Overview:

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. RasberryPi's have household, personal, and professional uses. They can be used in many career fields. A RaspberryPi can do everything one would expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. This lesson will review to how to use a RaspberryPi to make a Minecraft server for you and your friends!

Learning Outcomes

-Students will explain what a RaspberryPi is and demonstrate some ways to use it

- Students will install Ubuntu and develop Minecraft sever

- Students will build and utilize a Minecraft server

Materials

- RaspberryPi Minecraft Server Visual Guide pdf
- Computer
- 1 X RaspberryPi 4 (The 4GB and 8GB model will work best)
- 1 X RaspberryPi Power supply (Any 3.0A USB-C power supply works but an official RaspberryPi power supply is best)
- 1 X MicroSD card (the more storage the better for long term)
- 1 X SD Card Reader
- 1 X Micro-HDMI to HDMI cable (Optional but much easier)
- 1 X Keyboard and Mouse
- RaspberryPi Imager Software (Free)
- *OPTIONAL* – RaspberryPi starter kits like the CanaKit 8GB starter kit are more expensive but have all the needed parts and offer great value for the price

The Activity

Part 1: Set up the RaspberryPi

1. If you have a starter kit, make sure all parts, cases, heatsinks etc. are assembled properly.
2. Plug into power to test that your cable and the Pi both works. With no SD card in the status LED on the board should shine a solid red and there should be no green flashes and no HDMI output.

Part 2: Install and set up Ubuntu

Ubuntu is a Linux distribution Operating system. Like how Windows is an OS for computers, Ubuntu can also be used as an OS. Ubuntu is more lightweight and often used by programmers, servers, and developers and puts more emphasis on performance and compatibility while windows focus on the user experience.

1. First you must install the Free raspberry Pi Imager software. This will allow you to install ubuntu directly and easily or other Pi-Compatible OS's onto the Pi.
   https://www.raspberrypi.org/software/
2. Insert your MicroSD card using the SD card reader and select it in the RaspberryPi imager software.
3. Select Ubuntu Desktop 20.10 (RPI4/400) and then write the image to the SD card (This will take a while)
4. Now that you have Ubuntu installed, insert the MicroSD Card into the RaspberryPi and boot it up. If Ubuntu is installed correctly and the HDMI is plugged in, the red LED on the Pi should light up and the green LED should start flashing. The display will show a rainbow and then eventually switch to the ubuntu startup screen.
5. Go through all your system configurations and login to the ubuntu desktop.

Part 3: The Minecraft Server

A Minecraft "server" often refers to a network of connected servers, rather than a single machine. A multiplayer server allows two or more players to play Minecraft together. You can either download the server file need or set up your own server. Minecraft servers allow players to play online or via a local area network with other people. From a Minecraft server, you can build a personal community, serve pre-established communities to help them grow, can create a new world, share footage of it online, invite in new friends, and will grow your player base.

1. Open your terminal and make a new directory titled "MCServer"

2. Make sure you have java installed by using "java –version" if it says not found and gives you instructions on how to download it use the command "sudo apt install openjdk-11-jre-headless"
3. Launch the server using the following command (It will fail the first time because you need to accept the user agreement)
    a. java –Xms#G –Xmx#G -jar server.jar nogui
    b. Fill in the #'s with the number of gigabytes you want the server to use for ram
    c. I suggest a minimum of 2 gigs. (I use 4 because my Pi has 8 gigs total, use no more than half your total ram)
4. Open the eula.txt file using the command "nano eula.txt"
5. Change the "eula=false" to "eula=true" and save it with Ctrl+O and then Ctrl+X to exit
6. Run the command again to launch the server! You are all done!

Troubleshooting:

1. If anyone is going to join the server, you must port forward your RaspberryPi's IP address
    a. This requires the login info for your home router and/or internet service provider account, make sure your parents are ok with this before continuing.
    b. There are many tutorials online and each router has a slightly different interface so do some research before doing it.
2. The server will be slow for the first minute or 2 so let it have a minute to catch up.
    a. The RaspberryPi is meant to be a cheap replacement for paying to host a server. It does not have great performance, but it is playable.
    b. For an increase in performance consider researching RaspberryPi clustering.
3. If you plan on leaving it on 24/7, check on it occasionally. Make sure it does not overheat or run into any errors!
4. If you are having any issues with commands not working on ubuntu type the following command into the ubuntu terminal
    a. "sudo apt-get update && sudo apt-get upgrade"
    b. This will update any missing commands on your ubuntu OS.

Assessment

1. What is a RaspberryPi and what are three (3) projects you can integrate it in?

2. What is ubuntu and how is it used?

3. Name three (3) professions or field of study that use Raspberry Pi?

4. How can you test to confirm that the Pi works correctly?

5. How can you assess your work to confirm that the OS was properly installed?

Vocabulary

Command
An instruction for a computer to follow

Gigabyte
A measurement of digital storage on a computer

Linux
Linux is a family of open-source Unix-like operating systems based on the Linux kernel, an operating system kernel first released on September 17, 1991, by Linus Torvalds.

Micro Controller
A compact circuit designed for a specific purpose

Network
A group of computers connected and sharing data using a set of common protocols(AKA instructions for sending data)

Operating System(OS)
An operating system is system software that manages computer hardware, software resources, and provides common services for computer programs

Python
Python is an interpreted high-level general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant indentation

RAM
Temporary storage that allows programs to store data, run functions and access information faster than normal storage

Scratch
Scratch is a block-based visual programming language and website targeted primarily at children 8-16 as an educational tool for coding.

Server
A computer that runs some service for multiple people that connect to it as "Clients"

Terminal
the word "terminal" usually refers to a terminal program, or emulator, which provides a text-based interface for typing commands

Ubuntu
Ubuntu is a Linux distribution based on Debian and composed mostly of free and open-source software.

Extensions and/or Additional Resources

1. RaspberryPi Minecraft Server Visual Guide pdf
2. RaspberryPi Imager
- https://www.raspberrypi.org/software/
3. PaperMC Server.Jar
- https://papermc.io/downloads
4. Port Forwarding Guides
- https://www.noip.com/support/knowledgebase/general-port-forwarding-guide/
- https://www.youtube.com/watch?v=X75GbRaGzu8
- https://www.youtube.com/watch?v=jfSLxs40sIw
5. Install Ubuntu on a RaspberryPi
- https://ubuntu.com/tutorials/how-to-install-ubuntu-desktop-on-raspberry-pi-4#1-overview

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