Raspberry Pi Research Project

Rohan More & Ryan Cosner
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Introduction

A raspberry pi is a small, low cost, computer that can be used for many things like browsing the internet, watching videos, making spreadsheets, word processing, and playing games. Raspberry pi operates like a normal desktop computer, but is the size of a credit card. It is a device that helps people explore computing and helps people learn how to program with languages like scratch and python. Raspberry pi has different versions and can be bought in different configurations. The raspberry pi requires a power supply to power the system, a microSD card to load an operating system and store data, a monitor or tv to output a display from the pi, a keyboard and mouse to control the pi, and an ethernet cable to provide internet to the pi. There are many different operating systems that can be installed to the pi along with different options for memory. Some examples of operating systems for raspberry pi are Windows, Linux, and Raspbian. Each operating system has its pros and cons, but ultimately it is up to user to which operating system they would like to use. Memory options for raspberry pi are micro sd card, a usb flash drive, and an external hard drive. The raspberry pi can be used to communicate with many different sensors and programmed to output different information based on which sensor or device is attached to the pi. The raspberry pi has been used in many projects by students all over the world.

Literature Review

Before we did anything with our raspberry pi, we first had to solder our sensor and pins together. To do this, we watched a video on how to solder and desolder items. The video we used was an adafruit youtube video that we found on their website (https://www.youtube.com/watch?v=QKbJxytERvg). This guide showed us the basics to soldering, like what the iron does, what tips are good to use, tinning tips, and what solder does. After successfully solder the sensor pins to the sensor itself, we then proceeded to mount the sensor to the breadboard. No materials were needed to do this. No materials were needed to install Raspbian to the raspberry pi. However, materials were needed to install the lux/light sensor libraries. We used the adafurit's learn section in the email they sent when you first buy the sensor (https://learn.adafruit.com/adafruit-veml7700). After the sensor libraries were installed, we used the sample code they gave us on the same page to get our sensor up and running.

Operating System

Raspberry Pi is capable of running many different operating systems. Some of these operating systems include Windows 10, Linux, and Raspbian. Windows is made by Microsoft and is a modern operating system used in many computers today. Windows is a fairly simple operating system that most people are familiar with. Windows comes with a multitude of features to help you stay organized, personalize your computer the way you want it, protect your data, and simplify your workspace. Although windows is great for day to day work and browsing, it doesn't offer a good place for programming easily without downloading other things. Linux is a basic operating system used, like all operating systems, to communicate between your computer's hardware and software. Linux is widely used in phones, cars, thermostats, refrigerators, and televisions. It is used mostly in servers and embedded systems but can be run on desktops. Linux is made up of many pieces like bootloader, Kernel, Init system, Daemons, Graphical server, Desktop environment, and applications. Raspbian is the official supported operating system for raspberry pi. Raspbian is based on Debian and is optimized to work with raspberry pi hardware. It comes with over 35,000 packages bundled together for easy installation and is pre-installed with a multitude of software for educational use, general use, and programming. It includes Python, Scratch, Sonic Pi, Java and more. For our project we choose to use Raspbian because it is a simple operating system that works well with the raspberry pi hardware and provides the necessary tools to program our light sensor easily.

Memory

Unlike traditional computers, all raspberry pi's use microSD cards as a primary way to store information. The upside to pairing a microSD card with raspberry pi is that it is more effective. It is more effective because of how small and compact the raspberry pi is. A microSD card allows the raspberry pi to remain in a small and compact form. A huge downside for raspberry pis to using microSD cards is that they are limited in speed. There are numerous amounts of microSD cards on the market, all ranging from 2 gigabytes all the way to 1 terabyte! However, microSD cards come in different classes too. For starters, there is a class 2 microSD card. Class 2 is the slowest class with speeds capped out at 2 MB/sec. Then there is a class 4, 6, and 10. Class 4 is 4 MB/sec, Class 6 being 6 MB/sec, and class 10 being 10 MB/sec. You can also use a flash drive as a boot device for the raspberry pi. Flash drives also come in different forms regarding size. Flash drives come in sizes varying from 4 gigabytes to terabytes. Flash drives have different speeds based on USB 2.0 and USB 3.0. USB 2.0 has slower speeds while the fairly new USB 3.0 has faster speeds. You can also use an external hard drive/solid state drives. Using these external drives gives you much faster read and write speeds. However, because they use USB to connect to the device, the speeds will not be the same as an internal drive on a traditional computer. Using an external drive also gives you an advantage of more storage space. The operating system for our project, Raspbian requires at least 8 gigabytes to run without problems. We decided to settle for an 8-gigabyte microSD card. We choose an 8-gigabyte card because we don't need any special software besides a python ide. However, Raspbian already comes with a pre-installed ide that is up-to-date with the latest version of the python 3 libraries. The libraries needed for our light sensor are not that large in file size, it is actually relatively small at 22 kb. We also do not need a high-class/high-speed microSD card

because we will not be moving or importing files onto the SD card. Just in case we wanted to install a program or 2 we wanted to have a decent read and write speeds, so we decided to settle for a class 4 microSD card.

Communication

Communication between the raspberry pi and the sensor is actually quite simplistic. For your raspberry pi to communicate with your sensor you will need, a breadboard, wires, a sensor, a T-connector, and finally a ribbon cable. The sensor is connected to the breadboard at any spot on the breadboard. Then the T-connector is connected to the breadboard as well. Then you connect one side of the ribbon on the T-connector pins. With the other side of the ribbon cable, you connect it to the raspberry pi GPIO (General Purpose Input/Output) pins. The GPIO pins allow the raspberry pi to take incoming inputs from for example, a sensor. The GPIO pins are fully customizable. You can turn off and on certain pins within the raspberry pi terminal or python ide. The T-connector is just a safety measure for the raspberry pi. It allows you to safely connect the breadboard and raspberry pi together, so you don't have to mess with the GPIO pins themselves. To sum up how the raspberry pi communicates with our light sensor is by the sensor sending a current to the T-connector which then sends that current to a specific GPIO pin allowing data to be displayed in the python ide.

Conclusion

Raspberry pi is a credit card sized computer that is capable of many things. It is designed to help people explore computing and learn to program using different programming languages. Raspberry pi supports many kinds of operating systems and can be used with different memory solutions. In our project we choose to use the light sensor and used a microSD card for storage with Raspbian as our operating system. The sensor was easy to solder and wire using the breadboard and T-connector. The T-connector made it so the pi could talk to the sensor, along with the breadboard and wiring we did. Raspbian made it simple to code the sensor to do what it was supposed to, and the sensor worked with no issues.

References

"Download Raspbian for Raspberry Pi." *Raspberry Pi*, www.raspberrypi.org/downloads/raspbian/.

"What Is Linux?" *Linux.com*, www.linux.com/what-is-linux/.

"Windows 10 Features: What Is in Windows 10." *Microsoft*, www.microsoft.com/en-us/windows/features.

Staff, TechSpot. "MicroSD Card Buying Guide." *TechSpot*, TechSpot, 4 Mar. 2019, https://www.techspot.com/guides/1591-microsd-buying-guide/.

Rembor, Kattni. "Adafruit VEML7700 Ambient Light Sensor." *Adafruit Learning System*, https://learn.adafruit.com/adafruit-veml7700.

Industries, Adafruit. *YouTube*, YouTube, 10 Apr. 2014, https://www.youtube.com/watch?v=QKbJxytERvg.

END DOCUMENT