UC SANTA CRUZ
Baskin Engineering

Capstone Project

Alexa Modular Adapter

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amazon alexa

Abstract

The core feature of the Alexa Modular Adapter is to establish a connection between common switch control appliances and Alexa, a virtual assistant by Amazon, to improve the quality of life for those with physical disabilities. The installation process of the adapter has been voice-enabled, making the only physical interaction being the process of connecting wires to the adapter.

Approach

Software: The Alexa Voice Service(AVS) skills development kit is how Amazon devices process voice input. AVS is locally run on the Raspberry Pi (RPi). When given a voice command, the RPi sends that up the Alexa Cloud to process what has been said. Then, the cloud sends back what action the user has requested to smart home handlers. These handlers support features such as power, toggle, range, and mode for a device. Based on this directive, specific general purpose input/output(GPIO) pins are signaled.

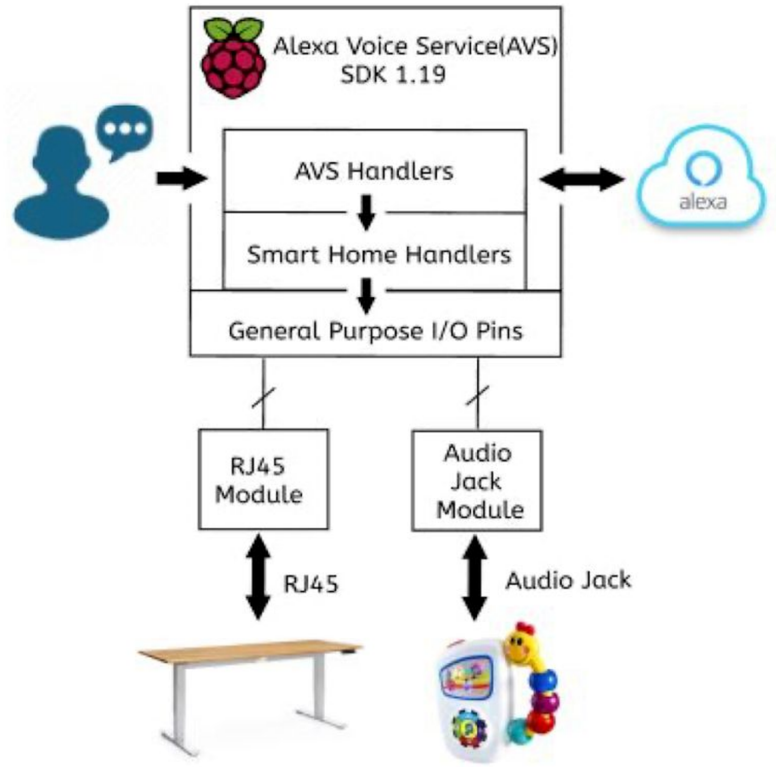
For the modular adapter to engage in offline activities such as connecting to the internet via voice commands, the modular adapter uses an offline Speech-To-Text transcriber called DeepSpeech. DeepSpeech was developed by Mozilla to take in audio and transcribe it into text.

Hardware: As shown in the diagram, the toy is connected to an audio jack port, and the table is connected to an RJ45 port. To support these ports, a breakout module is connected to the RPi's GPIO pins. However, the pins on a RPi operate at 3.3V. To protect the RPi from any damage, relays are used between the pins and connected devices. Using relays, the RPi is able to control devices safely.

Furthermore, the adapter can detect whether a device has been plugged into the audio jack or ethernet(RJ45) port. This is done through GPIO pins that are pulled down and detect for any change(i.e. when a device has been connected).

Overview

The Alexa Modular Adapter strives to improve the quality of life for those with physical disabilities. This is done by voice-enabling appliances that are controlled with physical switches. Examples of supported devices include common household devices. The team decided to use a motorized desk and an adapted toy to prototype with. One aspect we emphasized was to make the setup process as hand-free as possible. To accomplish that, the adapter has a plug-and-play feature that allows users to setup and control their connected devices mostly with voice.



Acknowledgements

David Frerichs and the *Alexa for Everyone* Team

Instructor Richard Jullig and the Teaching Assistant Arindam Sarma

Former team members, Bryan Jimenez and Cagan Bakirci

Installation with Voice

In order to establish communication with the Alexa Voice Service, the Adapter must be connected to the internet. Our implementation allows the user to use voice commands only to have the adapter link to a Wi-Fi network. Using a speech-to-text library called DeepSpeech, the user prompts the product saying, "Find Wi-Fi Networks," the user then selects one of the listed Wi-Fi networks and then spells out the password to that Wi-Fi network.

Results

The Alexa Modular Adapter prototype can currently support appliances that either use an RJ45 or a 3.5mm Jack to control its components.

Furthermore, the adapter can simply be setup by connecting it to compatible appliances and use the voice agent to finish the process.

After installation, the adapter can control appliances using voice commands such as "Turn __ on/off", "Change __ to mode X", and "Set __ to N unit."

Conclusion

By enabling a voice-user interface on the motorized standing desk, the user can adjust its height to the one that suits the task they wish to perform without too much hassle.

The motorized desk and the musical toy demonstrate the feasibility of a voice-enabled adapter for devices with RJ45 or audio jacks. Another class in pretty close reach would be devices that use IR/RF controllers, which have been worked ony by the other Alexa Accessibility team.