Introduction

Home automation has become very popular among homeowners and is an important smart system driven by Internet of Things. Home automation may include automating everyday routine activities such as turning on lights, reading the weather report, or opening the locks on exterior doors. When home automation was in its infancy, its hardware, software, and integration was segmented and did not interoperate well enough for a wide uptake rate. Today, home automation is more affordable and “smart” - with better interoperability between devices, accessories, and protocols. This project will seek to implement home accessories such as lighting using affordable hardware such as a Raspberry Pi based on user and environmental inputs. The purpose of this project is to design and integrate a Raspberry Pi as a “smart home” device and see how a small use case can be applied to larger home automated networks.

Platform Selection

The three main competing protocols for wireless home devices are WiFi, ZigBee, and ZWave (ZWave Plus).

WiFi

WiFi is an increasingly popular option with the ecosystem products such as Google Home or Amazon Alexa. This is a convenient for an end user that prefers to stay within those ecosystems and control Google Home or Alexa compatible devices from a mobile app. Unfortunately, this system is not as open source friendly and customizable as the other two platforms.

ZigBee

ZigBee is an open standard run by the Zigbee Alliance. ZigBee is designed to be a “mesh” network and operates at the 900Mhz and 2.4Ghz frequency range. ZigBee has a linear range as low as 10 meters. ZigBee is broken into multiple sub-protocols and they do not necessarily interoperate with each other well enough.

ZWave (ZWave Plus)

ZWave is also an open standard run but by SiliconLabs . ZWave is designed to be a “mesh” network as well and operates in the 900Mhz range in the United States. ZWave has since been updated to the ZWave Plus protocol which improves battery consumption, distance to 200 feet, streamlines the device inclusion process into the ZWave network, and provides additional device diagnostic capacities.

The platform selection process was a choice between ZigBee and ZWave. When browsing Home Depot’s website’s Smart Switch and Dimmer section, there were 76 ZWave options, 4 ZigBee options, and 30 WiFi options. In addition, ZWave had more open source support with source code for web based management applications and controllers available on GitHub.

Hardware

Raspberry Pi 3 Model B+

Raspberry Pi 3 Model B+ was the newest available Raspberry at the time. The Raspberry Pi 3 Model B+

Improved upon processing power and WiFi connectivity through a more capable network adapter which supported the 5Ghz frequency. There was a concern that the open source information regarding the newest Raspberry would not be as complete and cause problems with configuration. Fortunatley, the Raspberry Pi 3 Model B+ was an incremental upgrade and did not pose any significant challenges other than the ‘wiringpi’ module needing to be updated from version 2.44 to version 2.46 in order to support the GPIO.readall command for the new Raspberry.

Light Sensor

The light sensor that was used was part of an MCM Raspberry Pi Project Package for an older Raspberry Pi 3 Model B. It was re-used as an input sensor in this project in conjunction with a 50V 1uF electrolytic capacitor. The capacitor allows the user to measure the resistance to the light sensor.