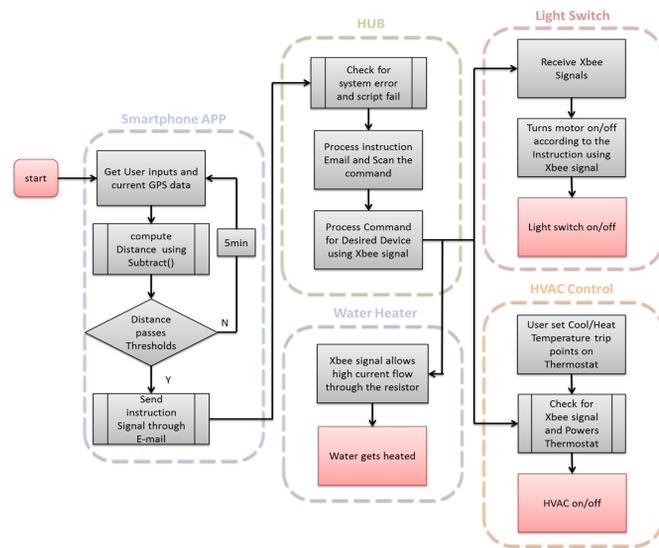


Behavioral Model



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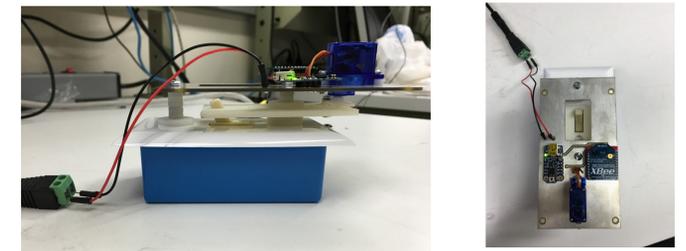
Introduction

Since the propagation of smartphones, consumers have demanded more and more of the “smart” technologies that will improve lives and pursue efficiency. Such demands allowed rapid expansion of “smart” technology in many areas such as communication, health care, and transportation. This project was started in order to meet some of the demands by designing a prototype of a smart home system that will **automatically** operate some of the home appliances **based on a user’s outside location**.

Light Switch Module



The light switch module physically turns the ordinary light switches ON and OFF. When the microcontroller receives a signal from the central hub, the servo is activated, performing appropriate actions. The user is also capable of maneuvering the switch manually for the situation when the user is home



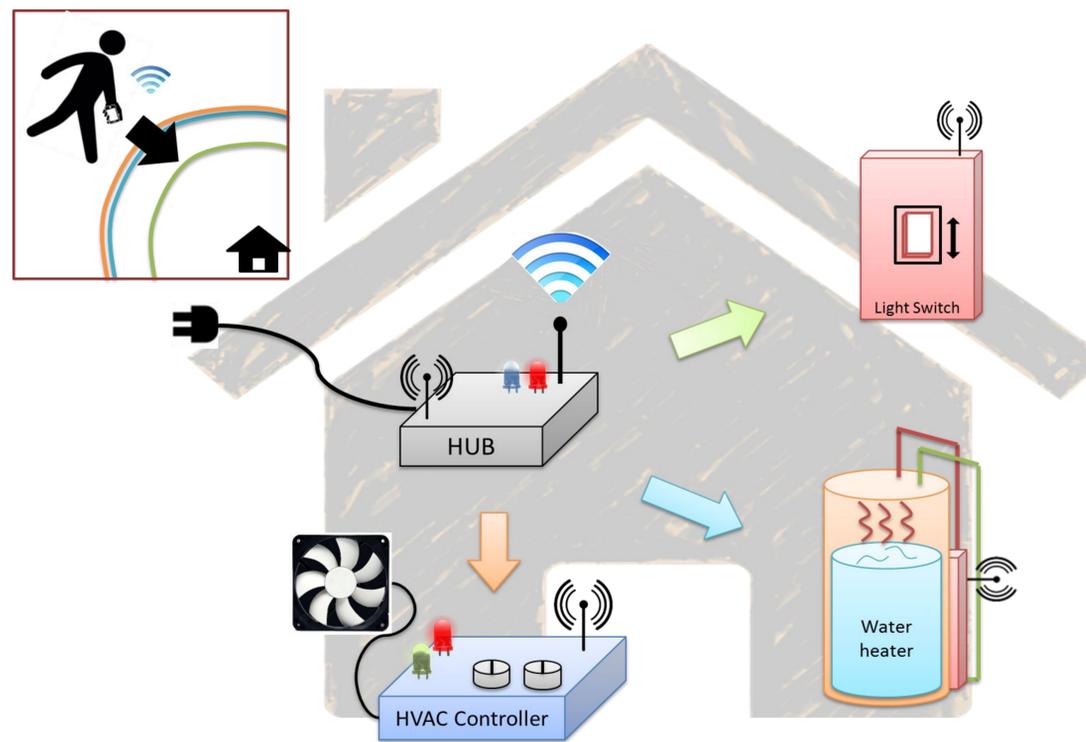
Smartphone Application

The Smartphone Application serves as the control for activating the endpoints of the home. The Smartphone App allows the user to input their custom settings such as home GPS location and thresholds. The application regularly retrieves the current GPS, computes the distance from home, and tests to see if any thresholds were passed. Based on the passing of the thresholds, an email command would be sent.

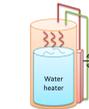


Central Hub

The central hub serves as the middleman of the home automation system. It checks for the email command sent from the Smartphone App, interprets the email, and sends signals to appropriate appliances using the XBee antenna. All the user has to do is the initial set up, such as supplying power and connecting to the internet, and the rest of the work is performed automatically.



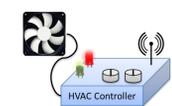
Water Heater



The water heater module models a high current circuit that allows 120 VAC to flow into a 20Ω resistor. When the XBee receives a signal from the central hub, the relay trips and current flows through the load. The resistor heats up as the current flows, which represents heating of the water.



HVAC Control System



We designed a simple thermostat to illustrate the HVAC application of the system. User can set a desired temperature set point using the control knobs. If Xbee control circuit receives the signal from the central hub, it will complete the HVAC circuit by sending battery power to the module. Then based on the current temperature, either the cooler (green LED and a fan) will turn on, or the heater (red LED) will turn on.



Results

Following results were observed in the testing process:

1. The application saves the home location data and checks to see if the user has left any threshold. When the app confirms that user is outside the threshold, it sends an appropriate email command.
2. The central hub checked for an email every 10 seconds, and successfully communicated with all the appliances .
3. The HVAC system activated when the current temperature exceeded the desired temperature set point.
4. The light switch was turned ON/OFF, waited two seconds, then went back to its neutral position.
5. The water heater’s relay tripped and the current flowed through the resistor. The resistor was heated to a significant temperature to model heating of water.