Extending the Compatibility of MUzECS Software

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Motivation

Bringing music to the computer science classroom is one way to capture a more diverse range of students. We have worked to make MUzECS more accessible for schools to spread programming knowledge to beginners far and wide.

MUzECS

MUzECS encompasses a small interactive microcontroller board that allows students to create music (**Figure 1**), a blocks-based programming environment in an offline Google Chrome app, and an accompanying high school curriculum. It is set apart by its two years of experience in high schools, its ability to function offline, and its procedural programming style (not event-driven).

Proposed expansion

Adafruit's Circuit Playground Classic (**Figure 4**) and the MUzECS board are similar: both are small and have colored LEDs, buttons, and a speaker. Additionally, the Playground has several more features, and is less than half the price of a MUzECS board. So, by extending the compatibility of the MUzECS software to include the Circuit Playground Classic, we offer a more affordable, more accessible addition to computer science curricula.

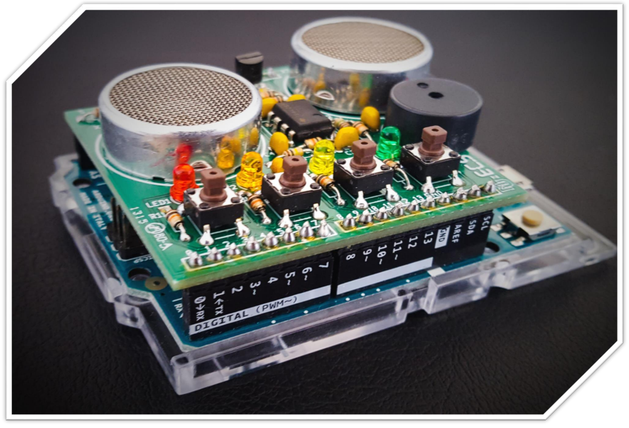

Figure 1: MUzECS shield attached to Arduino Leonardo. The MUzECS shield features four buttons, four colored LEDs, a piezo speaker, and an ultrasonic sensor.

Blocks

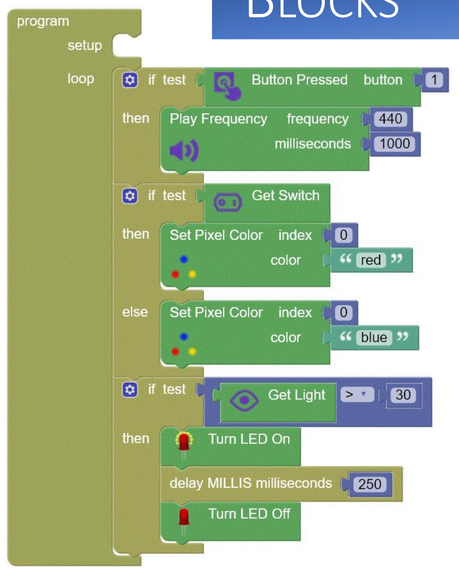

Figure 2: A MUzECS program for the Circuit Playground Classic.

The design of the new blocks:

- adhere to MUzECS's procedural programming style – no events!
- are modeled after Arduino functions to smoothly transition students to text-based Arduino IDE.
- are visually linked with the Circuit Playground Classic using matching images.

The distinctions between procedural style and event-driven blocks environments are illustrated in **Figures 2** and **3**. A program in MakeCode utilizes four separate events, whereas a program in MUzECS is one contiguous string of blocks. Along the lines of the "objects-late VS objects-early" debate, there is not yet enough evidence to support one's significant advantage over the other. It is important that the two styles coexist to maintain a basis for continued debate and future research.

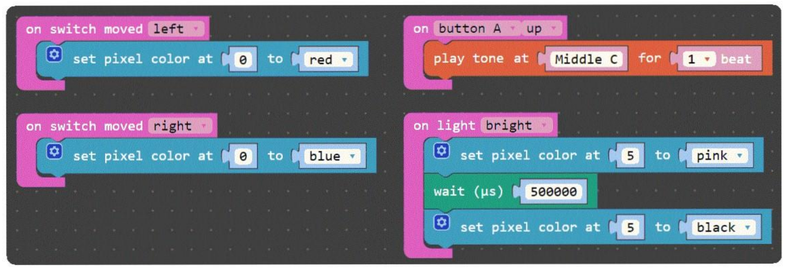

Figure 3: A program in Microsoft MakeCode for the Circuit Playground Express.

Since its conception, the MUzECS philosophy has stated that the programming blocks aim to transition students smoothly into the text-based Arduino IDE. In particular, the "setup" section in the "program" block is included to address the issue of initialization in students newly learning a text language. The setup section:

- is first to run,
- is designated for initialization,
- is visually distinct from the "loop" section, and
- does not allow "relative initialization.

thereby satisfying four points identified by a UC Santa Barbara team of researchers.

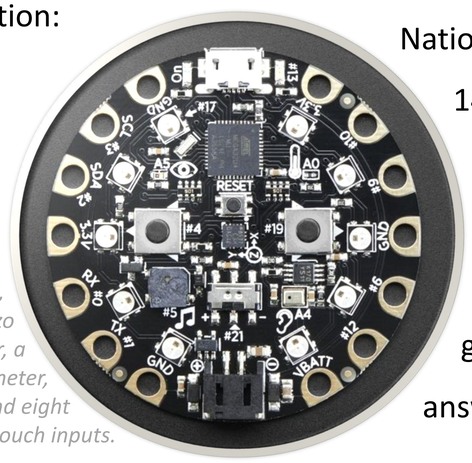

Figure 4: Adafruit's Circuit Playground Classic. It features two buttons, a slide switch, ten RGB LEDs, a piezo speaker, a light sensor, a sound sensor, a thermometer, an accelerometer, and eight capacitive touch inputs.

Future work

MUzECS has been deployed in schools around Milwaukee for two years, so it's high time the platform is improved on the basis of empirical data. For example, analyzing student programming assignments could reveal difficult concepts which call for, e.g., more expressive examples on the "else" block.

References

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