FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Appui à la Recherche et au Développement Agricole (AREA)

Weather Station Programmers' Workshop
October 2017

Prepared for Feed the Future Haiti Appui à la Recherche et au Développement Agricole (AREA)

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ACKNOWLEDGEMENT

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INTRODUCTION

The AREA project held a weather station programming workshop Oct. 26 and 27, 2017 at Hotel Montana in Pétion-ville, Haiti to train agricultural researchers, students and farmers how to program computers and sensors to take soil and climate measurements.

The workshop program was created by Dr. William Eisenstadt, a professor of electrical and computer engineering at the University of Florida; Dr. Caroline Staub, U.S.-based research coordinator and leader of the Climate Smart Solutions program; and Pierre William Blanc, electronic engineer and workshop trainer. Staff members of the AREA project in Haiti supported the delivery of the workshop.

Key elements:

- **First day:** Paticipants learned how to use laboratory kit parts and Arduino, an open-source electronics platform used to build interactive projects. The participants also learned how to use Arduino integrated development environment (IDE) to operate LEDs and soil measurement sensors.
- **Second day:** Participants used Arduino to program temperature and humidity sensors. The workshop wrapped up with the participants receiving certificates acknowledging their completing the training.

AGENDA

Day 1: Oct. 26, 2017

- 8:00AM – 9:00AM Opening with Introduction of workshop presenters and attendees
- 9:00AM – 10:30AM Session 1_ Ardruino and the laboratory kit parts
    - Distribution of workshop laboratory materials to lab groups
    - Arduino board and input and output pins
    - Arduino IDE installation on PC
    - Arduino IDE interface on PC
    - Connect Arduino board to PC serial port
    - Review experiment kit parts for lab
- 10:30AM – 10:45AM Break
- 10:45AM –12:00PM: Session 2_ First Arduino program flashing LEDs
    - Writing a simple program on the Arduino IDE
    - Setup {} and Loop {} in the Arduino
    - Basic Arduino program commands
    - Connect some LEDs and kit parts on a breadboard
    - Make Arduino turn LEDs on and off

    - Exercises to practice many LEDs programming
- 12:00PM – 1:00PM: Lunch break
- 1:00PM – 2:45PM: Session 3_ Arduino program for soil moisture measurements
    - Use serial monitor to see what the program is doing
    - Arduino sketches add great capability
    - Introduction to soil moisture measurement sensors
    - Soil moisture measurement kit parts
    - Soil moisture measurement circuit
    - Example of soil measurement software
    - Program Arduino to make soil moisture measurement
    - Calibrate instrument and test with soil sample
- 2:45PM – 3:00PM: Break

Day 2: Oct. 27, 2017

- 9:00AM – 10:30AM Session 4_Arduino program for temperature and humidity measurements
    - Distribution of kit parts and introduction to temperature and humidity measurement sensors
    - Temperature and humidity measurements kit parts
    - Arduino connections to temperature and humidity sensor
    - Example of temperature and humidity measurement software
    - Program Arduino to make temperature and humidity measurements
    - Build a working temperature and humidity sensor system
- 10:30AM – 10:45AM Break
- 10:45AM – 12:00PM Session 4_Arduino program for temperature and humidity measurements
    - Exercises to practice temperature and humidity sensors programming
- 12:00PM – 1:00PM: Lunch Break
- 1:00PM – 2:30PM: Session 4_ Survey and closing of the workshop
    - Workshop survey about contents and attendee learning
    - Open discussion on the workshop contents and related concepts
    - Collection of laboratory kits
    - Distribution of certificates

PARTICIPANTS

Twenty-five people (10 women and 15 men) attended one or both days of the workshop. On day 1, there were 24 participants (10 women and 14 man) and on day 2 there were 25 participants (10 women and 15 man). The audience included people who are from different regions of the country and different sectors:

Private sector:

- Wynne Farm, Kenscoff;
- Coopération des Coopératives des Planteurs de Café de Belle-Anse (COOPCAB), Belle-Anse;

Public sector:

- Ministère de l'Environnement (MDE), Port-au-Prince;
- Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural (MARNDR)), Port-au-Prince;
- Centre national de météorologie (CNM), Port-au-Prince;
- Centre Rural de Developpement Durable (CRDD), Duvivier;
- Centre Rural de Developpement Durable (CRDD), Montrouis;
- Centre Rural de Developpement Durable (CRDD), Bas-Boën;

Universities:

Students from state universities:

- Faculté d'Agronomie et de Médecine Vétérinaire (FAMV), Damien;
- Facultés Des Sciences (FDS), Port-au-Prince;
- Institut National d'Administration, de Gestion et des Hautes Etudes Internationales (INAGHEI), Port-au-Prince;
- Université publique, Hinche;

Students from private universities:

- Ecole Supérieure d'Infrotonique d'Haiti (ESIH), Port-au-Prince;
- Univiversité Espoir, Delmas;
- Université Notre-Dame d'Haïti(UNDH), Cayes

MORE DETAILS

Day 1

Dr. Absalon Pierre kicked-off the workshop by welcoming the participants and describing how the workshoip completed a previous workshop conducted in July 2017 on building and installing weather stations. Dr. Lemane Delva provided an overview of the different projects that are part of the Feed the Future Haiti AREA project and IFAS Global (http://global.ifas.ufl.edu/area-project/). He highlighted team from the University of Florida supporting the project and their

different areas of expertise. Workshop paticipants introduced themselves and expressed their interest in taking part in the worshop.

Dr. Absalon Pierre introducing workshop team to participants

Pierre William Blanc, an electronic engineer and leader of the workshop, emphasized the purpose of the training, which was to provide agricultural researchers, students and farmers the ability to program small computers and sensors for taking soil and climate measurements. The participants were split into two groups, and Taïsha Venort, AREA's gender specialist, advised that women be equally represented in both groups to foster collaboration.

During the first training module, Blanc distributed laboratory kits and parts to the participants. He identified the components on the Arduino Uno Redboard and their functions. After downloading and installing the Arduino IDE on their computers, participants connected the Arduino Uno Redboard to their computers. Blanc demonstrated how to navigate the Arduino IDE and configure the COM port number.

AREA staff during a break

View of the audience during worksop presentation

Blanc started the second training module by covering the operating principles of LEDs and resistors and how to properly connect them on the breadboard. Blanc also showed how to create an electronic circuit with the breadboard, how to connect it with the Arduino Redboard and how to modify an existing sketch in the editor of the Arduino IDE so that one or several LEDs blink. Participants were also introduced to the programming language of Arduino, with precision on the main functions, commands and variables that were used to write simple Arduino programs during the workshop.

Afterwards, participants were guided to create an LED circuit and write a simple sketch to cause the LEDs to blink.


Pierre William Blanc helping paticipants during practice

Participants building LED circuit

After lunch, Blanc covered how to configure the serial monitor so that the data collected by the soil mosture and humidity sensors can be displayed on the serial monitor of the Arduino IDE.Then, the soil moisture sensor was presented again with more detail regarding its operation mode. The Soil Mositure Program.txt sketch (used to take the soil moisture measurements) and the soil sensor hook-up were reviewed. Soil samples and water were provided to the participants so they can carry out the experiment with different soil conditions, by mixing the soil in the cup with more water progressively. The participants programmed the Arduino Uno Redboard and noticed how the sensor collected different soil moisture measurements as the soil conditions changed. The experiment was repeated so participants could use the comparison symbols (==, >=, <=, <, >) in Arduino IDE and get a clear understanding of these symbols, which are important to identify and display the different soil conditions (dry, wet and moist) based on the values measured by the sensor.

Samples of soil for the soil moisture practice

Anne (AREA staff) and Jessyka (student helper) giving assistance during practice

Day 2, Oct. 27

After recapping the main points presented the first day, students were introduced to temperature and humidity sensors. Participants learned the library concepts of programming so they could import new objects and functions into their Arduino IDE. Each group created their temperature and humidity sensor hook-up with the Arduino Uno Redboard, then they copied the sketch in the Temperature Humidty Program.txt file and pasted into their IDE editor, to complete the labotary experiment. We used a cup of hot water and a cup of cold water and ice to demonstrate how the temperature and humidity sensor works. By taking measurements when the sensor is placed near the hot and cold cups, we were able to verify the increase and decrease in temperature in the serial monitor.

After the lunch break, the session continued with other programming practices in the Arduino IDE that allowed the participants to use math symbols (+, -, %,*), to do average operations of measurement values and to see other statements such as if, while and for. These practices were done to show the participants other operations that are available in Arduino.

At the end of the day, each of the participants learned how to install the Arduino IDE software on a computer and program the Arduino Uno Redboard, to operate electronic circuits with sensors that measure soil moisture, temperaure and humidity at a weather station site.

In wrapping up the training, participants discussed how they could use the knowledge acquired to build weather stations and monitor changes in climate.

The workshop closed with AREA Chief of Party Maurice Wiener presenting attendees with certificates acknowledging their completion of the training.

Participants receiving certificates

AREA team and participants with their certificates

FEEDBACK AND OUTCOME OF THE WORKSHOP

During the open discussion, participants communicated a number of ideas and asked a variety of questions. These included:

- Would AREA assist them in replicating the workshop in other geographic areas in the country, such as Les Cayes and Kenscoff?
- What employment opportunities does AREA offer to build and program weather stations in other locations in Haiti?
- The importance of learning about other instruments to verify the accuracy of the sensor measurements.
- Whether there was any assistance to purchase instruments and electronic parts to build and to program weather stations.
- Suggestion to add a shield that support Secure Digital (SD) memory card to the electoric box in the weather station. This SD card will store temporary 1 or 2 days of climate data localy to avoid data loss in case of internet issues.

RECOMMENDATIONS

We are making the following recommendations based on the discussion with participants and our observations during the workshops:

- Establish another program to show the benefits of using data collected by climate sensors on the farm.
- Assist participants who want to buy instruments and electronic parts to build and program weather stations.
- Host future workshops in other locations.
- Distribute materials at the end of the workshop so participants are more focused on the trainer's explanations than on the materials.
- Familiarize AREA's local staff with the material so they have a better understanding of the content.
- Dedicate an AREA staff member to stay during the entire workshop to provide a assistance to participants during practice.