CEIS106 IoT Virtual System

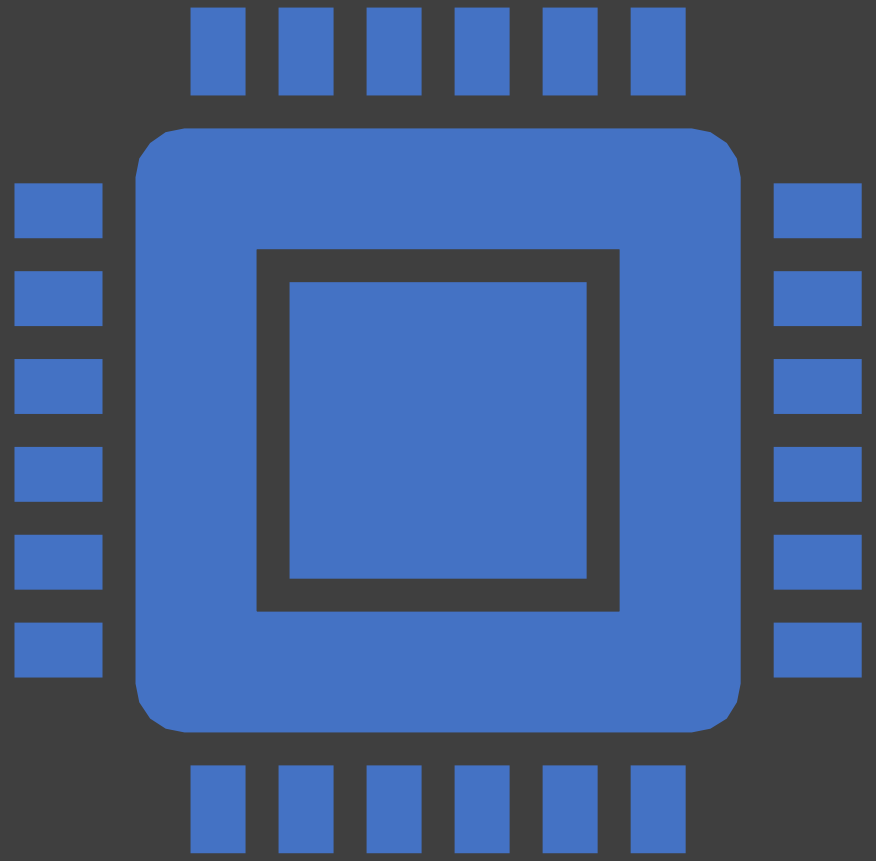
Roger Burns II

Introduction

- The Internet of Things is growing exponentially and the operating systems that control these devices are important to understand and explore.
- This project combines all aspects of the Internet of Things to develop a virtualized system to control a circuit.

What is Linux?

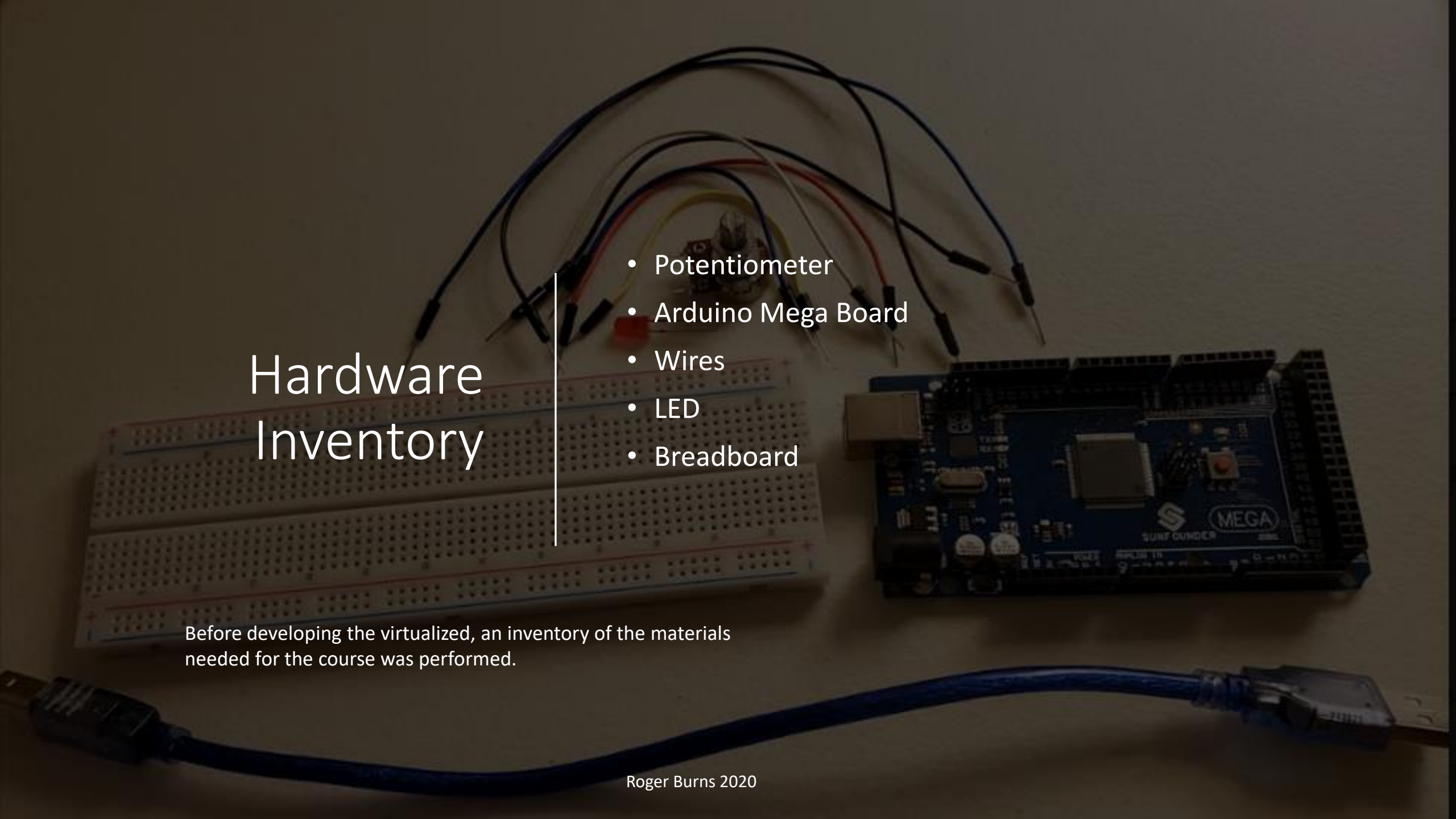
- Linux is an opensource operating system. It is the software on a device that allows applications and a user to access the device and performs functions. An operating system relays information from an applications to a device’s processor. The CPU performs the t ask then sends the information back to the application through the operating system.



Hardware Inventory

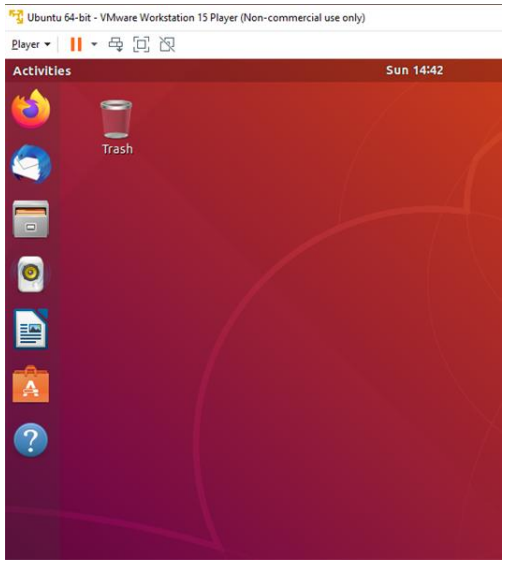
- Potentiometer
- Arduino Mega Board
- Wires
- LED
- Breadboard

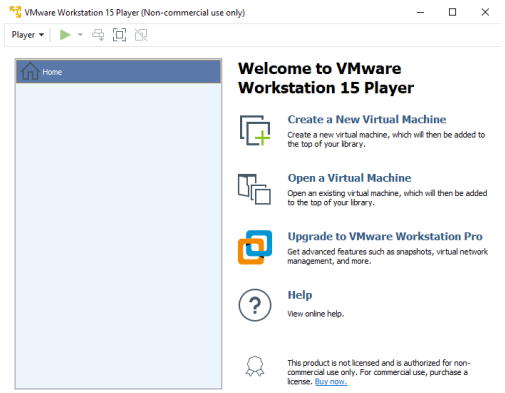
Before developing the virtualized, an inventory of the materials needed for the course was performed.

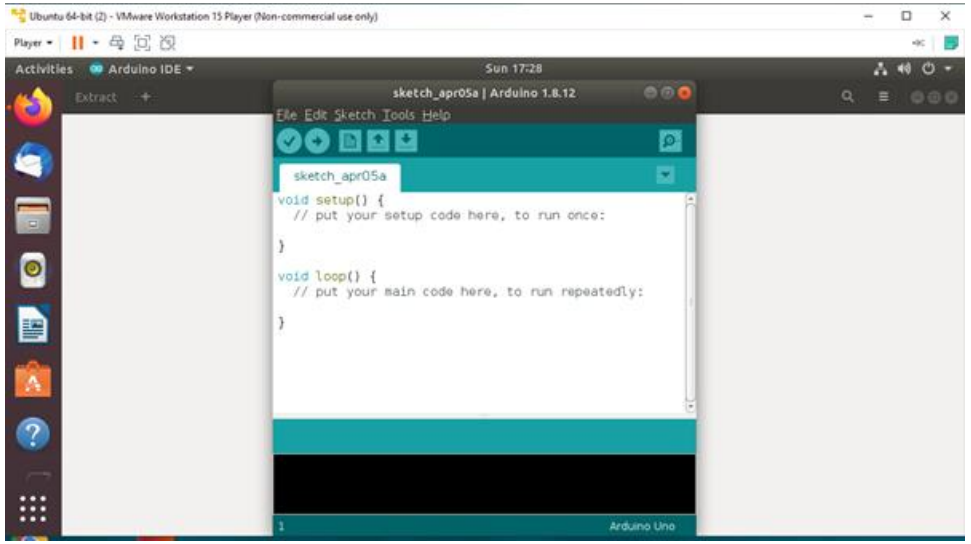


Software Inventory

- Linux ISO
- VMWare
- Arduino IDE







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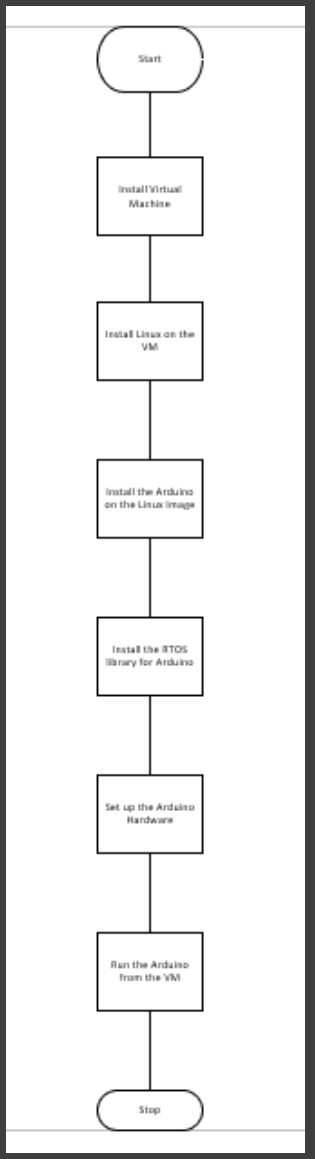
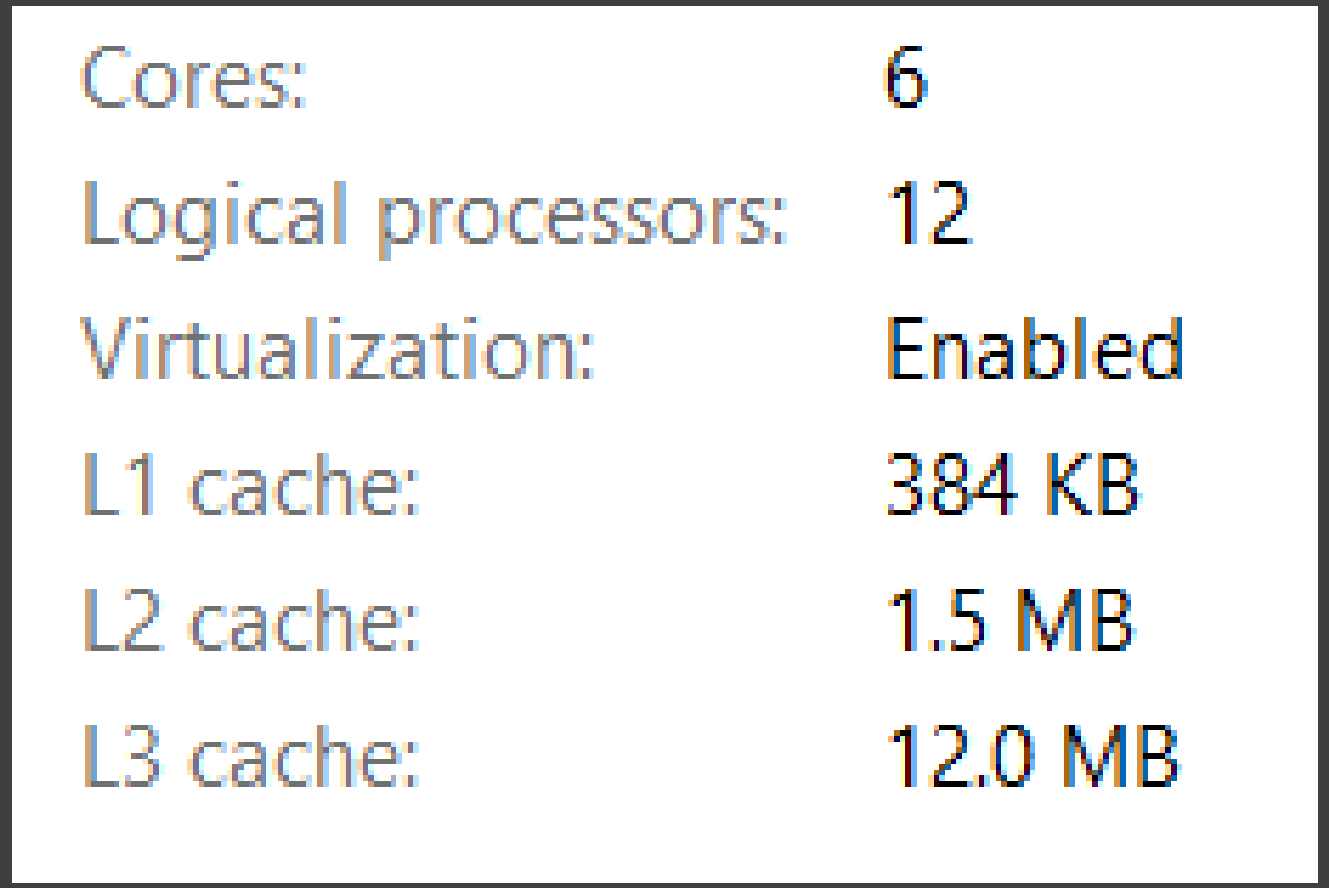
Flowchart

- **Install Virtual machine**
- **Install Linux on the VM**
- **Install Arduino on the Linux image**
- **Install the RTOS library for Arduino**
- **Set up the Arduino hardware**
- **Run the Arduino from the VM**

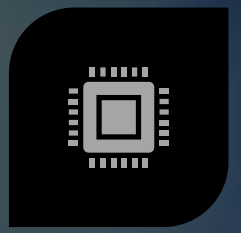


Accessing BIOS



- Command, option, O and F on my Mac was used to ensure virtualization was enabled.

Designing the Prototype and Installing the VM



ONCE THE VIRTUALIZATION HAS BEEN ENABLED THE VIRTUAL MACHINE CAN BE INSTALLED.

VMWARE IS VIRTUALIZATION SOFTWARE THAT ALLOWS MORE THAN ONE OPERATING SYSTEM TO RUN ON THE SAME MACHINE.

PRIOR TO INSTALLING THE VMWARE, A PROCESS FLOWCHART IS DEVELOPED SHOWING THE STEPS NEEDED IN THIS PROJECT.

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Installing Linux on the Virtual Machine.

- Linux is an open source operating system and can be downloaded and installed on Windows.
- The distribution of Linux used was Ubuntu. Ubuntu is very secure, powerful and easy to use.
- After installing the Linux ISO, the desktop was explored.

Explore the Linux Desktop

How do you open a terminal window?	• Right click and select open terminal
Name a browser and Office software you see in Ubuntu:	• Firefox and there are no Microsoft products but there is a basic text editor.
How would you compare the Linux desktop to other OS's you have used (Windows, Mac)?	• The GUI interface here is nice but not as fancy as Windows 10. The way you navigate through applications reminds me of an IOS like my Iphone.

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Installing Files

What is a tar file?	• A TAR file is composed of many files that used for backup or distribution purposes.
What is the sudo command?	• This allows the user to run applications with the security credentials of another user.
How would you compare installing software on Linux versus Windows or Mac?	• It easy but even with the GUI interface a command was still needed where in Windiows and MAC its GUI until the end.

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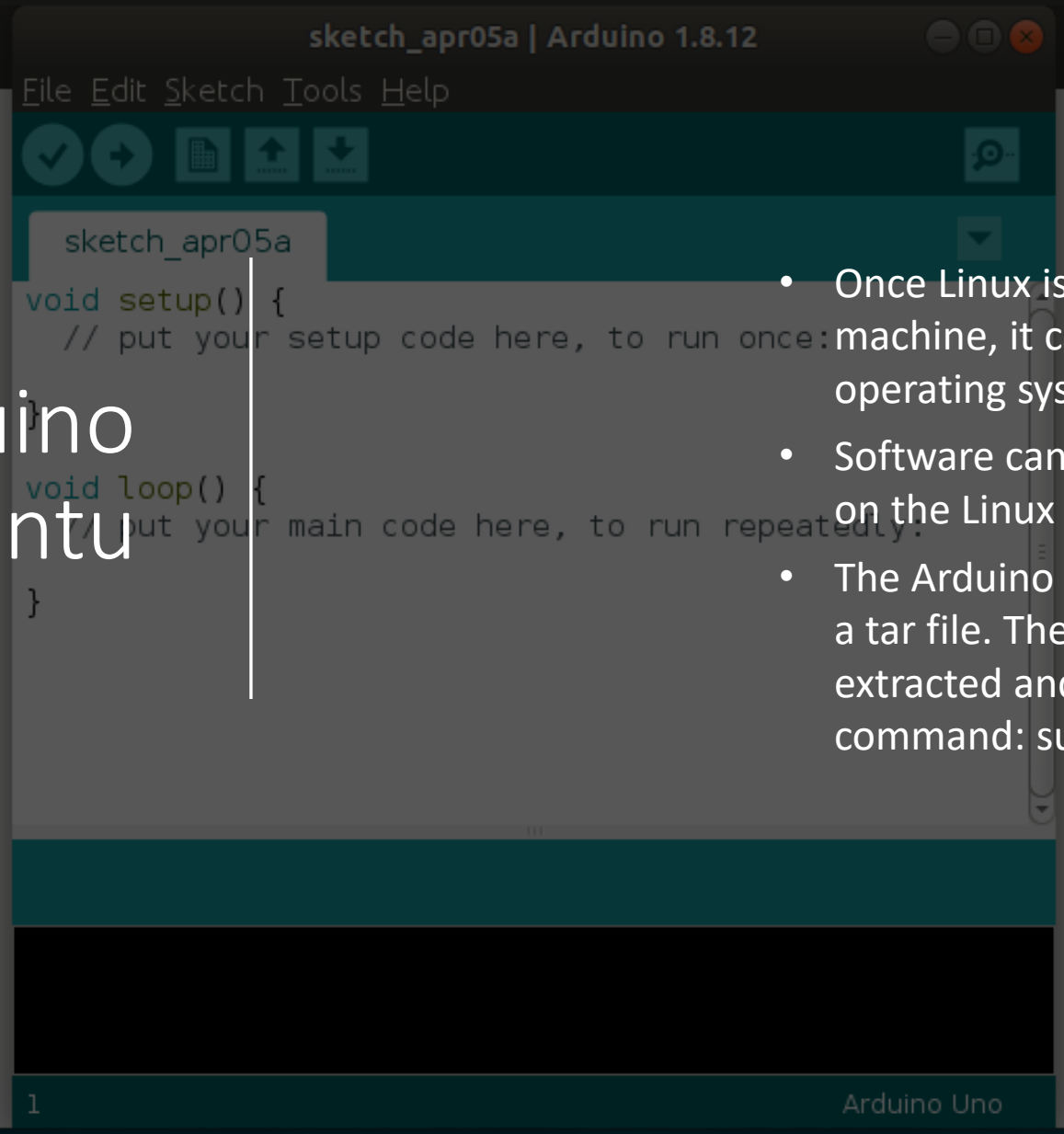
Install Arduino IDE on Obuntu



- Once Linux is installed in the virtual machine, it can be treated as any other operating system.
- Software can be downloaded and installed on the Linux OS including the Arduino IDE.
- The Arduino IDE foe Linux is downloaded as a tar file. The tar file needed to be extracted and then run by using a Linux command: sudo sh install.sh

RTOS

RTOS stands for Real Time Operating system and refers to the software in embedded systems such as IoT systems that schedules tasks in a predictive pattern such that it appears the tasks are running at the same time.

RTOS became crucial in IoT development as it controls the applications function and supports instant responses.

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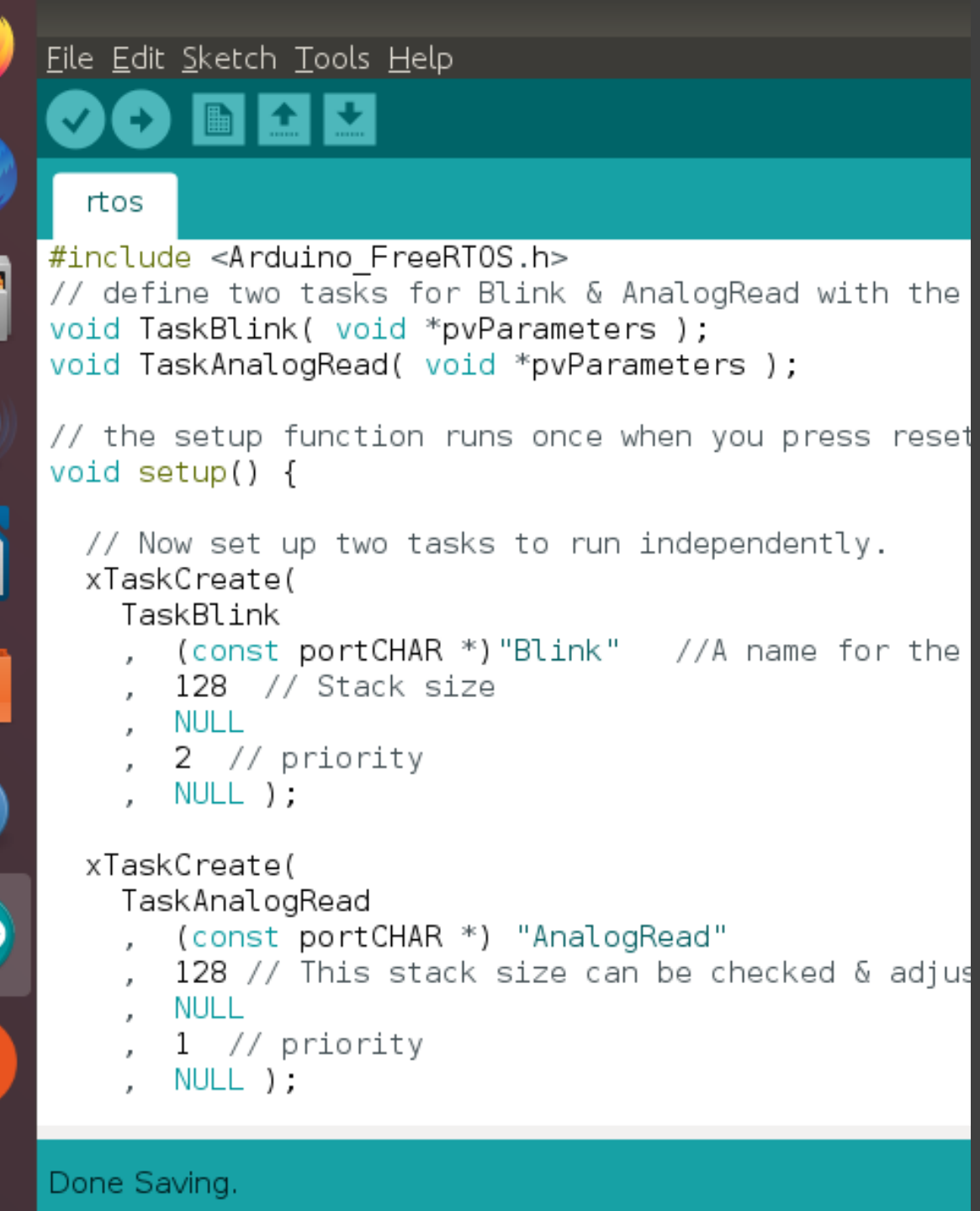
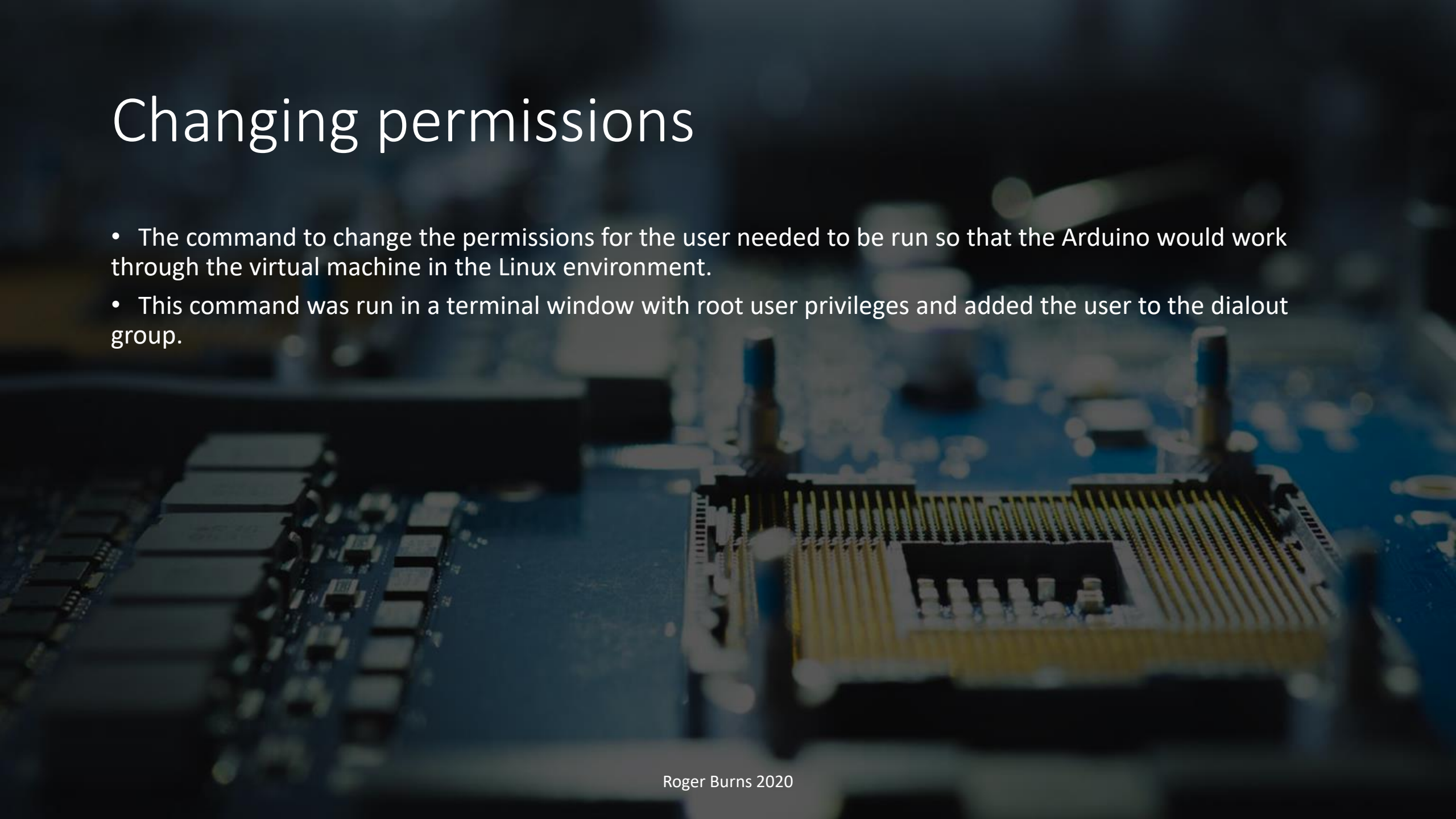


Install RTOS using the Arduino

An RTOS is a real time operating system for multitasking intended for applications with deadlines.

Changing permissions

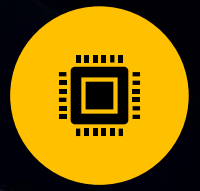
- The command to change the permissions for the user needed to be run so that the Arduino would work through the virtual machine in the Linux environment.
- This command was run in a terminal window with root user privileges and added the user to the dialout group.



Controlling the Arduino from the Virtual Machine

THE POTENTIOMETER AND LED WERE SET UP ON THE BREADBOARD AND CONNECTED TO THE ARDUINO ON PIN A0 AND PIN 13 RESPECTIVELY.

THEN THE ARDUINO WAS CONNECTED TO THE COMPUTER VIA USB.



WHEN THE ARDUINO WAS CONNECTED TO THE COMPUTER, THE VIRTUAL MACHINE MAPPING TO THE PORT NEEDED TO BE REVIEWED.

IN ADDITION, SECURITY SETTINGS IN THE LAPTOP PREVENTED THE ARDUINO FROM COMMUNICATING WITH THE LAPTOP. THE PERMISSIONS NEEDED TO BE CHANGED WITH THE COMMAND: SUDO USERMOD –A-G DIALOUT ROGER

WHEN THE CODE WAS UPLOADED TO THE ARDUINO, THE RESULT WAS THAT THE LIGHT AND POTENTIOMETER COULD BE RUN SIMULTANEOUSLY FROM THE SAME PORT.

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```
drwxr-xr-x 2 roger roger 4096 Apr  5 16:58 Videos
roger@ubuntu:~$ cd newDir
roger@ubuntu:~/newDir$ cat config.txt
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.116.130  netmask 255.255.255.0  broadcast 192.168.116.255
        inet6 fe80::c91:9fac:5eed:5cef  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:b0:45:3d  txqueuelen 1000  (Ethernet)
        RX packets 7321  bytes 8411810 (8.4 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3491  bytes 384145 (384.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
```

Scripts

config.txt file generated by the script and create.sh

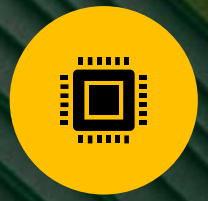
Conclusion

THIS PROJECT COVERED THE FUNDAMENTAL TOPICS OF OPERATING SYSTEMS IN THE INTERNET OF THINGS BY THE CREATION OF A VIRTUAL REAL TIME IOT SYSTEM.

BUILDING THE CIRCUIT AND WORKING WITH THE ARDUINO PROVIDED A HANDS-ON LEARNING OPPORTUNITY TO PUT INTO PRACTICE THE TOPICS COVERED IN THIS COURSE.

Career Skills

Communication – Using flowcharts to depict the plan of a project.



Electronics(voltage, resistance and current) and working with the Arduino.

Programming using the Arduino IDE.

Networking – Using a virtual machine.

Security – Changing the permissions on the project.

Operating Systems – Learning about virtual machines.

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