

IC23I Spring 2022 – Lab I – Introduction to Physical Computing with the Raspberry Pi

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In this lab you will start working with the Raspberry Pi, and learn the rudiments of using the GPIO pins for controlling external hardware.

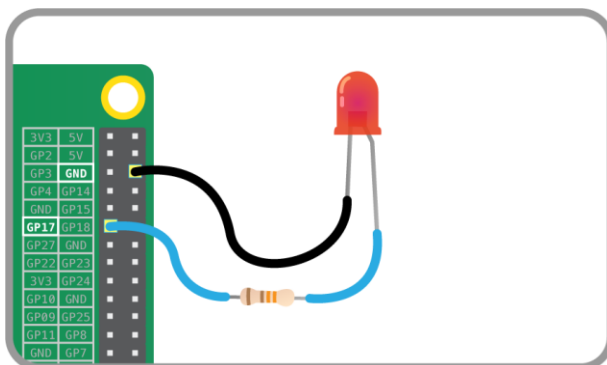
Learning outcomes

In this lab, you will learn

- to work on the Raspberry Pi OS and Python integrated development environments (IDEs) installed on it.
- to work with the GPIO pins, and control it using simple Python code
- to control simple external devices connected to the GPIO pins
- to control an oscilloscope connected to the Raspberry Pi and use it for data collection

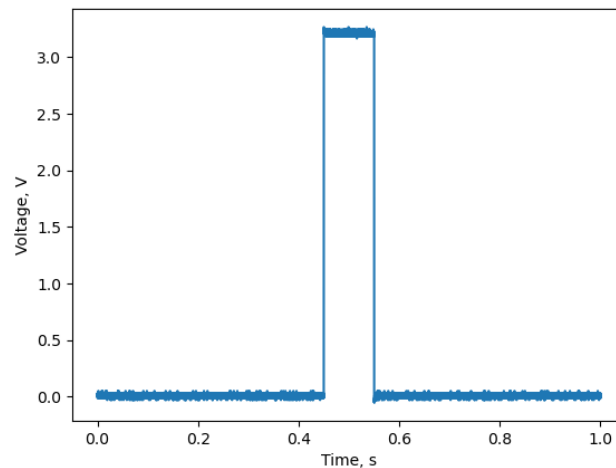
Circuit connection instructions

Connect the positive leg of an LED through a current limiting resistor (470 Ω) to one of the GPIO pins, and the negative leg to a ground GPIO pin.

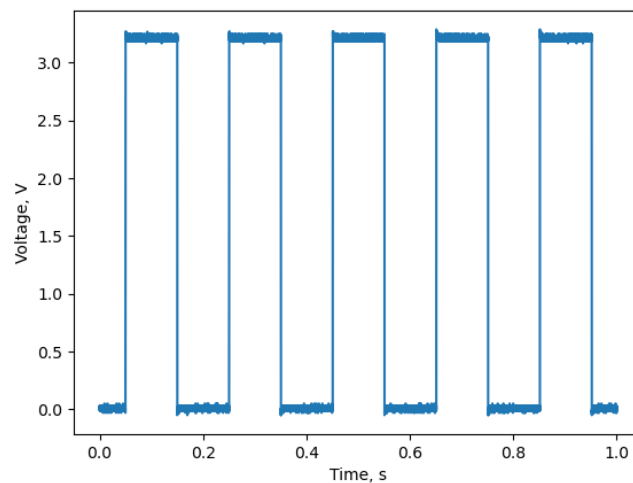


Tasks

- **Task 1** – Switch on and off an LED
- **Task 2** – Pulse an LED for **five** times, such that is on for 0.1 second and off for 0.1 second.
- **Task 3** – Switch an LED on **once** for 0.1 second and switch it off. Record the voltage across of the positive leg of the LED w.r.t ground using the oscilloscope and plot the data directly from the oscilloscope as shown.



- **Task 4** – Switch an LED on and off for 5 times, such that it is on for 0.1 second and off for 0.1 second each time. Record the voltage across of the positive leg of the LED w.r.t ground using the oscilloscope and plot the data directly from the oscilloscope as shown.



- **Task 5** – Repeat the Task 4 for an on/off period of 0.01 second, 0.001 second, and 0.0001 second. Explain your findings.

General Instructions

1. Wait for your TA to signal that the circuit connection is complete.
2. Log on to the Raspberry Pi using VNC Viewer on your computer.
3. Write the program onto the Thonny IDE on the Raspberry Pi.
4. If you run into any issues, ask your TA/Instructor.

Task completion criteria

1. You are able to switch the LED on and off using the Raspberry Pi.
2. You are able to pulse the LEDs as indicated in the Tasks 2-5.
3. You plot the graphs as indicated in Task 3 and Task 4.
4. You provide an explanation as indicated in Task 5.
5. Answering the MCQs

Challenge exercise

You can adjust the brightness of the LED by changing the duty cycle of the pulse signal you send to the LED via the GPIO. Write a routine that would periodically brighten and dim the LED. Record the signal you generate for achieving this using the oscilloscope.