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Chemistry R3 – Research Plan

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Low Energy Bluetooth Programming

In 1979, while doing work for his Ph.D., Bjarne Stroustrup began work on a programming language he called “C with Classes,” a superset of the C language. This program developed into what we know today as the C++ programming language. Today, C++ leads the world of computer programming along with the Java language as the top two universal programming languages. A multitude of devices use C++, from home computers to cell phones to supercomputers to drones, which is why a research project involving C++ programming will not only lead to the accomplishment of a valuable science project, but also opens a whole new world of opportunities for the future.

**History**

Dennis M. Ritchie, an employee at Bell Labs (AT&T), worked on a project called Multics to develop the first universal programming language for a large computer. After AT&T withdrew from the project, Ritchie and his co-worker, Brian Kernighan, worked on their own to develop the UNIX operating system, which ran the programming language B. B had quite a few drawbacks though, which led Ritchie to develop the programming language C. C was very similar to B, but added a lot of features. The C language still exists today, but many languages have since improved upon it, including Java and C++. C++ was first developed in 1979 by Bjarne Stroustrup, adding the “object oriented” element to the language C. In 1983, the name officially changed from “C with Classes” to “C++” and its first commercial release was in October of 1985. The language has since been developed even further to best suit the needs of changing technology.

**Bluetooth Low Energy**

Quite recently, Bluetooth developed their newest version, 4.0 Low Energy. This newest version of Bluetooth uses 50% - 99% less power than previous versions of Bluetooth, while retaining most of the same features. In this particular project, Bluetooth Low Energy will be used simply as a scanner for the presence of a device of our choosing, using an inconsequential amount of energy.

**Raspberry Pi**

The Raspberry Pi is a relatively new technology developed for educating kids and as a hobbyist’s tool. It is a credit car sized computer fully capable of running a full-blown operating system. Our particular model includes USB, Ethernet, and HDMI compatibility and will be used to run Ruby Slippers and perform all communication via a Low Energy Bluetooth adapter.

**The Project**

***Stage 1***

The first stage of the project is becoming fluent in the C++ programming language. The majority of this stage will be performed at home on a personal computer. An online self-teaching tutorial will be used, such as cplusplus.com or CodingUnit Programming Tutorials, along with instruction by my mentor. A compiler will be downloaded so that practice programming can be done at home. Once a week for a few hours, a meeting will be set up with Jeff Squires, Ph.D., at Church of Epiphany (the project has no religious affiliations). This meeting will serve as a time to determine the fluency at that point, work through any questions or challenging concepts encountered the previous week, as well as delve into new topics for the following week. These meetings will remain on a weekly basis until fluency is achieved, whence experimental testing will commence.

***Stage 2***

Once fluency in general C++ programming and specifically Bluetooth protocol is achieved, the experimental portion of the project will commence. During this stage, I will work to determine different factors affecting the Bluetooth detection. These factors include, but are not limited to, distance between the Bluetooth devices and the ideal location within the house to capture the most traffic throughout the day. Empirical testing will be the primary source of data, but I will also monitor the program itself to determine the actual range of detection.

***Stage 3***

Stage three consists of taking my previous data as well as my training in C++ and write a program for the Raspberry Pi to execute using the Low Energy Bluetooth adapter. I will then merge this program with the existing Ruby Slippers, which consists of a program that scans the WiFi network for phone traffic. Together, these two functions will create a very effective system of detection within a home.

**Goals/Uses**

The completed Ruby Slippers program could be easily adapted for a multitude of uses around the house, especially with the development of smart appliances. However, because of a limited budget and limited technologies, our version of Ruby Slippers will only interact with the Nest, a smart thermostat with a less-than-ideal system of detecting whether or not a person is home. Because of this faulty system, any lengthy stay at home could be disrupted with a sudden shut-off of the heating or cooling. Our program aims to improve this detection not only to aid in the improvement of efficiency, but also to improve overall customer satisfaction and maintain a comfortable temperature in you home.

Throughout the duration of this project, a thorough knowledge of C++ programming will be acquired. Using this knowledge, a program will be developed to allow a Raspberry Pi to detect nearby phones via a Low Energy Bluetooth adapter. This program will be used to enhance the already impressive abilities of the Nest thermostat and could easily be adapted to other home uses as the technologies arise.

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