

Flowbits - rectangular blocks that can be connected together to form circuits.

(TODO: Better name?)

Basic concepts

- Blocks attach to each other with magnets. Power lines are on top of magnets.
- There is one power block that supplies power.
- The signal is transmitted digitally between each block (using IR light).
- Each block typically has one output signal that it broadcasts to all neighbors, and uses the neighbors output signals for some of its parameters.
- There is one generic computational block that can be set to different modes / functions.
- There might also be other types of blocks eventually, e.g. sensor blocks, motor blocks, tentacle blocks, light driver blocks, wall power remote control blocks, etc..
- Dimensions of block probably around 7x7 to 8x8 cm, leaves room for 4xAA battery case and fits nicely in hand.
 - Rectangular grid allows for double sized or odd sized blocks too (e.g. one to two octave piano keyboard block).

Blocks

Powerblock

- 4xAA battery holder
- DC 5V input jack
- PWM output drivers x 6 (one for each edge, encode value to 0..full output cycle)
- Servo outputs x 6 (one for each edge, encode incoming edge value to servo position)
- (Power switch)
- Builtin speaker would be nice too.

Sensor Block

-

General computation block

- ATmega microcontroller, 4 RGB leds, potentiometer for navigation and parameter adjustment, 4 clickable edges, 2x7 segment led screen
- Each mode has a number of parameters, whose values can be set with the rotating wheel to a specific value, or to the (average) value of specified neighbor output(s), or maybe to more complex functions (simple signal / noise generators)
- Available modes (followed by parameters for the mode):
 - Signal generator
 - Waveform
 - Sine, Square, Sawtooth, etc
 - Frequency
 - Amplitude
 - Noise generator

- Sequencer
- Random melody / sequence generator
- Mixer
- Filter
- Delay filter (echo, reverb, etc effects)
- RGB signal visualizator
- Neural network / game of life nodes (4 of them, one for each side)
- etc

Part list (for general computation block):

- Rotary encoder x1
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=987-1398-ND>
 - 10 pcs: 0.93900 / a
- Microcontroller x1
 - ATmega 328 PU
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=ATMEGA328-PU-ND>
 - 3.05 (25 pieces: 1.91 / a)
 - or AT90USB162 (builtin usb support, surface mount)
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=AT90USB162-16AU-ND>
 - 2.88 (25 pieces: 1.8 / a)
- Resonator 16 Mhz x1
 - Digikey
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=490-1214-ND>
 - 10 pcs: 0.399 / a
 - Futurlec
 - <http://www.futurlec.com/Crystals/RESON16M0P3pr.shtml>
 - 0.2 / a
- Capacitors x2
 - Filter caps for microcontroller
 - (Close to zero, already have)
 - Power cap for scratchy contact
 - 47uF or similar electrolyte
- Protection diode for power polarity
 - ~0.5 - 1 A @ 6V
- Resistors
 - Series resistors for RGB lights, LED segment display..
 - LED Segment display: 14 (or 16) resistors
 - RGB Leds: 12 resistors
 - Maybe use resistor networks for saved space and improved sanity
 - Resistor network, 7 resitors, 8 pin, 220 Ohm: (maybe a bit too expensive)
 - Digikey
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=4608X-1-221LF-ND>
 - 0.25 / a when 50+
 - Futurlec
 - <http://www.futurlec.com/ResNetworks.shtml>

- 220ohm 9 Resistor Network (10 pins)
 - 0.25 / a
- Combination resistors for tilt switch, 4 of different unique values (high accuracy, we'll get 16 different values that we need to differentiate after A/D)
- IR Leds, 940 nm, 3mm x4
 - Digikey
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=754-1241-ND>
 - 0.11 / a when 25+
 - Futurlec
 - <http://www.futurlec.com/LED/INF3940pr.shtml>
 - 0.13 / a when 25+
- IR transistors 940nm x4
 - Digikey
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=1080-1158-ND>
 - 0.21 / a when 10+
 - Futurlec
 - <http://www.futurlec.com/LED/INFD3940TRANSpr.shtml>
 - 0.15 a
- RGB Leds, common anode, diffuse x4
 - 0.25 / a from ebay seller for 100+
- Tactile swithces x 4
 - <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=450-1650-ND>
 - 0.056 / a when 50+
- LED Dual 7 Segment screen x1
 - Futurlec
 - <http://www.futurlec.com/LED/7DR5621BSpr.shtml>
 - 0.75 / a when under 25
- Magnets x 8
 - <http://www.dealextreme.com/p/super-strong-rare-earth-square-re-magnets-100-pack-51744>
 - 0.144 / a when 100+
 - Tilattu
- Plastic cover material - diffuse, translucent white or darker plastic, preferably something not as brittle as acrylic
- Plastic case, 3D printed?
- PCB (smaller than total footprint)
- Programming header?
- Shift register, 74HC595 x2
 - Through hole
 - <http://www.futurlec.com/74HC/74HC595pr.shtml>
 - \$0.5
 - \$0.42 when 25+
 - \$0.35 when 100+
 - SMD version (SOIC)
 - <http://www.futurlec.com/74HC/74HC595SMDpr.shtml>
 - \$0.15

Parts to be ordered from three sources, digikey, futurlec, and dealextreme + 3D printed case. Maybe ponocos

german partner for a lasercut top surface ~2€ /a when ordering 25.

Cost: 8.86 + case plastic, pcb etc -> ~10\$(+)

TODO: LEDs need sources and sink capable of driving them, atmega only supports max 25-30mA per pin, and max 110mA total.

Need 4 sinks for

- 3 RGB channels
- 1 x 4 IR sender leds (one channel) (could also be source-driven)

Need 6 sources for

- 2 (or 3) led segment displays (selecting character to light up)
- 4 RGB Leds, for selecting directions to light up

7 darlington transistors sink

- <http://www.futurlec.com/Linear/ULN2003Apr.shtml>
 - \$0.3 / a for 25+
- <http://www.futurlec.com/Linear/MC1413Ppr.shtml>
 - \$0.26 / a for 25+

Single PNP transistor

- <http://www.futurlec.com/Transistors/PN2907Apr.shtml>
 - 0.6A, 500mW dissipation, high gain.
 - \$0.04 / a for 100+
 - Most widely used, so use this by default
- <http://futurlec.com/Transistors/MPS2907Apr.shtml>
 - \$0.04 / a for 100+
- <http://futurlec.com/Transistors/2SA1515pr.shtml>
 - \$0.04 / a for 100+

We have two reels (~4k pcs) of PNP SMD transistors (100mA) at the lab.

Single NPN sink transistor

- <http://futurlec.com/Transistors/KTC3203pr.shtml>
- ~\$0.04 / a for 100+
- Not very common, but available from futurlec. Substitutable with any NPN transistor with hfe > 100, voltage 20+, and current handling of more than 500mA

metal strip for holding magnets (thin copper?)

- or trap them in a wire loop?

-> About \$0.05 per source or sink -> + \$0.5