

LEVEL B: SCOPE AND SEQUENCE

LESSON 1

Administrative and File Management

- Understanding the Raspbian File System
- Completing File Tasks in the Graphical User Interface (GUI)
 - Creating a Folder
 - Creating a File
 - Renaming a File or Folder
 - Changing Permissions on a File or Folder
 - Root User
 - Deleting Files or Folders
 - Navigating Folders Using File Manager
- Completing File Tasks Using the Command Line
 - Working Directory
 - Listing Directory Contents
 - Creating a File
 - Creating a Directory
 - Moving to Another Directory
 - Copying a File or Folder
 - Moving or Renaming a File or Folder
 - Deleting a File or Folder
- Other Useful Command Line Tools
 - Confirming Raspbian Version
 - Taking a Screen Capture
- Activities:
 - Activity #1: GUI File and Folder Operations
 - Activity #2: Command Line File and Folder Operations

LESSON 2

Functions

- Understanding Functions
 - Keeping Code Organized
 - Grouping Related Program Blocks
 - Global and Local Variables
 - Functions with Arguments
 - Using Functions in Programs
- Activities
 - Activity #1: Simple Function Program
 - Activity #2: Calling a Function with a Loop
 - Activity #3: Functions with Passed Arguments

LESSON 3

Program Layout Options and Advanced String Concepts

- Program Layout Options
 - While True Loops
 - Try, Except, Finally Program Layout
- Advanced String Concepts
 - Determining the Length of a String
 - Accessing the Value of a Specific String Position
 - Accessing Values from Multiple String Positions
 - Uppercase and Lowercase
 - Replacing Characters in a String
- Activities
 - Activity #1: While True Loop
 - Activity #2: Error Handling Program
 - Activity #3: Practice with Strings

LESSON 4

Pulse Width Modulation

- Import Methods
 - Standard Module Import
 - Importing a Module Using an Alias
 - Importing Multiple Modules
 - Importing Specific Functions from a Module
- Analog Signals vs Digital Signals
- Pulse Width Modulation (PWM)
 - PWM Duty Cycle and Frequency
 - Hardware PWM vs Software PWM
 - GPIO Commands to Control PWM
- Activities:
 - Activity #1: Building an LED and Piezo Circuit
 - Activity #2: Controlling an LED with PWM
 - Activity #3: Adjusting LED Brightness

LESSON 5

Switches and Correcting for Switch Bounce

- Pull-up and Pull-down Options
- Slide or Toggle Switch
- Switch Bounce
- Using a Delay to Save System Resources
- Activities:
 - Activity #1: Adding Switches to the Circuit
 - Activity #2: Counting Button Presses
 - Activity #3: Tuning a Loop Using a Delay
 - Activity #4: Adding LED Confirmation Using the Slide Switch

LESSON 6

Logical Operators

- Logical Operators in Python
- Using a Pushbutton Switch as a Toggle
- Using a Pushbutton Switch to End a Program
- Activities:
 - Activity #1: Using a Pushbutton Switch as a Toggle
 - Activity #2: Use And/Or to Control Different Events
 - Activity #3: Add Stop Button Functionality

LESSON 7

Working with a 3x4 Matrix Keypad

- Matrix Style Input Panel
 - Program Flow for Checking a Matrix
 - Storing Values as Strings Versus Integers
 - Membrane Type Switches
 - Matrix Keypad Warning
- Variables and Scope
- Activities:
 - Activity #1: Adding the Switch Matrix
 - Activity #2: Creating a Program to Display Keypad Presses
 - Activity #3: Adding Exit Functionality to the Keypad Program

LESSON 8

Github and Python 2 vs Python 3

- Library Files
 - What is Github?
 - Cloning a Library from Github
 - When to Clone a Remote Library
 - Completing the Library Installation
 - Viewing Code Inside Files on Github
- Python 2 vs Python 3
 - Thonny and Python
- Activities:
 - Activity #1: Cloning and Installing a Github Repository
 - Activity #2: Exploring the Adafruit MCP3008 Repository
 - Activity #3: Viewing Code on Github

LESSON 9

Analog Signal Processing with the Raspberry Pi

- Voltage Dividers
- Analog Input on the Raspberry Pi
- Integrated Circuits (IC)
 - IC Datasheets
 - IC Pin Numbering
 - IC Pinouts
 - ESD and IC Handling Precautions
- Digital Communication
 - The MCP3008 A/D Converter
- Activities:
 - Activity #1: Connecting the MCP3008
 - Activity #2: Reading a Value from the MCP3008
 - Activity #3: Adding a Voltage Divider
 - Activity #5: Updating the Raspberry Pi's Software

LESSON 10

Potentiometers, Phototransistors, and Advanced List Commands

- Variable Resistors
- Light Sensors
- Advanced List Commands
 - Creating a List Using the Split Command
 - Adding Items to a List
 - Finding Items in a List
 - Determining if an Item is Part of a List
 - Finding the Length of a List
 - Sorting a List
 - Printing all Items in a List Along with Their Index Values
 - Removing Items from a List
 - Clearing All Items from a List
- Activities
 - Activity #1: Adding the Potentiometer and Phototransistor
 - Activity #2: Incorporating the LED as an Indicator
 - Activity #3: Working with Lists

LESSON 11

RFID Systems

- RFID Technology
 - How RFID Works
 - RFID for Access Control
 - Security Concerns for RFID
 - MFRC522 Tag Reader
 - RFID Tags
 - Reading Text from the RFID Tag
- Removing Trailing Spaces in Python
- Determining Program Type: Python Code SHEBANG or #!
- Reading and Writing Tags
- Activities:
 - Activity #1: Adding the RFID Reader and Software
 - Activity #2: Reading and Writing Tags
 - Activity #3: Creating an Access Control Program

LESSON 12

RFID II

- Using a File for Input
 - Input File Types and Formatting
 - Opening a File in Your Program
 - Reading Values from a File
- Multithreaded Operation
 - Important Notes About Multithreaded Operation
- Formatting and Displaying Time and Date
- Breaking Out of a Loop
- Activities:
 - Activity #1: Read an External File in Python
 - Activity #2: Tag Reader Indicator
 - Activity #3: Adding Date and Time Messages

LESSON 13

Level Shifting and Infrared Sensors

- Signal Level Shifting
 - Hardware Level Shifting
- Infrared (IR) Obstacle Sensor
 - Alignment of Obstacle Sensors
- Infrared Line Sensor
 - Alignment of Line Sensors
- Activities
 - Activity #1: Level Shifter and the RGB LED
 - Activity #2: Adding the IR Obstacle Sensor
 - Activity #3: Adding the IR Line Sensor

LESSON 14

Ultrasonic Range Sensing and NUMPY

- Ultrasonic Rangefinders
 - Ultrasonic Signals
 - Finding Range with an Ultrasonic Sensor
 - Using Distance Information in Programs
 - Error Handling
- NumPy
- Integers and Floats
- Printing with Notation
- Activities:
 - Activity #1: Adding the Ultrasonic Range Sensor
 - Activity #2: Creating a Program to Read Ranges
 - Activity #3: Averaging the Range Values Using NumPy
 - Activity #4: Adding the RGB LED as a Distance Indicator

I2C and Temperature Sensing

- I2C Communication
 - I2C Addressing
 - Enabling I2C on the Raspberry Pi
 - List of I2C Devices
 - Detecting Attached I2C Devices
- The BMP280 Temperature Sensor
 - BMP280 Wiring
 - BMP280 Commands
 - Temperature Conversion
- The WGET Command
- Running Modules as Imports vs Directly
- The SYSTEMEXIT() Command
- Activities:
 - Activity #1: Enabling the I2C Interface
 - Activity #2: Adding the BMP280 Temperature Sensor
 - Activity #3: Creating a Program to Display Temperature
 - Activity #4: Adding the RGB LED to Indicate Temperature

LESSON 16

OLED I2C Display

- OLED Display Hardware
 - Resolution and Pixels
 - OLED Technology
 - I2C Communication
- SSD1306 Display Driver
 - Required Modules
 - Size Configuration
 - Starting the Display
 - Variables that Simplify Communication with the Display
 - Drawing on the Display
- Unicode Characters
- Activities
 - Activity #1: Modify the Circuit
 - Activity #2: Create a Program to Display Text
 - Activity #3: Modify the Program to Display Sensor Information

LESSON 17

Capacitive Touch Sensor

- Capacitors
 - Construction
 - Current Limiting
 - Charge Time
 - Calculating Charge Time
 - Parallel vs. Series
- Capacitive Touch Sensor
- Male-to-Female Jumper Wires
- GPIO Pin Level Sensing
- Activities:
 - Activity #1: Powering a Circuit Using a Capacitor
 - Activity #2: Measuring Capacitor Discharge Time
 - Activity #3: Using the Capacitive Touch Sensor

LESSON 18

Range Sensing Game (final project)

- Level Shifting with Resistors
- Absolute Value in Python
- Modifying a File for Import Use
- Activities:
 - Activity #1: Modifying Ultrasonic.py
 - Activity #2: Adding the Ultrasonic Range Sensor
 - Activity #3: Building the Range Game