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

Date:

Experiment – 7

Aim of the Experiment:

Familiarization with Analogue to Digital Converter (ADC) using various sensors and actuators interfacing with Raspberry Pi and LEDs.

Objective:

1) Introduction to **Analogue to Digital Converter (ADC)** Technique, its behaviour and applications.
2) Implementation of ADC on Micro-python with Raspberry Pi - **Turn the Knob: Welcome to Analog World.**
3) Implementation of ADC on Micro-python with Raspberry Pi - **Turn the Knob: Control an LED using POT.**
4) Implementation of **Swinging Servo** using Raspberry Pi with control systems that require constant angle changes.
5) Implementation of **Swing the servo from left to right using POT** with ADC technique using Raspberry Pi.
6) Implementation of **Thermometer: Calculation of Temperature** using thermistor module and Raspberry Pi.
7) Implementation of a **LDR Testing to calculate the Percentage of Light** using LDR module and Raspberry Pi.
8) Implementation of a **Light Theremin: Electronic musical instrument** using LDR module and Raspberry Pi.

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)	1
4	LED	3mm, Red	1
5	Trimmer Pot	10k	1
6	Mini Servo Motor	SG 90, Plastic Gear	1
7	Thermister Module	KY-013 Analog Temperature Sensor Module	1
8	LDR Light Sensor	5mm	1

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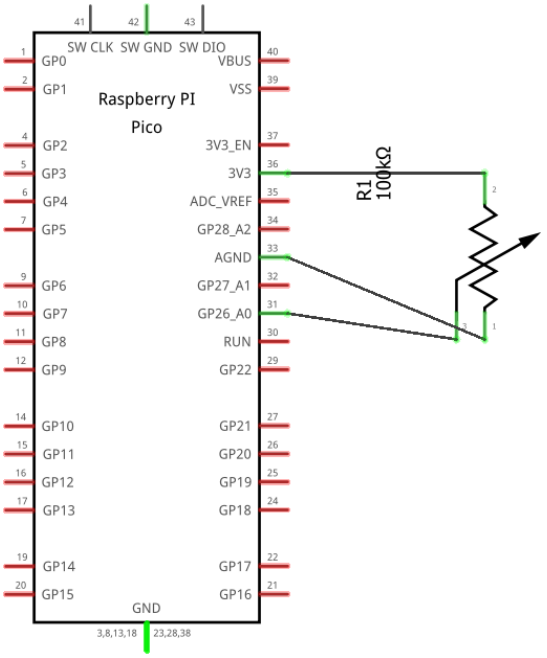
9	LDR Light Sensor Module	5mm	1
10	Transistor	NPN, 2N2222	1
11	Buzzer	Active, Small	1
12	Breadboard	840 Tie points	1
13	Jumper Wire	----------	As per requirement

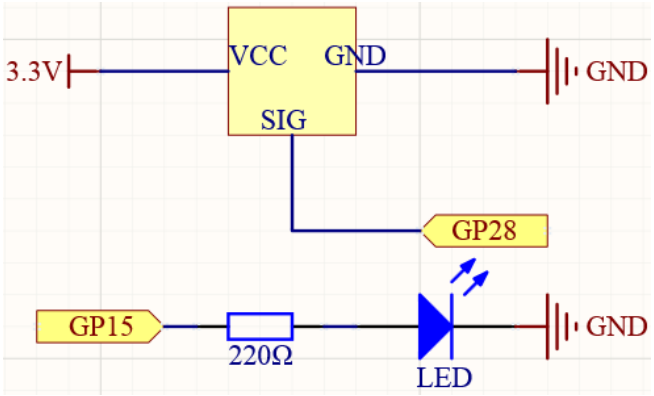
Circuit/Schematic Diagram:

Objective 2



(Figure 1: Circuit diagram for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Welcome to Analog World.)

Objective 3



(Figure 2: Circuit diagram for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Control an LED using POT.)

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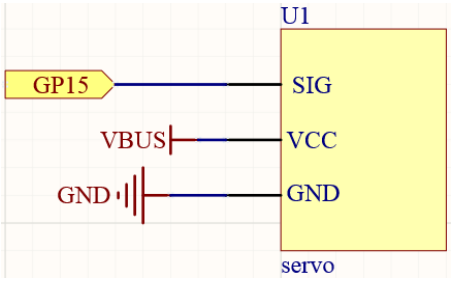
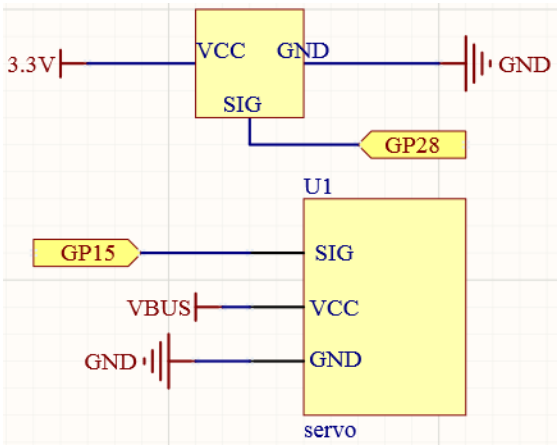
Objective 4



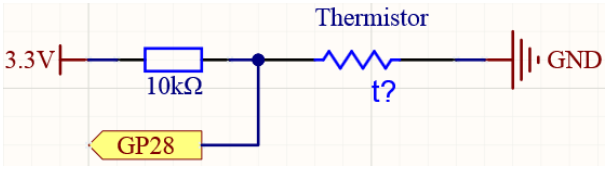
(Figure 3: Circuit diagram for implementation of Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

Objective 5



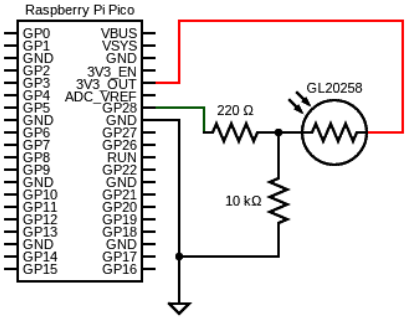
(Figure 4: Circuit diagram for implementation of Swing the servo from left to right using POT with ADC technique using Raspberry Pi.)

Objective 6



(Figure 5: Circuit diagram for implementation of Thermometer: Calculation of Temperature using thermistor module and Raspberry Pi.)

Objective 7



(Figure 6: Circuit diagram for implementation of a LDR Testing to calculate the Percentage of Light using LDR module and Raspberry Pi.)

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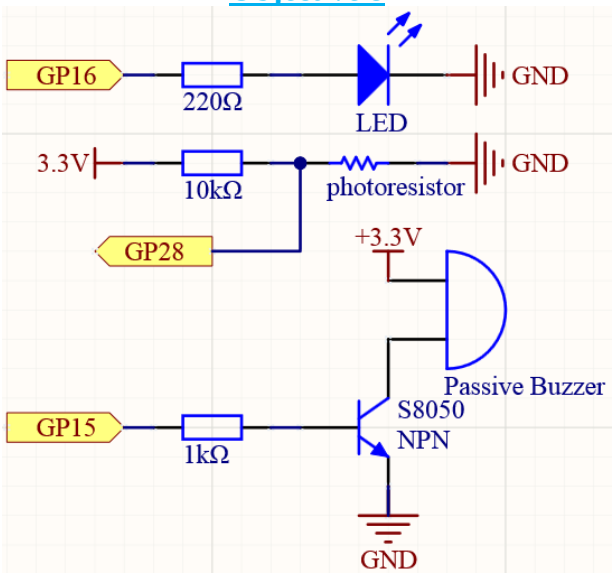
Experiment – 7

Objective 8



(Figure 7: Circuit diagram for implementation of a Light Theremin: Electronic musical instrument using LDR module and Raspberry Pi.)

Observation:

Objective 2

(Figure 8: Simulation based electronic circuit for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Welcome to Analog World.)

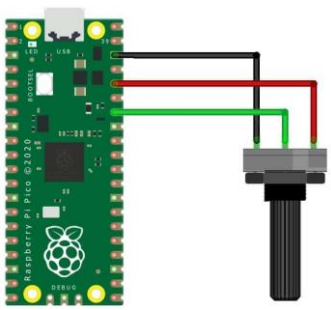


Figure 9: (Breadboard Schematic representation of an electronic circuit for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Welcome to Analog World.)

Figure 10: (Hardware implementation based electronic circuit for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Welcome to Analog World.)

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Objective 3

(Figure 11: Simulation based electronic circuit for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Control an LED using POT)

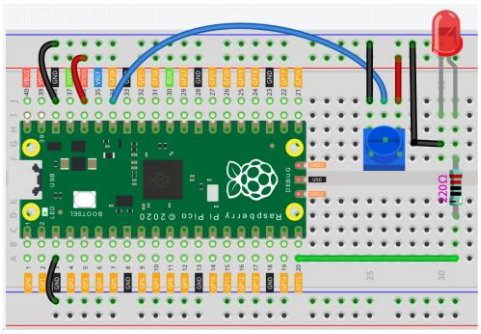

Figure 12: (Breadboard Schematic representation of an electronic circuit for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Control an LED using POT.)

Figure 13: (Hardware implementation based electronic circuit for implementation of ADC on Micro-python with Raspberry Pi - Turn the Knob: Control an LED using POT)

Objective 4

Figure 14: (Simulation based Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

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Experiment – 7

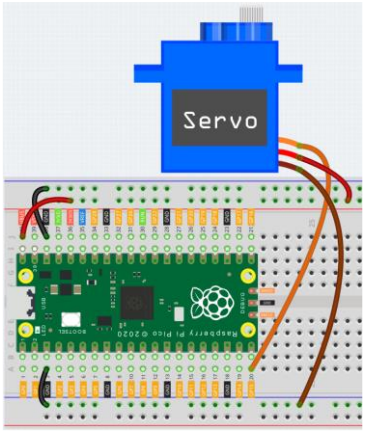

Figure 15: (Breadboard Schematic representation of an electronic circuit for implementation of Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

Figure 16: (Hardware implementation based electronic circuit for implementation of Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

Objective 5

Figure 17: (Simulation based Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

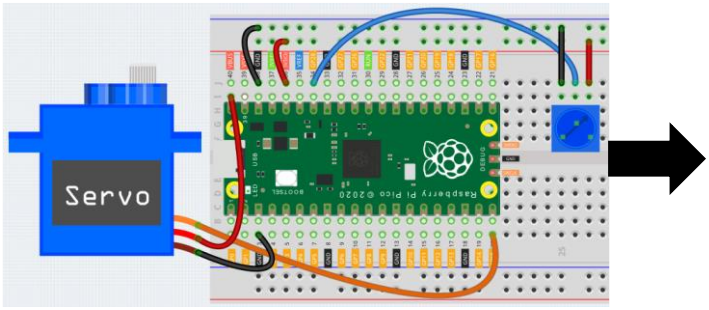

Figure 18: (Breadboard Schematic representation of an electronic circuit for implementation of Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

Figure 19: (Hardware implementation based electronic circuit for implementation of Swinging Servo using Raspberry Pi with control systems that require constant angle changes.)

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Experiment – 7

Objective 6

Figure 20: (Simulation based Thermometer: Calculation of Temperature using thermistor module and Raspberry Pi.)

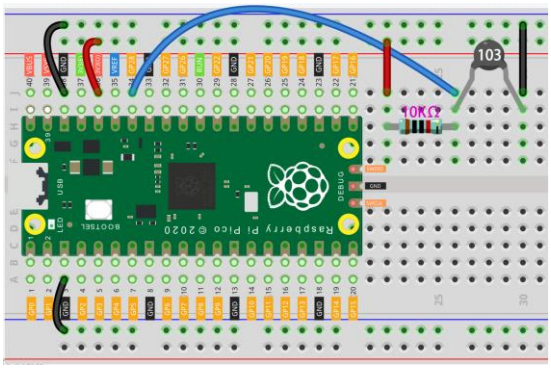

Figure 21: (Breadboard Schematic representation of an electronic circuit for implementation of Thermometer: Calculation of Temperature using thermistor module and Raspberry Pi.)

(Figure 22: Hardware implementation based electronic circuit for Thermometer: Calculation of Temperature using thermistor module and Raspberry Pi)

Objective 7

Figure 23: (Simulation based LDR Testing to calculate the Percentage of Light using LDR module and Raspberry Pi)

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Experiment – 7

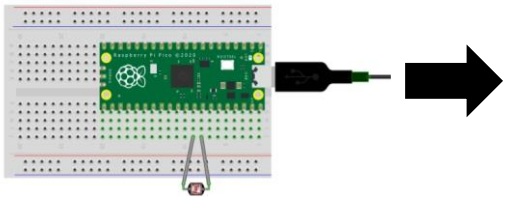

Figure 24: (Breadboard Schematic representation of an electronic circuit for implementation of LDR Testing to calculate the Percentage of Light using LDR module and Raspberry Pi)

(Figure 25: Hardware implementation based electronic circuit for LDR Testing to calculate the Percentage of Light using LDR module and Raspberry Pi)

Objective 8

Figure 26: (Simulation based Light Theremin: Electronic musical instrument using LDR module and Raspberry Pi)

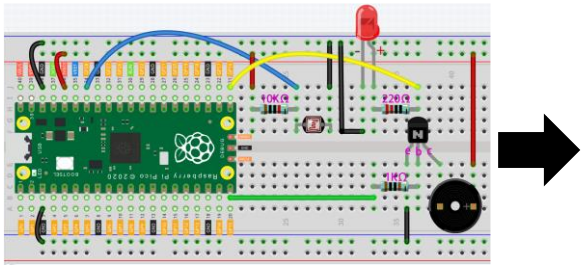

Figure 27: (Breadboard Schematic representation of an electronic circuit for implementation of a Light Theremin: Electronic musical instrument using LDR module and Raspberry Pi)

Figure 28: (Hardware implementation based electronic circuit for implementation of a Light Theremin: Electronic musical instrument using LDR module and Raspberry Pi)

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Experiment – 7

Codes:

Objective 2

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 2")
print("Name:                          ; Registration No.:                ")
print("Objective : 2  Implementation of ADC on Micro-python with Raspberry Pi
- Turn the Knob: Welcome to Analog World.")
```

Objective 3

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 3")
print("Name:                          ; Registration No.:                ")
print("Objective : 3  Implementation of ADC on Micro-python with Raspberry Pi
- Turn the Knob: Control an LED using POT.")
```

Objective 4

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 4")
print("Name:                          ; Registration No.:                ")
print("Objective : 4   Implementation of Swinging Servo using Raspberry Pi with
control systems that require constant angle changes. ")
```

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Experiment – 7

Objective 5

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 5")
print("Name:                          ; Registration No.:                ")
print("Objective : 5    Implementation of Swing the servo from left to right using POT with ADC technique using Raspberry Pi.”)
```

Objective 6

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 6")
print("Name:                          ; Registration No.:                ")
print("Objective : 6   Implementation of Thermometer: Calculation of Temperature using thermistor module and Raspberry Pi.")
```

Objective 7

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 7")
print("Name:                          ; Registration No.:                ")
print("Objective : 7    Implementation of a LDR Testing to calculate the Percentage of Light using LDR module and Raspberry Pi.")
```

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Experiment – 7

Objective 8

```
print("Hello, Pi Pico!")
print("This is Experiment - 7 and Objective - 8")
print("Name:                          ; Registration No.:                ")
print("Objective : 8   Implementation of a Light Theremin: Electronic musical
instrument using LDR module and Raspberry Pi.")
```

Conclusion:

Precautions:

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Post Experiment Questionnaire:

Answer all the Questions in brief with some appropriate examples.

1) A voltage of 2.5V is applied to the ADC on the Raspberry Pi Pico. The ADC has a resolution of 12 bits and a voltage range of 0-3.3V. What is the digital value that represents this voltage?
2) A voltage of 1.8V is applied to the ADC on the Raspberry Pi Pico. The ADC has a resolution of 12 bits and a voltage range of 0-3.3V. What is the digital value that represents this voltage?
3) A digital value of 3500 is read from the ADC on the Raspberry Pi Pico. The ADC has a resolution of 12 bits and a voltage range of 0-3.3V. What is the voltage that this digital value represents?
4) A signal with a frequency of 50Hz is applied to the ADC on the Raspberry Pi Pico. The maximum sample rate of the ADC is 15ksps. Will the ADC be able to accurately sample the signal?
5) A voltage of 2.1V is applied to the ADC on the Raspberry Pi Pico. The ADC has a resolution of 12 bits and a voltage range of 0-3.3V. How accurate the reading will be?
6) A digital value of 2000 is read from the ADC on the Raspberry Pi Pico. The ADC has a resolution of 12 bits and a voltage range of 0-3.3V. How to calculate the percentage error if the actual voltage was 2.5V?

Name of the Student
Registration No
Semester
Branch, Section