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IAP 2013

6.270

LEGO ROBOTICS COMPETITION

MIT AUTONOMOUS LEGO

INVITE YOUR FRIENDS!

REGISTER AT http://mit.edu/6.270 BY DEC 14

CONTACT US AT 6.270-organizers@mit.edu

Meet the Organizers

- Isaac
- Ronald
- Daniel
- Ryan
- Jessie
- Christina
- Andrew

6.270-organizers@mit.edu

Two hundred and seventy years into the sixth millennium . . .

The human race exceeded the original Earth's capacity long ago, and was forced to transform into galactic hunter-gatherers. Constantly on the move, they must gather up an entire solar system's resources to power their next stellar jump. Though their tools and spacecraft are powerful, the clans' numbers are too small, so most of the gathering is done by robot.

It's been a long time since the planet-harvests were good enough to build new ships. You, the captain of one of these roving colonies, own an aging fleet, and some of the ships are breaking down. You must design a robot that can handle the uncertainties of an old ship. The robot must also harvest resources from the surrounding solar systems to power your colony.

But Lo! On the holoscreen, appears an unknown ship! It hails from a foreign colony, and is trying to steal your resources! Well, there's only one way this can play out....

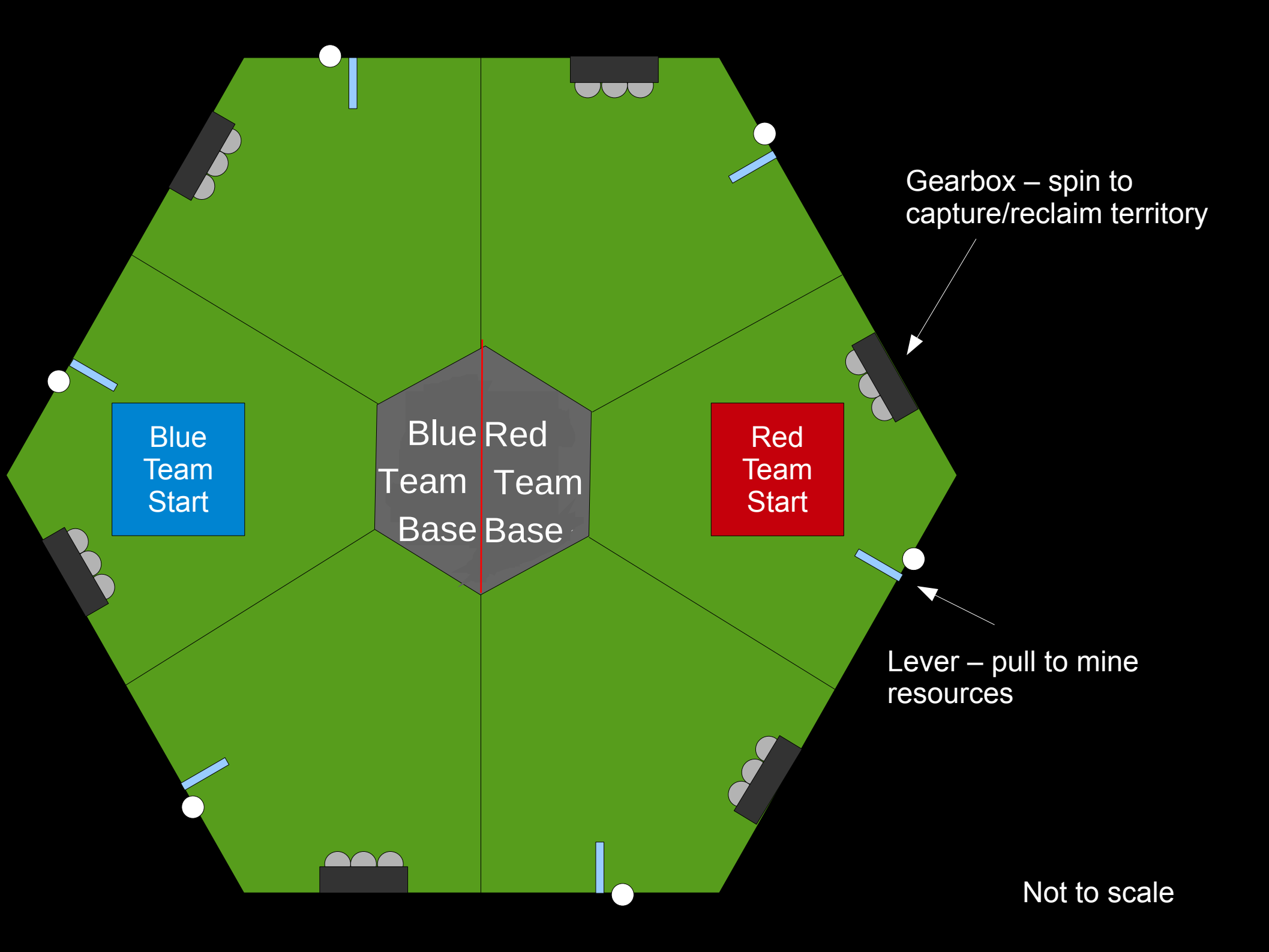
The Game

Explore the galaxy

Capture territories

Gather resources

Deposit at your colony


Gearbox – spin to capture/reclaim territory
Blue Team Start
Blue Team Base
Red Team Base
Red Team Start
Lever – pull to mine resources
Not to scale

Details

- 2 minute round – first 10 seconds Exploration only
- Capture territory by spinning gearbox
- Must capture territory to mine resources
- Mine resources (ping pong balls) by pulling lever
- Max 5 resources per minute in each territory
- Deposit resources in center

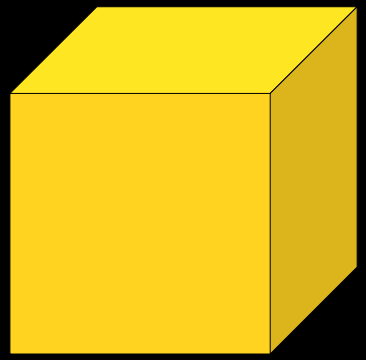
Rules subject to change

Scoring

Explore	10 points per new territory (30 points per territory in first 10 seconds)
Capture	100 points per territory
Gather	40 points per resource
Deposit	40 points per resource

Rules subject to change

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

[videos]

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
Wednesday, January 30th
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 Isaac or email 6.270-organizers@mit.edu
- Lab hours: 9am – 11pm

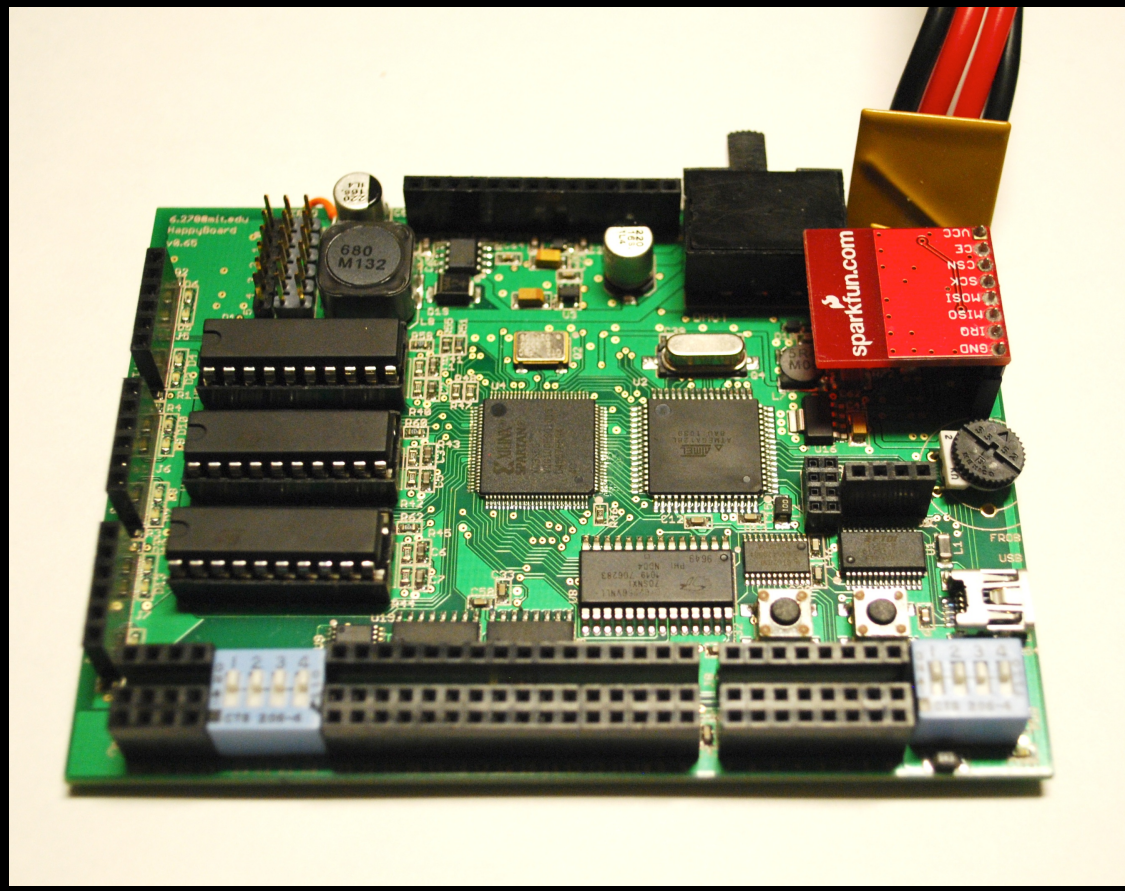
  (staffed from noon to close)
- Grading P/D/F – 6 units – to pass:
  - Qualifying robot
  - Team attendance
  - Robot web page and source code due at end of course

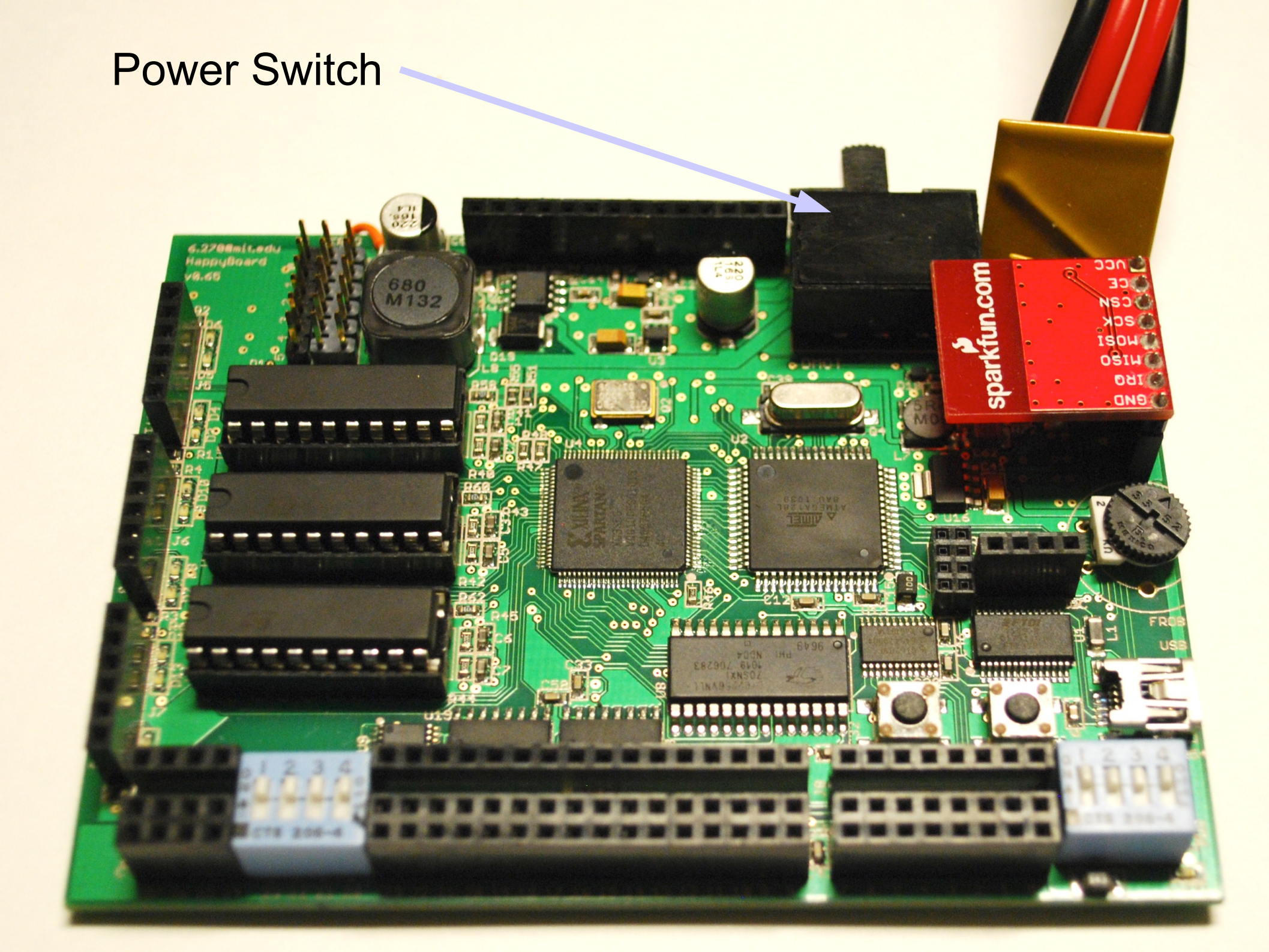
Lab Guidelines

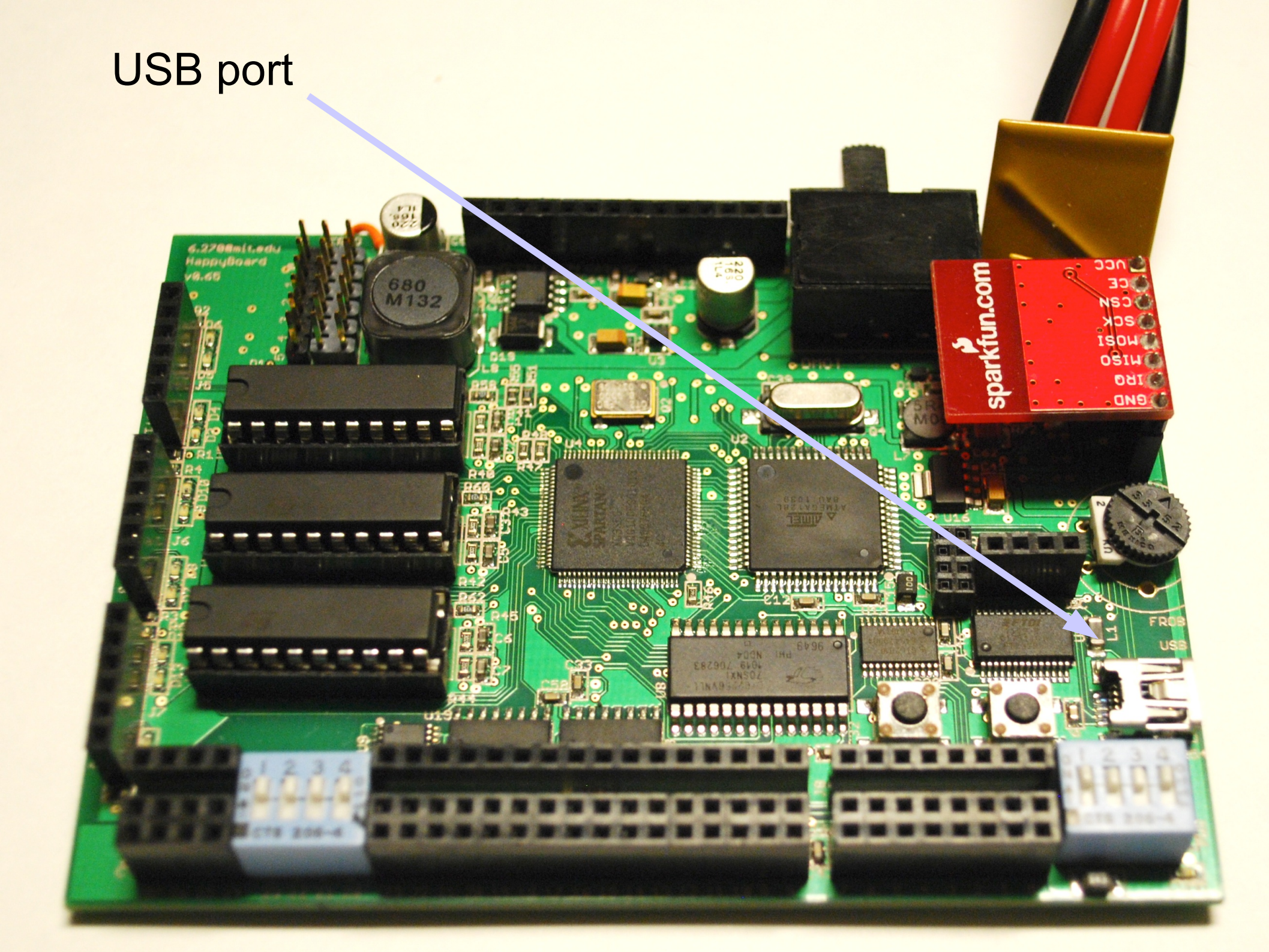
- No food!
- We are guests – there is expensive equipment – leave it alone or 6.270 will be kicked out
- Only solder or hot-glue over ceramic tiles
- NO FOAM TAPE ON ANYTHING!

Happyboard Introduction

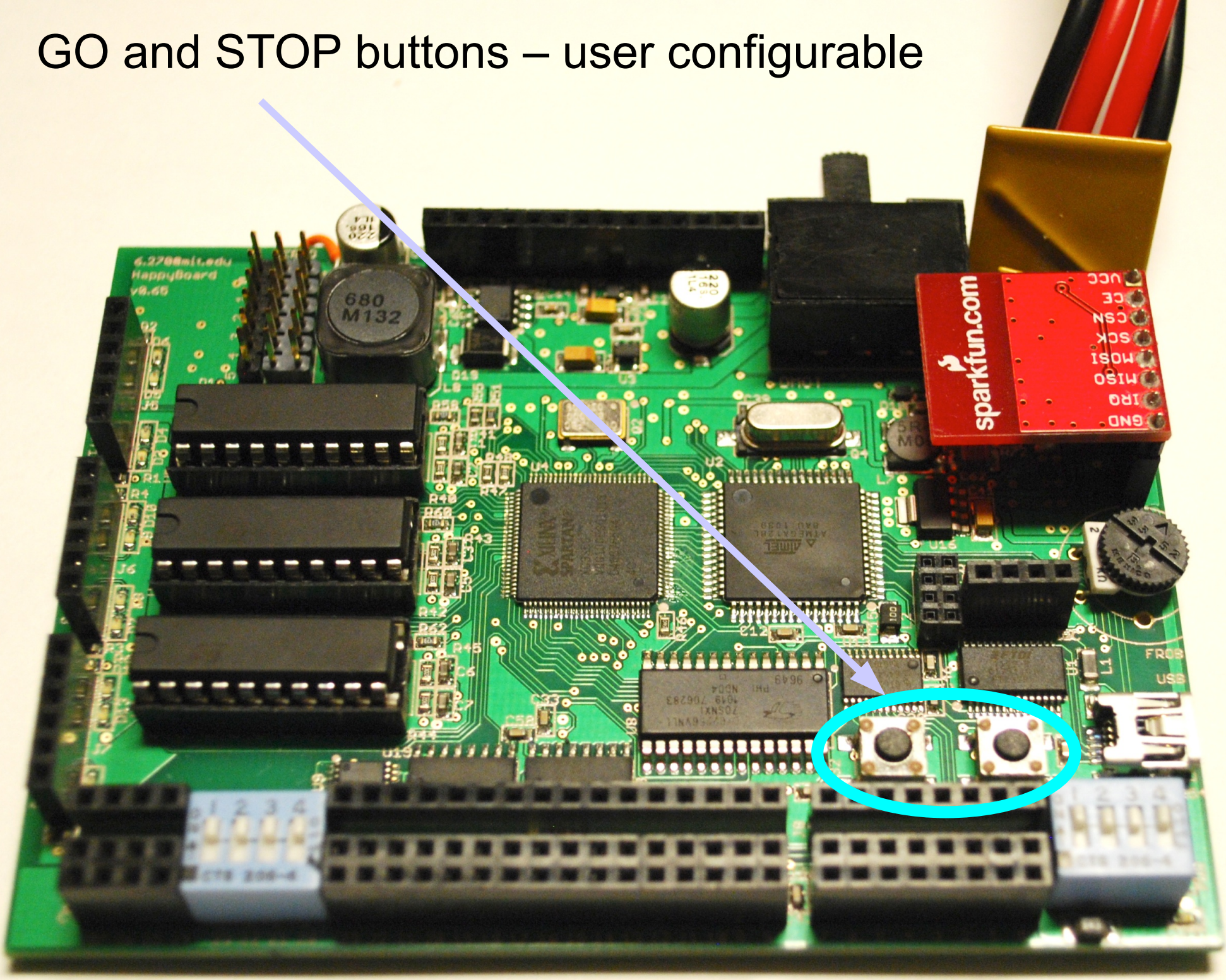
- Programmable microcontroller
- Lots of I/O:
  - USB
  - 8 digital IO
  - 16 analog inputs
  - 4 high-speed encoder
  - 6 DC Motors
  - 6 Servos
  - Wireless
  - I2C
  - LCD




Power Switch
sparkfun.com
VCC
CE
CSN
SCK
MOSI
MISO
IRQ
GND

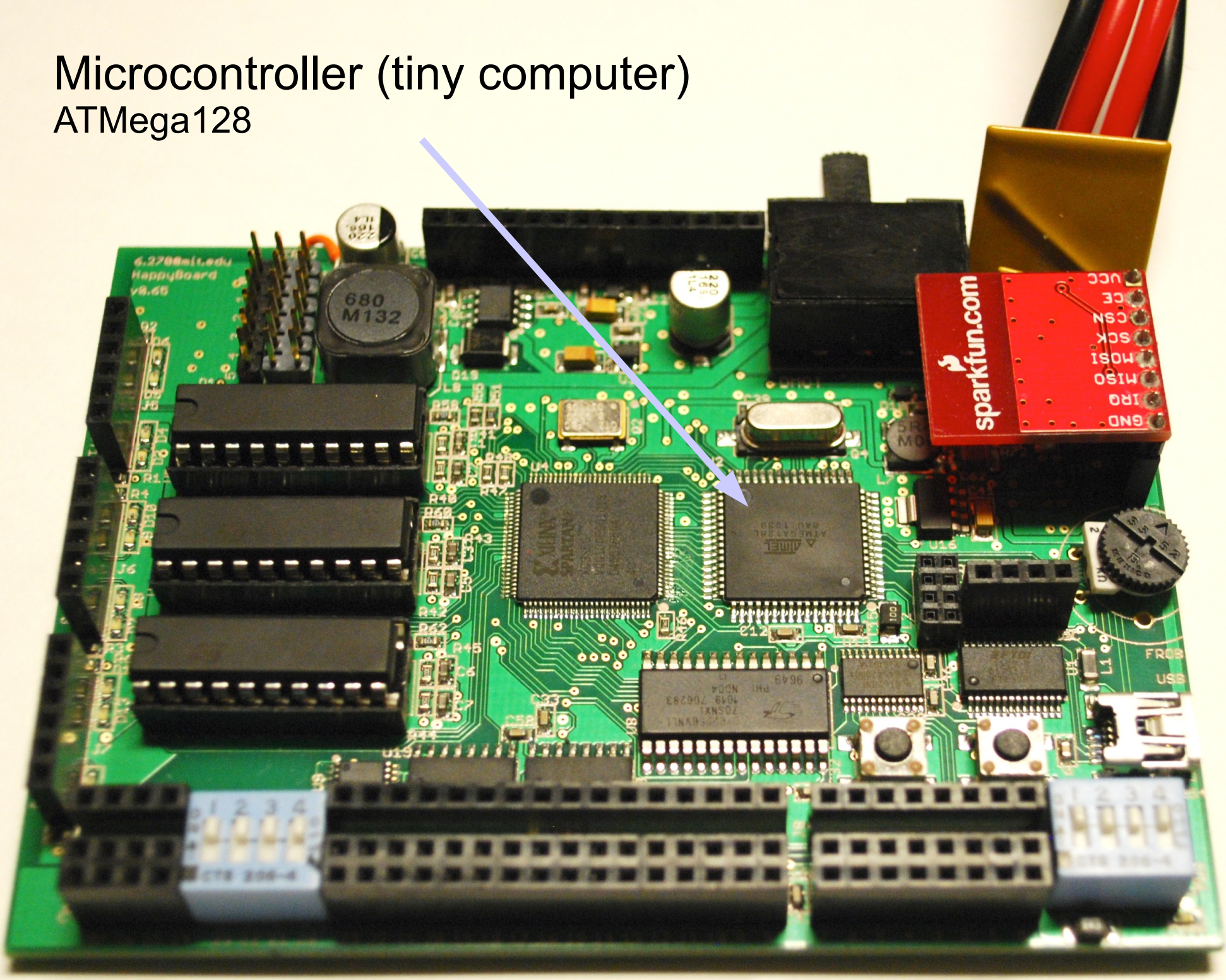

USB port
sparkfun.com
VCC
CE
CSN
SCK
MOSI
MISO
IRQ
GND
6.270@mit.edu
HappyBoard
v0.66
680
M132

GO and STOP buttons – user configurable

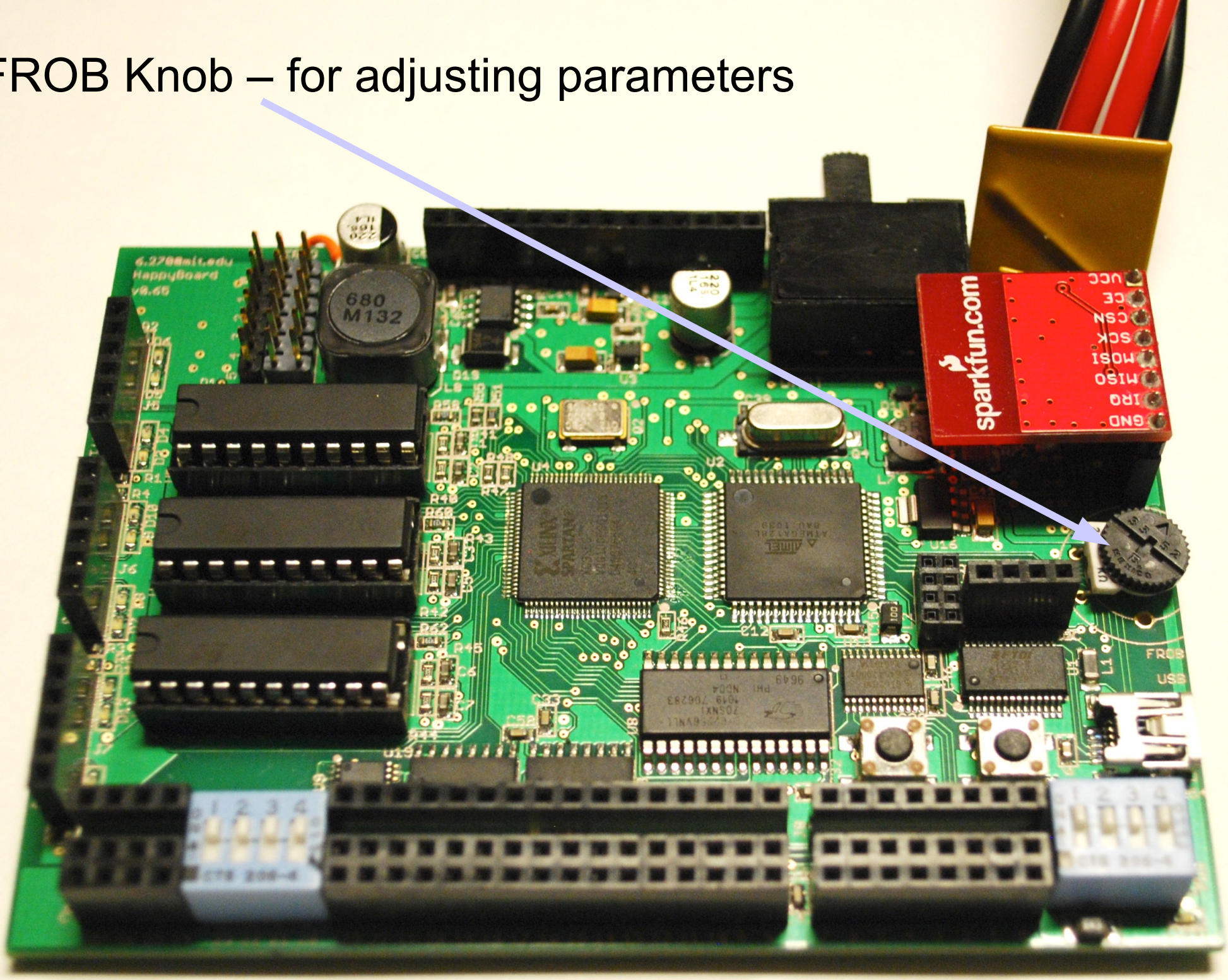


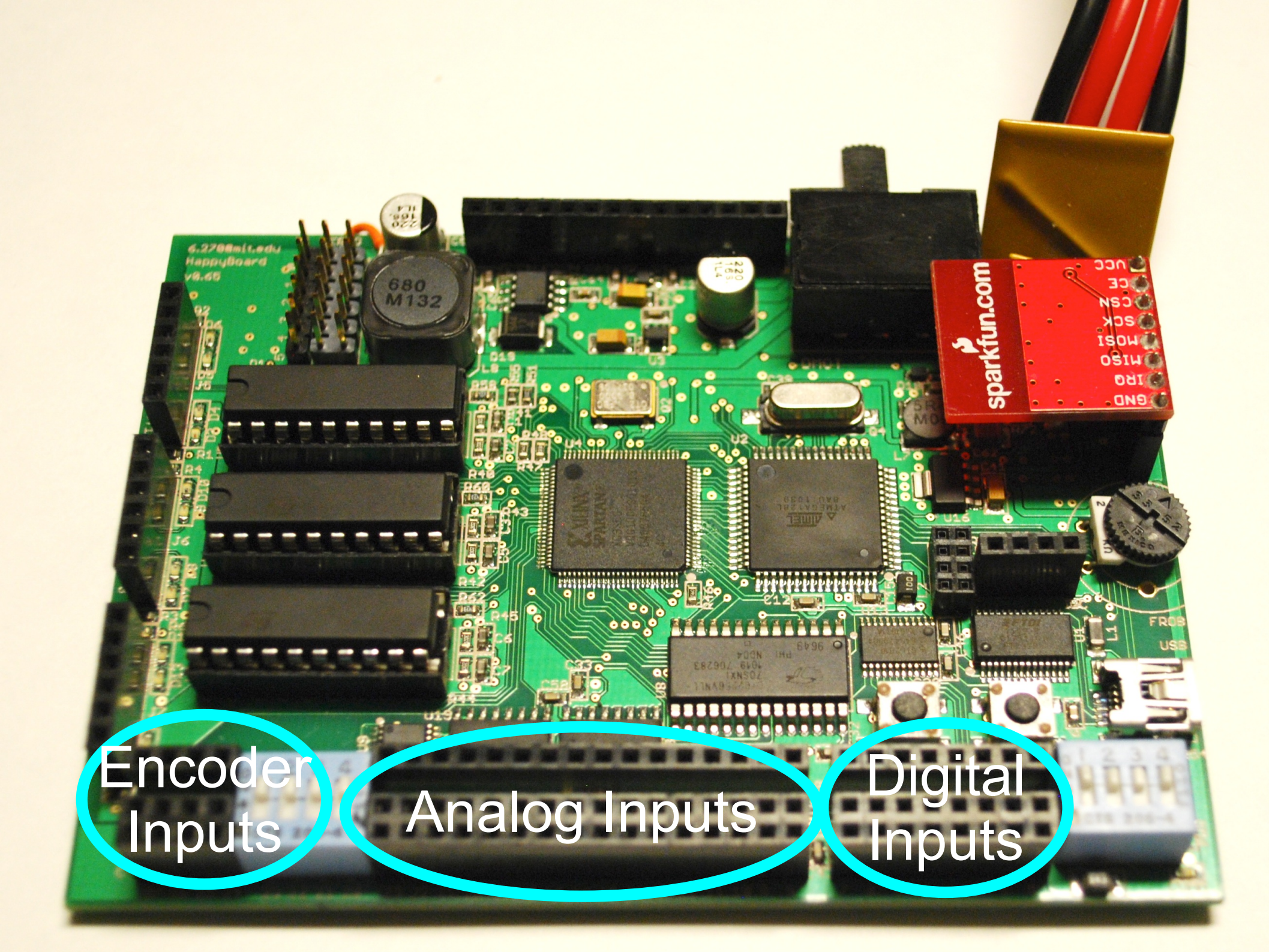
Microcontroller (tiny computer)

ATMega128



FROB Knob – for adjusting parameters

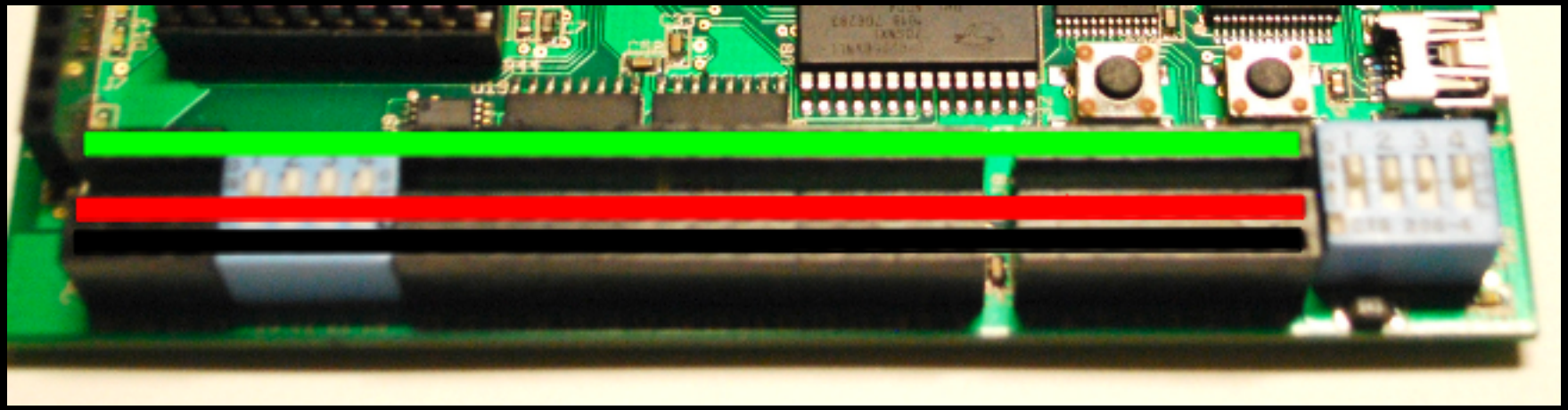


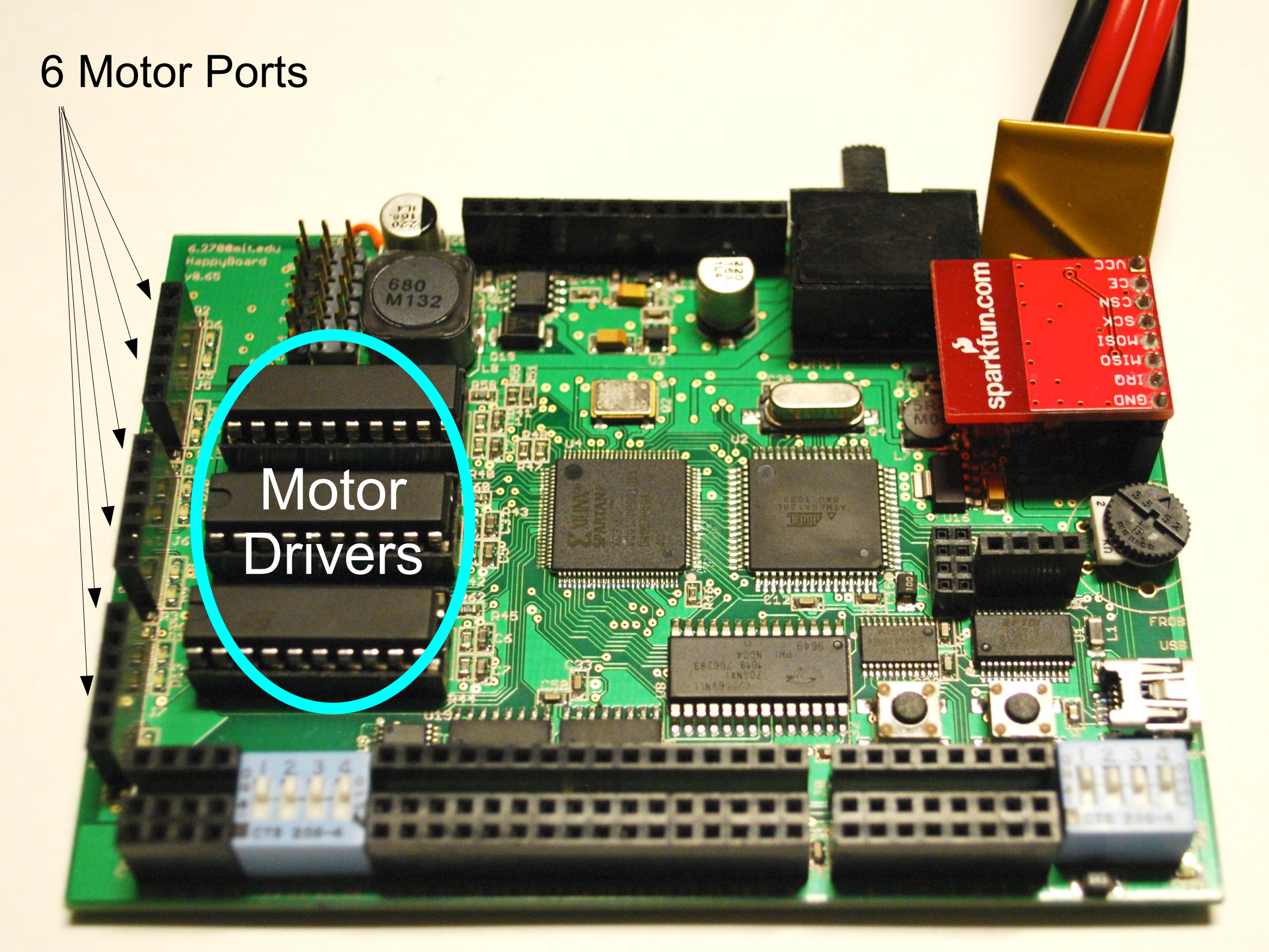

Encoder Inputs
Analog Inputs
Digital Inputs

Green: Signal (input)

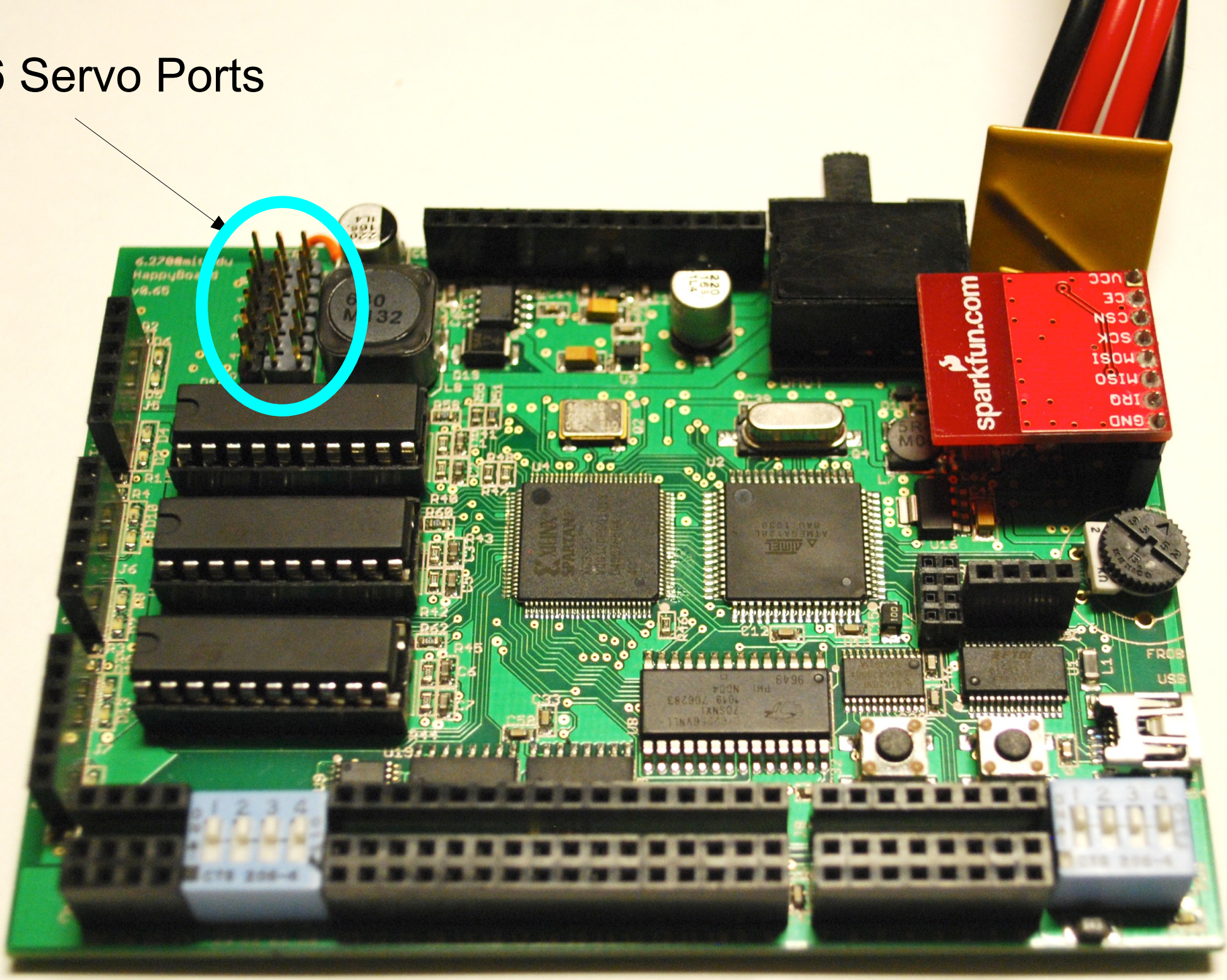
Red: +5V

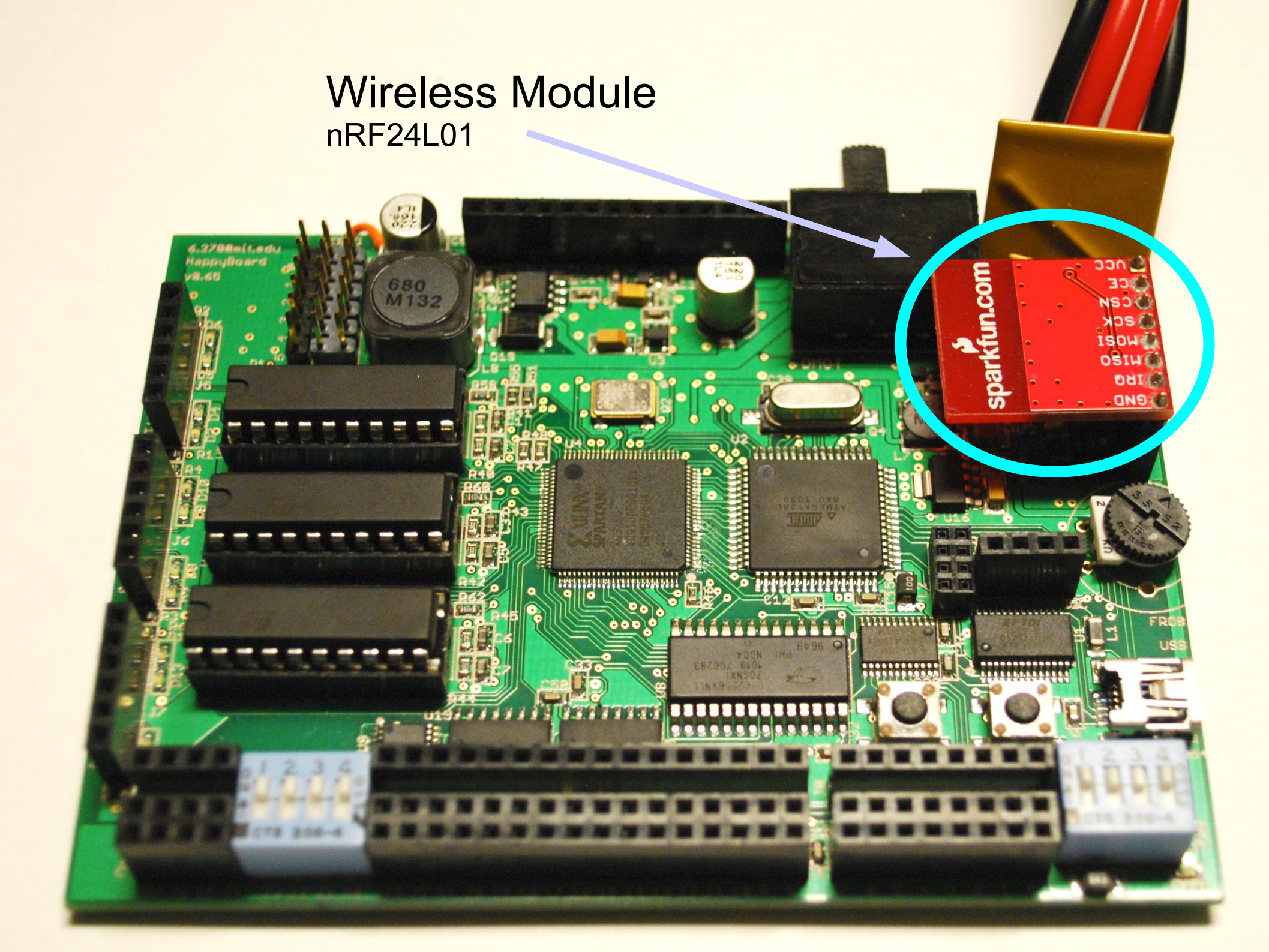
Black: Ground



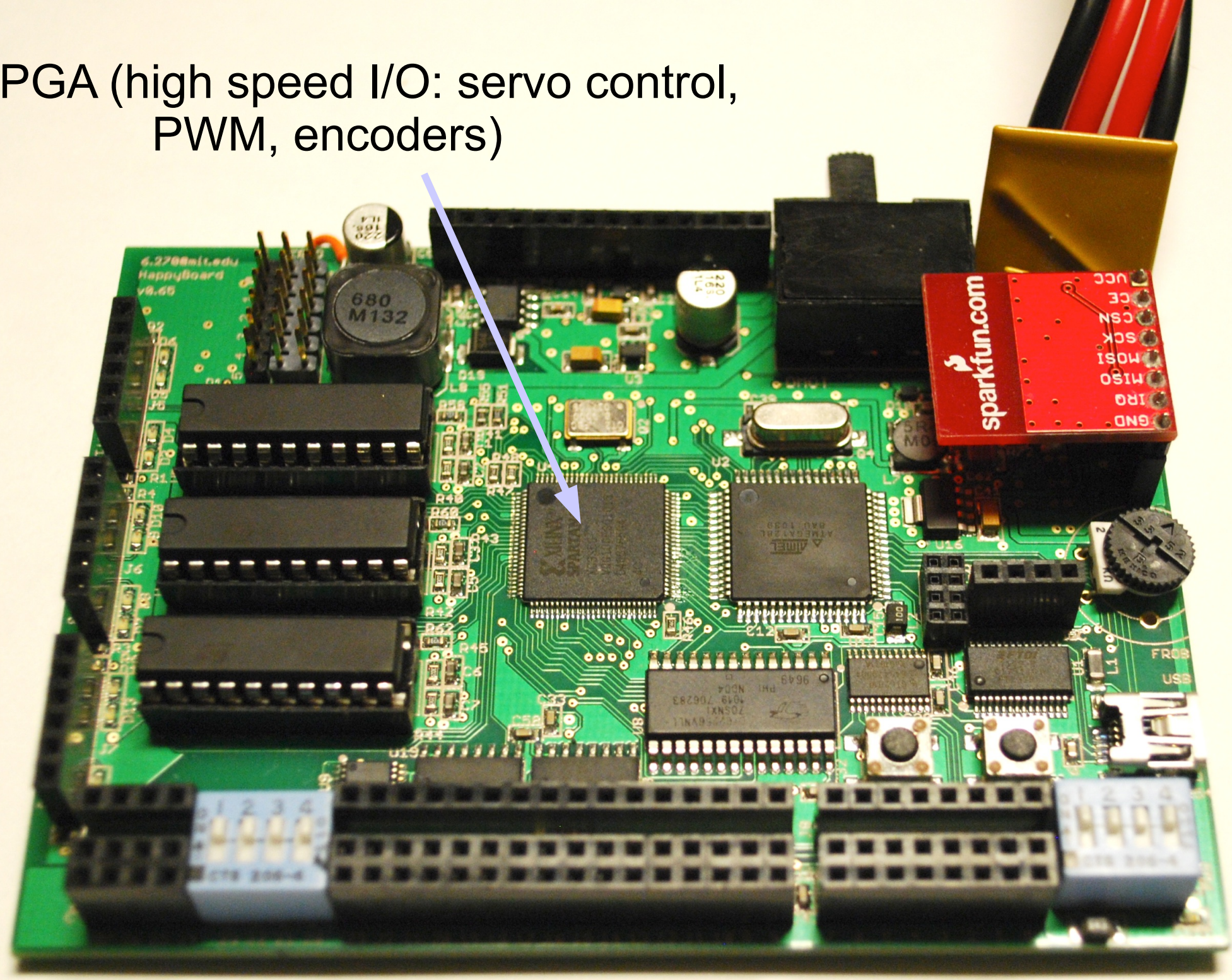

6 Motor Ports
Motor Drivers
sparkfun.com
VCC
CE
CSN
SCK
MOSI
MISO
IRQ
GND

6 Servo Ports




Wireless Module
nRF24L01
sparkfun.com
VCC
CE
CSN
SCK
MOSI
MISO
IRQ
GND

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



Batteries

- 2 Lithium-polymer Batteries
  - 500 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

- Don't leave charging unattended!
- Don't leave charging overnight!

- Seek TA immediately if battery wires come loose or if battery swells up