

Robust field data logger

“flo(g)gr”

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BRINGING
ENVIRONMENTAL
UNDERSTANDING TO ALL

the first Fieldwork Hackday
FSC Slapton Ley, May 19-20, 2012



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The Problem



- new mobile devices are cool and clever...
- but...
 - fragile
 - hard to extend
 - may not have connectivity

Image credit: Marcus Grabac

<http://www.flickr.com/photos/uploaded/4709034184/>

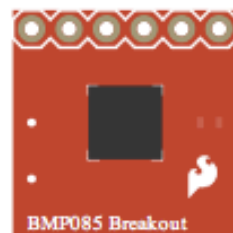
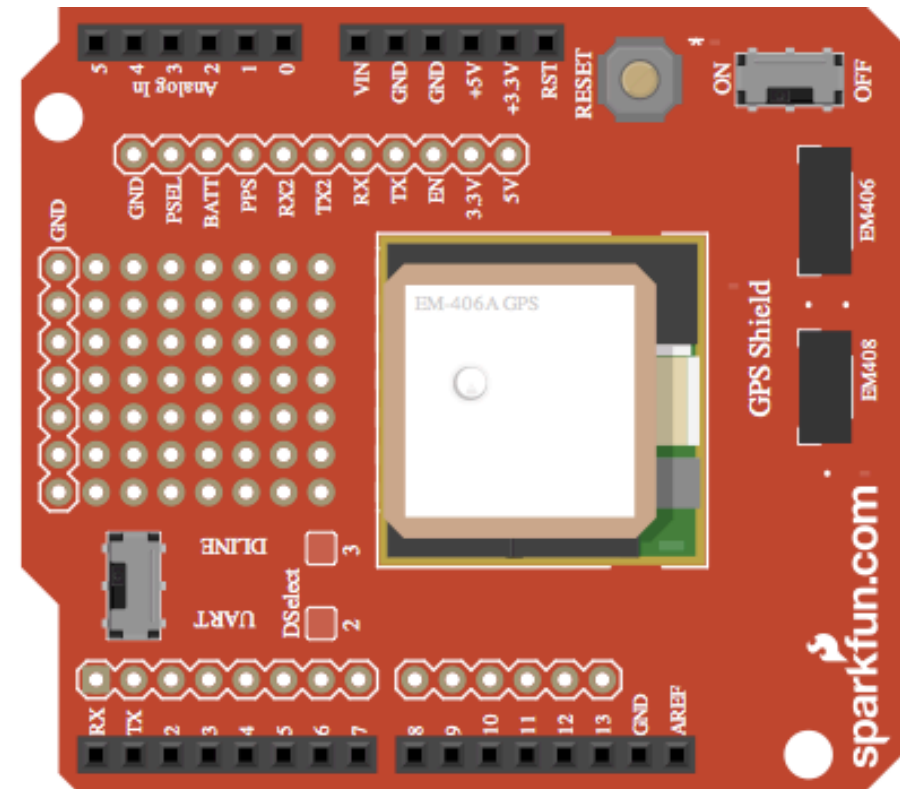
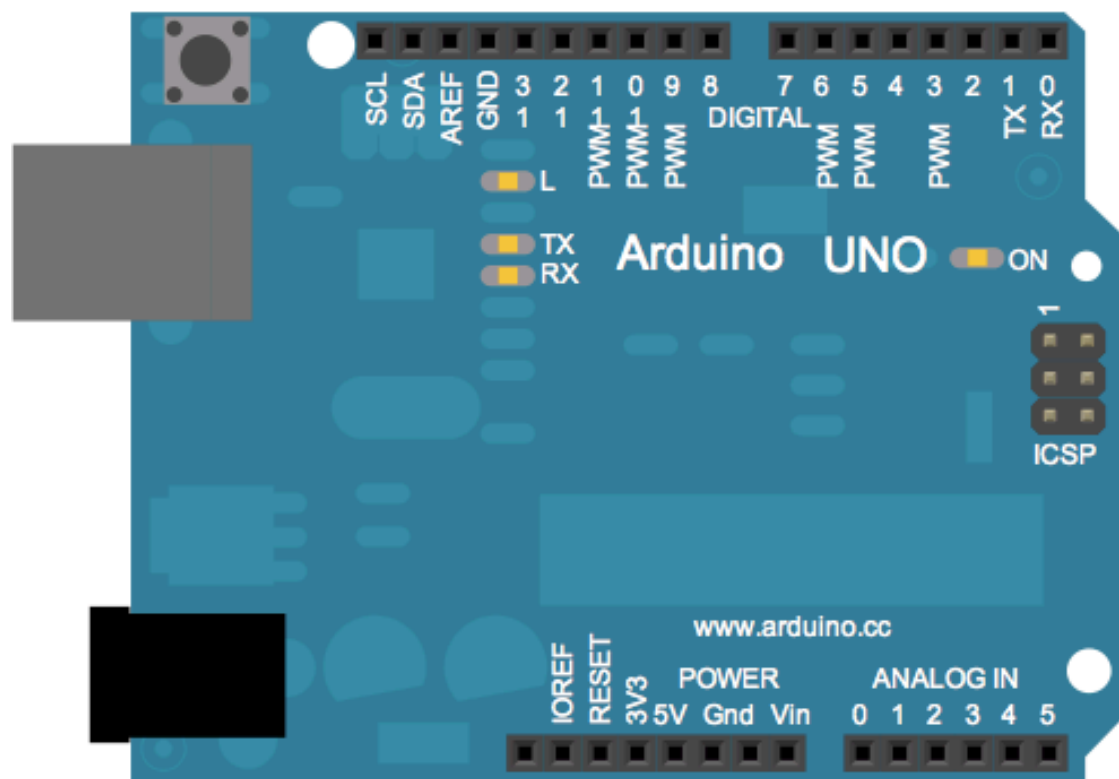
Build something that
works better here....



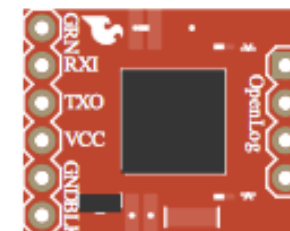
Design thoughts

- robust!
- physical - interesting but not distracting
- not a continuous logger - record data where and when it is of interest; better for battery life and specific choice of stations
- extensible / hackable - add new sensors later
- SD card - easy access to raw data
- not a replacement for traditional methods - enables quicker collection once those have been learned

Components



Arduino Uno
GPS EMP406A
SD card breakout
BMP085 Barometer



Prototype #1

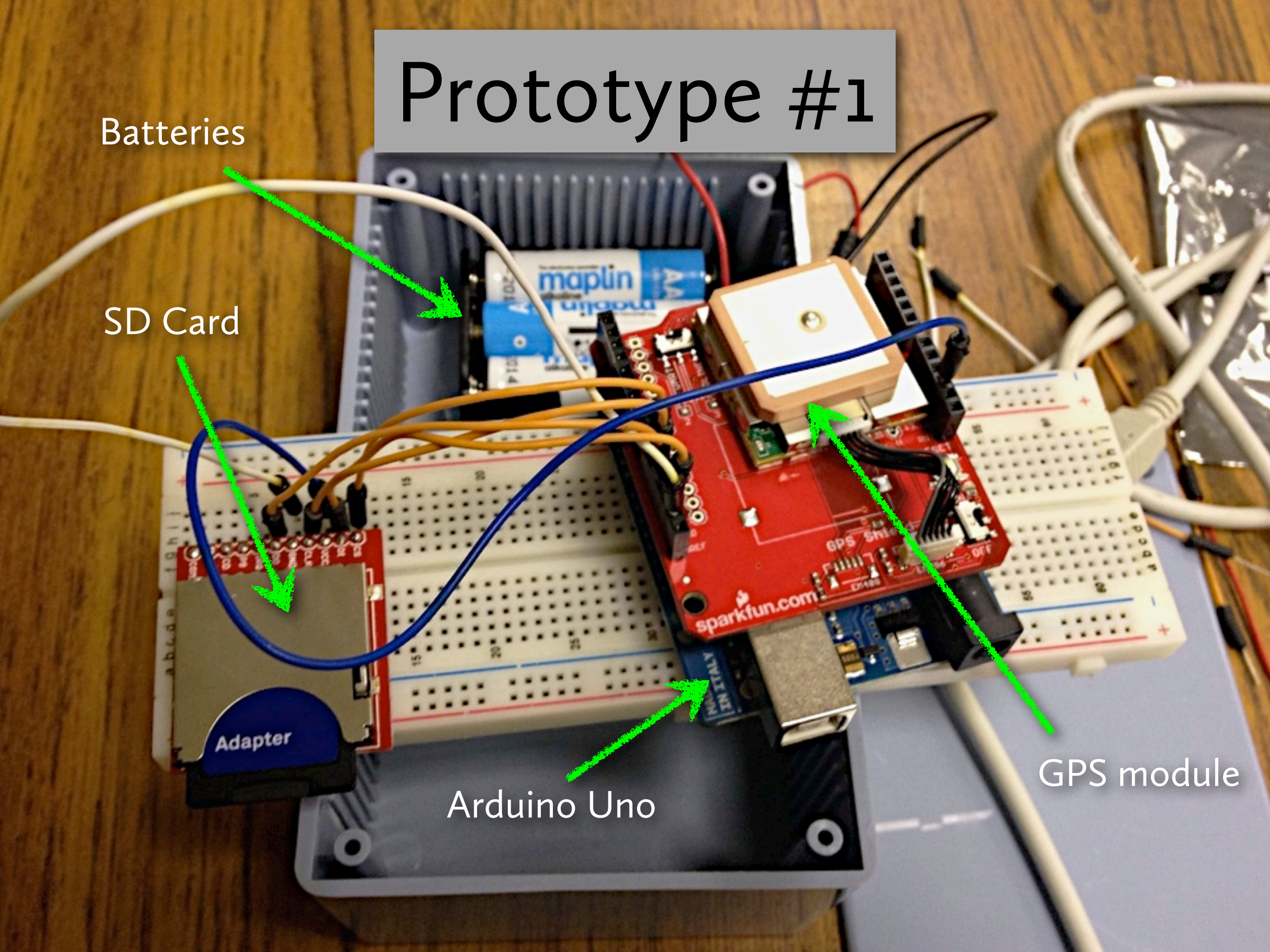
Batteries

SD Card

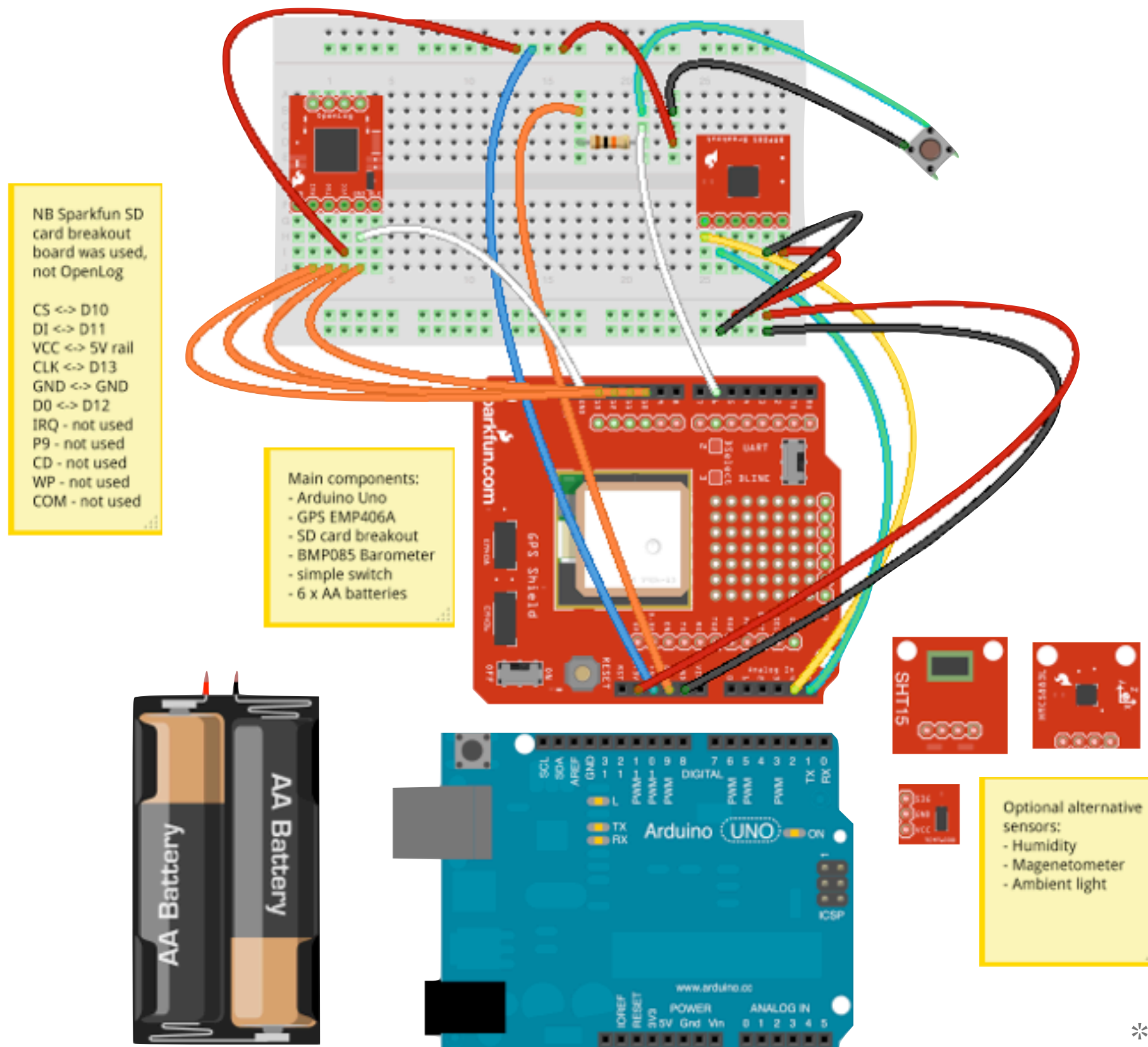
GPS module

Arduino Uno

Adapter



Completed prototype*



*by 3pm Sunday

Example data capture

```
20120520T130921+00:00,50.29305,-3.65210,5,29.90,29.25,0.56,246.00,100614.00
20120520T130947+00:00,50.29266,-3.65235,6,32.20,29.25,0.56,235.00,100609.00
20120520T131013+00:00,50.29249,-3.65259,5,33.10,160.72,0.11,228.00,100632.00
20120520T131047+00:00,50.29216,-3.65255,6,30.00,132.09,0.44,215.00,100651.00
20120520T131135+00:00,50.29239,-3.65328,7,31.30,332.44,0.46,217.00,100645.00
20120520T131245+00:00,50.29300,-3.65266,7,35.00,103.69,0.37,208.00,100600.00
20120520T131312+00:00,50.29285,-3.65233,7,35.30,111.68,0.59,206.00,100588.00
```

Date/Time	Lat/Lon	Satellites	Alt/Crs/Spd	Temp (x0.1°C)	Pressure (Pa)
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Written as CSV formatted strings to datalog.txt on SD card

Analysis

		Enter abiotic data for each station											
		Transect Station Number											
		1	2	3	4	5	6	7	8	9	10	11	12
Units													
Plant height	cm	32.5	3	12.4	40.2	41	8.6	67.5	29.5	40.5	148	114	69.5
Soil depth (cm)	cm	0	0	12.1	10.5	15	0	16.2	11	7.9	15	11.2	7
Light Intensity	Lux	180	175	161	144	148	162	93	153	111	30	43	67
Soil surface Temp	C	18	18.2	18.9	19.1	18.1	18.7	17.3	17.6	18.1	18	17	17.1
Relative Humidity	%												
Wind Speed	Km/Hr	2.13	1.2	1.3	0.8	2.13	2.96	1.26	1.26	0.6	0.3	0	0
Soil pH	-												
% Water in Soil	%												
% Organic in Soil	%												

Example of current data set used in FSC studies

A	B	C	D	E	F	G	H	I	J	K
Timestamp	Lat	Long					Temp	Temp (Deg C)	Pressure	Pressure (millibars)
20120520T130921+00:00	50.29305	-3.6521	5	29.9	29.25	0.56	246	24.6	100614	1006.14
20120520T130947+00:00	50.29266	-3.65235	6	32.2	29.25	0.56	235	23.5	100609	1006.09
20120520T131013+00:00	50.29249	-3.65259	5	33.1	160.72	0.11	228	22.8	100632	1006.32
20120520T131047+00:00	50.29216	-3.65255	6	30	132.09	0.44	215	21.5	100651	1006.51
20120520T131135+00:00	50.29239	-3.65328	7	31.3	332.44	0.46	217	21.7	100645	1006.45
20120520T131245+00:00	50.293	-3.65266	7	35	103.69	0.37	208	20.8	100600	1006
20120520T131312+00:00	50.29285	-3.65233	7	35.3	111.68	0.59	206	20.6	100588	1005.88

Captured data imported to Google Spreadsheet / ODS

Code!

- Available on Github

https://github.com/andypiper/fsc_flogr



github
SOCIAL CODING

A screenshot of the Arduino IDE interface. The title bar reads "fsc_flogr | Arduino 1.0". The main text area contains C++ code for an Arduino sketch. The code includes comments and library headers for TinyGPS, SD, and Wire. It defines constants for chipSelect, buttonPin, and buttonState, and declares variables for calibration values. The status bar at the bottom shows "Done uploading." and "avrdude done. Thank you." The bottom right corner indicates "Arduino Uno on /dev/tty.usbmodemfd121".

```
/*
 * An extensible data logger
 * Stores data to SD card for easy analysis
 *
 * Parses NMEA sentences from an EM406 running at 4800bps into readable
 * values for date, time, latitude, longitude, elevation, course, and
 * speed. Make sure the shield switch is set to DLINE.
 *
 * Barometric pressure from BMP085
 */

// Leaving the Serial logging enabled can cause avrdude to fail to transfer
// compiled binary to the board!!

// use TinyGPS library from arduiniana.org
#include <SoftwareSerial.h>
#include <TinyGPS.h>
#include <SD.h>
#include <Wire.h>

// pin for the SD card I/O
const int chipSelect = 10;

// the number of the pushbutton pin
const int buttonPin = 6;
// variable for reading the pushbutton status
int buttonState = LOW;

// barometer BMP085 values
#define BMP085_ADDRESS 0x77 // I2C address of BMP085
const unsigned char OSS = 0; // Oversampling Setting

// Calibration values
int ac1;
int ac2;
int ac3;
unsigned int ac4;
unsigned int ac5;
```

Future

- Field and user testing
- Boxed (and funkier - dedicated PCB?)
- Simple LCD confirmation display
- Ports for probes etc
- configurable via SD card to offer continuous log if desired
- More data analysis tools - apps and web

Thanks

- Neil - wiring ninja!
- FSC Hackday team - aka “Team Awesome”
- Bristol Hackspace - components and advice
- anyone who put up with me complaining about Arduino and Strings...



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