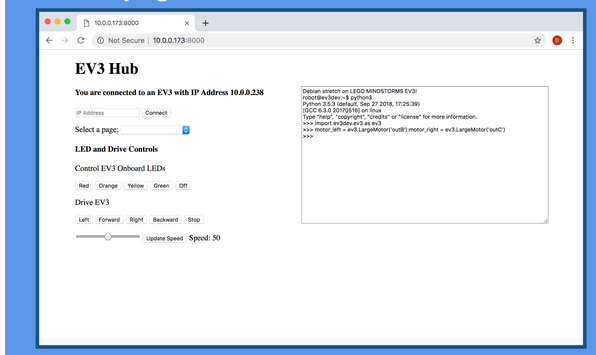
LEGO Robotics Classroom Programing Hub

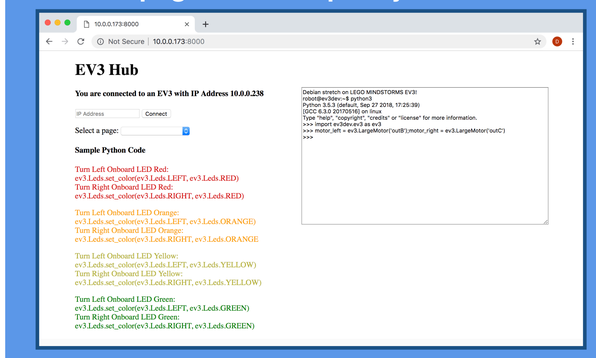
Daniel McGinn

User Interface

Webpage with LED and Drive Controls



Webpage with Sample Python Code



Implementation

Ideally, this programming system could be integrated directly into the LEGO Education Website. The LEGO education website features a variety of lesson plans to perform basic operations with an EV3. Pictures of code are interspersed within the lesson plan. By integrating the programming hub into their website, LEGO could replace the pictures of code structure with editable code modules that could be deploy to an EV3 in real time.

Future Steps

To further improve the Programming Hub, I plan to add the following features:

- Ability to serve multiple webpages to connect to multiple EV3s at once
- Example code contained within a textbox to allow users to modify the code and send to the terminal directly from the textbox
- More pages of example code

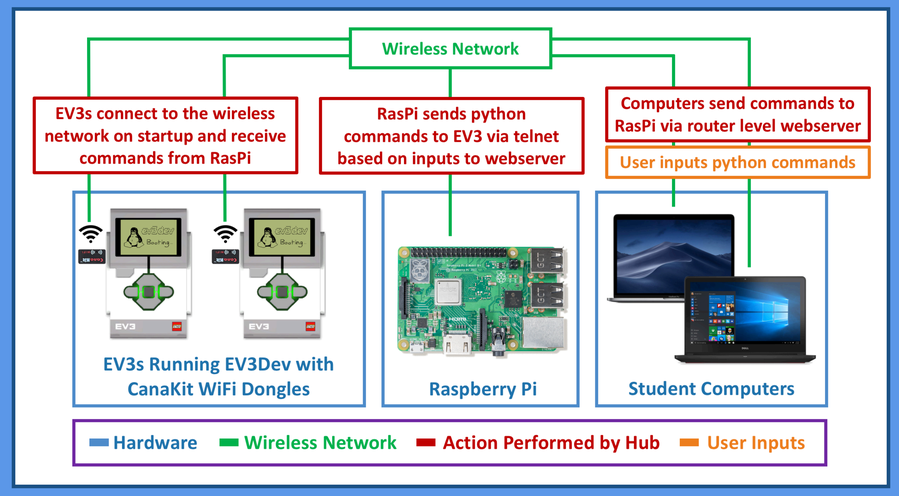
Problem Statement

Accessibility is a major barrier for robotics in the classroom. Many teachers from kindergarten through college avoid working robotics into their curriculum because that task of setting up a classroom activity can be very daunting, especially for teachers that isn't familiar with coding. While LEGO offers a variety of classroom exercises for their EV3 platform, the task of setting up LEGO EV3s can be difficult and time consuming. Students have the option to connect to an EV3 with a cable, over Bluetooth, or over Wi-Fi. However, with the current system, student needs to connect to each EV3 individually from their computer.

Diagram of Solution

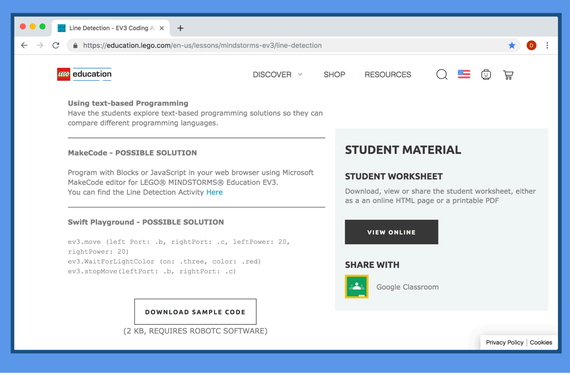
The LEGO Robotics Classroom Programming Hub takes the stress out of setting up a robotics activity in the classroom. The system automatically connects to a local network, connects to EV3s within range, and serves a webpage that allows students to program EV3s through a web browser. Instead of connecting to each EV3 individually, the programming hub automates the process to allow more time to focus on building robots and playing with code. The website features a terminal window, which accepts python commands, and a sidebar that shows the user how to control the basic functions of the EV3.

Programming Hub System Map

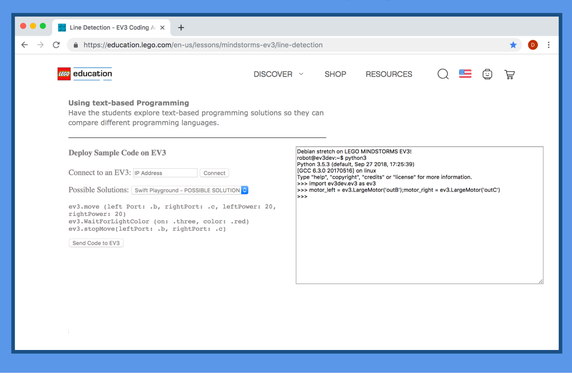


Integration Into LEGO Website

Current LEGO Tutorials



LEGO Tutorials with Deployable Code



Technical Details

The Programming Hub runs on a Raspberry Pi and can control LEGO EV3s that are running ev3dev, a Debian Linux-based operating system. Each EV3 is outfitted with a CanaKit WiFi Dongle and configured to automatically connect to a local network. The Raspberry Pi, which is configured to connect to the same network, runs a python script on startup that serves a webpage at the router level that students can connect to via an internet enabled device. Once the webpage is open, the user is prompted to enter their EV3 IP Address, which appears on the upper left side of the EV3 screen. Once the IP Address is submitted, the Raspberry Pi connects to the specified EV3 and establishes a telnet connect to send Python commands to the EV3. At this point, the user can enter python commands through the terminal window on the right side of the webpage. The left side of the webpage features buttons that the user can push to run prewritten python code to the EV3 and example code that the user can edit and paste into the terminal window. The user can toggle between these two options with a dropdown menu.

Code

All the code written for this project is available on github at https://github.com/DanielMcGinn18/EV3Hub

Acknowledgments

Thank you to my project advisor and ME Department Chair Chris Rogers, Assistant Research Professor Ethan Danahy, All the staff and researchers at the Tufts CEEO, and the staff at LEGO.

References

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