
IAP 2012
25TH YEAR ANNIVERSARY!
6.270
MIT AUTONOMOUS LEGO ROBOTICS COMPETITION
Feudal Frenzy
ORACLE
EE CS
LEGO
intempo
Dropbox
ANALOG DEVICES
sparkfun ELECTRONICS

Meet the Organizers

- Scott
- Isaac
- Tommy
- Steven
- Andrew
- Adrian
- Luke

6.270-organizers@mit.edu

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

Earth has been abandoned, and the only remaining inhabitants are the humans who chose to stay following the destruction of Earth's natural resources and mass exodus of 3276.

Condemning the technology that scarred the landscape before, they live much like the people of the medieval times, with castles, kingdoms and a primitive agrarian society. However, they are plagued by war and disease; hunger and tribal warfare threaten to wipe out all of civilization. It is a new dark age.

But there is hope: long-dormant robots, left behind by wise men and women before the apocalypse, arise from the depths of the mines of Miasmador. In the final hour, these robots will battle for supremacy by demonstrating their superior resource gathering and leadership abilities to win the support of future generations, and save humanity from destruction.

Your task, as the wise engineers of pre-apocalypse Earth, is to develop these autonomous robots. You have just 1 month to do so.

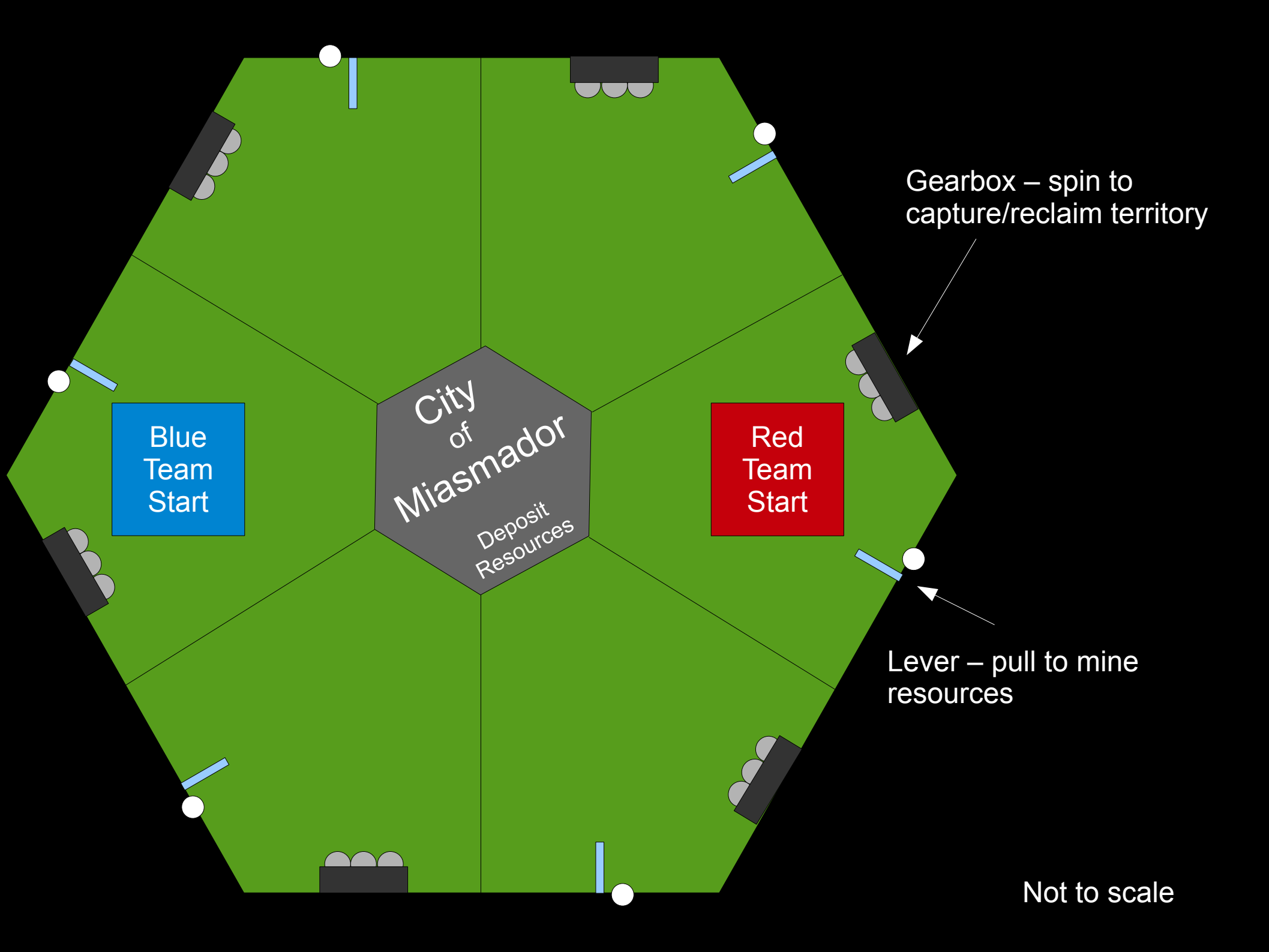
The Game

Explore the land

Capture territories

Gather resources

Deposit in Miasmador


Gearbox – spin to capture/reclaim territory
Blue Team Start
City of Miasmador
Deposit Resources
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

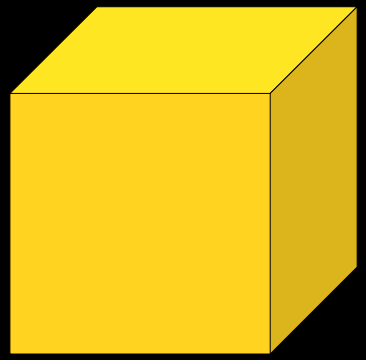
Rules subject to change

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

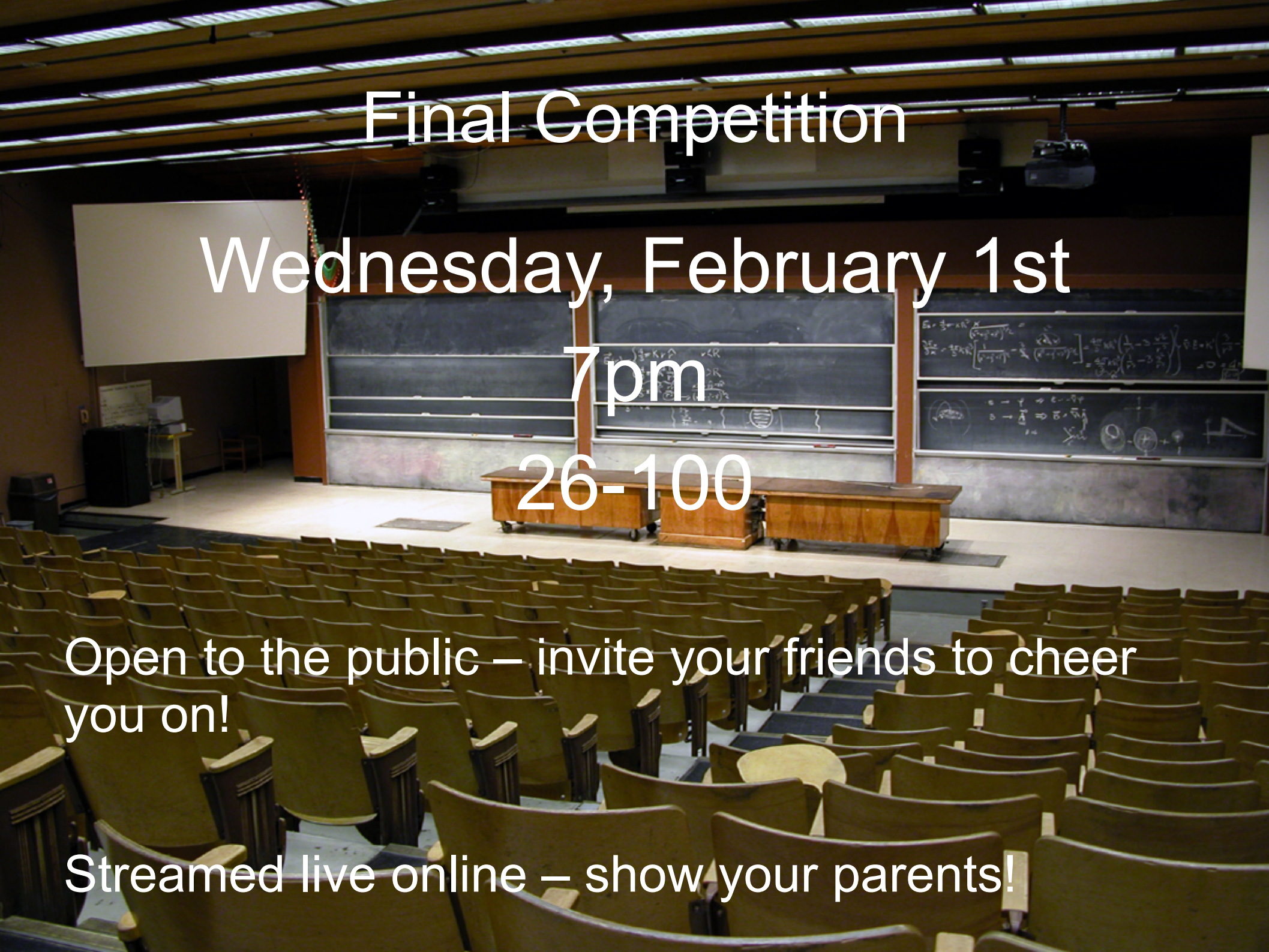
[videos]

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, February 1st
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 Scott or email 6.270-organizers@mit.edu
- Lab hours: 9am – 11pm

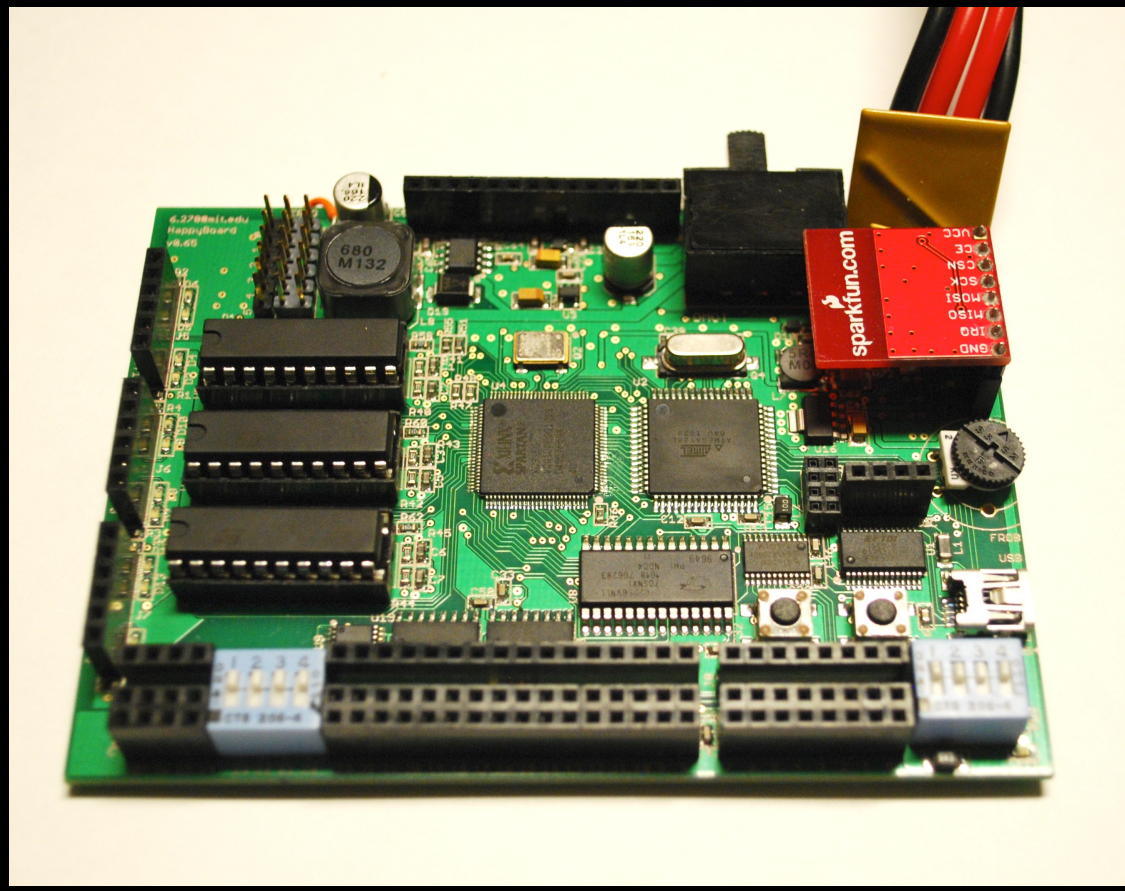
  (staffed from noon to close)
- Grading P/D/F – 6 units – to pass:
  - Qualifying robot
  - Team attendance
  - Robot web page and source code due at end of course

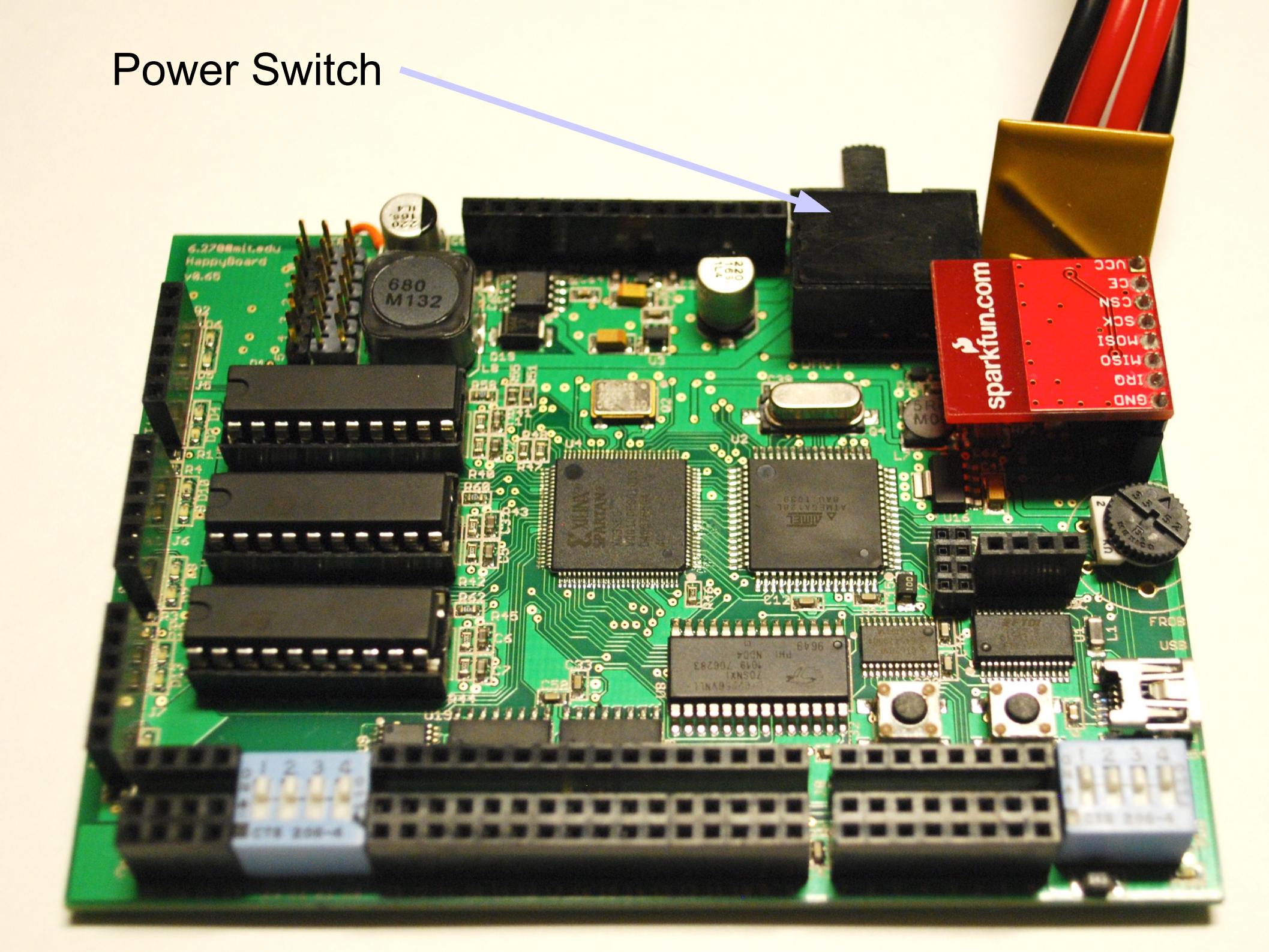
Lab Guidelines

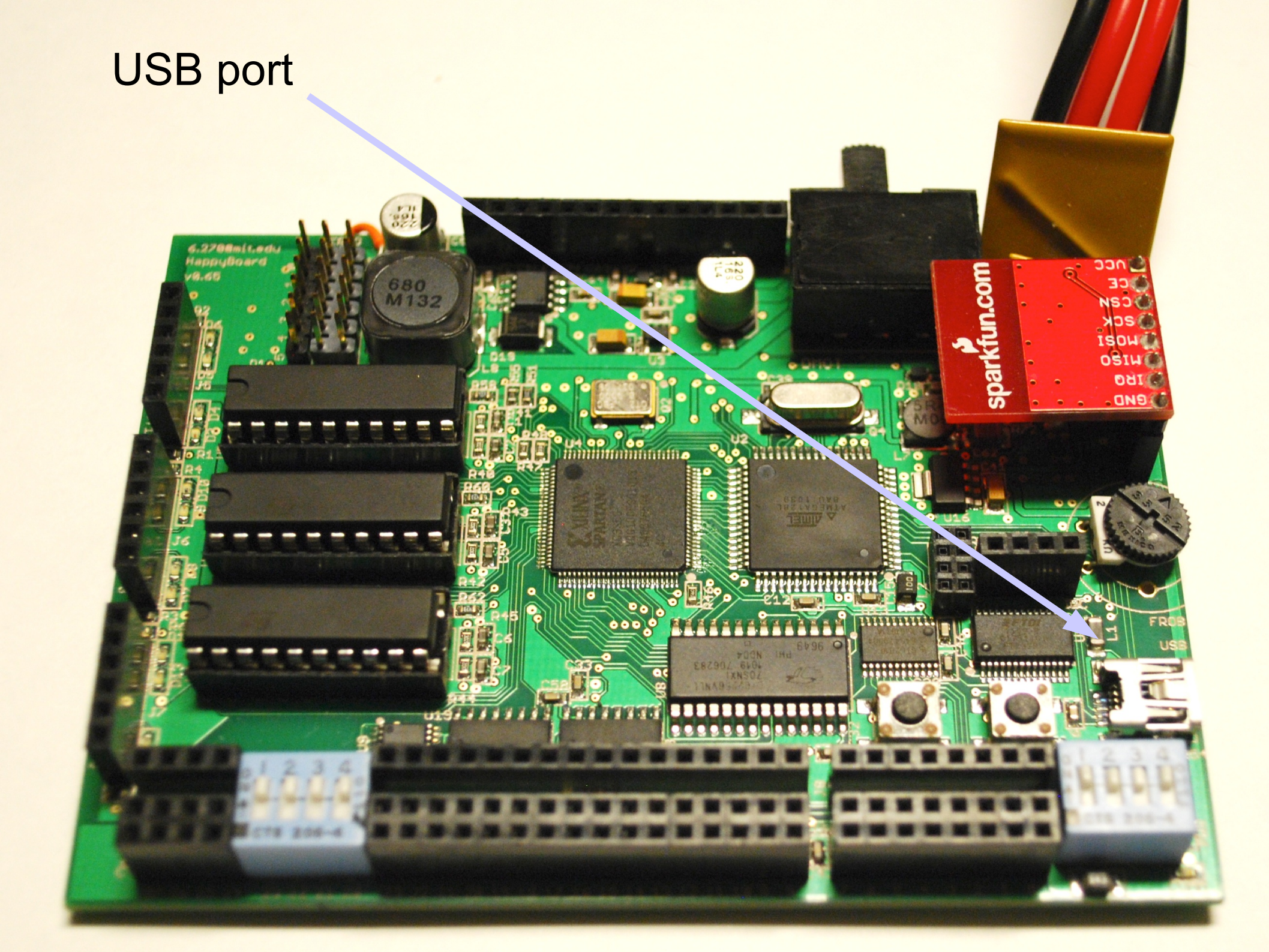
- No food!
- We are guests – there is expensive equipment – leave it alone or 6.270 will be kicked out
- Only solder or hot-glue over ceramic tiles
- NO FOAM TAPE ON ANYTHING!

Happyboard Introduction

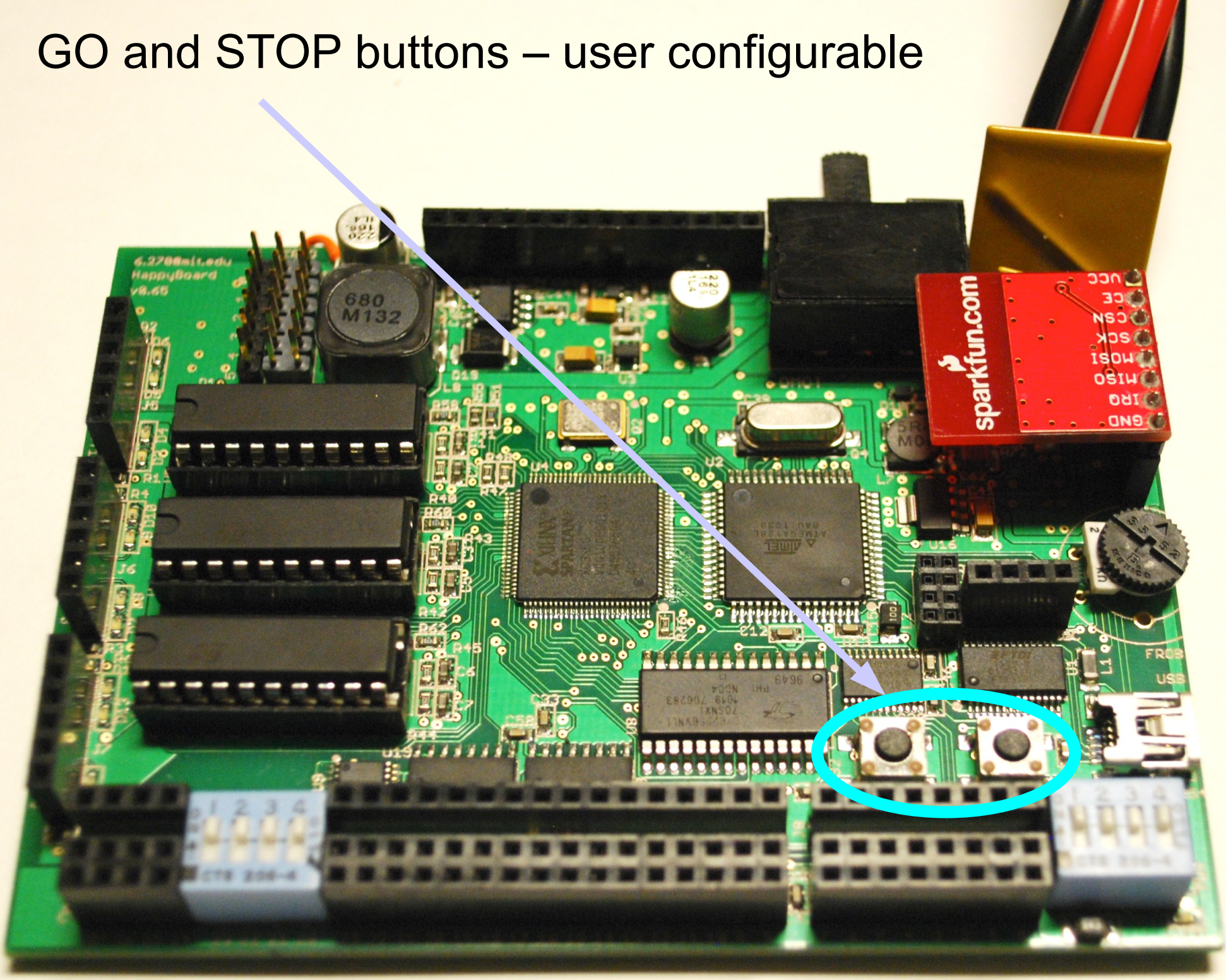
- Programmable microcontroller
- Lots of I/O:
  - USB
  - 8 digital IO
  - 16 analog inputs
  - 4 high-speed encoder
  - 6 DC Motors
  - 6 Servos
  - Wireless
  - I2C
  - LCD




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

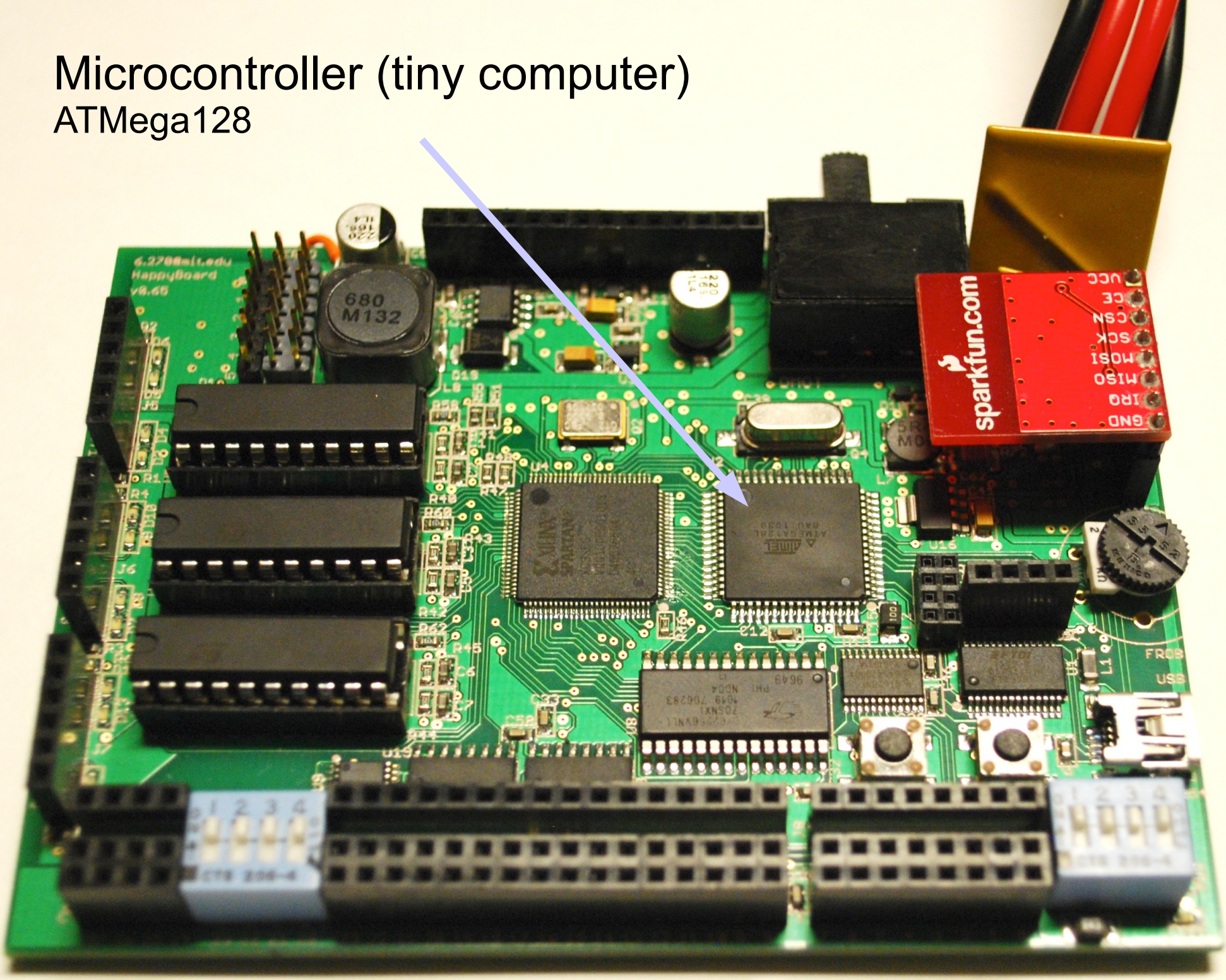

USB port
sparkfun.com
VCC
CE
CSN
SCK
MOSI
MISO
IRQ
GND
6.270@mit.edu
HappyBoard
v0.66
680
M132

GO and STOP buttons – user configurable

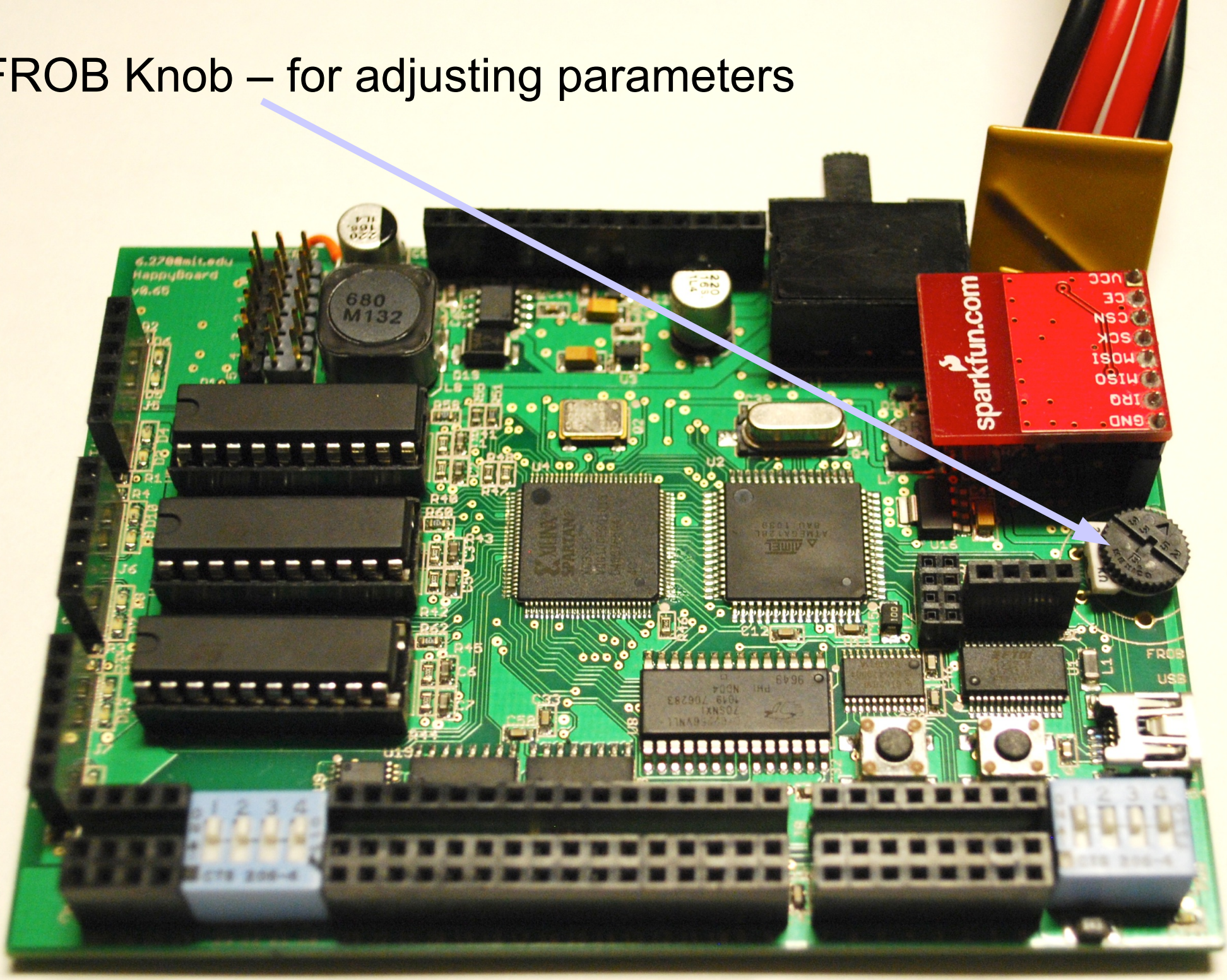


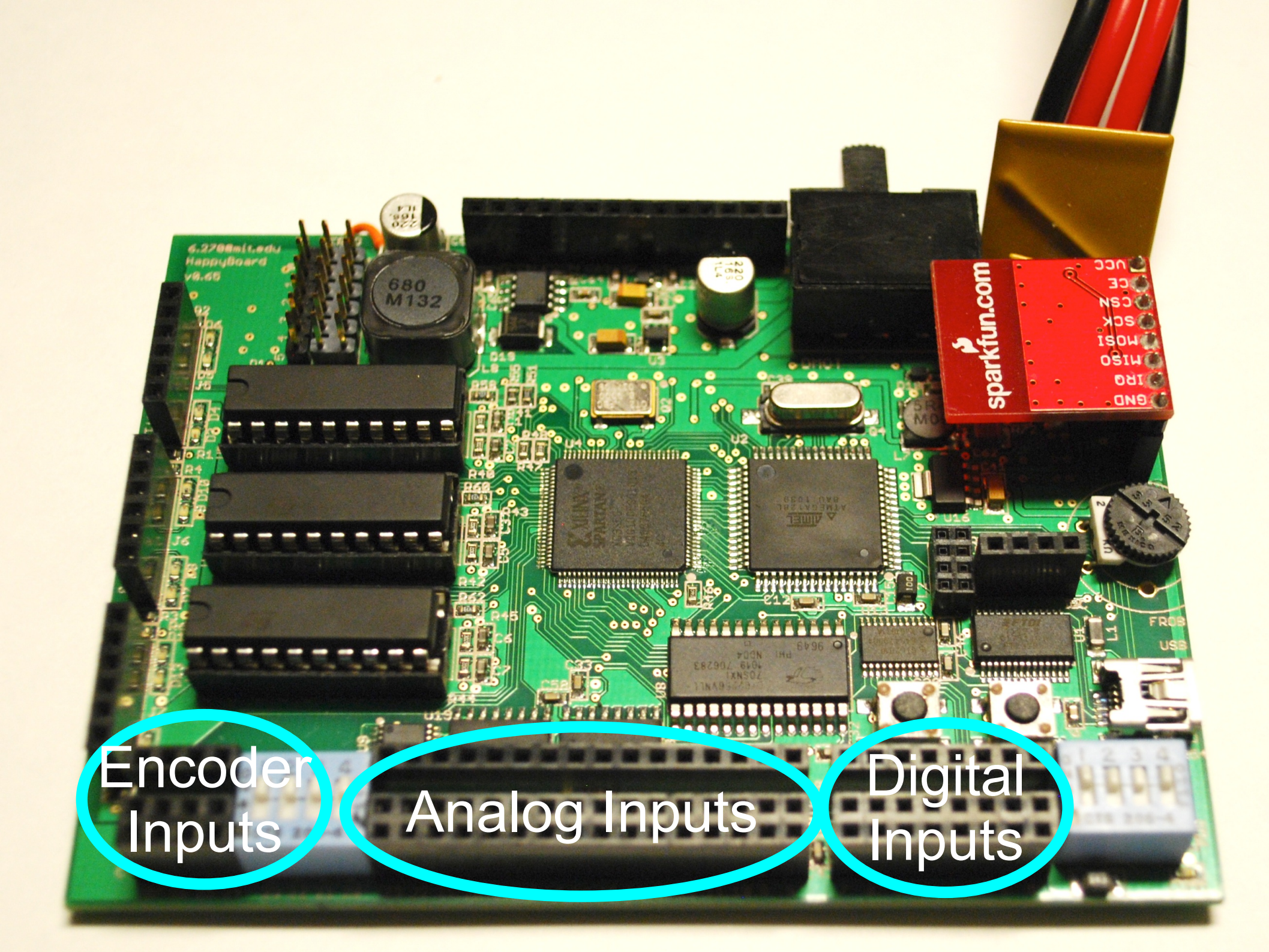
Microcontroller (tiny computer)

ATMega128



FROB Knob – for adjusting parameters

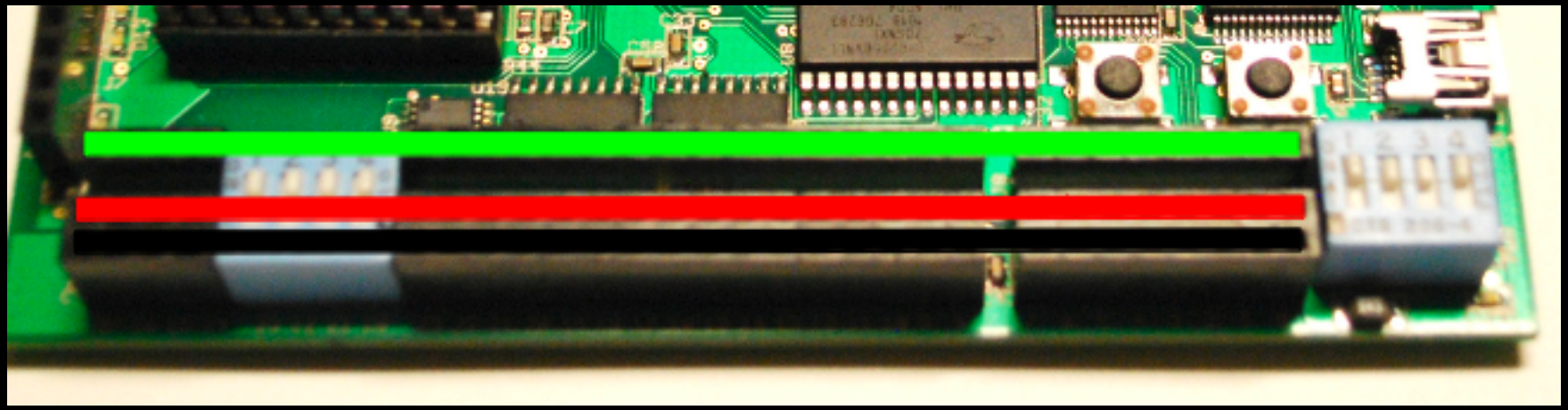


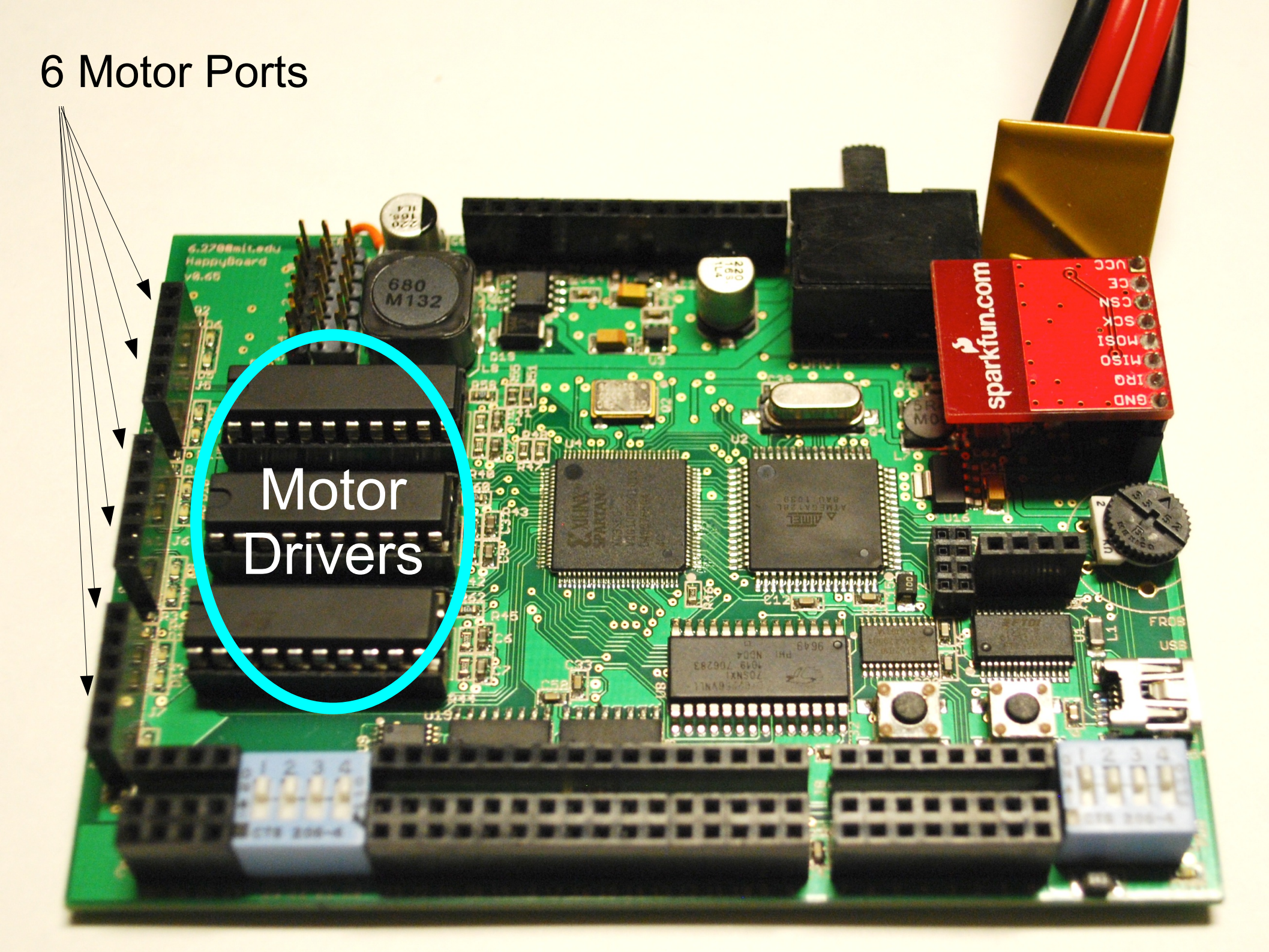

Encoder Inputs
Analog Inputs
Digital Inputs

Green: Signal (input)

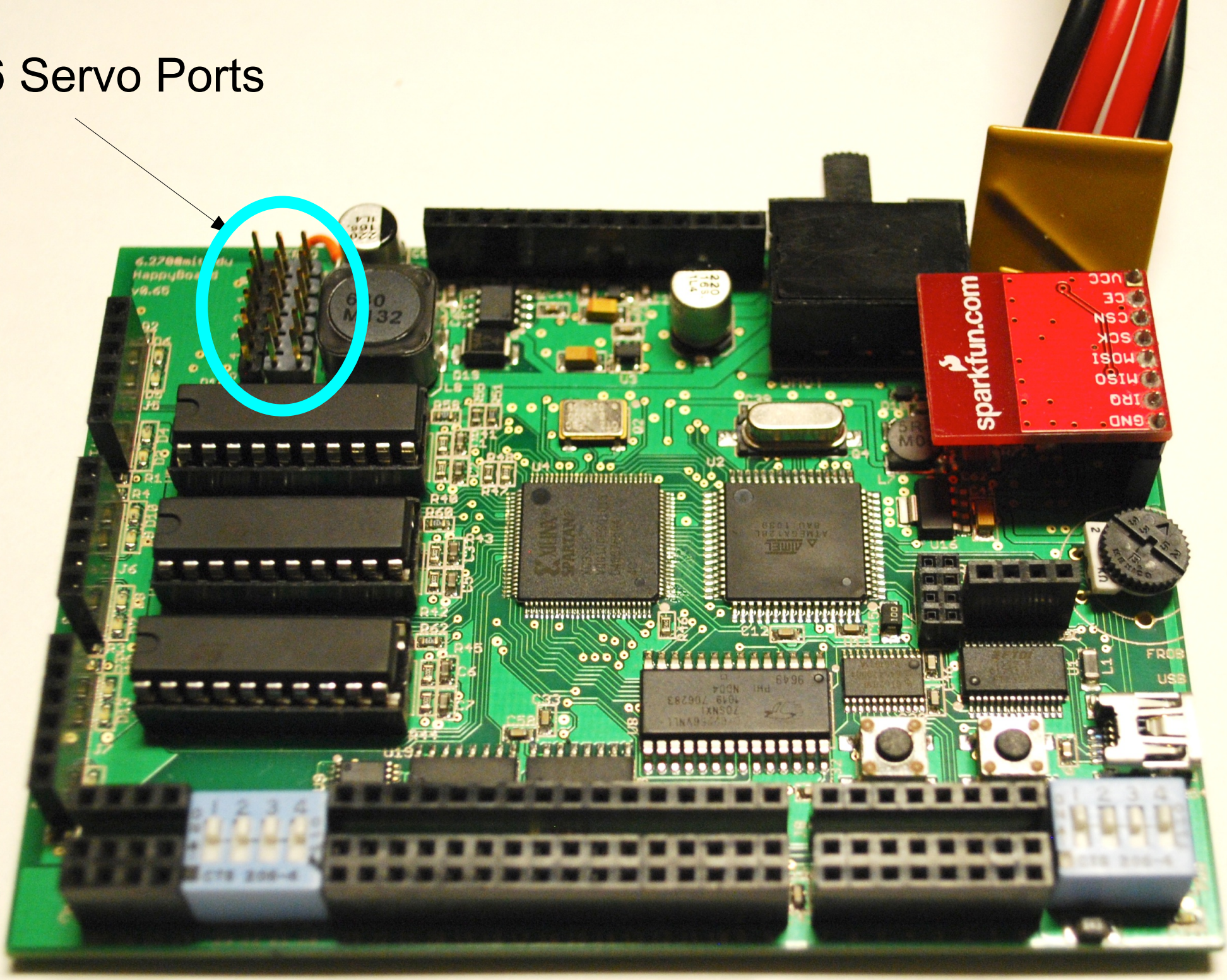
Red: +5V

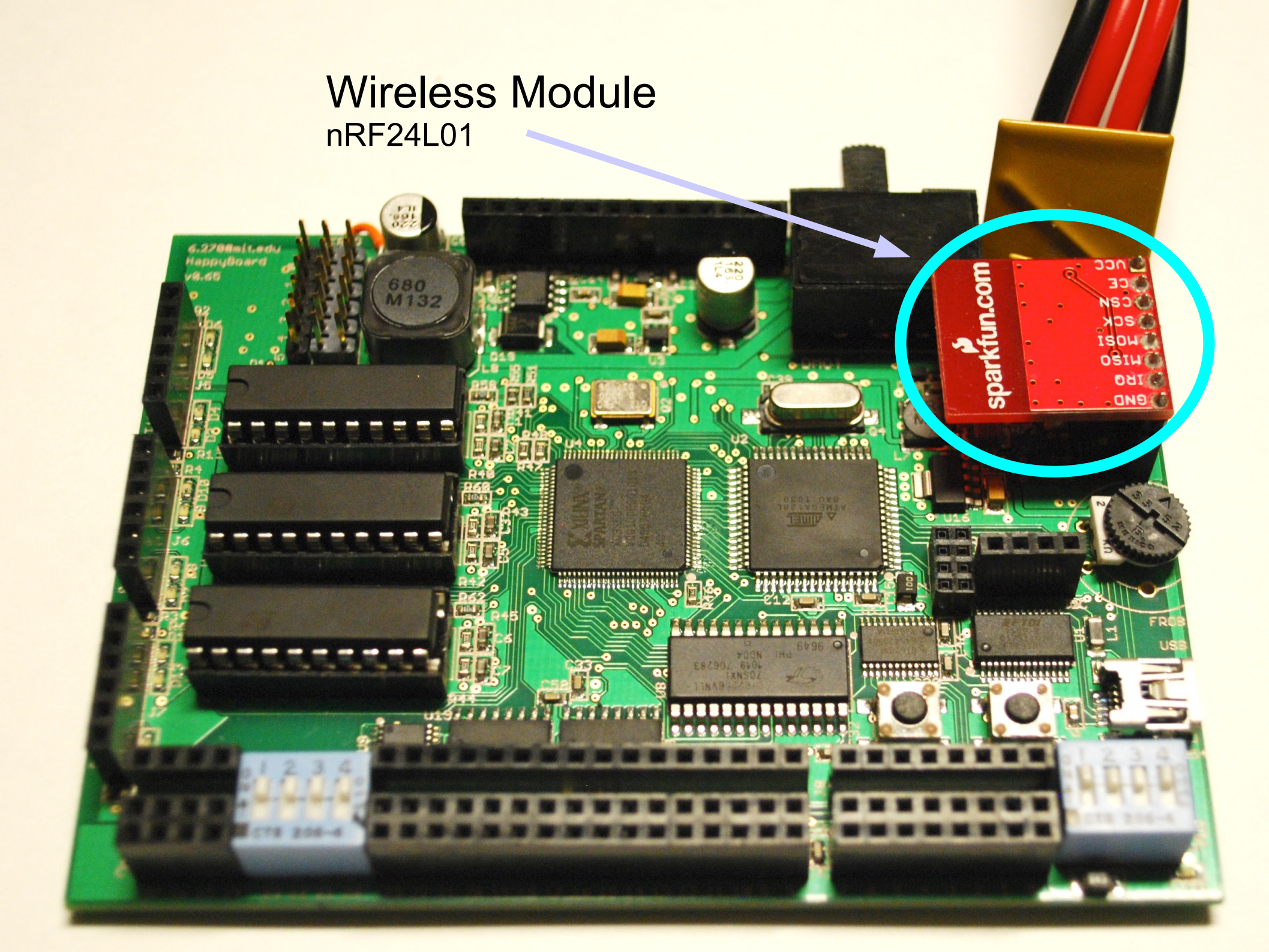
Black: Ground



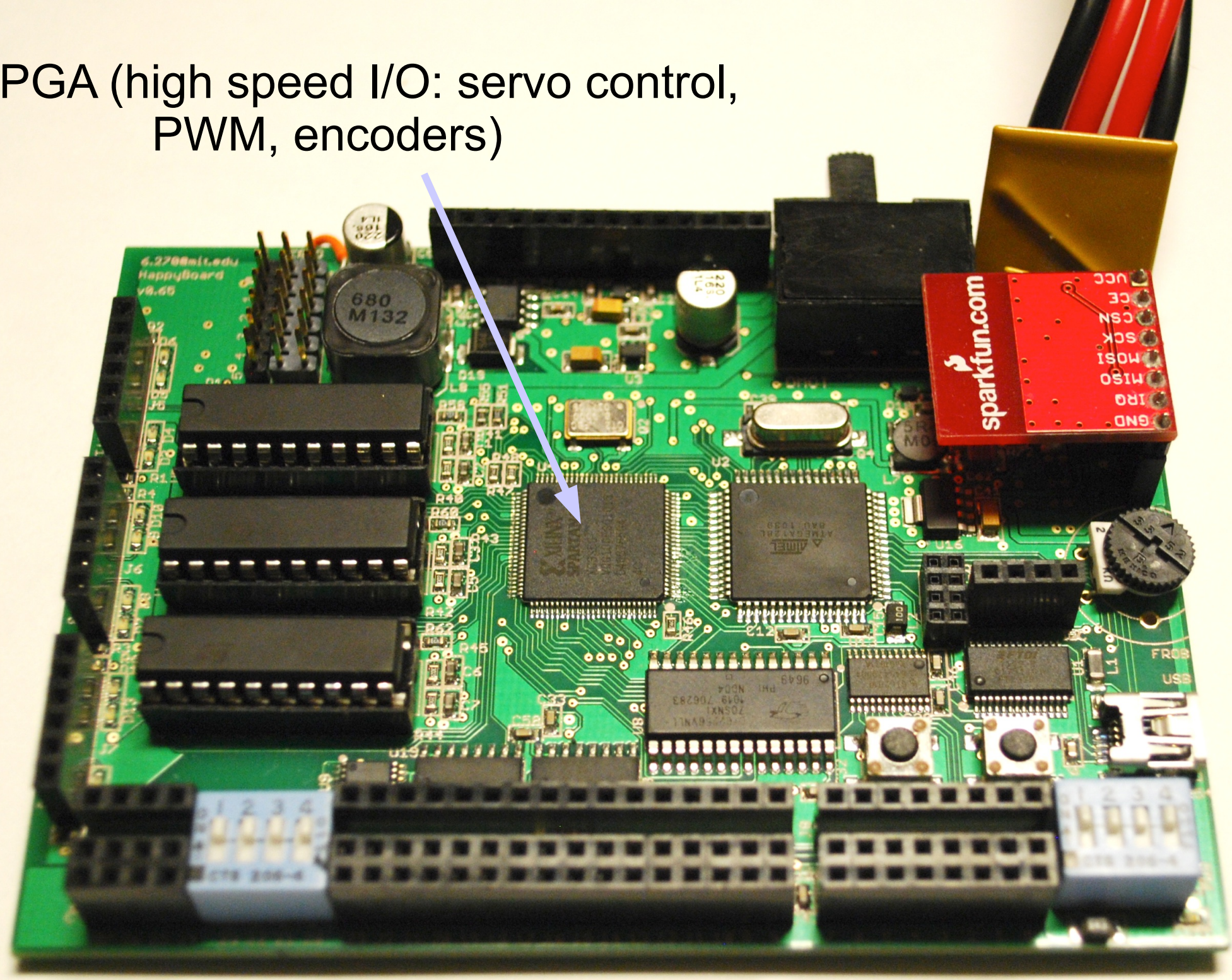

6 Motor Ports
Motor Drivers
sparkfun.com
VCC
CE
CSN
SCK
MOSI
MISO
IRQ
GND

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

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

Later today...

- 12pm - Kit distribution after lecture
  - Meet in lab (38-600) – wait for instructions before taking your kit
- 1pm – Setting up your development environment
  - Bring a laptop and your kit
  - Meet outside 34-101
- 3pm – Lecture 2: Lego, Motors, Sensors
  - 34-101
- 5pm – Pizza & chat – get to know each other and the organizers
  - Hallway outside lab