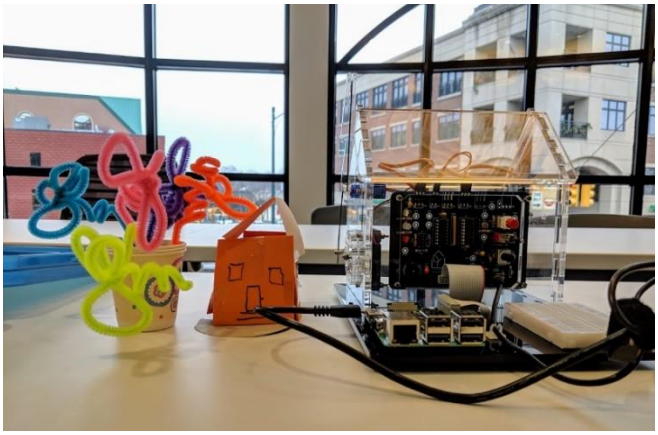


IoT Greenhouse™ – Setup Guide

Overview:

The IoT Greenhouse™ is a learning system developed to teach the fundamentals of Python programming and Internet of Things (IoT). It removes barriers of existing IoT training solutions by abstracting both hardware and software components. Students interact with hardware without challenges that building prototype circuits create. Additionally, students quickly create robust Python code to control the system using APIs provided by the IoT Greenhouse service software.

This abstracted hardware and software enable the student to realize early success and efficiently develops a foundational knowledge of software and Internet of Things. With these successes behind them, student continue with additional in-depth lessons that build on fundamentals while uncovering the complexities of hardware and software technologies.

This document provides a basic guideline for setting up the IoT Greenhouse™ and testing system hardware.

Prerequisites:

There are no prerequisites for this task.

Performance Outcomes:

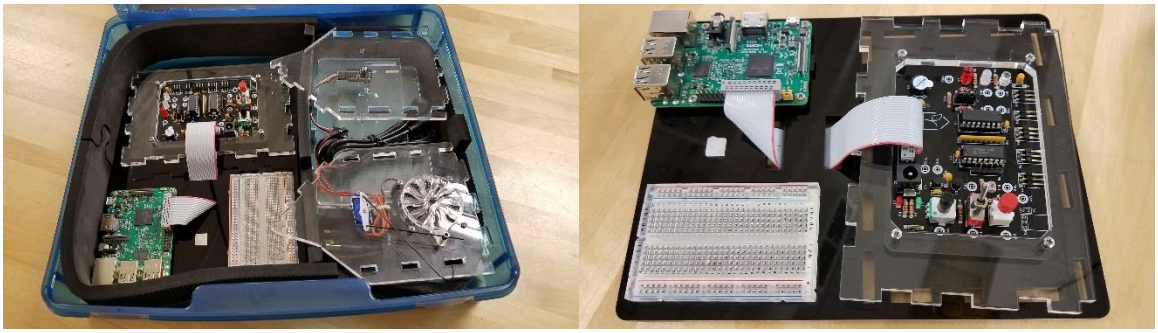
1. Construct the IoT Greenhouse™
2. Connect a USB power supply
3. Boot the system and view the IoT Greenhouse™ desktop
4. Download Python test code and run

Resources:

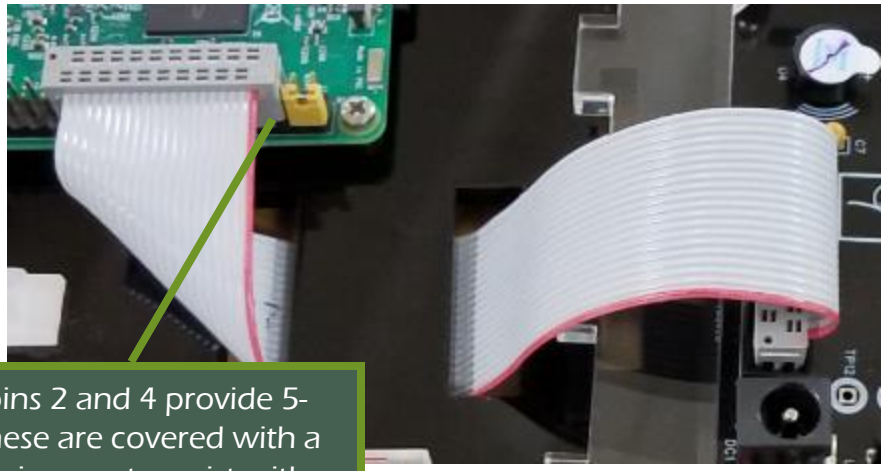
1. IoT Greenhouse™ system
2. USB power supply and cables.
3. HDMI monitor, USB keyboard and mouse, or laptop with Ethernet cable
4. 2.4 GHz Wi-Fi

Step 1: Build the IoT Greenhouse™

1. Remove greenhouse components from the kit. The control board should remain connected to the base unit. This maintains the position of the ribbon cable attached to the 40 pin GPIO header of the Raspberry Pi.

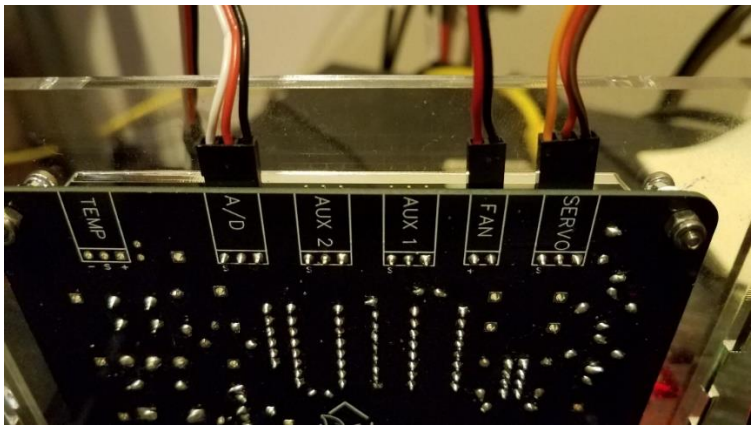


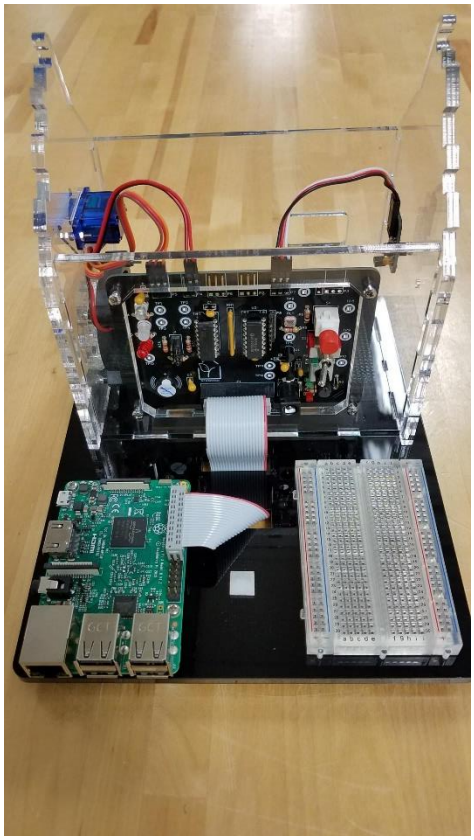
2. A close-up of this connection is below. The ribbon cable header is attached starting at pin 5 of the GPIO header. A two-pin jumper is provided on pins 2 and 4 of the header to assist with indexing the header placement. This jumper can be removed if assess to the 5-volt supply voltage on pins 2 and 4 is required.
Caution: The Raspberry Pi is a 3.3-volt device. Connecting 5-volts to any GPIO pin will damage the device.



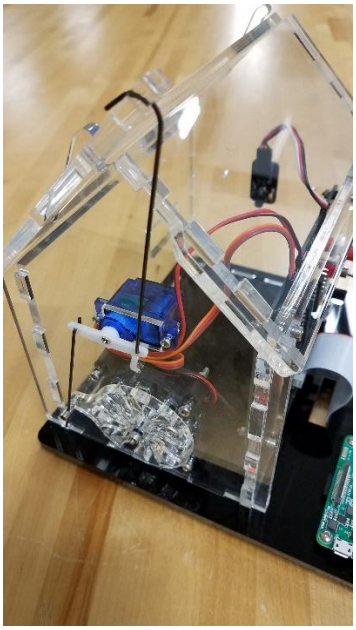
GPIO pins 2 and 4 provide 5-volts. These are covered with a two-pin jumper to assist with indexing the header, as well as discouraging use of these pins. Applying 5-volts to any GPIO pin will damage the Raspberry Pi.

4. Insert the sides of the greenhouse into the base.
5. Connect the servo, fan, and temperature sensor leads to the control board. The orientation of the connectors is critical. Reference the image below when making your connections. Note that when looking at the back of the controller board, black leads go to the right side of the connection.



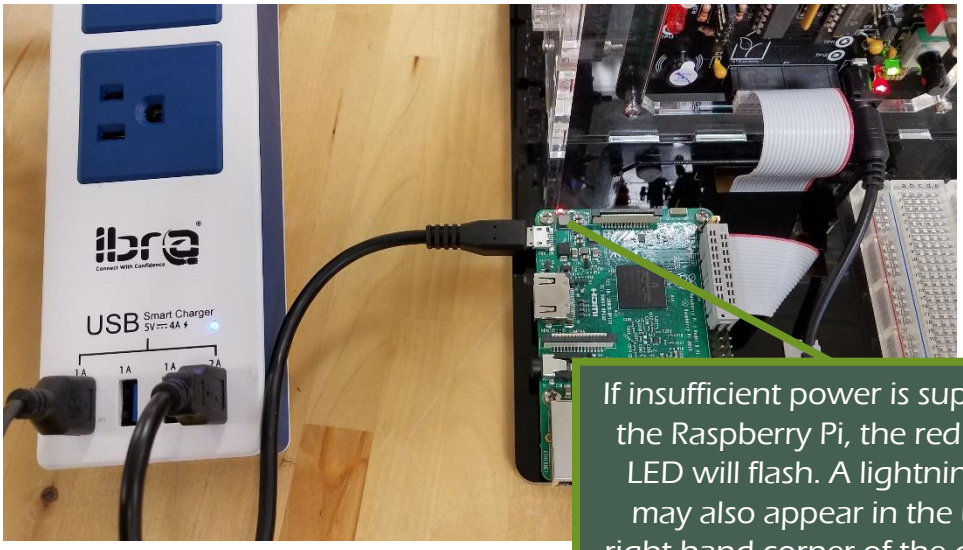


6. Attach the greenhouse roof segments and attach the linkage to the servo motor.



Step 2: Connect the Device

7. Attach USB power to both the Raspberry Pi and the controller board. The Raspberry Pi requires a high-power USB source. Note in the image below that the Raspberry Pi is powered through the micro-USB that is connected to the 2 Amp output of the power source. A 1 Amp output is using to power the controller board via the USB to 2.1 mm barrel connector.

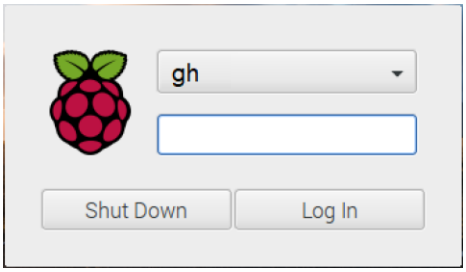


If insufficient power is supplied to the Raspberry Pi, the red power LED will flash. A lightning-bolt may also appear in the upper right-hand corner of the desktop.

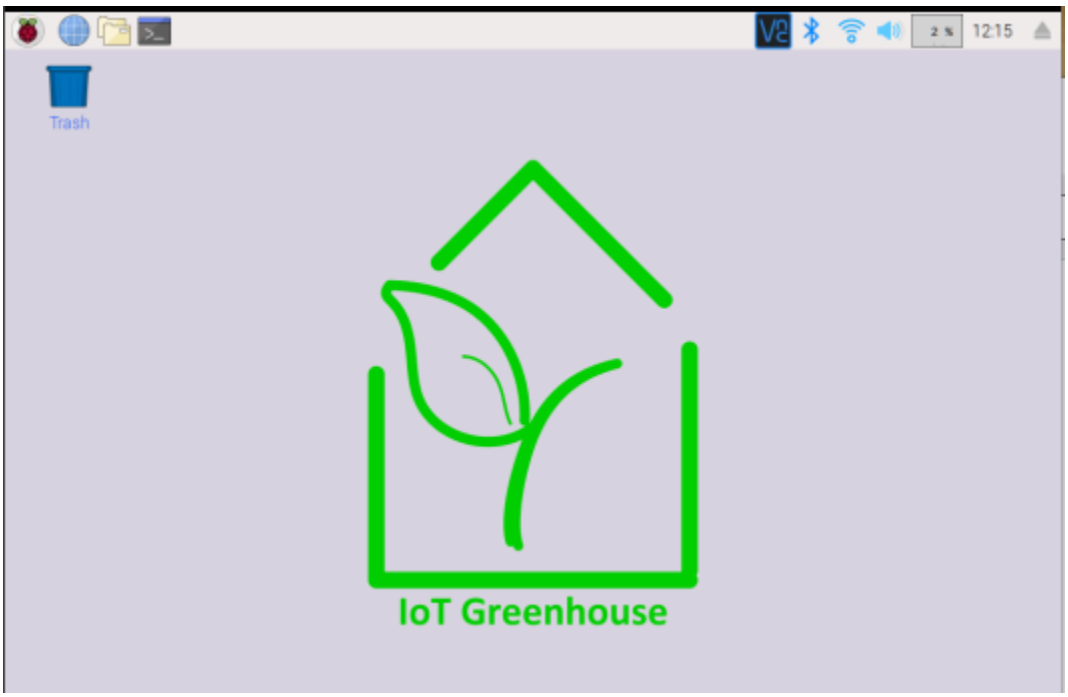
8. There are two methods for connecting and interacting with the Raspberry Pi desktop.
9. **Method 1:** HDMI monitor and USB keyboard/mouse - Attach an HDMI monitor to the Raspberry Pi's HDMI port and connect a USB keyboard and mouse to the Raspberry Pi's USB ports. The image to the right shows HDMI and USB cables connected in addition to the micro-USB connection used to supply power to the unit.

10. Connect the HDMI display before applying power to the Raspberry Pi. This enable the Raspberry Pi to set the screen resolution for the monitor.
11. Apply power to the micro-USB to boot the system. The system boots and a login screen will appear. Select the **gh** user from the drop down. There is also an **iot_gh_admin** account. See the IoTGreenhouse.UserAccounts document for additional information.

12. Enter the password for the **gh** user and click Log In. The initial password for the **gh** user was provided during order fulfillment. If the **gh** user password is not known, use the **iot_gh_admin** login to reset the gh user password. Again, see the IoTGreenhouse.UserAccounts document for additional detail.



13. The IoT Greenhouse™ desktop is displayed.



14. **Method 2:** Remote connection using VNC viewer - The second method for connecting and interacting with the system is to use a laptop or workstation with the VNC Viewer remote access software installed. The viewer software can be installed from the following link.

Download VNC Viewer

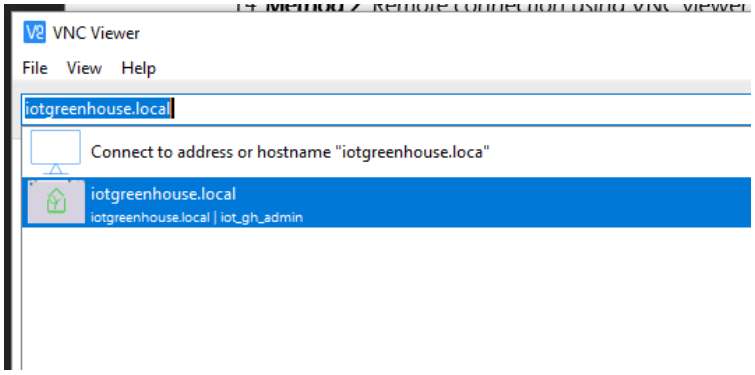
15. If you are using a Windows or Linux computer, you'll also need to download and install Bonjour services. See the guide provided aby Adafruit below.

Bonjour Networking for Windows and Linux

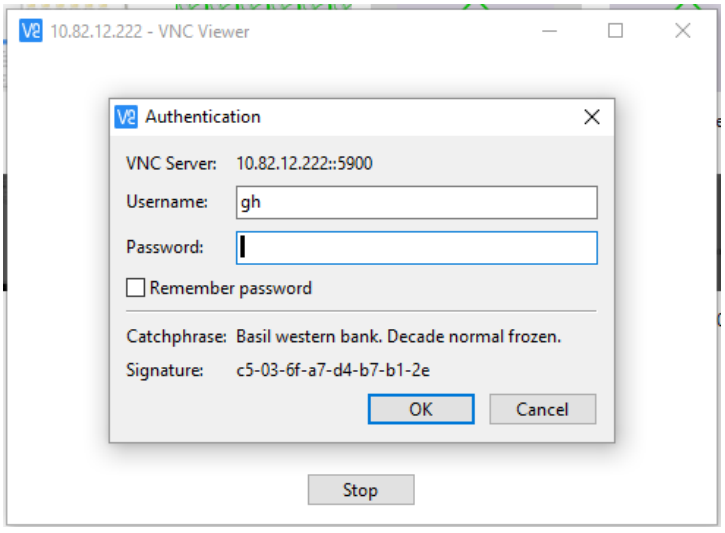
16. Connect the Ethernet cable between the Raspberry Pi and your computer to create a peer-to-peer network. The image to the right shows the Ethernet cable connected in addition to the micro-USB connection used to supply power to the unit.

17. Once the network cable is connected, boot the Pi by applying power to the unit.
18. Open the VNC viewer application and enter the following device name into the address textbox. The **.local** is appended to the device name due to the peer-to-peer network connection and the multicast DNS standard.

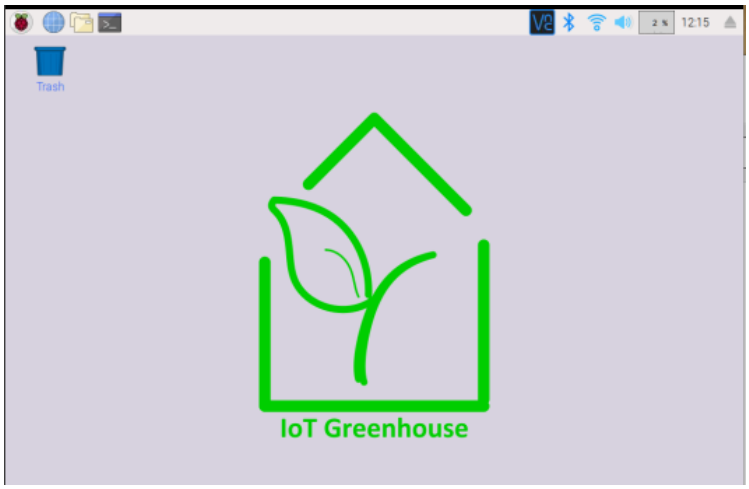
iotgreenhouse.local



19 The connection is opened, and an authentication dialog appears. Enter gh as the user along with the required password to connect.

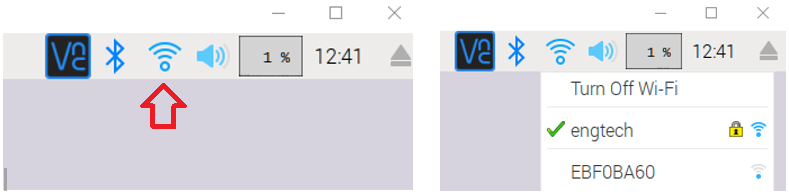


19. The remote IoT Greenhouse™ desktop is displayed.

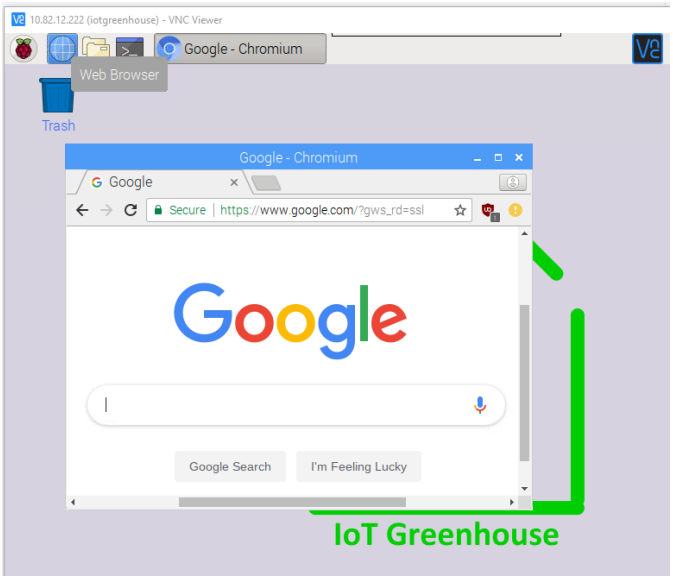


Step 3: Connect the Internet using Wi-Fi

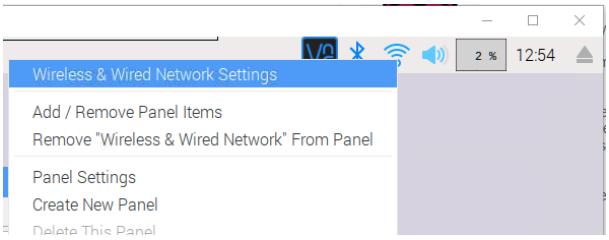
20. Select the Wi-Fi access by clicking on the Wi-Fi tool provided on the task bar. The system only supports 2.4 GHz connections.



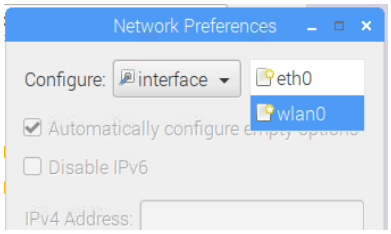
21. Open the web browser using the tool provided on the task bar. Navigate to a website such as Google to verify connectivity.



22. User may want to set a static IP address for the device to enable a remote connection via Wi-Fi. To specify a static IP address, right click on the Wi-Fi icon and select Wireless & Wired Network Settings from the options displayed.

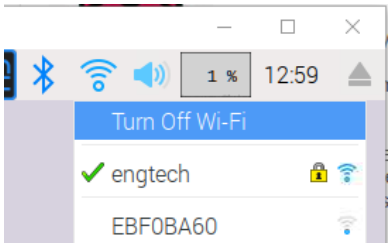


23. Select wlan0 from the Configure dropdown.

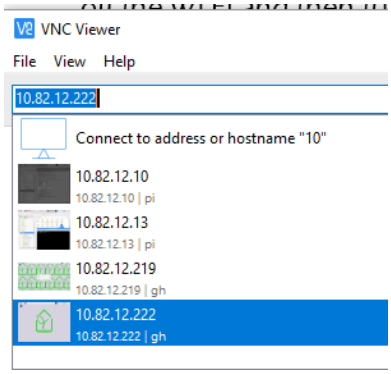


24. Enter a valid static IP address for your network. Click Apply and close.

25. Reset the IP address for the Wi-Fi by right-clicking on the Wi-Fi icon and turning off the Wi-Fi and then turn back on.

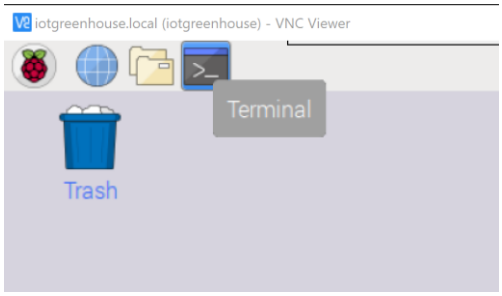


26. Close the remote VNC window and return to the VNC View application. Remove the Ethernet cable. Verify your workstation and greenhouse are on the same network and enter your greenhouse IP into the address textbox. The VNC authorization screen appears. Authenticate again using he gh credentials. The remote desktop is now available via Wi-Fi connection.



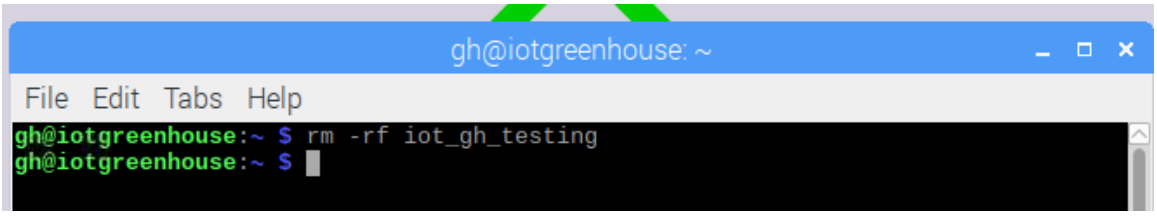
Step 4: Running Test Code

27. Select the icon on the taskbar to open a Terminal window.



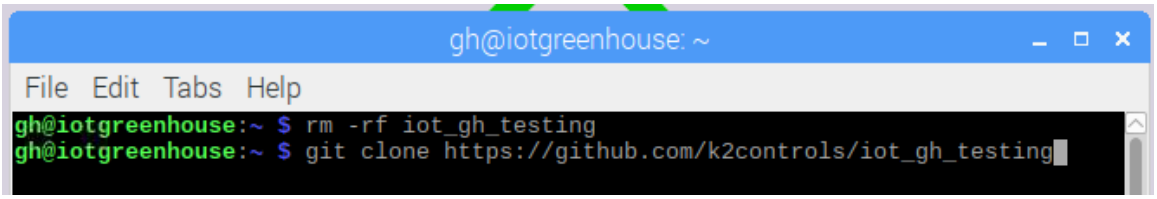
28. Enter the following command at the terminal prompt to remove any prior work associated with this introductory activity.

```
rm -rf iot_gh_testing
```

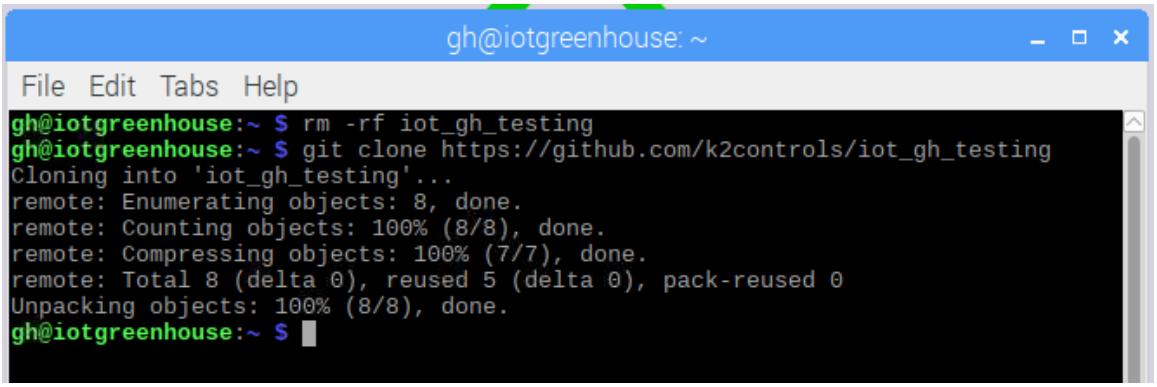


29. Enter the following command at the terminal prompt to create a local version of the test code.

```
git clone https://github.com/k2controls/iot_gh_testing
```

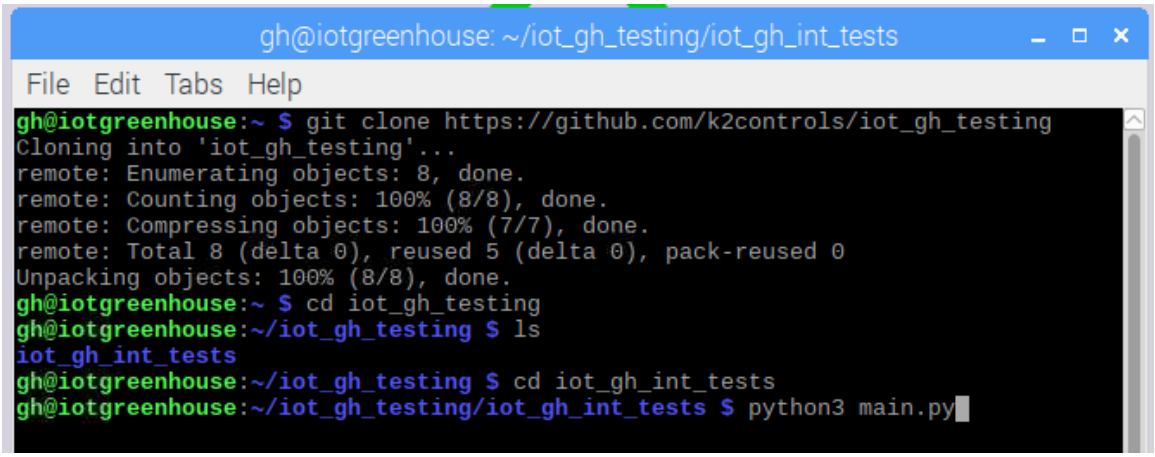


30. The required **iot_gh_testing** folder and files are created.

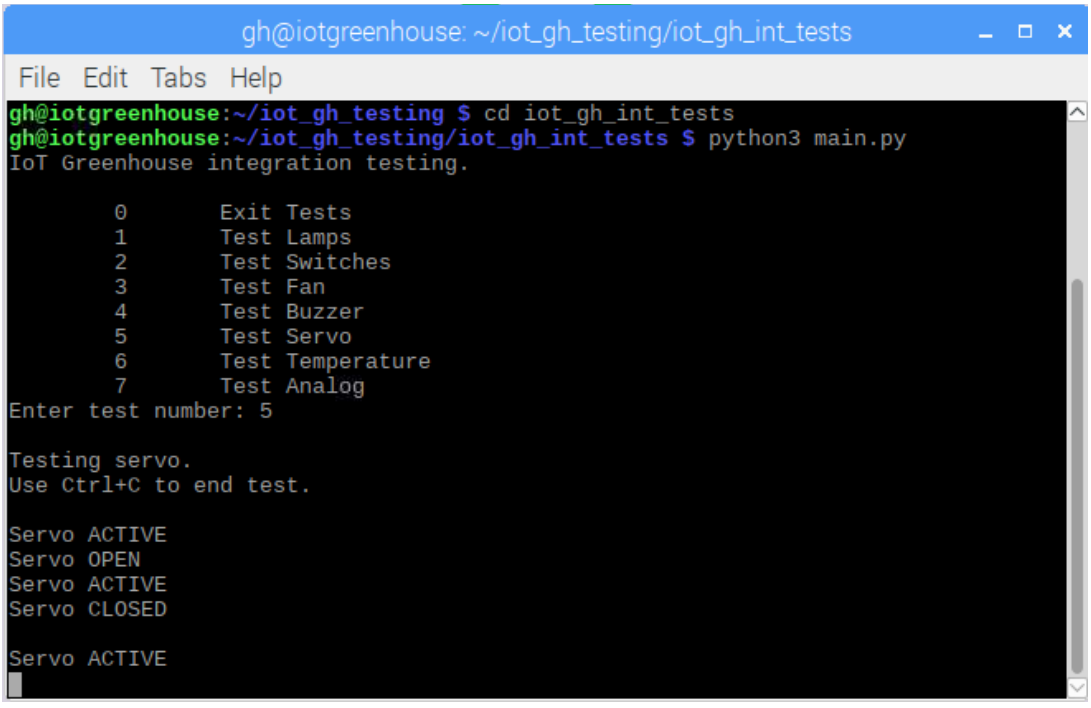


31. Use the *Change Directory* (cd) command to move to the test folder and then execute the Python test file. The commands are listed below, and results shown in the following screen capture. The ls command is used to list the contents of the directory.

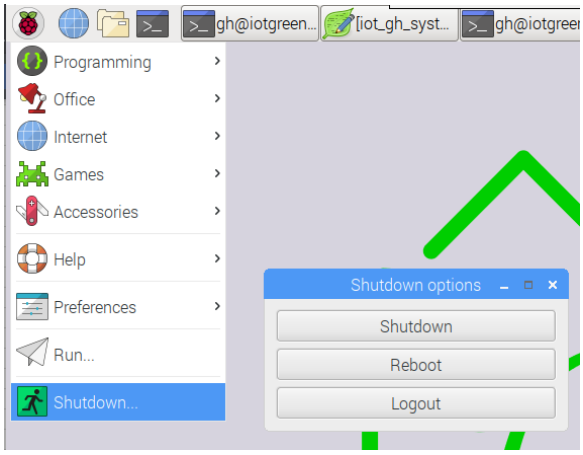
```
cd iot_gh_testing
ls
cd iot_gh_int_tests
python3 main.py
```



32. The Python testing application runs, displaying a menu of testing options. Enter a number from the menu and press Enter. Use Ctrl-C to end the test. Entering an option of zero (0) ends the test.



33. Close the terminal window when testing is complete.
34. Use the Shutdown option on the Raspberry Pi menu to Shutdown the system.



35. Wait for the green activity LED on the Raspberry Pi to be off before removing power from the Raspberry Pi.
36. The Setup and Testing procedure is completed.