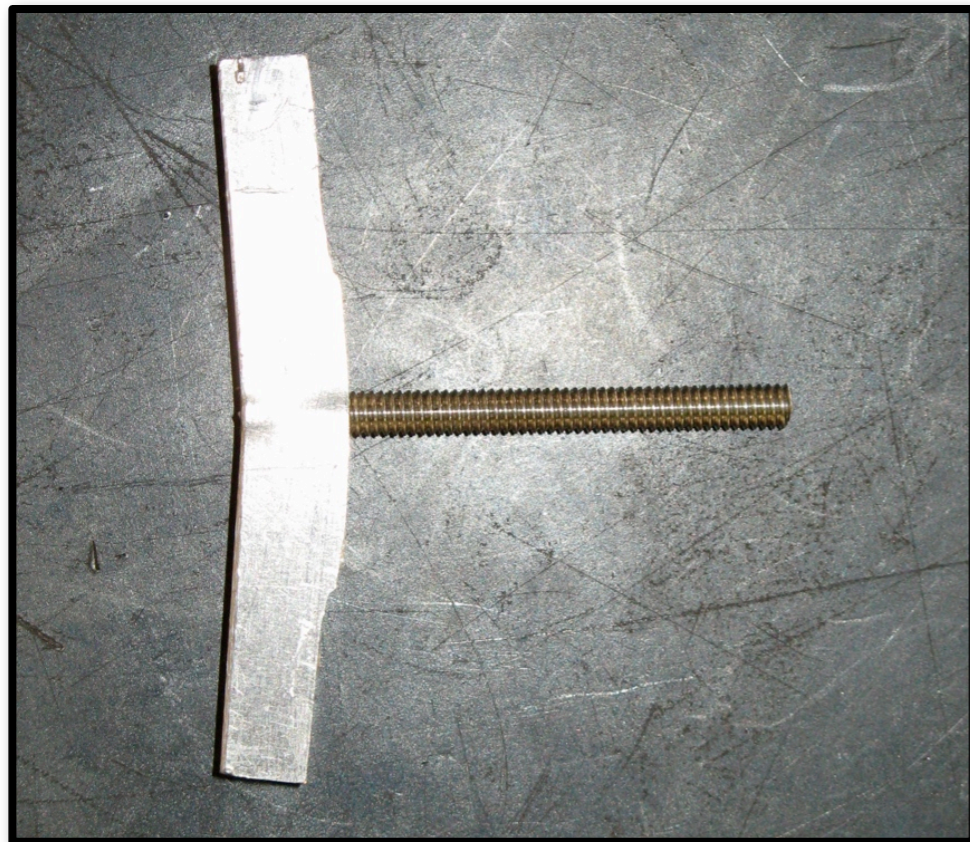
- **Variable** power delivery
- **Pulse shaping** to reduce electromagnetic losses



- Charges in $\frac{1}{4}$ second
- 85% efficient charger

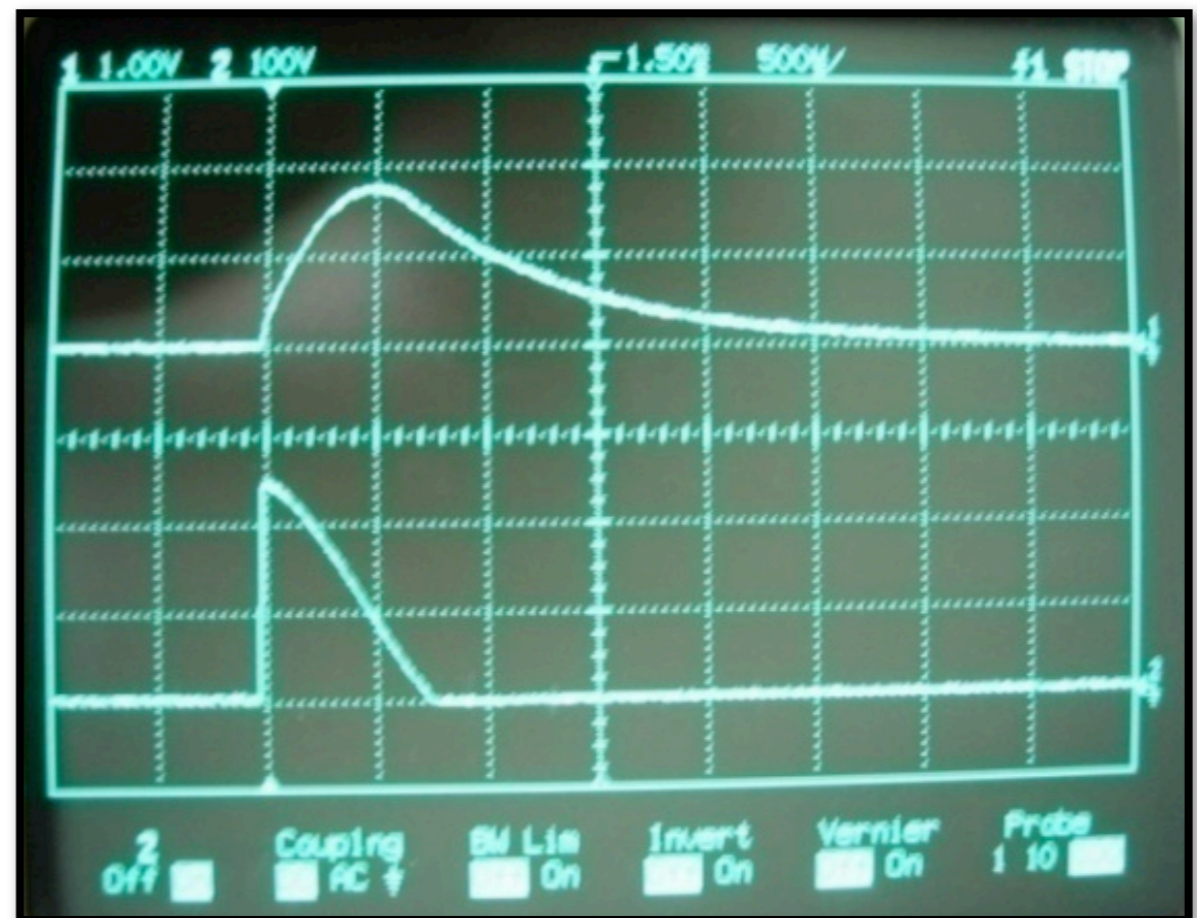


Kicker



- Provides over **150 Amps** at **250 Volts**
- Stores **75 Joules**

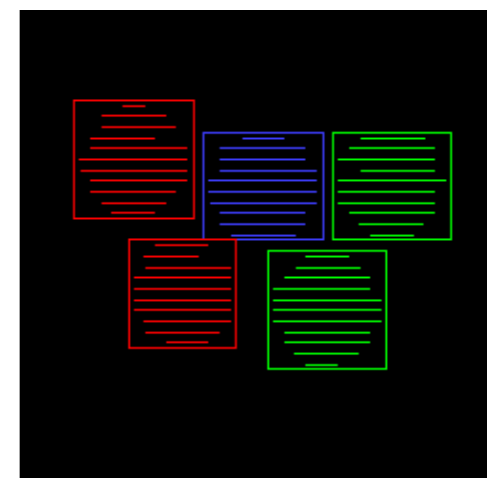
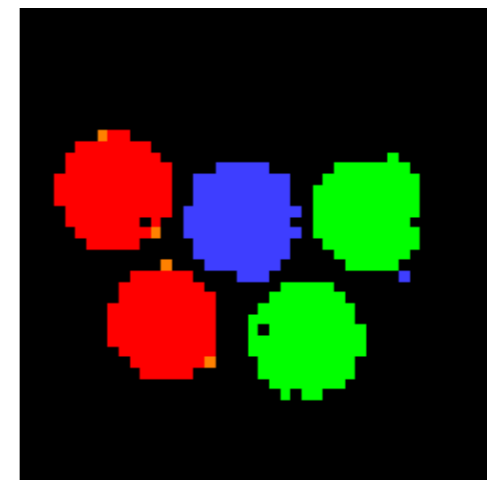
- Over **50 Kilowatts** of electrical power





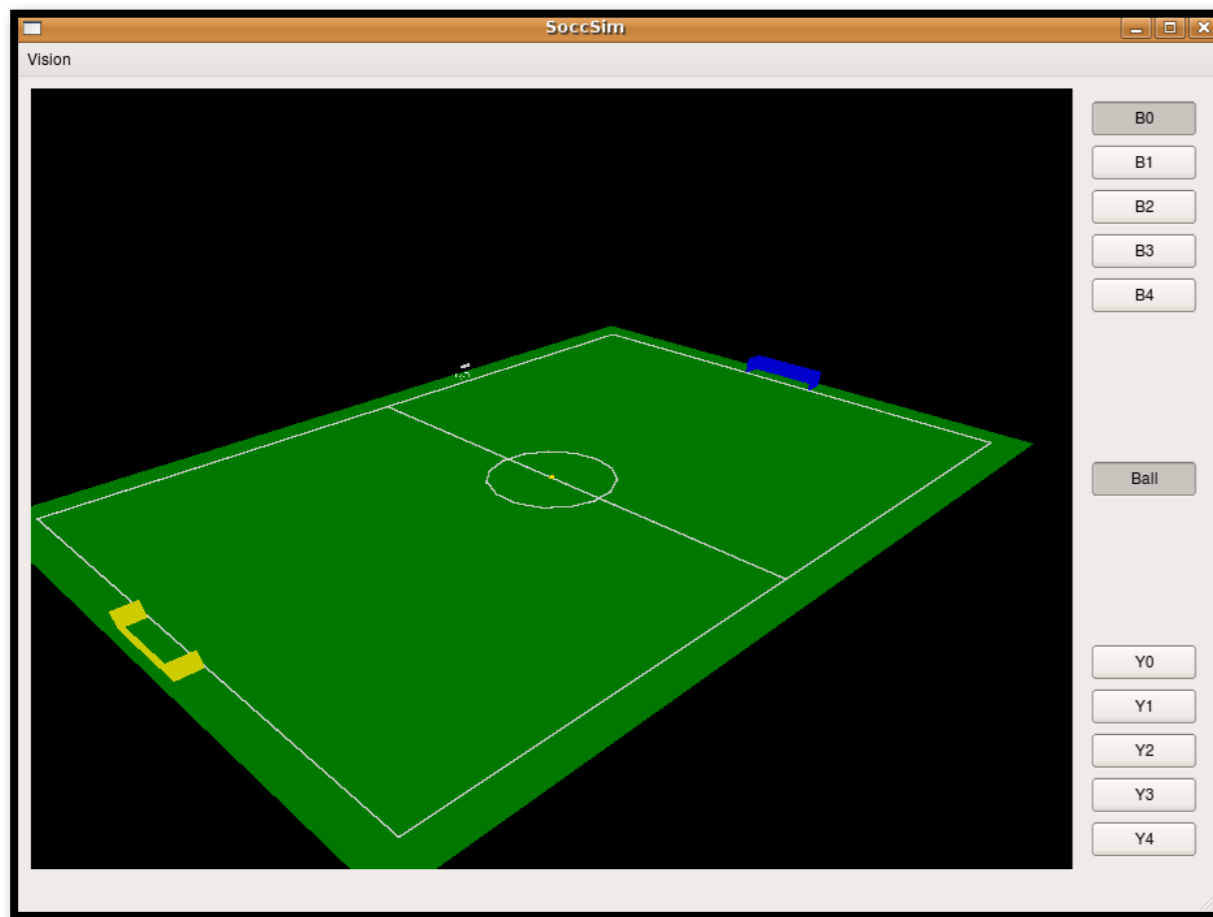
Vision

- Greater than **5 mm accuracy**
- **90FPS** Gigabit Ethernet cameras
- Easy, graphical **configuration** and **calibration**
- High speed **execution** thanks to precomputed **lookup tables**
- Location and lens **Profiles**





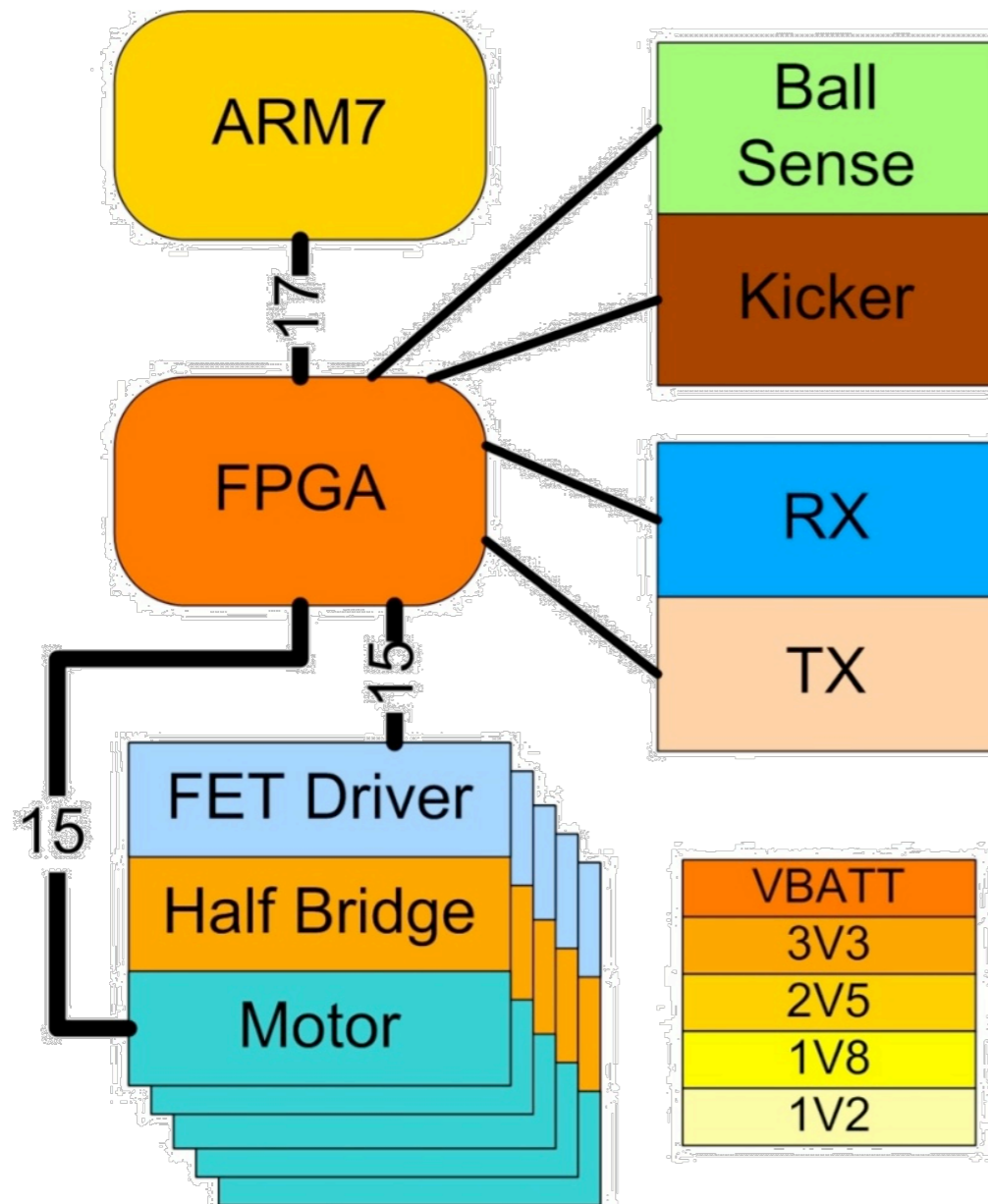
Gameplay



- **Simulator** allows development without robots
- **Hierarchical** gameplay architecture
- **Scriptable** plays
- **Probabilistic** game state estimator



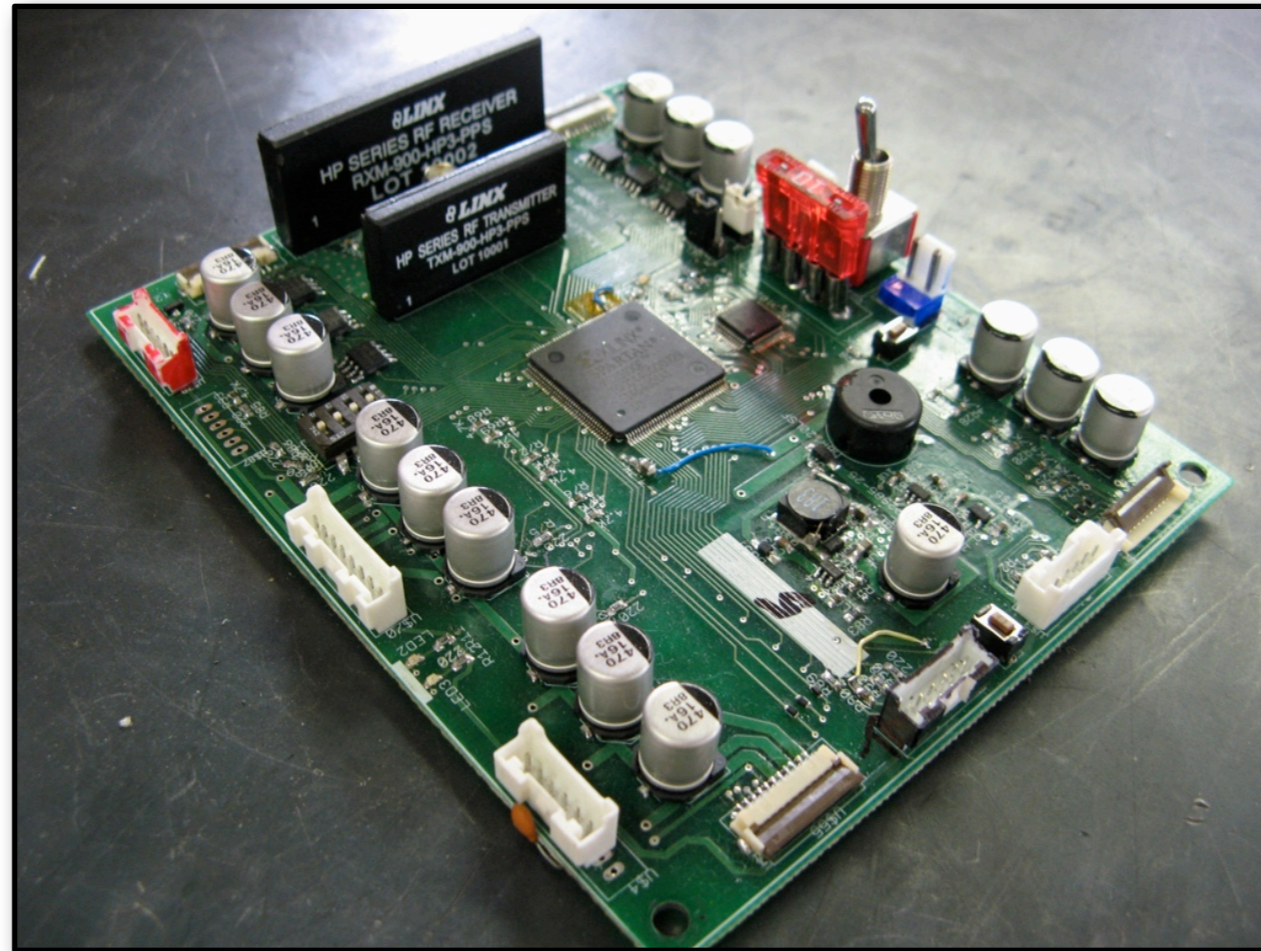
Controller



- **Translates** instructions from the server to physical movements
- **“Dumb”** though some local feedback control



Controller



- Server updates at **100 hz**
- **Two** layer
- **325+** surface mount parts
- **Five** power rails



Scale



- Over **750 parts** per robot
- **3000+** nets per board
- **325+** surface mount parts
- **\$1500** per robot
- **Thousands of hours** of development and fabrication time ... remaining!



Competition: Suzhou, China





Competition: Suzhou, China





Competition: Suzhou, China





Competition: Suzhou, China



RoboJackets

www.robjackets.org

Team:

Phillip Marks – Roman Shtylman – Ben Johnson – Stefan Posey
Stuart Donnan Jake Nieman - Alex Cunningham



THE GEORGE W. WOODRUFF
SCHOOL OF MECHANICAL ENGINEERING



**Student Government
Association**

For further information:
Andy Bardagjy - andyb@gatech.edu