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يُونِيسَيْتِي إِسْلَامُ إِنْتَارَا بَغْسَا مِلْدِسِيَا
Garden of Knowledge and Virtue

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ABSTRACT

This experiment explores the use of serial communication between an Arduino microcontroller and a Python script to transmit potentiometer readings from the hardware to a computer. The setup involves connecting a potentiometer to the Arduino, reading its values, and sending them over the serial port. Python then receives and displays these values. Additionally, the report demonstrates how to visualize the potentiometer readings graphically using Matplotlib. Through this experiment, the effectiveness of serial communication in data transmission and visualization is showcased.

INTRODUCTION

Serial communication between microcontrollers and computers is a fundamental aspect of many embedded systems projects. It enables the exchange of data, facilitating tasks such as sensor data acquisition and control signal transmission. In this experiment, we focus on establishing serial communication between an Arduino microcontroller and a Python script to transmit potentiometer readings from the hardware to a computer. By leveraging this communication protocol, we aim to demonstrate a practical application of interfacing sensors with computer-based systems.

MATERIAL AND EQUIPMENT

- Arduino Board
- Potentiometer
- Jumper Wires
- LED
- 220 resistor
- Breadboard

EXPERIMENT SETUP

1. Circuit Setup:

- Connect one leg of the potentiometer to 5V on the Arduino.
- Connect the other leg of the potentiometer to GND on the Arduino.
- Connect the middle leg (wiper) of the potentiometer to an analog input pin on the Arduino, such as A0.

2. Connection to Computer:

- Connect the Arduino to the computer via a USB cable.
- Power on the Arduino and upload the provided Arduino sketch using the Arduino IDE

METHODOLOGY

1. Arduino Code:

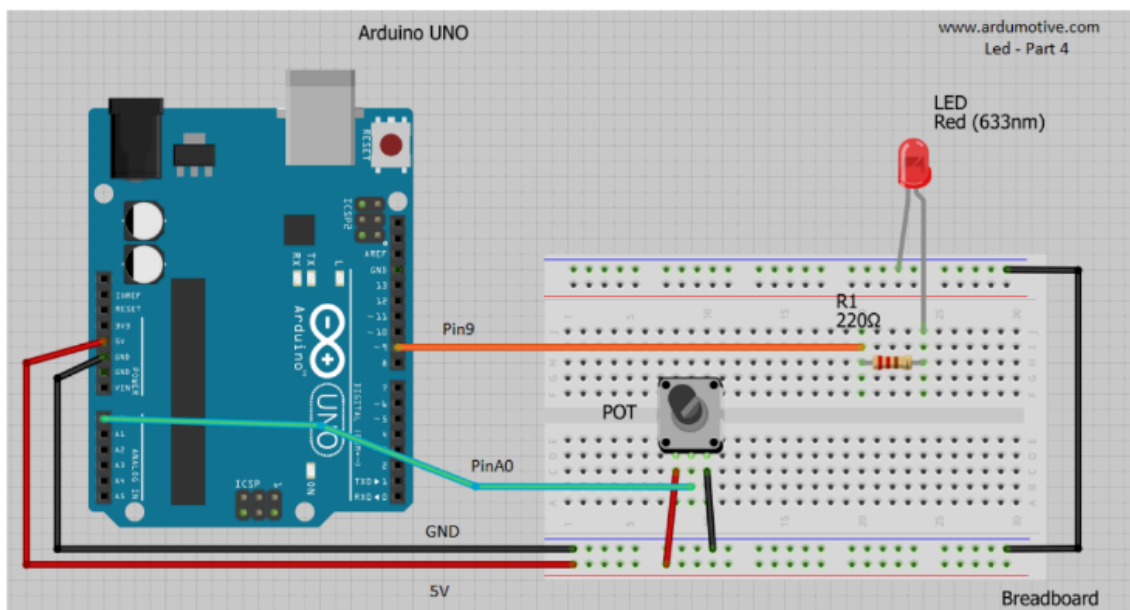
- Write an Arduino sketch to read the potentiometer value and send it over the serial port.

2. Python Script:

- Use the pyserial library to establish serial communication between Python and the Arduino.
- Write a Python script to read the potentiometer data from the serial port and display it.

3. Graphical Visualization:

- Enhance the Python script using the matplotlib library to generate and display a graph of the potentiometer readings.



PYTHON CODE

```
import time

import serial

import matplotlib.pyplot as plt

import matplotlib.animation as animation

def animate(i, dataList, ser):

    ser.write(b'g')

    arduinoData_string = ser.readline().decode('ascii')

    try:

        arduinoData_float = float(arduinoData_string)

        dataList.append(arduinoData_float)

    except:

        pass

    dataList = dataList[-50:]

    ax.clear()

    ax.plot(dataList)

    ax.set_ylim([0, 1100])

    ax.set_title("Arduino Data")

    ax.set_ylabel("Value")

dataList = []

fig = plt.figure()

ax = fig.add_subplot(111)

ser = serial.Serial("COM11", 9600)

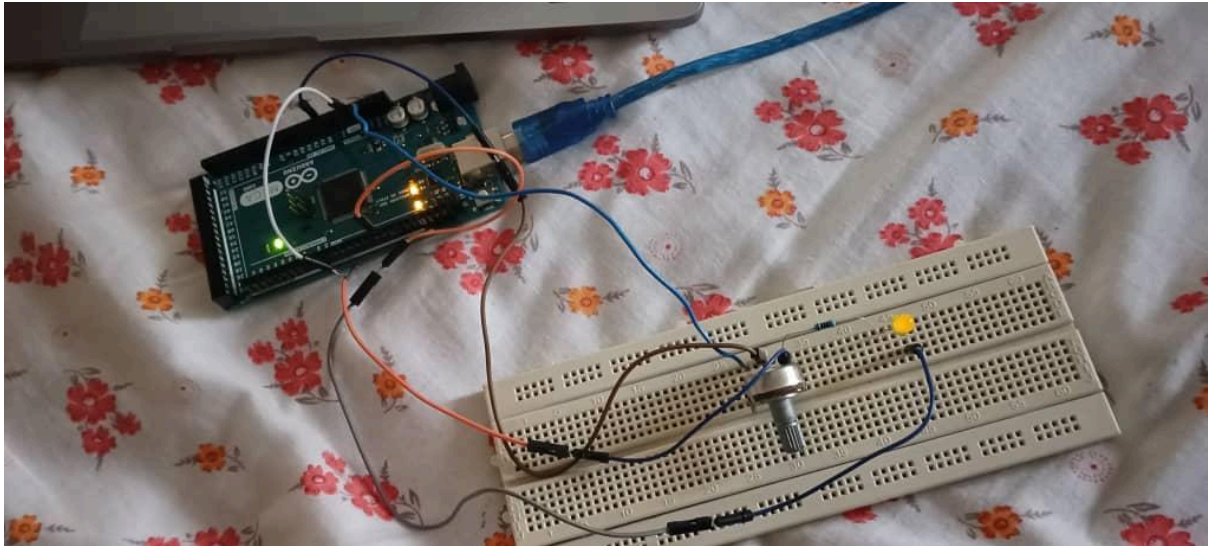
time.sleep(0.1)

ani = animation.FuncAnimation(fig, animate, frames=100, fargs=(dataList, ser), interval=10)

plt.show()
```

RESULT

- Successful establishment of serial communication between Arduino and Python.
- Accurate transmission and display of potentiometer readings.
- Graphical visualization enhances data interpretation and understanding.



DISCUSSION

- Serial communication offers a reliable method for transferring data between microcontrollers and computers.
- Graphical visualization improves data comprehension and analysis.
- Limitations such as baud rate mismatch and potential interference from other serial communication tools are addressed.

CONCLUSIONS

The experiment showcased a compelling demonstration of employing serial communication to transmit sensor data from an Arduino to a Python script efficiently. By utilizing this method, researchers successfully established a seamless connection between the hardware and software components, enabling real-time data acquisition and processing. Moreover, the integration of graphical visualization techniques notably enriched the presentation and interpretation of sensor readings, offering a more intuitive understanding of the data. This approach not only enhances the accessibility of the results but also facilitates more insightful analysis and decision-making. Furthermore, the adaptable nature of this methodology suggests its potential extension to a myriad of sensor applications and data visualization tasks within embedded systems projects, promising versatile and scalable solutions for diverse engineering endeavors.

RECOMMENDATION

- Explore additional sensor types and data visualization techniques to expand the scope of experimentation.
- Investigate methods for optimizing serial communication protocols for real-time applications.
- Consider integrating feedback mechanisms to enable bidirectional communication between hardware and software components.

REFERENCE

- Arduino Documentation: <https://www.arduino.cc/reference/en/>
- PySerial Documentation: <https://pyserial.readthedocs.io/en/latest/>
- Matplotlib Documentation: <https://matplotlib.org/stable/contents.html>

CERTIFICATE OF ORIGINALITY AND AUTHENTICITY

This is to certify that we are responsible for the work submitted in this report, that the original work is our own except as specified in the references and acknowledgment, and that the original work contained herein has not been untaken or done by unspecified sources or persons.

We hereby certify that this report has not been done by only one individual and all of us have contributed to the report. The length of contribution to the reports by each individual is noted within this certificate.

We also hereby certify that we have read and understand the content of the total report and no further improvement on the reports is needed from any of the individual contributors to the report. We therefore, agreed unanimously that this report shall be submitted for marking and this final printed report has been verified by us.

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