

INTRO TO ROBOTICS LEVEL C: SCOPE AND SEQUENCE

LESSON 1

Networking and Remote Access

- Computer Networking
 - LAN vs. WAN
 - IP Addresses
 - Determining the Current IP Address of Your Raspberry Pi
- Changing Your Password
- Remote Access Methods
 - VNC Access
 - SSH Access
- Activities:
 - Activity #1: Change Password and Determine IP Address
 - Activity #2: Remote Access Using Secure Shell (SSH)
 - Activity #3: VNC Viewer Installation and Connection

LESSON 2

Infrared Remote Control

- Infrared Communication
 - IR Remote Control Data
 - IR Remote Codes
- The Socket Module
- Bytes and Strings
- Bash Scripts
- Curl Command
- Activities:
 - Activity #1: Building the RGB LED and Receiver Circuit
 - Activity #2: Installing the LIRC Package Software
 - Activity #3: Creating a Program to Control the RGB LED with the IR Remote

LESSON 3

Creating GUI Programs with Tkinter

- Python Program Elements
 - Classes and Methods
 - Method Calls for Imported Modules
 - Simplifying Method Calls
- The Tkinter Module
 - The TK Class
 - The Canvas Class
 - The Event Class
- Activities:
 - Activity #1: Displaying Mouse Position
 - Activity #2: Displaying Keyboard Input
 - Activity #3: Controlling LED with Keyboard Presses

LESSON 4

Transistors

- Transistors
 - NPN Transistors
 - PNP Transistors
 - Identifying Transistors
 - Component Reference Designators
 - Transistor Specifications
 - Pulse Width Modulation with Transistors
- Dual-Color LED
- Resistance Values in Series and Parallel
- Activities:
 - Activity #1: Driving an LED with a Transistor
 - Activity #2: Adding a Second Transistor and LED
 - Activity #3: Driving the Dual-Color LED

LESSON 5

Command Line Programs

- Bash Programming
 - Bash Scripts
 - Creating a Bash Script
 - Running a Bash Script
- Controlling GPIO Pins with WIRINGPI
 - Reading the Status of All Pins
 - Changing the Mode of a Pin
 - Changing the State of an Output Pin
 - Modifying the Duty Cycle of a PWM Pin
 - History of Commands Typed into the CLI
- Making Programs Run at Startup
 - Modifying the /ETC/RC.LOCAL File
 - Stopping a Program that was Launched at Startup
- Activities:
 - Activity #1: Creating a Bash Script
 - Activity #2: Controlling a GPIO Pin Using WIRINGPI
 - Activity #3: Adding a Program on Startup

LESSON 6

Working with Audio

- Amplifiers
 - Amplifier Gain
 - Distortion
- The PAM8302 Amplifier
- Audio Output Hardware
 - Raspberry Pi Audio Output Quality
 - USB Audio Output Devices
 - Audio on GPIO Pins
- Audio Input Hardware
 - USB Audio Input Devices
- Software Audio Functions
 - The ARECORD Command
 - The APLAY Command
- The OS Module

- Activities:
 - Activity #1: Adding the Amplifier and Speaker
 - Activity #2: Recording Audio Files
 - Activity #3: Playing Your Voice File with the IR Remote

LESSON 7

Servo Motors

- Servo Motors
 - Types of Servos
 - Servo Options
 - Keeping Servos Safe
- Driving a Servo
 - Servo Drive Commands
 - Servo Drive Latency
 - Using Servos in Projects
- Activities:
 - Activity #1: Adding the Servo and Testing
 - Activity #2: Controlling the Servo with Keyboard Input
 - Activity #3: Controlling the Servo with Your IR Remote

LESSON 8

Working with Data

- Technical Terms
 - Dataset
 - Mutable vs. Immutable
 - Ordered vs. Unordered
 - Iterating
- Dataset Characteristics
 - Lists
 - Tuples
 - Sets
 - Dictionaries
- Mixed Datasets
 - Identifying Components of a Dataset

- Activities:
 - Activity #1: Creating a Dataset
 - Activity #2: Printing the Number of Students and Teachers
 - Activity #3: Adding a Student to the Dataset

LESSON 9

Working with Accelerometers and Gyros

- Accelerometers
 - Other Forces
 - Multiple Axes
- Gyros
 - Using Gyro Information
- The MPU6050 Sensor
 - Software Commands
- Activities:
 - Activity #1: Adding the MPU6050 Sensor and Driver
 - Activity #2: Controlling the RGB LED
 - Activity #3: Controlling the Servo

LESSON 10

Using Tkinter for Displaying Data

- Tkinter Window Construction
 - The Grid Method
 - Changing the Window Title
- New Widget Types
 - The Label Widget
 - The Button Widget
 - The Entry Widget
- Creating Tkinter Loops
- Activities:
 - Activity #1: Timer Display
 - Activity #2: Displaying Accelerometer Data
 - Activity #3: Displaying All MPU6050 Axis Data

LESSON 11

Building a Web Server Using Bottle

- Web Page Control
 - Components Required for Web Page Control
 - IP Addresses and Ports
- HTML Code
 - HTML Tag Types
- The Bottle Web Server
- The PIP Installer
- Activities:
 - Activity #1: Preparing the Circuit and Installing Bottle
 - Activity #2: Modifying the Program to Control the RGB LED
 - Activity #3: Adding the Green and Blue Elements

LESSON 12

Interfacing with a Camera

- Raspberry Pi Camera
 - Camera Specifications
 - ESD Precautions
- Camera Connections
 - Accessing the Camera Connector on Your Raspberry Pi
- Enabling the Camera
- Camera Commands
 - The Flip Options
 - The Timeout Option
 - The Encoding Option
 - Using Multiple Options
 - Camera Commands in Python
 - Camera Errors
- Activities:
 - Activity #1: Connecting the Camera
 - Activity #2: Taking a Photo from the Command Line
 - Activity #3: Building an Image Capture and Display Program

LESSON 13

Building a Web Camera Server with Apache

- Types of Web Content
 - PHP Scripts
 - Javascript Code
 - CGI Scripts
- The Apache Web Server
 - Advantages of Apache
 - Apache File Locations
 - Apache URL Behavior
- RPi Cam Web Software
 - Rpi Cam Video Modes
- Activities:
 - Activity #1: Installing the RPi Cam Software Package
 - Activity #2: Viewing the Camera Over the Network
 - Activity #3: Changing the Autostart Setting

LESSON 14

Using Relays

- Relays
 - Mechanical Construction
 - Input Coil Current
 - Relay Types
 - The Relay Carrier Board
 - Driving the Relay
- Activities:
 - Activity #1: Building the Circuit
 - Activity #2: Adding the LED Load Circuit
 - Activity #3: Controlling the Relay and LED with the IR Remote Control

LESSON 15

Working with Data from the Internet

- Methods for Gathering Data from Websites
 - Parsing Data
 - API Data Access
 - Database-Style Web Page Content
 - The URLLIB.REQUEST Python Module
 - The REQUESTS Python Module
 - Viewing Feed Data
- Cheerlights
 - Update Frequency
- Activities:
 - Activity #1: Adding the OLED Screen
 - Activity #2: Changing the RGB Color Using an Internet Feed
 - Activity #3: Display Cheerlights Color on OLED Display

LESSON 16

Web Page Control

- Using Images with HTML
- The Apache Web Server
 - Apache File Locations
 - Web Server Permissions
 - Listing Permissions
 - The Apache CGI Processing Module
- Creating and Running CGI Scripts
 - Creating a Web Page to Run CGI Scripts
- Activities:
 - Activity #1: Web Pages with Links
 - Activity #2: Adding an Image
 - Activity #3: Adding CGI Scripts to Control an RGB LED

LESSON 17

IOT with the Raspberry Pi

- IOT (The Internet of Things)
 - Home-Built vs. Commercial Solutions
 - The Cayenne Software Package
- Activities:
 - Activity #1: Adding a Switch and Installing Cayenne
 - Activity #2: Controlling an LED and Monitoring a Switch
 - Activity #3: Monitor an Input Using Cayenne

LESSON 18

Final Project: Alarm

- Project Overview
 - User Interface
 - Program Operations
 - Required Files and Modules
- Activities:
 - Activity #1: Circuit Modifications
 - Activity #2: File and Folder Preparation
 - Activity #3: Creating the Alarm Program