

An Open Source Hardware & Software Online Grid of Weather Stations For Sri Lanka

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Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Consultative Group for International Agricultural Research

Ratified on October 2nd, 2013

Full Open Access & Open Source

Research data and publication

- ▶ International Public Goods
- ▶ Public Domain
- ▶ Publications Open Access
- ▶ FOSS models and algorithms



Partners:



2018: all 15 CG centres, already FOSS4G Lab:
gsl.worldagroforestry.org

Introduction

Early Prototyping

Rationale

 δT Tower δT parts δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δ Tower

δ parts

δ Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

For agricultural and hazard monitoring, WMO-level accuracy of weather data is not needed. We are introducing a low-cost weather station based on Arduino for extending the National network of the Meteorological Department in Sri Lanka.

- ▶ Low-cost, locally-made, OSHW weather station
- ▶ National Distributed Monitoring Grid
- ▶ Online Aggregation
- ▶ Mobile/Web Apps

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

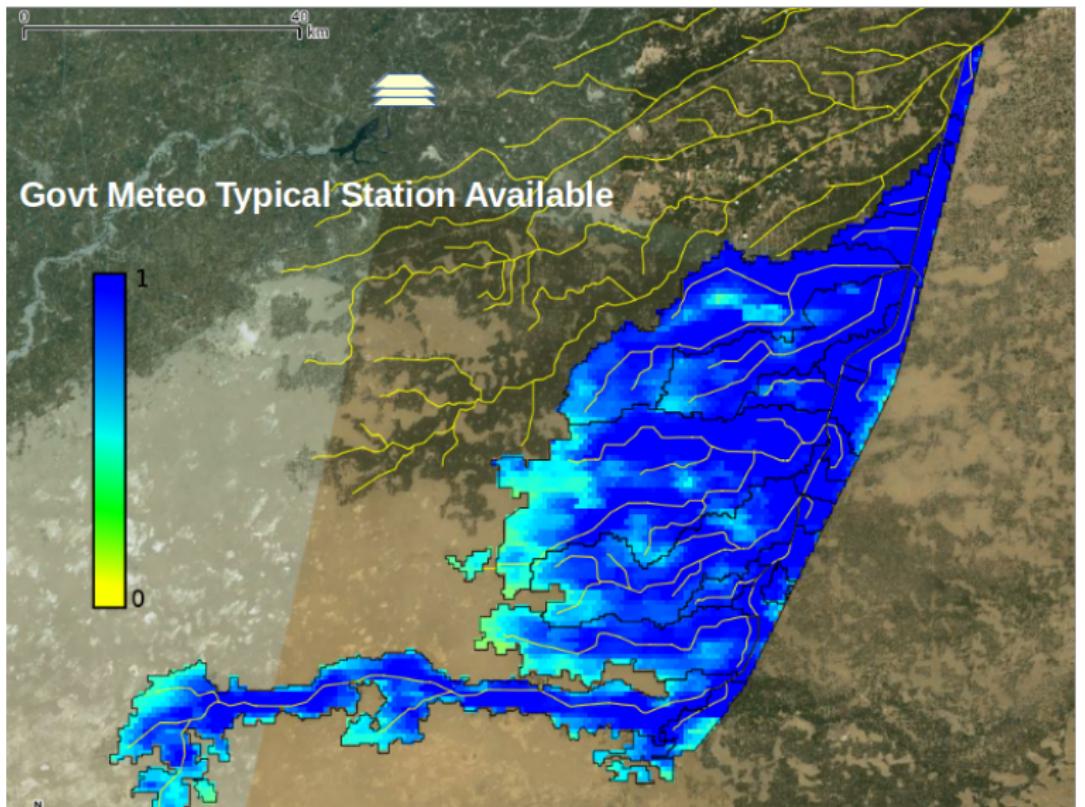
Software

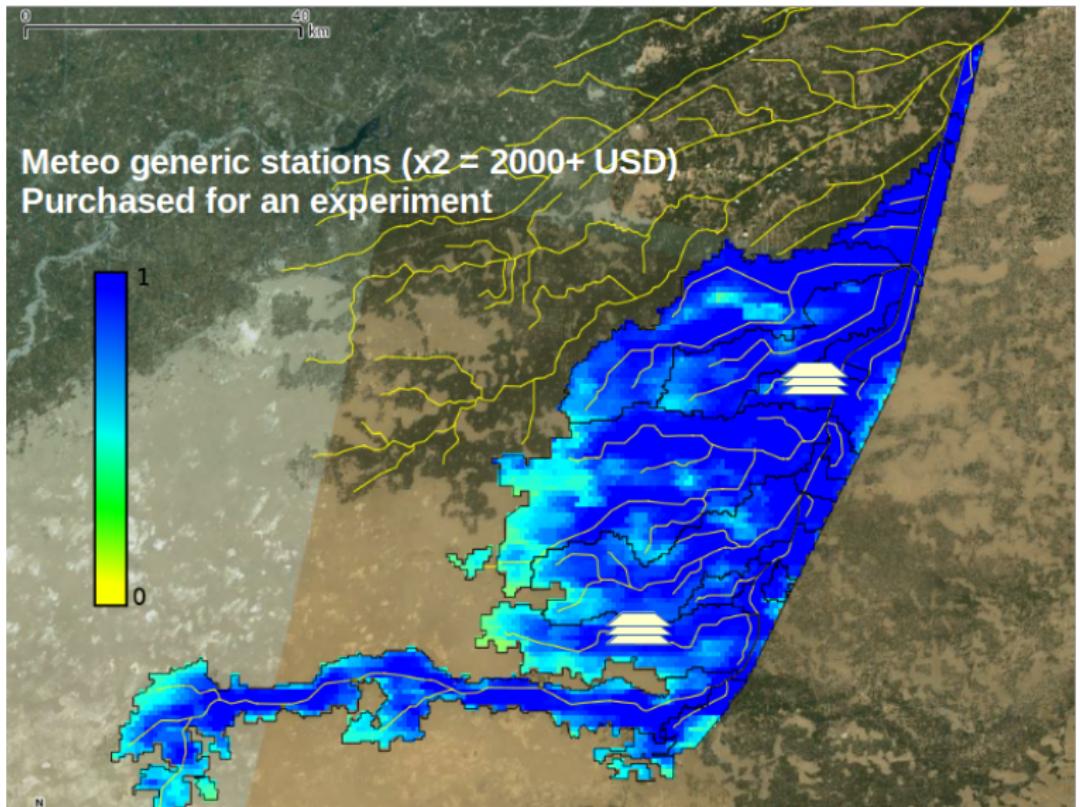
Arduino IDE

istSOS

PyWPS

Conclusions





Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raiingauge 1

Raiingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

RaiGauge 1

RaiGauge 2

Electronics

Weather Shield

Set up

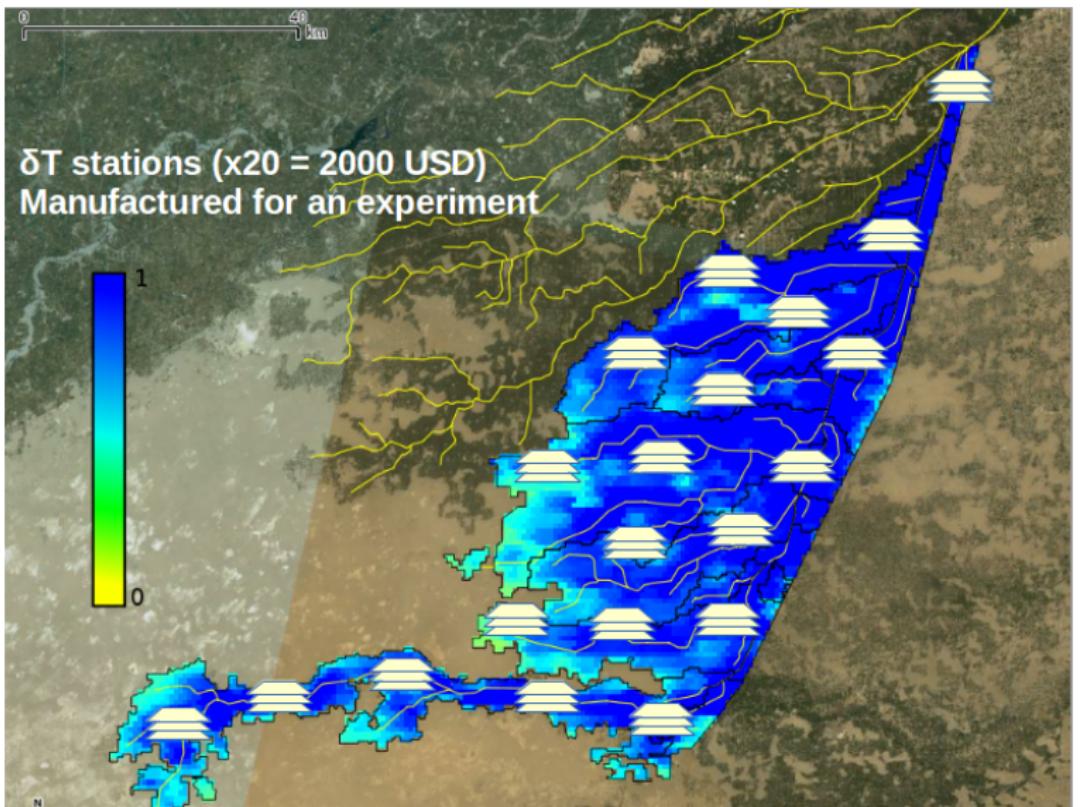
Software

Arduino IDE

istSOS

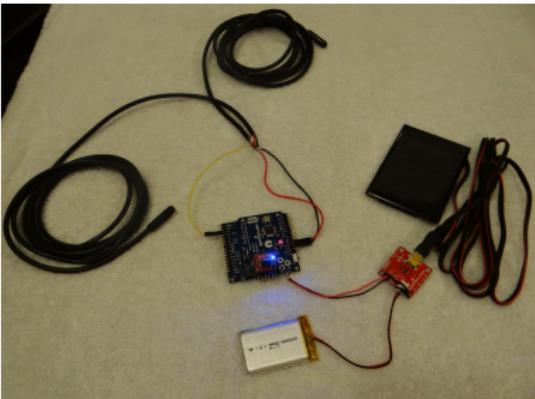
PyWPS

Conclusions



Micro Weather Station v0: Temperature Profiler for ET models calibration

- ▶ Arduino Pro 3.3V
- ▶ Water-proof Digital Temperature Sensors
- ▶ Li-ion Battery + Solar Panel
- ▶ OpenLog data logger with SD card
- ▶ Cost < 100 USD



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Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

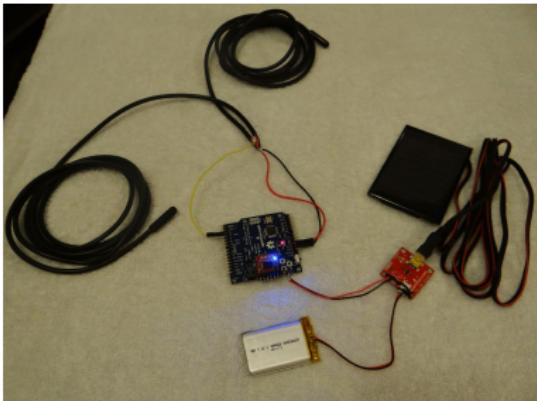
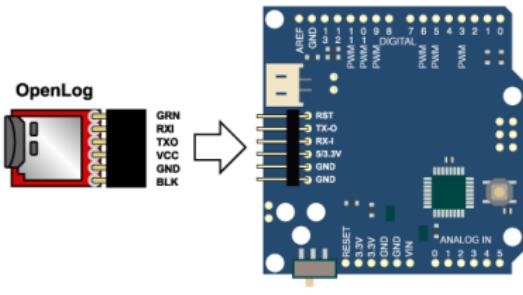
Arduino IDE

istSOS

PyWPS

Conclusions

OpenLog + Arduino Pro



Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

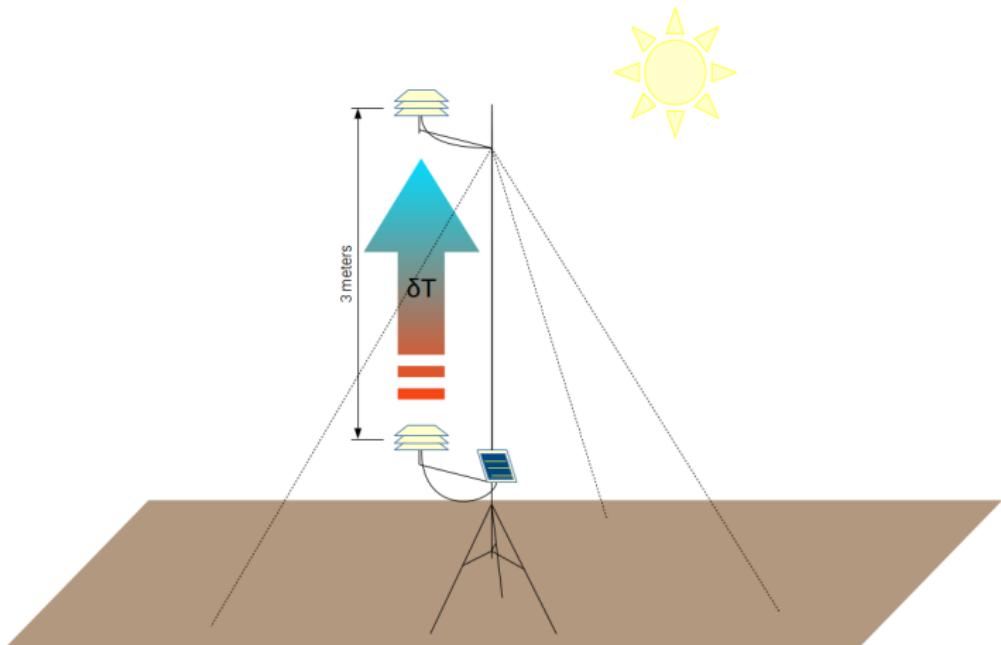
Software

Arduino IDE

istSOS

PyWPS

Conclusions



Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

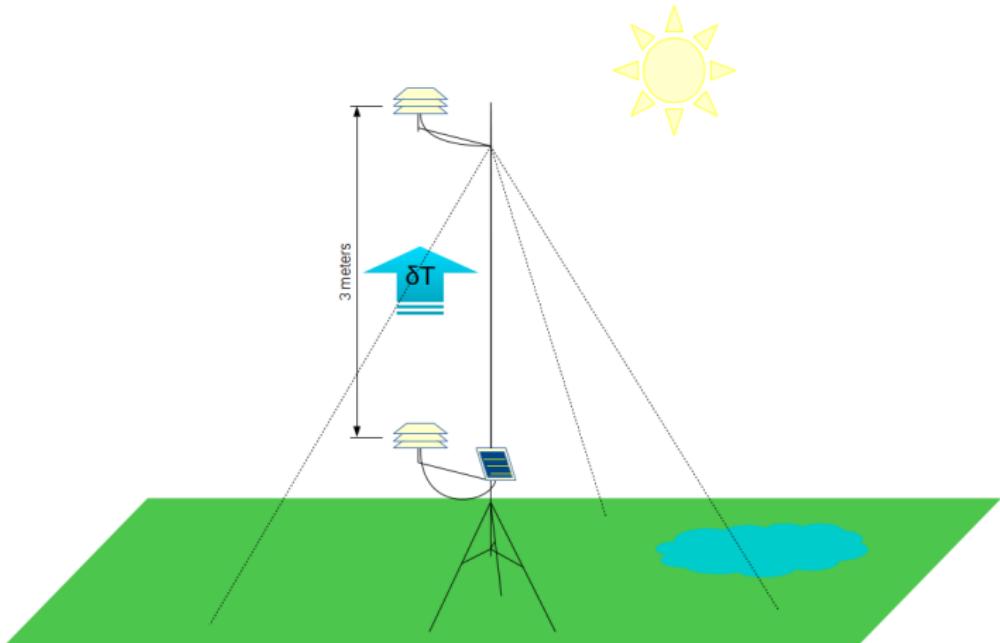
Software

Arduino IDE

istSOS

PyWPS

Conclusions



Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

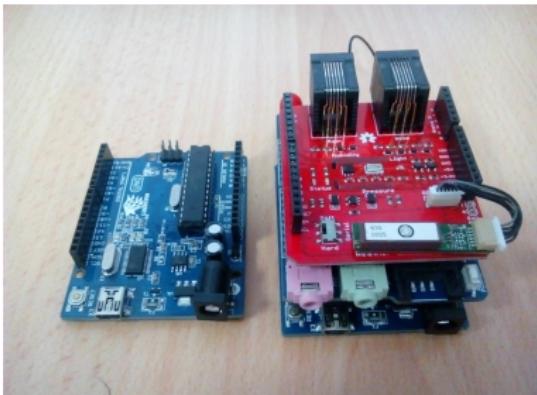
PyWPS

Conclusions

Micro Weather Station v1:

Meteorological support for Irrigation Department in Sri Lanka, for faster management of rural reservoirs spilling in case of high rain intensity.

- ▶ Lakduino (www.lakduino.com)
- ▶ Weather Sensor Board
- ▶ GPRS Modem Board
- ▶ Data logger with 8/16Gb micro-SD card
- ▶ Moto battery + Solar Panel



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Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Chemin, Bandara

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions





Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

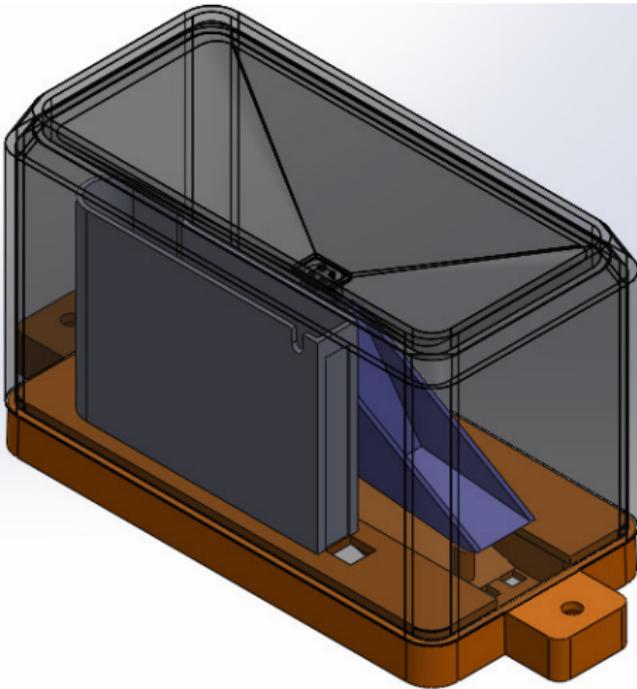
Software

Arduino IDE

istSOS

PyWPS

Conclusions

[Introduction](#)[Early Prototyping](#)[Rationale](#)[δT Tower](#)[δT parts](#)[δT Setup](#)[MWS Tower](#)[Power Supply](#)[Wind Sensors](#)[Raingauge 1](#)[Raingauge 2](#)[Electronics](#)[Weather Shield](#)[Set up](#)[Software](#)[Arduino IDE](#)[istSOS](#)[PyWPS](#)[Conclusions](#)

Chinese made raingauge 3D view
from scion.lk



Public Domain, locally-designed rain gauge
<https://grabcad.com/library/rain-gauge-design-1>
from scion.lk

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions



Lakduino



UP: Weather Sensor Shield
MID: GPRS Shield
LOW: Lakduino



Made in country by a local SME in electronics.

Picture credit: Neil Palmer (IWMI)

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions



Picture credit: Niroshan Bandara (UoM)

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

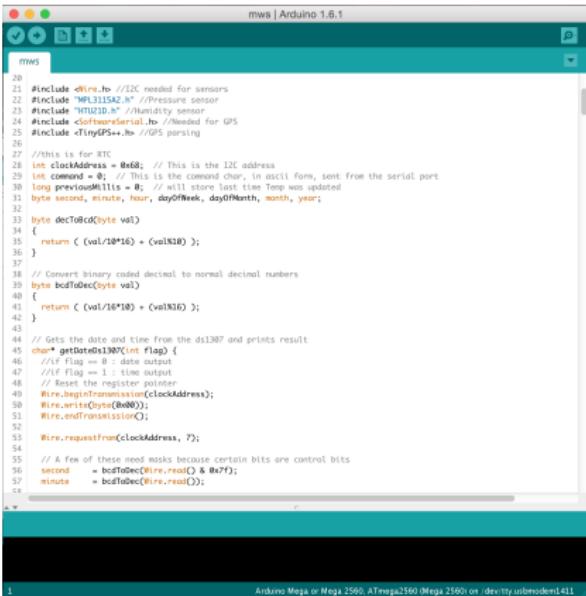
Software

Arduino IDE

istSOS

PyWPS

Conclusions



```
mws | Arduino 1.6.1

mws

21 #include <Wire.h> //I2C needed for sensors
22 #include <MPU6050.h> //Pressure sensor
23 #include <HTU21D.h> //Humidity sensor
24 #include <SoftwareSerial.h> //Needed for GPS
25 #include <tinyGPS++.h> //GPS parsing
26
27 //this is for I2C
28 int clockAddress = 0x68; // This is the I2C address
29 char Command = 0x00; // This is the command char, in ascii form, sent from the serial port
30 long previousMillis = 0; // Used to store the time Temp was updated
31 byte second, minute, hour, dayOfWeek, dayOfMonth, month, year;
32
33 byte decTobcd(byte val)
34 {
35     return ((val/10*10) + (val%10));
36 }
37
38 // Convert binary coded decimal to normal decimal numbers
39 byte bcd2dec(byte val)
40 {
41     return ((val/16*10) + (val%10));
42 }
43
44 // Gets the date and time from the ds1307 and prints result
45 char* getDs1307(int flag) {
46     //If flag == 0 : date output
47     //If flag == 1 : time output
48     //If flag == 2 : register pointer
49     Wire.beginTransmission(clockAddress);
50     Wire.write((byte)0x00);
51     Wire.endTransmission();
52
53     Wire.requestFrom(clockAddress, 7);
54
55     // A few of these need masks because certain bits are control bits
56     second = bcd2dec(Wire.read() & 0x7F);
57     minute = bcd2dec(Wire.read());
58
59     return "Date and Time from DS1307";
60 }

Arduino Mega or Mega 2560, ATmega2560 (Mega 2560) or derivative submodels (411
```

Arduino IDE (<http://arduino.cc>) with source code for accessing sensors and data logging.

- ▶ OGC SOS server implementation written in Python.
- ▶ Sensor Observation Service standard.
- ▶ Manage and dispatch observations from monitoring sensors



Introduction

Early Prototyping

Rationale

 δT Tower δT parts δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

[Introduction](#)[Early Prototyping](#)[Rationale](#)[δT Tower](#)[δT parts](#)[δT Setup](#)[MWS Tower](#)[Power Supply](#)[Wind Sensors](#)[Raingauge 1](#)[Raingauge 2](#)[Electronics](#)[Weather Shield](#)[Setup](#)[Software](#)[Arduino IDE](#)[istSOS](#)[PyWPS](#)[Conclusions](#)

Developed by Jachym Cepicky (<http://les-ejk.cz/>)

- ▶ OGC WPS standard
- ▶ Server side
- ▶ Written in Python Language
- ▶ Version 4 in the making
- ▶ v4 Low-level API: integration with GRASS GIS
- ▶ v4 Possible pyGRASS support

PyWPS

PyWPS v2 style

WPS_hakra_ef.py (~/wps_processes/evapfr) - gedit

Fichier Édition Affichage Rechercher Outils Documents Aide

Ouvrir Enregistrer Annuler

WPS_hakra_ef.py x

```

# EF processing
if os.system("t.eb.evapfr lst=lst ouput=hakra_ef_%s >&2" % (self.Inputs[0]['value'])):
    return """Could not process Hakra EF map"""

#Mask non Hakra Command Area
if os.system("r.napcalc hakra_ef_%s=%sif(isnull(MASK),null(),hakra_ef_%s)" >&2"" % (self.Inputs[0]
['value'])):
    return """Could not clip Hakra Command Area"""

# export
if os.system("r.out.gdal in=hakra_ef_%s out=hakra_ef_%s.tif type=Float32 >&2" % (self.Inputs[0]
['value'],self.Inputs[0]['value'])):
    return """Could not export Hakra EF map"""

#clean the mess 2
os.system("rm -f %s" % tmpfilelist)
del rnd, tmpfilelist, f, lstfiles, wildcard, tmpdir

if __name__ == "__main__":
    p = Process()
    D.Inputs[0]['value'] = "2012-09-01"

```

Python Largeur des tabulations: 8 Lig 67, Col 9 INS

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions

An Open Source Hardware/Software Low-Cost Weather Station

- ▶ **Arduino:** Micro-controller
- ▶ **Sensors:** Rain, wind, temperature, humidity
- ▶ **Local:** 80+ % made in the country of use by SMEs
- ▶ **Local:** Maintenance & spare parts with local SMEs
- ▶ **Local:** Local shop sells rural solar power kit
- ▶ **Local:** Local blacksmith for steel work

We work with a rural tank manager from irrigation department for realtime rain alerts.

Red Cross is evaluating the concept for a project in Togo.
Other countries are evaluating for other applications.



Introduction

Early Prototyping

Rationale

δT Tower

δT parts

δT Setup

MWS Tower

Power Supply

Wind Sensors

Raingauge 1

Raingauge 2

Electronics

Weather Shield

Set up

Software

Arduino IDE

istSOS

PyWPS

Conclusions