

# The Robots of the Rings: The Two Towers

6.270 Kickoff 2014

# The Organizers

- Christina
- Andrew
- Steven
- Jessie
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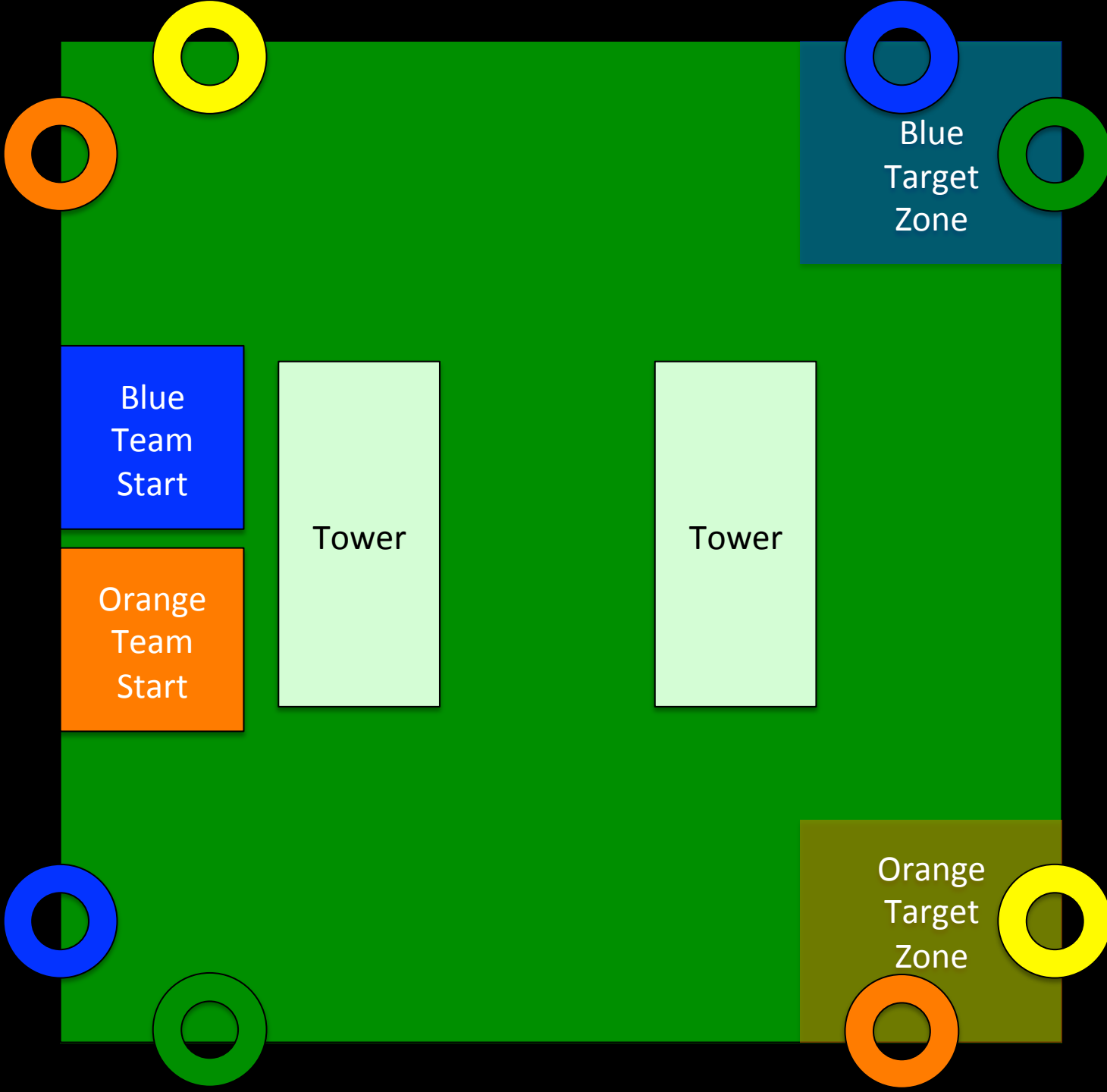
## The Story So Far...

Frodo and Sam have destroyed the one ring, but destroying so much evil at once has put the world out of balance.

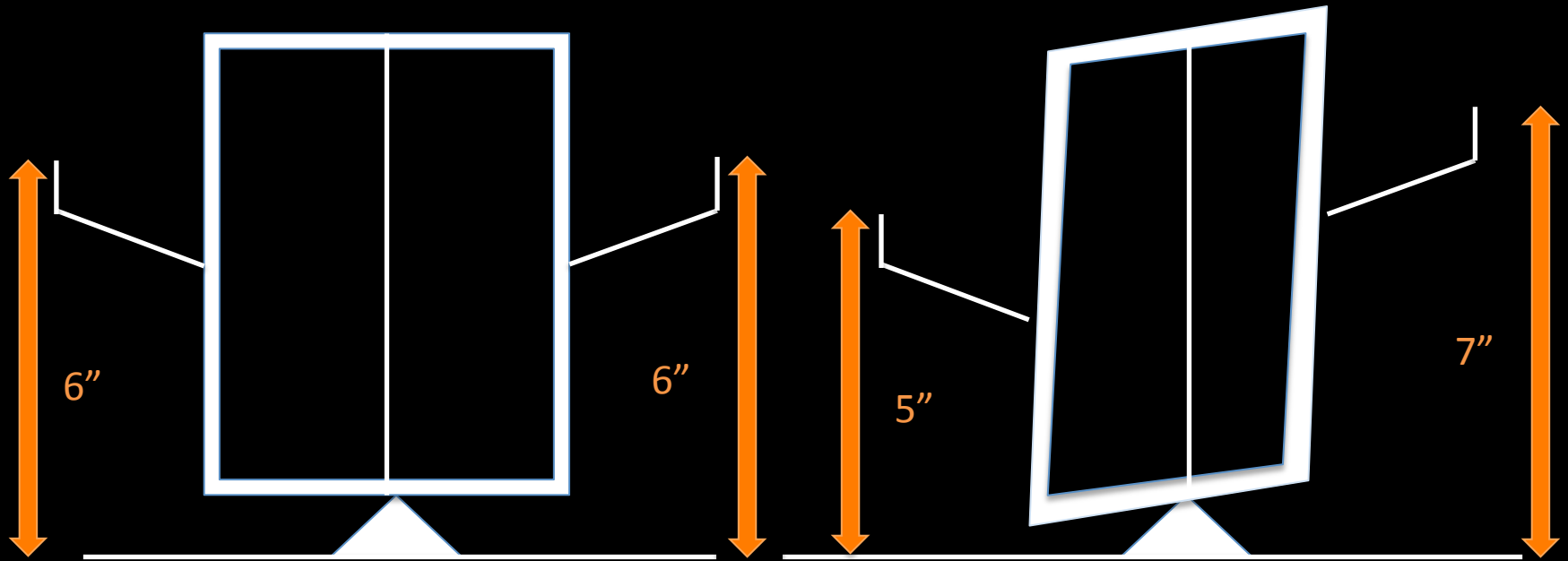
In order to bring the world back to order, Gandalf asks for their help again in locating new rings of power and gathering them around the two towers.

However, exhausted from their first (very, very long) excursion across Middle Earth, Frodo and Sam decide they'd much rather sit this one out.

Your task as mechanic from Legoton is to build a robot that can help Gandalf on his quest and let Frodo and Sam get their well deserved rest. You have to build quickly however, as Gandalf leaves in one month.



# The Towers

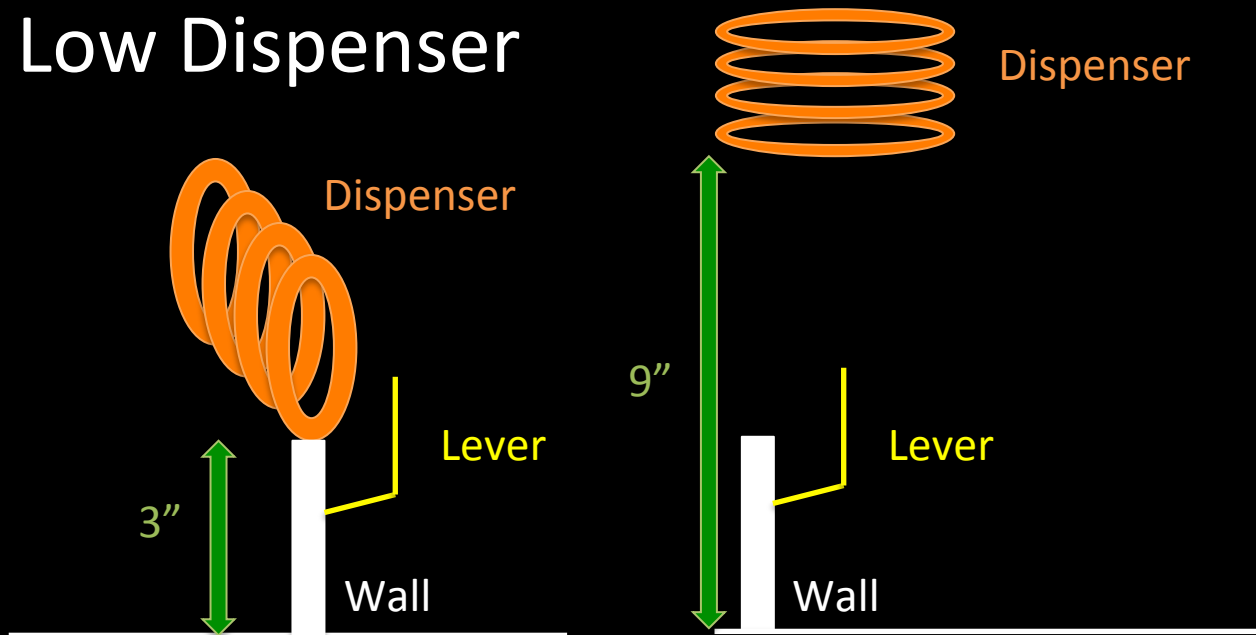


# The Dispensers



High Dispenser

Low Dispenser



# Scoring

- Explore** 100 points for reaching target zone  
100 points per ring hung on a new side
- Recover** 10 points per ring recovered
- Deposit** 25 points per ring around base of tower  
100 points per ring on tower  
x2 bonus per ring on a balanced tower

# General Rules

Robot starts in 1x1x1 ft cube

All structure = Lego

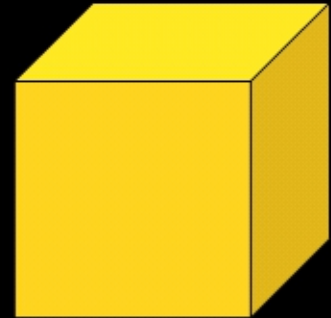
No detachable parts

Rubber bands for stored energy

Tape/glue ONLY for attaching motors/sensors to Lego

No Lego modifications except large dark-gray baseplate

Sportsmanship (don't attack opponent)





# Drop Test

Robot must survive 3ft drop test - must have motors installed and be able to drive

Why? To encourage robust designs

Must pass drop test before final competition

# Sensor Points

Only parts provided in kit are allowed

Can “buy” more electronics/sensors with 20 free sensor points - see website for sensor prices

Spend up to \$30 of your own money on extra sensors not in the kit

# Final Competition

Tuesday, January 28th

7pm

26-100

Open to the public - invite your friends to cheer you on!

Streamed live online - show your parents!

# Administrivia

- If you haven't gotten emails, talk to staff or email [6.270-organizers@mit.edu](mailto:6.270-organizers@mit.edu)
- Lab hours: 9am - 11pm  
(staffed from noon to close)
- Grading P/D/F - 6 units - to pass:
  - Qualifying robot
  - Team attendance
  - Robot web page and source code due at end of course

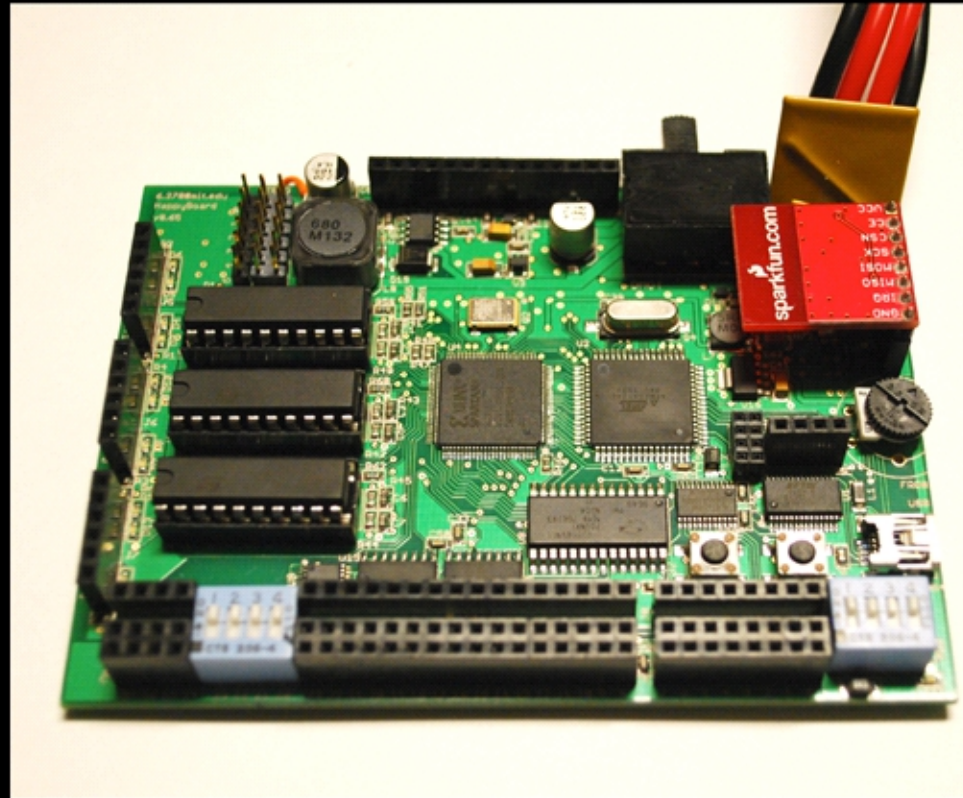
# Lab Guidelines

- No food!
- We are guests - there is expensive equipment  
- leave it alone or 6.270 will be kicked out
- Only solder or hot-glue in 38-500
- **NO FOAM TAPE ON ANYTHING!**

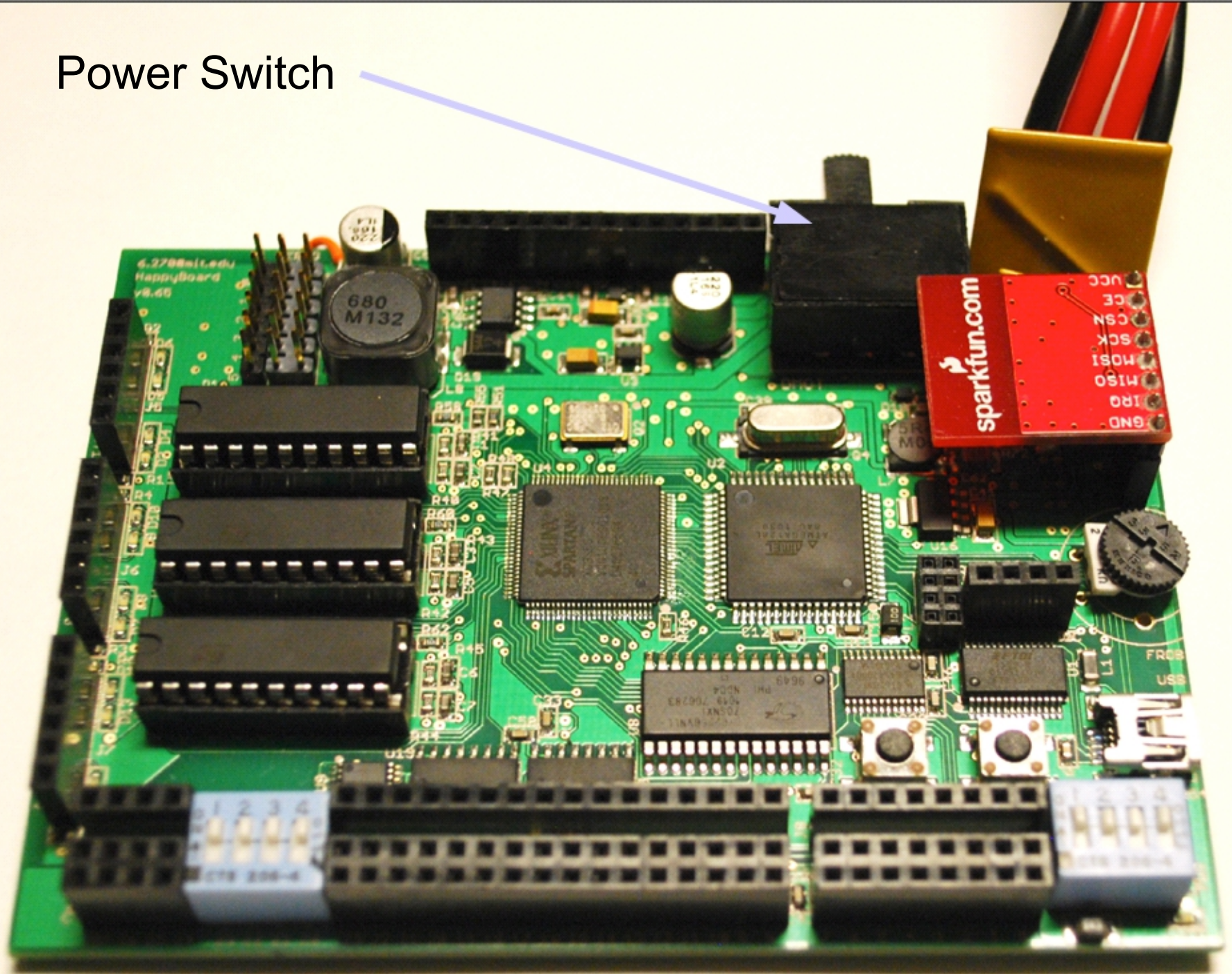


# Happyboard Introduction

- Programmable microcontroller
- Lots of I/O:
  - USB
  - 8 digital IO
  - 16 analog inputs
  - 4 high-speed encoder
  - 6 DC Motors
  - 6 Servos
  - Wireless
  - I2C
  - LCD

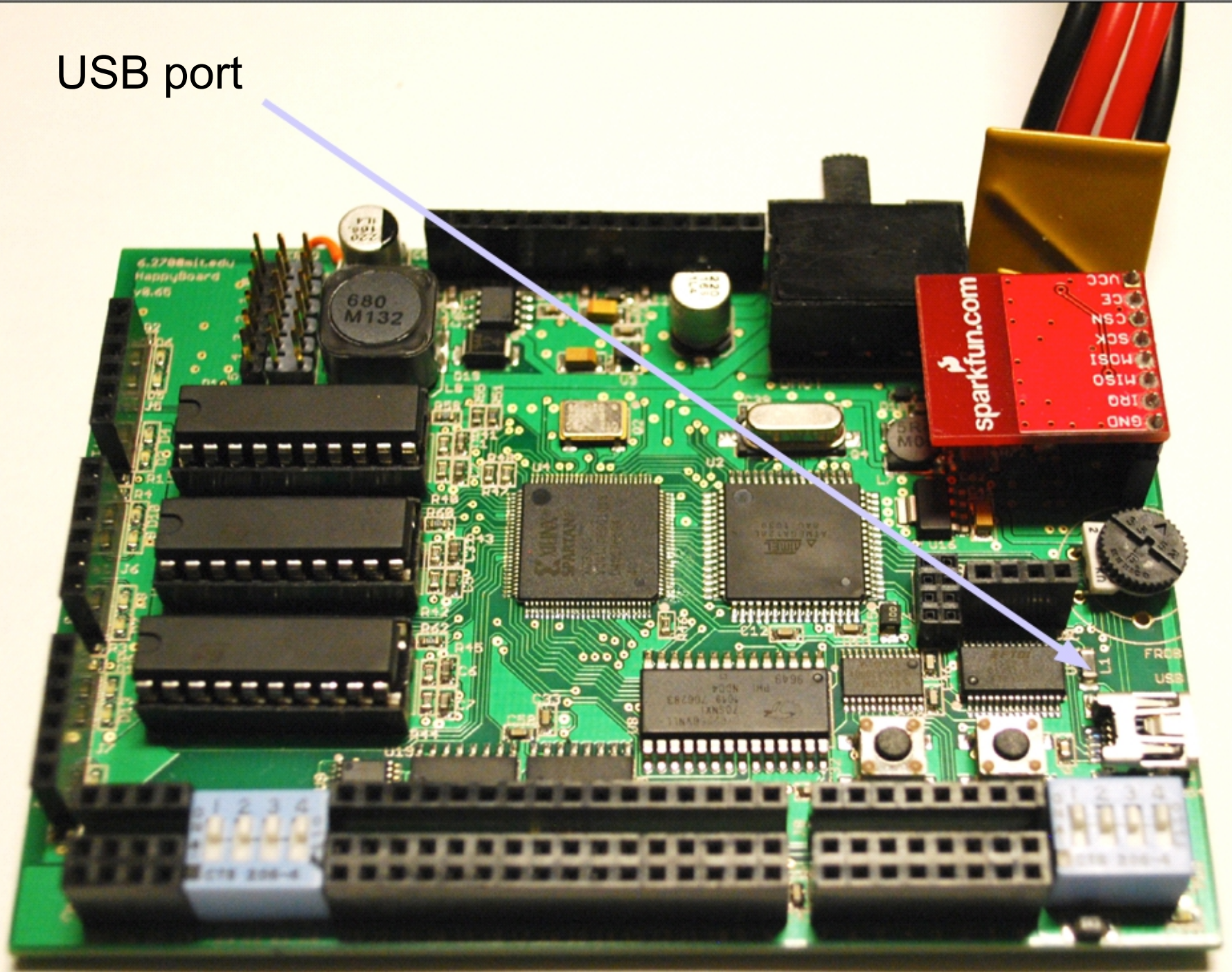


Power Switch



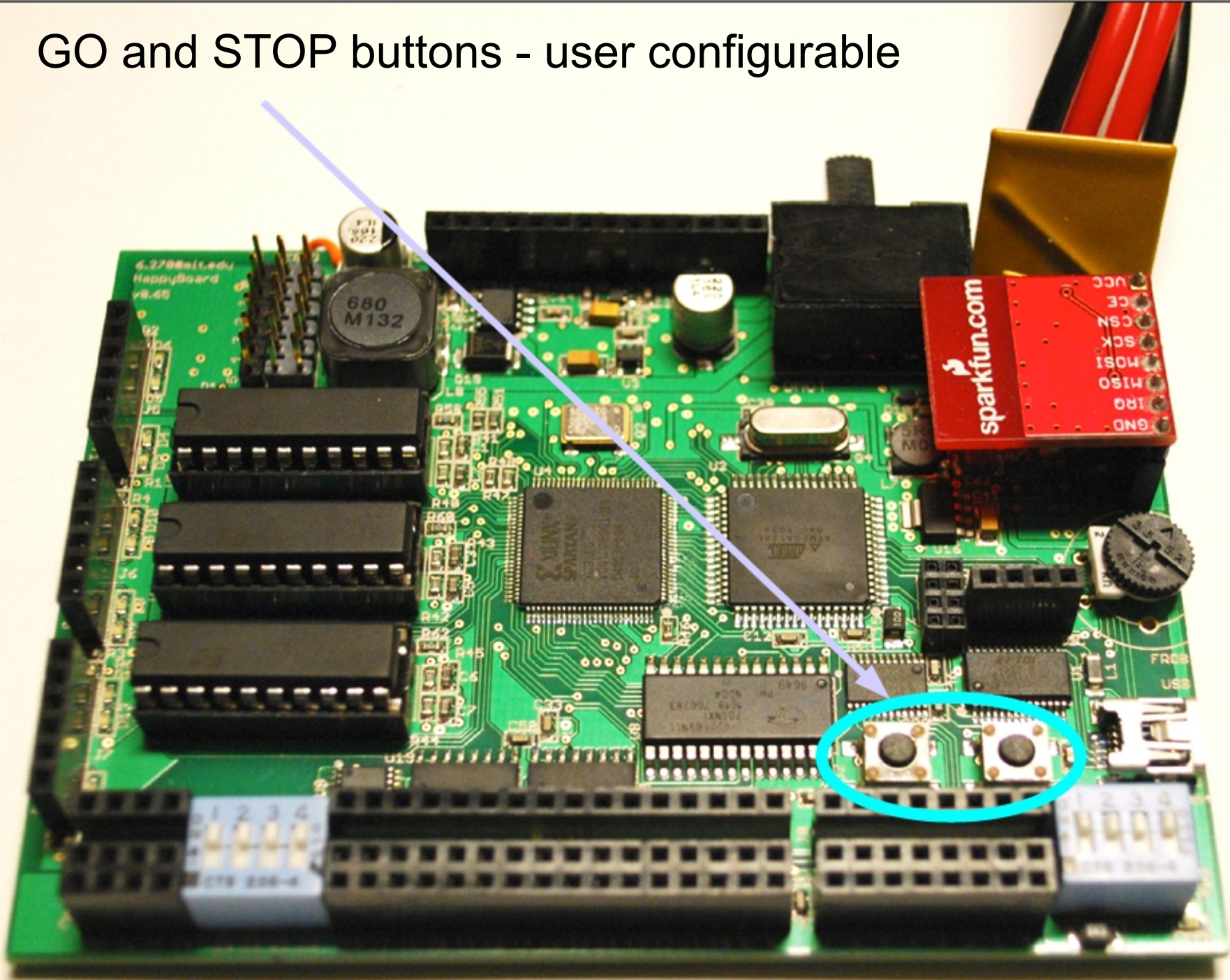


USB port



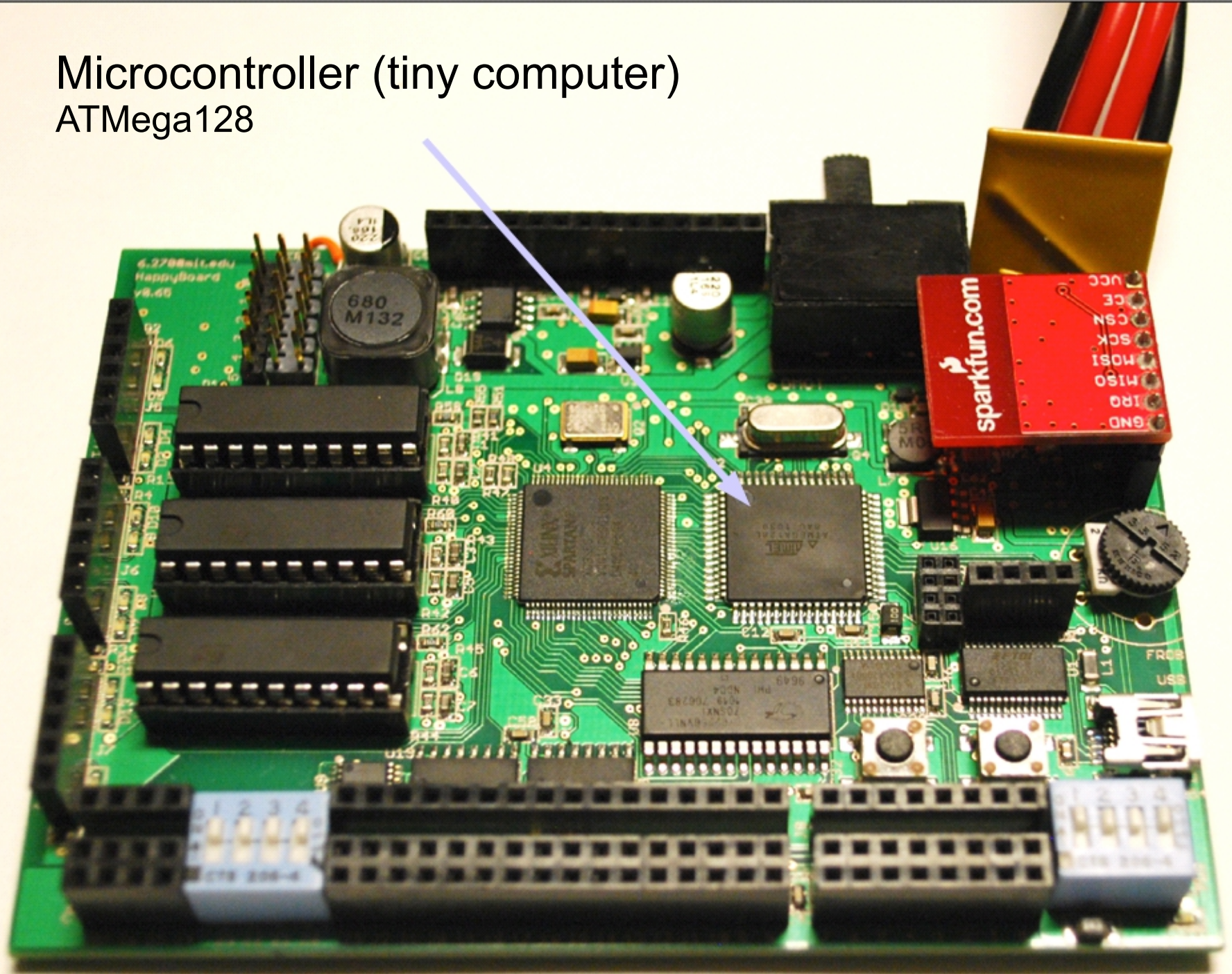


GO and STOP buttons - user configurable

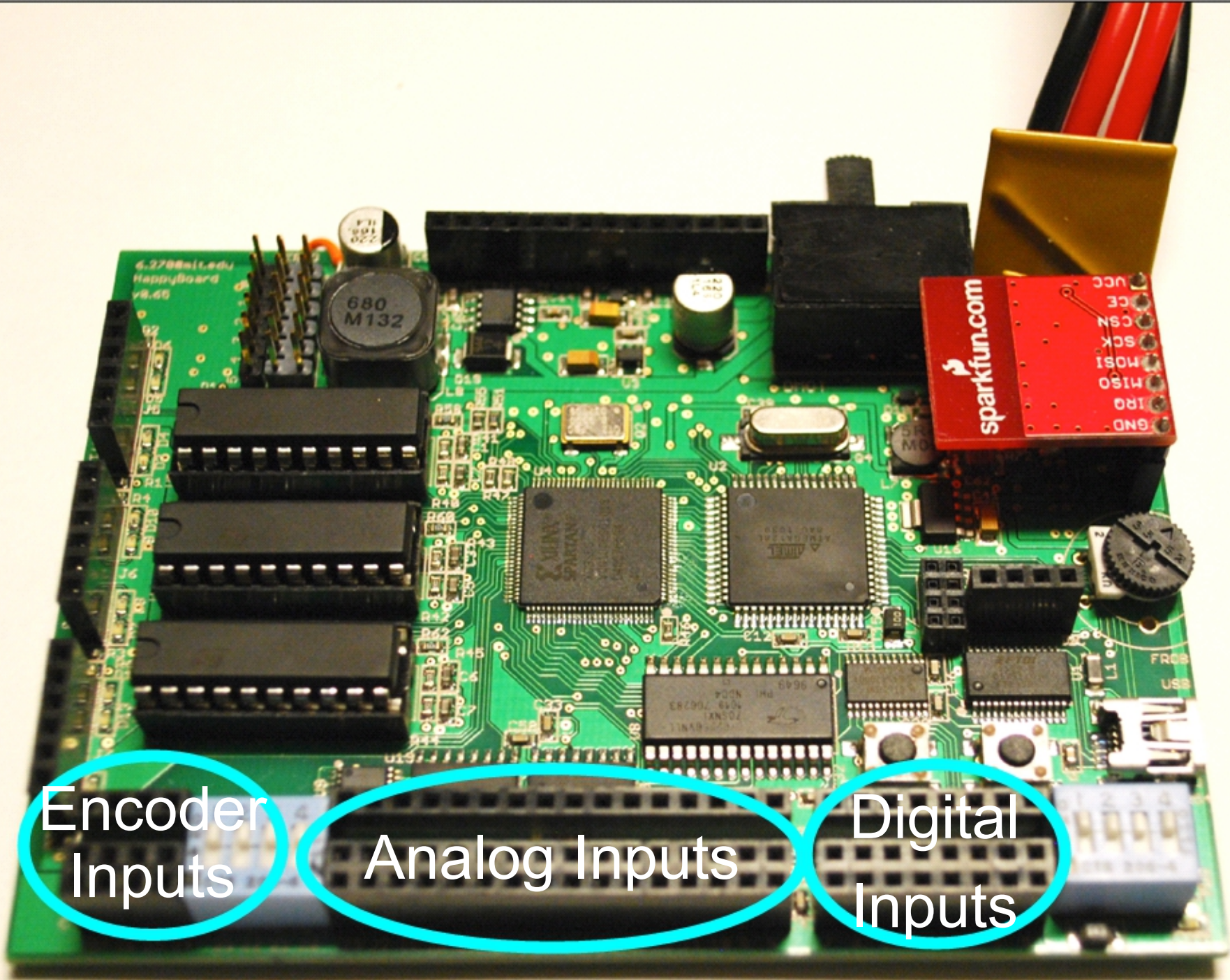




Microcontroller (tiny computer)  
ATMega128







Encoder  
Inputs

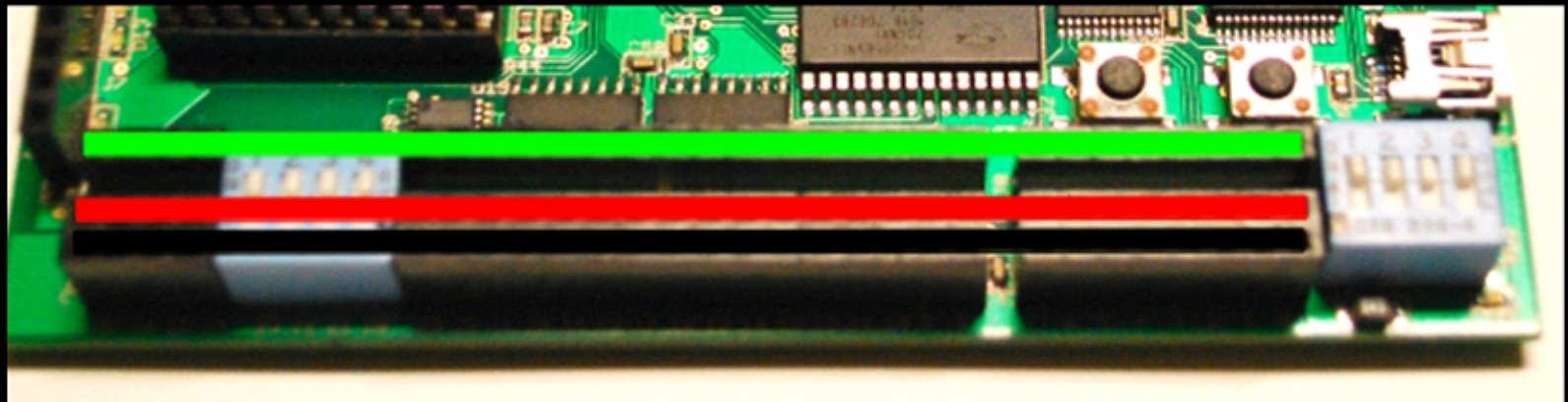
Analog Inputs

Digital  
Inputs

Green: Signal (input)

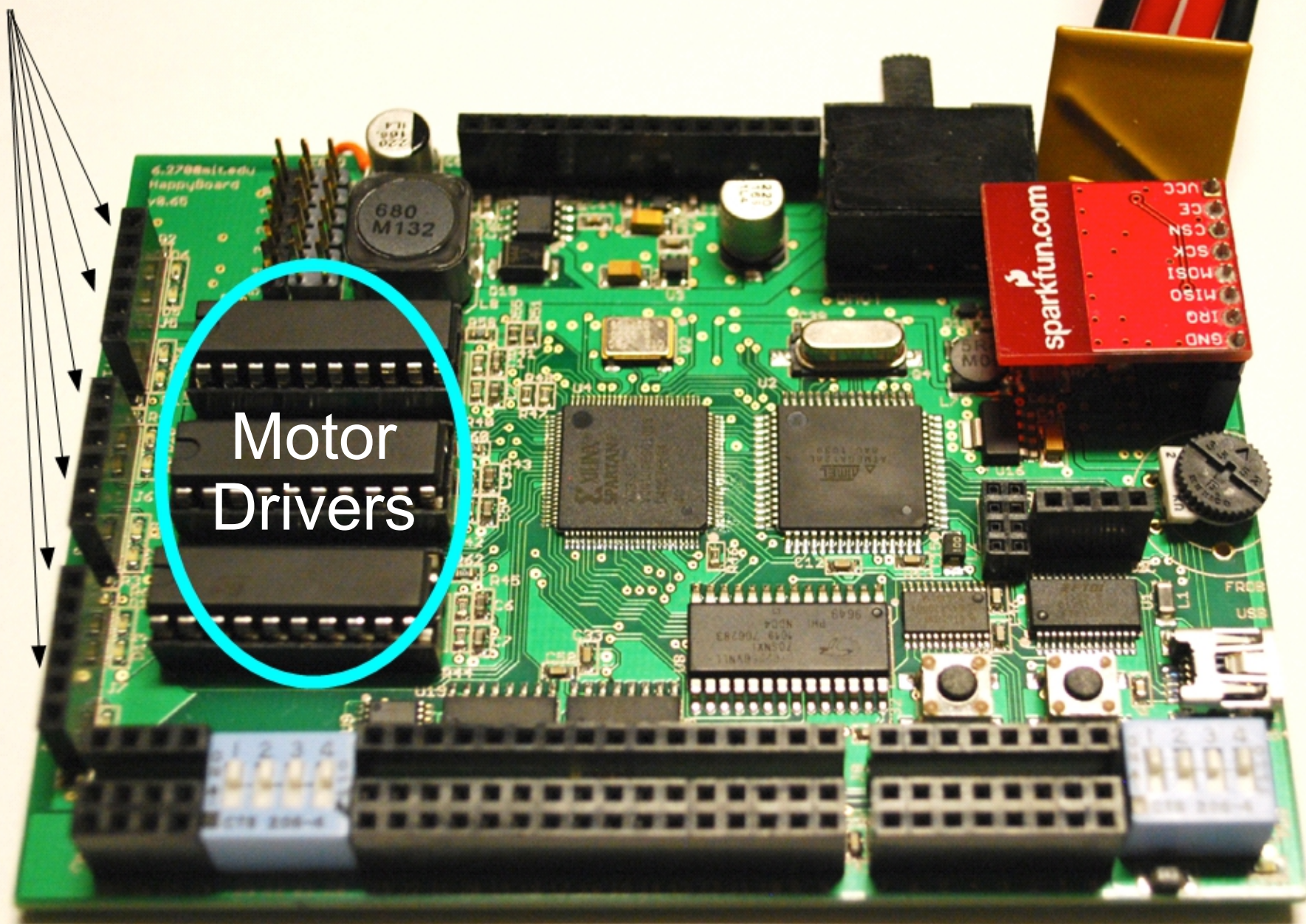
Red: +5V

Black: Ground



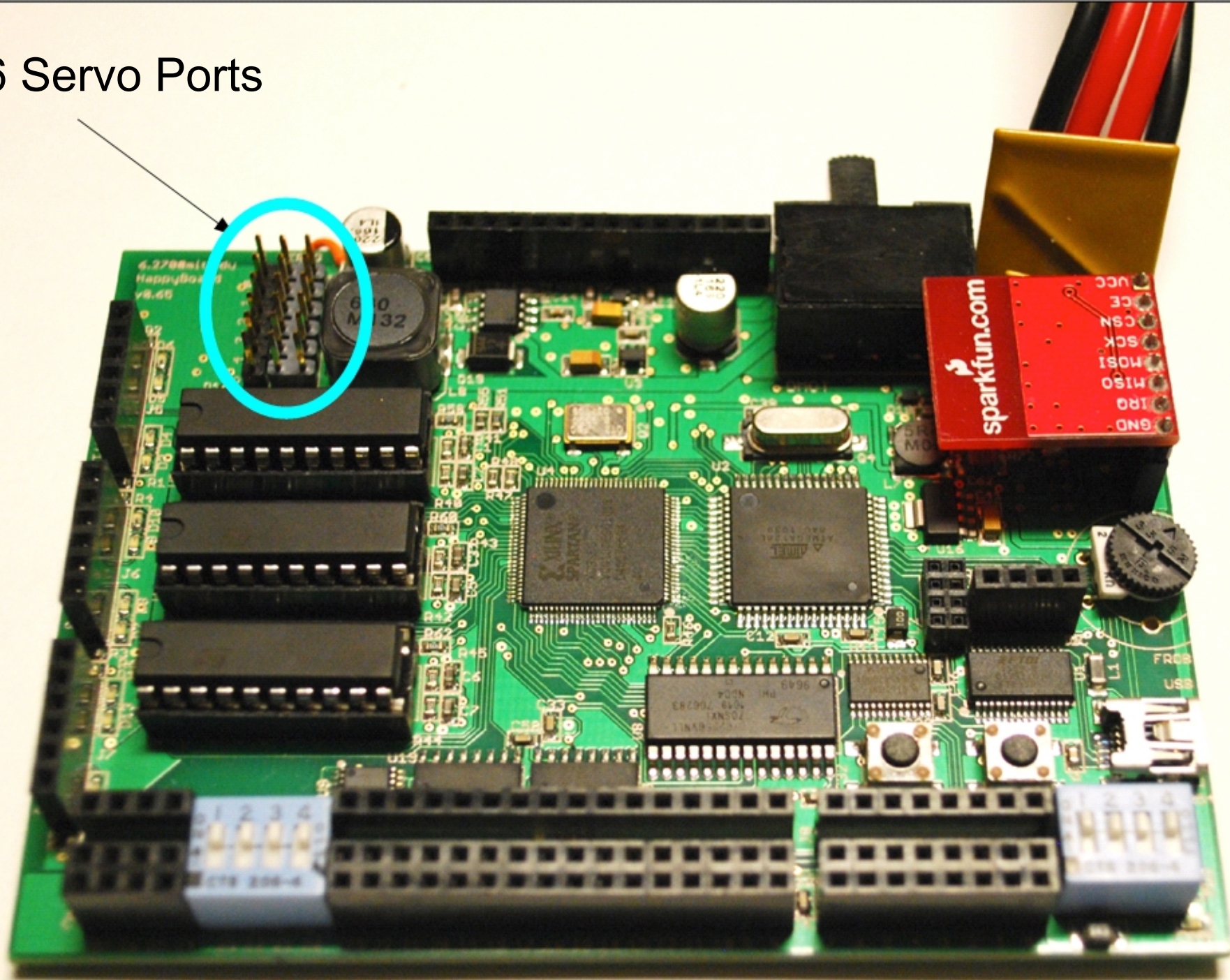


# 6 Motor Ports



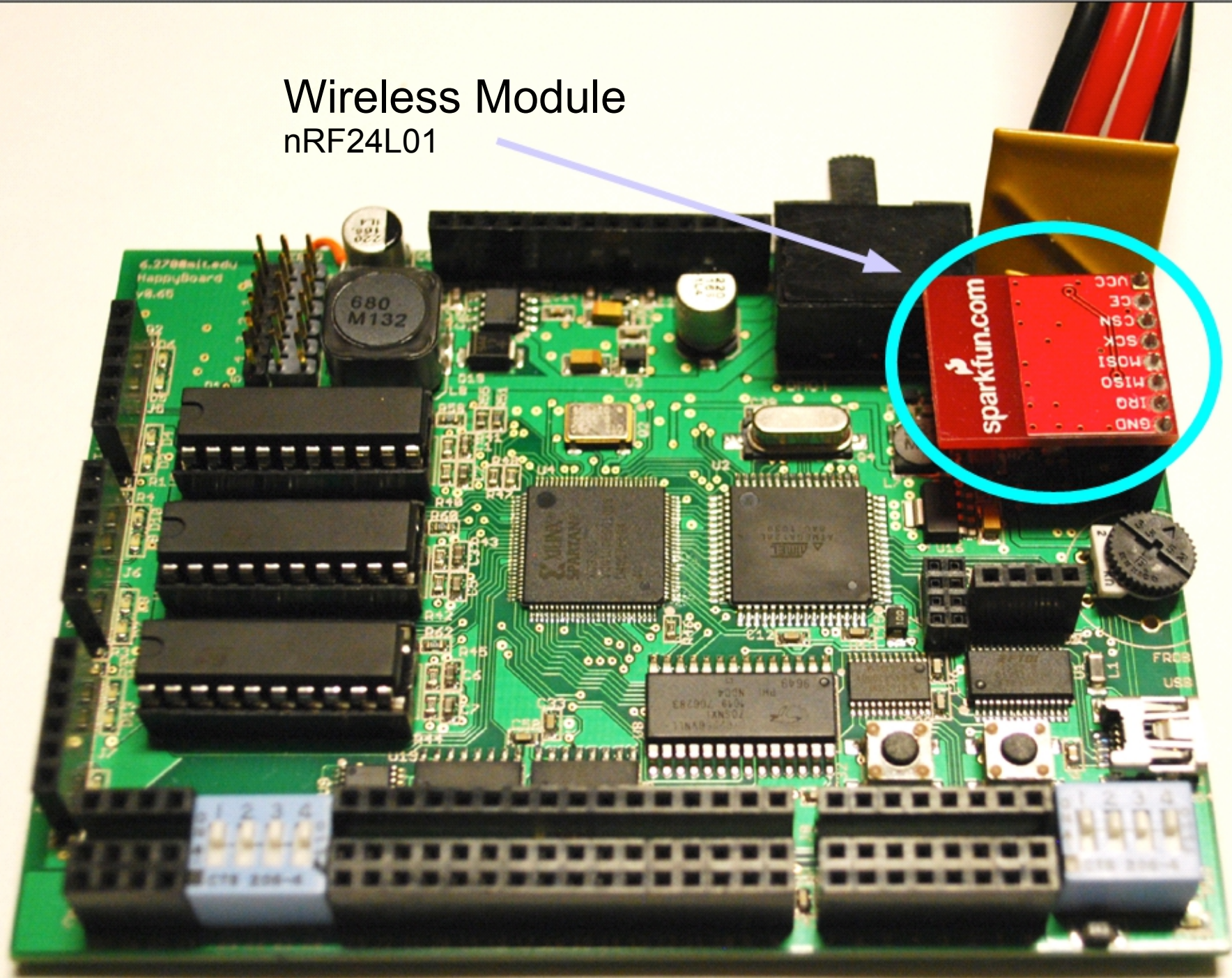
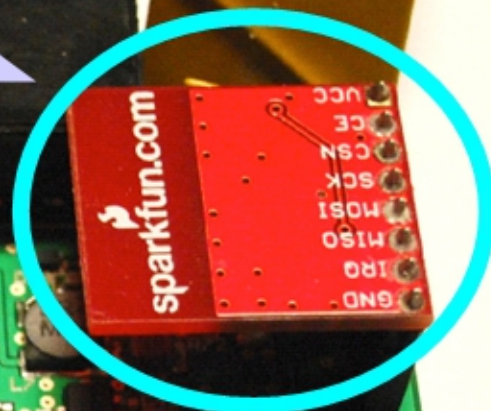


6 Servo Ports



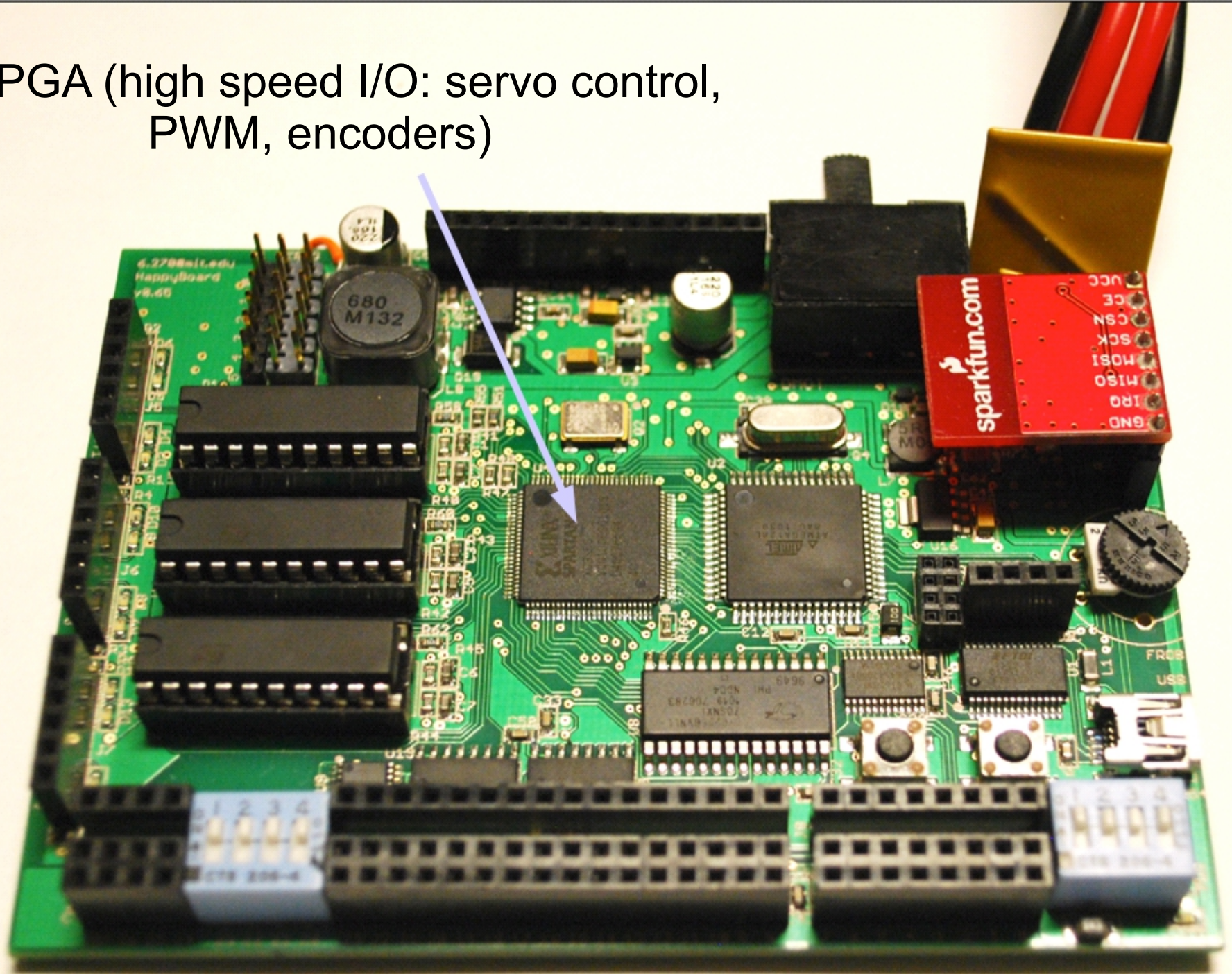


# Wireless Module nRF24L01





FPGA (high speed I/O: servo control, PWM, encoders)





# Batteries

- 2 Lithium-polymer Batteries

- 800 mAh for logic
- 2200 mAh for motors
  - 20 amps continuous!



- LiPoly Chemistry:

- 7.4V (2-cell batteries)
- Nice discharge curve
- High energy density
- Beware: under voltage
- Beware: over-charge



# More Batteries

- Very high energy density means catastrophic failure if abused!

[http://www.youtube.com/watch?v=d4INx2Wn6Oc&feature=player\\_detailpage#t=8s](http://www.youtube.com/watch?v=d4INx2Wn6Oc&feature=player_detailpage#t=8s)

- **Don't leave charging unattended!**
- **Don't leave charging overnight!**
- Seek TA immediately if battery wires come loose or if battery swells up

# Schedule: Big Picture

## This week

- Build chassis/drivetrain
- Driving straight
- Navigate to points
- Testing

## Week 2

- Fine-tune navigation  
(e.g. optimize turns)
- Build manipulation  
Devices
- Testing

## Week 3

- Implement Strategy
- Testing
- Testing
- Testing

# Thanks!

- Turn in your media and safety forms to the front
- Kit building will begin in 38-600 at 12:30pm
- Questions? Concerns?  
[6.270-organizers@mit.edu](mailto:6.270-organizers@mit.edu)