POST-LAB IOT Projects using Python (CSE 4110) ASSIGNMENT

Date:

Experiment – 4

Aim of the Experiment:

Physical Computation of different switch interfacing with Raspberry Pi and LEDs.

Objective:

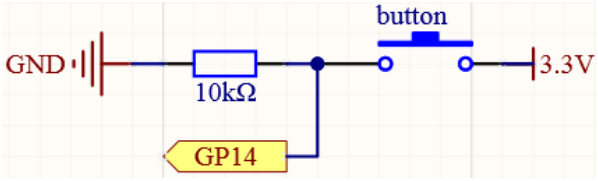
1) Introduction to different types of switches and explore the **concept of Pull-up and Pull-Down mode** of a switch.
2) Familiarization with push button and **reading a button** (in both Pull-up and Pull-Down mode) using Micro-Python Script.
3) Controlling an LED with button using **external Pull-Down resistors**.
4) Controlling an LED with button using **internal Pull-up and Pull-Down resistors.**
5) Implementation of a push button as **External Reset Button.**
6) Controlling an LED using a **Push Button as Toggle Switch.**
7) Controlling an LED and a buzzer using a **transistor** and a Push Button.

Components/Equipment/items Required:

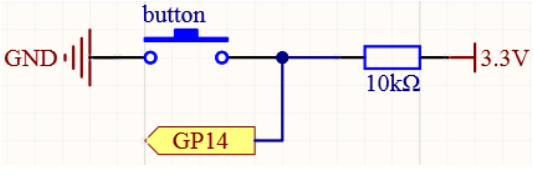
Sl No.	Name of the Component/Equipment	Specification	Quantity
1	Raspberry Pi Pico	RP2040 microcontroller chip, 125MHz	1
2	Raspberry Pi Pico cable	USB Type A to Micro-B	1
3	Resistors (carbon type)	¼ watt (330 Ω)	8
		¼ watt (10 kΩ)	2
4	LED	3mm, Red	8
5	Tactile Push Button Switches	6 x 6 x 6 mm	2
6	Breadboard	840 Tie points	1
7	Jumper Wire	----------	As per requirement

Circuit/Schematic Diagram:

Objective 2



(Figure 1: Circuit diagram for implementation of reading a button in Pull Down Mode)



(Figure 2: Circuit diagram for implementation of reading a button in Pull Up Mode)

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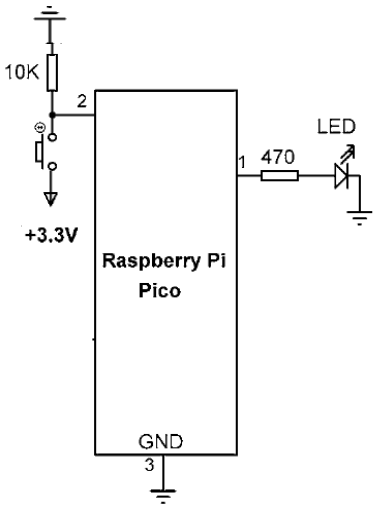
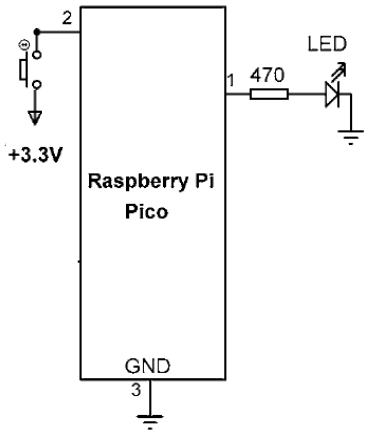
Objective 3

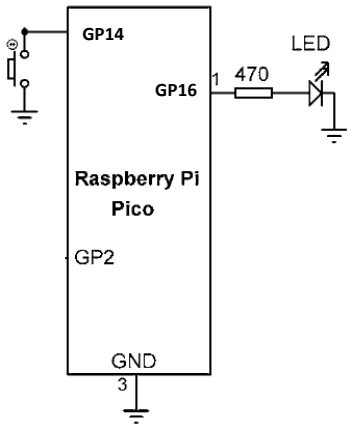


(Figure 3: Circuit diagram for controlling an LED with button using external Pull-Down resistor.)

Objective 4

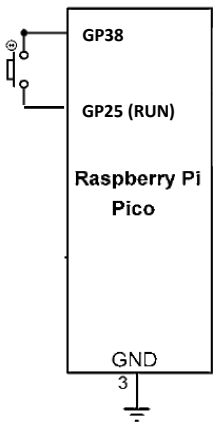


(Figure 4: Circuit diagram for controlling an LED with button using internal Pull-Down resistor.)



(Figure 5: Circuit diagram for controlling an LED with button using internal Pull-up resistor.)

Objective 5



(Figure 6: Circuit diagram for implementation of a push button as External Reset Button.)

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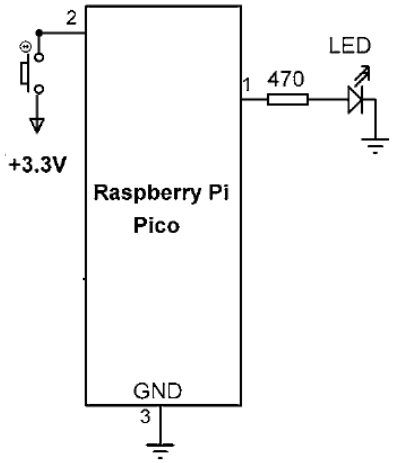
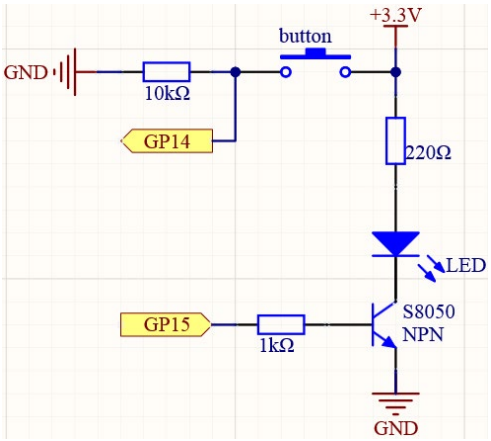
Objective 6



(Figure 7: Circuit diagram for controlling an LED using a Push Button as Toggle Switch.)

Objective 7



(Figure 8: Circuit diagram for controlling an LED and a buzzer using a transistor and a Push Button.)

Observation:

Objective 2

(Figure 9: Simulation based electronic circuit for implementation of reading a button in Pull Down Mode)

(Figure 10: Simulation based electronic circuit for implementation of reading a button in Pull Up Mode)

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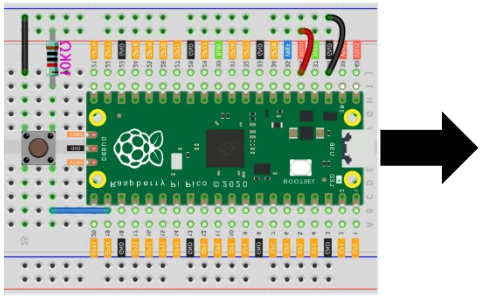

Figure 11: (Breadboard Schematic representation of an electronic circuit for implementation of reading a button in Pull Down Mode)

Figure 12: (Hardware implementation based electronic circuit for implementation of reading a button in Pull Down Mode)

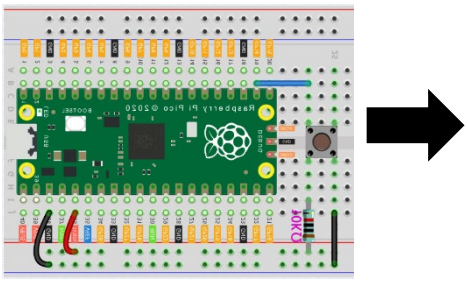

Figure 13: (Breadboard Schematic representation of an electronic circuit for implementation of reading a button in Pull Down Mode)

Figure 14: (Hardware implementation based electronic circuit for implementation of reading a button in Pull Down Mode)

Objective 3

(Figure 15: Simulation based electronic circuit for controlling an LED with button using external Pull-Down resistor.)

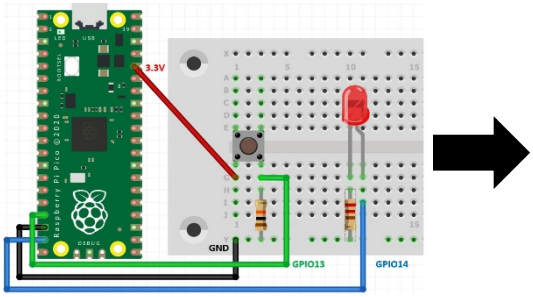

Figure 16: (Breadboard Schematic representation of an electronic circuit for controlling an LED with button using external Pull-Down resistor.)

Figure 17: (Hardware implementation based electronic circuit for controlling an LED with button using external Pull-Down resistor.)

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Objective 4

(Figure 18: Simulation based electronic circuit for controlling an LED with button using internal Pull-Down resistor)

(Figure 19: Simulation based electronic circuit for controlling an LED with button using internal Pull-Up resistor)

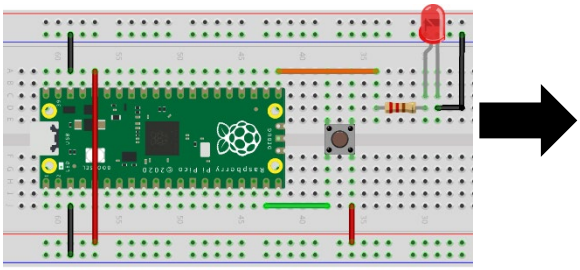

Figure 20: (Breadboard Schematic representation of an electronic circuit for controlling an LED with button using internal Pull-Down resistor.)

Figure 21: (Hardware implementation based electronic circuit for controlling an LED with button using internal Pull-Down resistor)

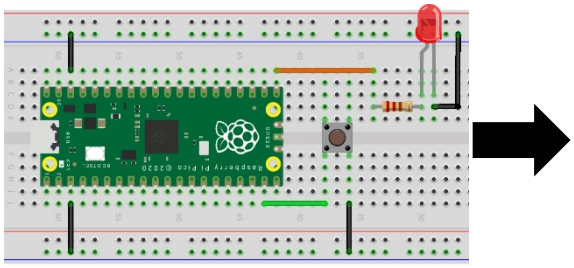

Figure 22: (Breadboard Schematic representation of an electronic circuit for controlling an LED with button using internal Pull-Up resistor.)

Figure 23: (Hardware implementation based electronic circuit for controlling an LED with button using internal Pull-Up resistor)

Objective 5

Figure 24: Simulation based electronic circuit for a push button as External Reset Button

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Experiment – 4

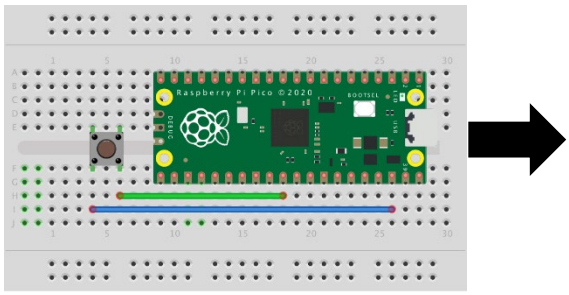

Figure 25: (Breadboard Schematic representation of an electronic circuit for a push button as External Reset Button.)

Figure 26: (Hardware implementation based electronic circuit for a push button as External Reset Button)

Objective 6

(Figure 27: Simulation based electronic circuit for a controlling an LED using a Push Button as Toggle Switch.)

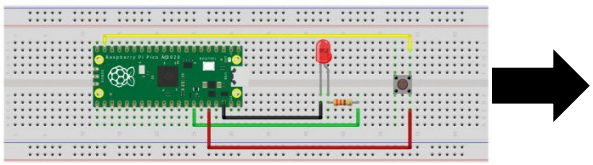

Figure 28: (Breadboard Schematic representation of an electronic circuit for controlling an LED using a Push Button as Toggle Switch.)

Figure 29: (Hardware implementation based electronic circuit for controlling an LED using a Push Button as Toggle Switch.)

Objective 7

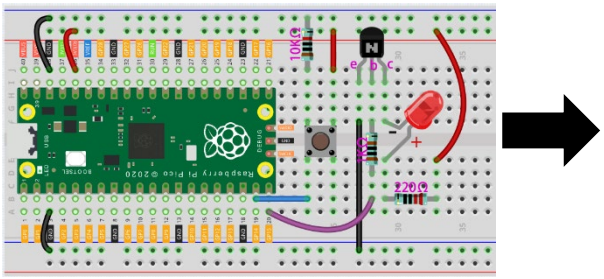

Figure 30: (Breadboard Schematic representation of an electronic circuit for controlling an LED and a buzzer using a transistor and a Push Button)

Figure 31: (Hardware implementation based electronic circuit for controlling an LED and a buzzer using a transistor and a Push Button)

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Experiment – 4

Codes:

Objective 2

```
print("Hello, Pi Pico!")
print("This is Experiment - 4 and Objective - 2")
print("Name:                          ; Registration No.:                ")
print("Objective : 2   Reading a button (in both Pull-up and Pull-Down mode)
using MicroPython Script.")
```

Objective 3

```
print("Hello, Pi Pico!")
print("This is Experiment - 4 and Objective - 3")
print("Name:                          ; Registration No.:                ")
print("Objective : 3   Controlling an LED with button using external Pull-Down
resistors.")
```

Objective 4

```
print("Hello, Pi Pico!")
print("This is Experiment - 4 and Objective - 4")
print("Name:                          ; Registration No.:                ")
print("Objective : 4  Controlling an LED with button using internal Pull-up and
Pull-Down resistors.")
```

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Experiment – 4

Objective 6

```
print("Hello, Pi Pico!")
print("This is Experiment - 4 and Objective - 6")
print("Name:                          ; Registration No.:                ")
print("Objective : 6  Controlling an LED using a Push Button as Toggle Switch.")
```

Objective 7

```
print("Hello, Pi Pico!")
print("This is Experiment - 4 and Objective - 7")
print("Name:                          ; Registration No.:                ")
print("Objective : 7   Controlling an LED and a buzzer using a transistor and
a Push Button.")
```

Conclusion:

Precautions:

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Post Experiment Questionnaire:

1) (a) Write how many input and output terminals an SPST, SPDT, DPST, DPDT switch has?

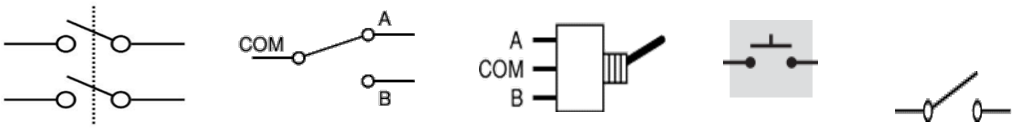
(b) For which condition mechanical switches are more preferable than momentary switch and vice-versa?

(c) For separation of Line and Ground, which mechanical switch is more preferable?

(d) Give a comparison between SPDT and DPDT type of switches.

(e) Identify the switches given below from their symbols/schematics:

(i) (ii) (iii) (iv) (v)



2) Select any one CORRECT answer from the following given choices.

(a) A switch has ……

i) One state

ii) Two states

iii) Three states

iv) None of the above

(b) A relay is …….. Switch.

i) A mechanical

ii) An electronic

iii) An electromechanical

iv) None of the above

(c) The switch that has the fastest speed of operation is …….. switch

i) Electronic

ii) Mechanical

(iii)Electromechanical

(iv)None of the above

(d) The most inexpensive switch is …….. switch

i) Electronic

ii) Mechanical

(iii)Electromechanical

(iv)None of the above

Experiment – 4

(e) A relay is superior to a mechanical switch because it ……

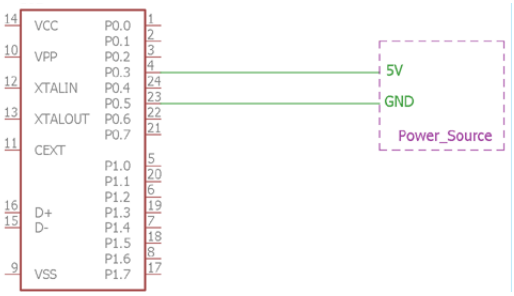
i) Is relatively inexpensive

ii) Does not require moving contacts

(iii) Combines control with power amplification

(iv)None of the above

3) Can we connect the digital logic pins directly to the Logic level voltage or with the ground like the below image? or any modification is required here. Justify your answer.



4) When should and should not we use a pull-down/pull-up resistor for an input pin?

5) Suppose we have a logic circuit where the Supply source is 3.3V(as in Raspberry pi pico) and the acceptable logic high voltage is 3V, and we could sink a current maximum of 30uA, then calculate the suitable value of pull-up resistor?

6) Suppose we have a logic circuit where the Supply source is 3.3V(as in Raspberry pi pico) and the acceptable logic low voltage is 1V, and we could source upto current maximum of 200uA, then calculate the suitable value of pull-down resistor?

7) Is there a way to detect a long press on a button? For example, let's say I have one button and two LEDs, long press turns on the second led but short press turns on the first LED.... If so, how can I do it? Justify your answer through your code.

8) Suppose, I have a button, which for some reason fires multiple times when pressed. How can I make the button execute the code just once each time it is pressed? Modify the code below to solve this problem.

```
from machine import Pin
from utime import sleep

button = Pin(3, Pin.IN, Pin.PULL_DOWN)

def my_handler(button):
  print("hello")
  sleep(1)

button.irq(trigger = Pin.IRQ_FALLING, handler = my_handler)
```

Name of the Student
Registration No
Semester
Branch, Section