Workshop Objective

The goal of workshop is to introduce young learners to the potential of App Inventor at MIT (AIM), a blocks-based programming language, as a means for fostering their digital empowerment (the belief that they can effect meaningful change in their lives by building digital artifacts), while growing their understanding of plant health and different forms of energy. This workshop has youth use AIM to develop a tablet app that can communicate with the Internet of Things (IoT) and allows real-time monitoring of a plant.

Description of the Activity

In order to help young learners understand the connection between healthy plants and different energy sources (e.g., light, moisture, or temperature), we developed an AIM+ IoT activity that students can follow to build (and potentially customize) a plant monitoring app. In addition to helping students make the connection between plant health and different environmental factors related to energy (e.g., not enough light, too much or too little water, extreme temperatures), this workshop will present learners with several additional opportunities: a lens into the potential of IoT in their everyday lives; and an understanding of building blocks for basic IoT functionality**.** In building the plant monitoring app, the youth will use both an Arduino (one of the mostly widely used IoT prototyping platforms) and the Grove Kit (www.seeedstudio.com), a popular extension kit for Arduino that lets users add various inputs (e.g., buttons, and touch, heat and light sensors) and outputs (LCD displays, buzzers, LEDs). For this activity, students will use four Grove inputs - a temperature sensor, a moisture sensor, a light sensor - and an LCD display for output.

Once built, the app allows the youth to get notifications about the state of the plant (how much light the plant is getting, the temperature of the room, and its moisture levels - Figure 2) on their phone via Bluetooth. The application also allows for a "conversation" to take place between the user and their plant. For instance, when someone waters the plant, the "plant" (via the Arduino and moisture sensor) sends the message "Did you water me?" If the user replies "Yes" on their phone, it sends a message back to the plant (via the BLE on the Arduino) and the plant send a message back saying "Thanks for watering me!"

To reduce the technical complexity and provide more time for them to explore the app itself, several of the components will be preassembled for the students. The students will be given a fully functional version of the app, which they will then add features to. We are also going to “black box” the Arduino coding, allowing students to focus instead on exploration of sensors and how they help them understand their environments and the role energy plays in it. During the workshop, both cohorts of learners will be tasked with adding in bar charts that can better visualize the data from the sensors. Next, the older cohort (11-13yr olds) will be tasked with deciding what readings should produce alerts on the phone or on the Arduino LCD (e.g., it needs water, or it is too hot in the room for the plant). They will be shown some basic code but will largely develop the alerts themselves. The younger cohort will be given code that is complete and they will be shown how to customize it. If any learners from the lower cohort are more advanced, the design provides enough flexibility to allow them to build and explore similar to the older cohort. By having them expand and iterate on the initial version of the healthy plant app, we provide these young learners with opportunities to develop their computational identities and recognize their own growing digital empowerment.

The workshop will conclude with a discussion between the learners and the mentors around how the sensors are able to capture the “energy” (light, heat, moisture) in the plants environment and students brainstorming how they could collect this energy information in different contexts to give them new insights into energy’s relationship to their lives.

Workshop Schedule

[The workshop schedule has been appended to the application as a table for easier reading]

Intended Learning Goals

There are two main learning goals of this workshop. The first, is to provide learners with a more nuanced understanding of the several factors that contribute to a plant’s health. The second, is an increase in the learners’ digital empowerment to create artifacts that can help them capture, report, understand, and potentially respond to these factors in different settings (e.g., capturing energy use in their homes). We would capture this learning through the use of a pre- and post-question given to each student that asks them, “How might you use digital technologies to learn about energy in your homes?”. We expect that students would be able to show growth in their ability to consider different ways of thinking about energy and how to design computational solutions.