Wireless Weather Stations and Maintenance Training for Haitian Agriculture

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Eisenstadt Bio in IoT work

- Eisenstadt working on wireless sensor platforms for 10 years.
- > 35 Years of Electronics Design experience.
- Developed wireless temperature and detection devices for mosquito monitoring and donated blood monitoring, and monitoring food freshness.
- Microphones systems Asian Psyllid Control and mosquito traps.



2

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Outline

- Need for weather stations for agriculture in Haiti
- First generation weather station
- Haiti workshops for technology transfer
- Second generation weather stations
- Next steps
- Questions



3



Haiti Background

- Farm micro-climate has extreme variations
 2715-m variation in elevation.
- Two wet (monsoon) seasons, timing depends location.
- Public weather stations with available data only at 2 airports.
- Historical weather data not available.
- Overwhelming need for local weather data for agriculture.





Generation One Weather station

- Arduino based weather stations, low cost (\$400) and very educational.
- Work with WiFi to the cloud.
- Open code, inexpensive to fix, but not NOAA certified instruments.
- Modified for needs in Haiti.
- Report data to Weather Underground



Weather Station Components

Weather Gauges

- Rain gauge counts rain accumulation
- Wind vane reports wind direction
- Wind anemometer measures wind speed
- Internal sensors
 - Temperature, humidity, pressure, light

Weather Gauge Stand



Weather Station Installation Workshop 2016

- First weather station at Bas Boen CRDD (agricultural research center).
- Instructed 40 Haitians in two day workshop.







Weather Station Reporting to Weather Underground

PWS Data PWS Widgets WunderStation

Status: The weather station is fully functional

PWS viewed 61 times since May 1, 2017



Weather Station Builder Workshop July 2017

- 1 day in class workshop with 40 attendees.
- Had research teams build weather stations for four agricultural centers.
- Installed weather stations at 4 agricultural sites after workshop.
- Materials translated and presented in French.
- http://global.ifas.ufl.edu/are a-project/project-partners/climate-smartsolutions/



Programmer's Workshop October 2017

- 2 day in class workshop with 25 attendees.
- Taught agricultural students and researchers to program for sensors.
- 3 laboratories taught
 - control LEDs,
 - measure soil moisture
 - measure temperature and humidity
- Workshop (French) given to universities to develop curriculum.





2nd Generation Weather Station

- Created by students (Mist Makers) in the ECE NSF MIST Center.
- Uses the particle "photon" processor board for WiFi connection.
- Can be redesigned to use the particle "electron" processor for phone system connection.
- Add SD card storage and soil moisture.



NEXT STEPS Hardware Generation 2

- Field-test the design by deploying it in typical operating environments on campus.
- Field-testing in Haiti in Spring 2018.
- Include a mesh network of soil sensors for more accurate soil moisture data.
- Create PCB design for the power components and sensors to reduce cost.
- Write a manual to facilitate working with and refurbishing the product.

NEXT STEPS Training and Software

- Construct a short course about building and maintaining 2nd Generation Station.
- Develop automated data reporting to UF Dropbox database (in addition to weather underground).
- Interface with climate modelers and their software.
- Add in cell phone communication features.

Lessons learned

- Open software, open systems, with low cost replaceable boards are the only way to succeed with IoT for Haiti.
- Using the cloud is essential for preserving data and providing it free to the people who need it.
- There is a enormous difference in making electronics work in a laboratory and in the field.
- WiFi and Cloud communication software is never finished, there are continual upgrades and changes by vendors which require new weather station programming.

Summary

USAID AREA subproject work in Haiti presented.

- Provided solar powered wireless WiFi weather stations and training.
- Uses low cost module parts, hardware repairable, designs are open software.
- Report weather data to the cloud (<u>www.wunderground.com</u>) automatically.



15

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Questions?