EV3 Python on Udemy

There are about 20 videos with a total video duration of about 5 hours. The essentials of EV3 Python programming are explained in parts 1 and 2 (two hours) and parts 3 and 4 mainly give practice and examples. As such, parts 3 and 4 are optional, but strongly recommended.

Table of Contents (overview)

Why take this course? (11 minutes)

Introduction (3 minutes)

Part 1: Setting up

- **1A (9 minutes) Set up the EV3**
- **1B (5 minutes) Connect the EV3 to the computer**
- **1C (24 minutes) Install VS Code and the two needed extensions, configure, and connect to EV3**

Part 2: The Components

- **2A (24 minutes) Motors**
- **2B (30 minutes) The Intelligent Brick (display, buttons, LEDs and loudspeaker)**
- **2C (19 minutes) Sensors**

Part 3: Putting the pieces together

- **3A (3 minutes) Collide, back up, turn and continue**
- **3B (2 minutes) Line follower**
- **3C (7 minutes) Wall follower**
- **3D (9 minutes) Steer with light**
- **3E (2 minutes) Follow an object**
- **3F (3 minutes) Follow a beacon (only for home model)**
- **3G (5 minutes) Program with colors**
- **3H (9 minutes) Self-parking**
- **3I (3 minutes) Beware of steep slopes (only for education model)**

Part 4: Make a drawbot and a writerbot

- **4A Drawbot part 1 (38 minutes, with the option of skipping the final 15 minutes which is a mathematical derivation)**
- **4B Drawbot part 2 (22 minutes)**
- **4C Writerbot part 1 (33 minutes) Write a script that can write characters that do not contain arcs.**
- **4D Writerbot part 2 (22 minutes) Modify the script so that it can also write characters that contain arcs**

Table of Contents (detailed)

Why take this course? (11 minutes)

- 01:49 Why Python?
- 02:07 Robots and automation
- 02:31 Money talk
- 03:33 The Lego EV3 robot
- 04:30 Two types of EV3 kit: home and education
- 04:47 More on Python
- 05:41 Microsoft Visual Studio Code (the code editor needed for this course)
- 06:04 The EV3 extension for VS Code
- 06:12 The VS Code EV3 programming workflow
- 07:25 Overview of the videos
- 08:01 Videos of some sample scripts being run
- 09:34 The contents of this course
- 10:30 What this course will NOT teach you

Introduction (3 minutes)

- 00:00 This is a recap of the 'Why take this course?' trailer

Part 1: Setting up

- **1A (9 minutes) Set up the EV3**
  - 01:01 Build the Education Vehicle robot
  - 02:43 Obtain a suitable SD card
  - 02:57 Download the latest Linux Debian Stretch EV3dev image
  - 03:03 Download and install Etcher
  - 03:15 Flash the image to the card
  - 03:19 Insert the card into the SD slot on the EV3, boot the EV3 and explore the Brickman interface
- **1B (5 minutes) Connect the EV3 to the computer**
  - 00:28 USB connection
  - 01:45 Bluetooth connection
  - 02:27 WiFi connection
  - 03:50 Ethernet connection
- **1C (24 minutes) Install VS Code and the two needed extensions, configure, and connect to EV3**
  - 00:56 Download and install Microsoft Visual Studio Code (VS Code)
  - 01:59 Start VS Code and install two extensions
  - 03:22 Configure VS Code
  - 03:35 Three levels of settings
  - 04:53 Modify User settings
  - 09:25 Write and run some non-EV3 Python scripts

- 14:17 Open and run an EV3 Python script
- 15:48 Connect VS Code to your EV3
- 19:00 Run the starter script

Part 2: The Components

- **2A (24 minutes) Motors**
  - 00:46 Turn through a specific angle
  - 08:31 Turn on for a specific time at a specific speed
  - 09:04 Turn on at a specific speed 'forever'
  - 10:45 The medium motor
  - 12:13 Motor pair classes
  - 14:00 MoveTank
  - 14:24 MoveTank for a given angle
  - 16:23 MoveTank for a given time
  - 16:38 MoveTank 'forever'
  - 16:53 Stop the motors
  - 17:08 A sample script using MoveTank
  - 18:12 MoveSteering
  - 21:22 MoveSteering for a given angle
  - 22:48 MoveSteering for a given time
  - 23:03 MoveSteering 'forever'
  - 23:30 A sample script using MoveSteering
- **2B (30 minutes) The Intelligent Brick (display, buttons, LEDs and loudspeaker)**
  - 00:18 LEDs
  - 01:54 Display
    - 02:26 Print()
    - 10:17 Display text with text_pixels() or text_grid()
    - 16:05 Center the text
    - 18:44 Graphics
    - 20:36 Display an image file
  - 22:12 Sound
    - 24:56 Play a WAV sound file
    - 26:40 Text to speech
    - 27:31 Other sound functions
  - 27:48 Buttons
- **2C (19 minutes) Sensors**
  - 03:16 Touch sensor
  - 04:17 Color sensor
  - 06:39 Gyro sensor (education kit only)
  - 09:07 Ultrasonic sensor (education kit only)
  - 11:53 Infrared sensor, including remote control functions (home kit only)
  - 14:34 Beacon and remote control functions (home kit only)

Part 3: Putting the pieces together

In these exercises we use two or more components to make slightly more complex scripts.

- **3A (3 minutes) Collide, back up, turn and continue**
  - 01:41 The script
  - 02:06 Demonstrations
- **3B (2 minutes) Line follower**
  - 01:26 The script
  - 01:42 Demonstrations
- **3C (7 minutes) Wall follower**
  - 00:46 The script
  - 01:15 Demonstrations
  - 02:12 Proportional wall follower
  - 03:07 The script
  - 03:30 Demonstrations
  - 05:18 PID wall following (not fully explained)
  - 06:36 Maze solver (not fully explained)
- **3D (9 minutes) Steer with light**
  - 01:25 The script
  - 01:38 Demonstrations
  - 02:49 Steer with calibrated light
  - 06:49 The script
  - 07:02 Demonstrations
  - 08:16 The improved script
- **3E (2 minutes) Follow an object**
  - 00:58 The script
  - 01:52 Demonstrations
- **3F (3 minutes) Follow a beacon (only for home model)**
  - 02:07 The script
  - 02:56 Demonstrations
- **3G (5 minutes) Program with colors**
  - 02:46 The script
  - 04:00 Demonstrations
- **3H (9 minutes) Self-parking**
  - 02:23 The script
  - 02:39 Demonstrations
- **3I (3 minutes) Beware of steep slopes (only for education model)**
  - 02:16 The script
  - 02:45 Demonstrations

Part 4: Make a drawbot and a writerbot

- **4A Drawbot part 1 (38 minutes, with the option of skipping the final 15 minutes which is a mathematical derivation)**
    - 00:22 Design considerations
    - 05:27 Home version
    - 05:55 Education version
    - 07:15 Choosing, holding, raising and lowering the marker pen
    - 13:40 Make the robot go straight
    - 16:37 Make the robot turn on the spot
    - 19:39 Make the robot trace an arc
    - 20:18 Long mathematical derivation. I recommend that you do NOT follow this in the video but instead work through it in the PDF document or simply skip it altogether and go directly to the next video.
- **4B Drawbot part 2 (22 minutes)**
    - 00:58 Logo-like commands
    - 01:57 Let's draw a triangle and circle
    - 04:38 Script to adjust the pen height
    - 05:15 The main drawbot script
    - 09:17 Demonstration videos for drawing a triangle and a circle
    - 15:12 Draw a pentagram
    - 18:42 Challenges (spiral, 'squiral', vortex, smiley)
    - 20:43 Drawing the letter 'A'
- **4C Writerbot part 1 (33 minutes) Write a script that can write characters that do not contain arcs.**
    - 04:48 Make a script that can write characters made up only of straight lines
    - 20:25 A working script
    - 24:00 Demonstration video
    - 24:49 Improving the script
    - 30:02 The improved script
    - 30:41 Demonstration video
- **4D Writerbot part 2 (22 minutes) Modify the script so that it can also write characters that contain arcs**
    - 08:42 Coding time!
    - 13:54 Demonstration videos
    - 16:05 Conclusion

Build Instructions

Instructions for building the education vehicle with the education kit can be found here:

- education.lego.com/en-us/support/mindstorms-ev3/building-instructions#robot
- robotsquare.com/2013/10/01/education-ev3-45544-instruction/

This course includes building instructions for

- A version of the education vehicle that can be built with the home kit
- A bumper (both home and education versions)
- A drawbot/writerbot (both home and education versions)

Contents of ZIP file

Unzip the ZIP file. This will give you several folders each of which is to be opened in VS Code when instructed. There are about 50 python script files, mostly quite short and simple. Note that the ZIP file does *not* include a folder 'nonev3 python scripts' since *you* will make this folder and its two scripts (helloworld.py and polygon.py) when you work through video 1C. You can copy and paste these two scripts from the PDF document. The ZIP file also contains a file called **settings.txt** from which, in accordance with the instructions in video 1C 'Set up VS Code', you will copy and paste code into the **settings.json** file that contains the user settings for VS Code. The ZIP file does *not* contain the sound and image files needed for this course but links are provided in the PDF document so that you can download these files.

- A file **settings.txt** from which you will copy code to paste into the settings.json file
- An **ev3 python scripts** folder contains scripts that mostly demonstrate a single type of EV3 hardware
- A folder called **part3** contains scripts that demonstrate how different types of EV3 hardware can work together
- A folder called **part4** contains scripts for the drawbot/writerbot

Listing of supplied scripts:

- **ev3 python scripts**
  - large_motor.py
  - medium_motor.py
  - movetank.py
  - movesteering.py
  - leds.py
  - print_integers.py
  - print_integers2.py
  - print_integers3.py
  - hello_world_large.py
  - print_fonts.py
  - center_text.py
  - smiley.py
  - play_wav_file.py
  - sound.py
  - buttons.py
  - touch_sensor.py
  - light_to_tones.py
  - gyro_angle_and_rate.py

- gyro.py
- us_sensor.py
- us_sensor_directivity.py
- ir_sensor.py
- remote_control.py
- touch_sensor.py

- **part3**
  - collide_reverse_turn.py
  - line_follower.py
  - wall_follower_us.py
  - wall_follower_ir.py
  - wall_follower_prop_us.py
  - wall_follower_prop_ir.py
  - steer_with_light.py
  - steer_with_cal_light1.py
  - steer_with_cal_light2.py
  - object_follower_us.py
  - object_follower_ir.py
  - beacon_follower.py
  - program_with_colors.py
  - self_park1.py
  - self_park_ir.py
  - beware_steep_slopes.py
- **part4**
  - adjust_cam.py
  - challenges.py
  - drawbot.py
  - writer1.py
  - writer2.py
  - writer3.py