LAB REPORT 5:
DAQ INTERFACING WITH MICROCONTROLLERS.

GROUP 5

MCTA 3203

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MECHATRONICS SYSTEM INTEGRATION

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INTRODUCTION

Data Acquisition (DAQ) is critical for collecting and analyzing data from various sensors in real time. It involves converting physical phenomena such as temperature, light intensity, or pressure into electrical signals that can be digitized, stored, and analyzed. This experiment demonstrates using Arduino as a simple DAQ system to acquire data from a Light Dependent Resistor (LDR) and an LM35 temperature sensor. The Arduino reads the sensor data and transfers it to PLX-DAQ, a real-time tool for logging and analyzing data.

The LM35 temperature sensor provides temperature readings in degrees Celsius with high precision, while the LDR measures the intensity of ambient light. These sensors, combined with Arduino and PLX-DAQ, offer a simple yet effective method for monitoring environmental changes. This experiment serves as an introduction to the principles of DAQ systems and demonstrates their practical applications in data logging and analysis.

ABSTRACT

This experiment investigates the use of Arduino as a Data Acquisition (DAQ) device for real-time data logging and analysis. A circuit incorporating an LM35 temperature sensor and a Light Dependent Resistor (LDR) is constructed, allowing for simultaneous measurement of temperature and light intensity. Data from the sensors is acquired by Arduino and transferred to PLX-DAQ for visualization and analysis. The experiment successfully demonstrates the implementation of a low-cost, user-friendly DAQ system and its capability to record environmental changes with accuracy. This report details the circuit design, data acquisition process, and the analysis of logged data, showcasing the system's potential applications in environmental monitoring and automation.

MATERIAL AND EQUIPMENT

- PLX-DAQ
- Arduino Board
- LDR
- LM35
- Jumper Wires
- Resistor
- Breadboard

EXPERIMENTAL SETUP

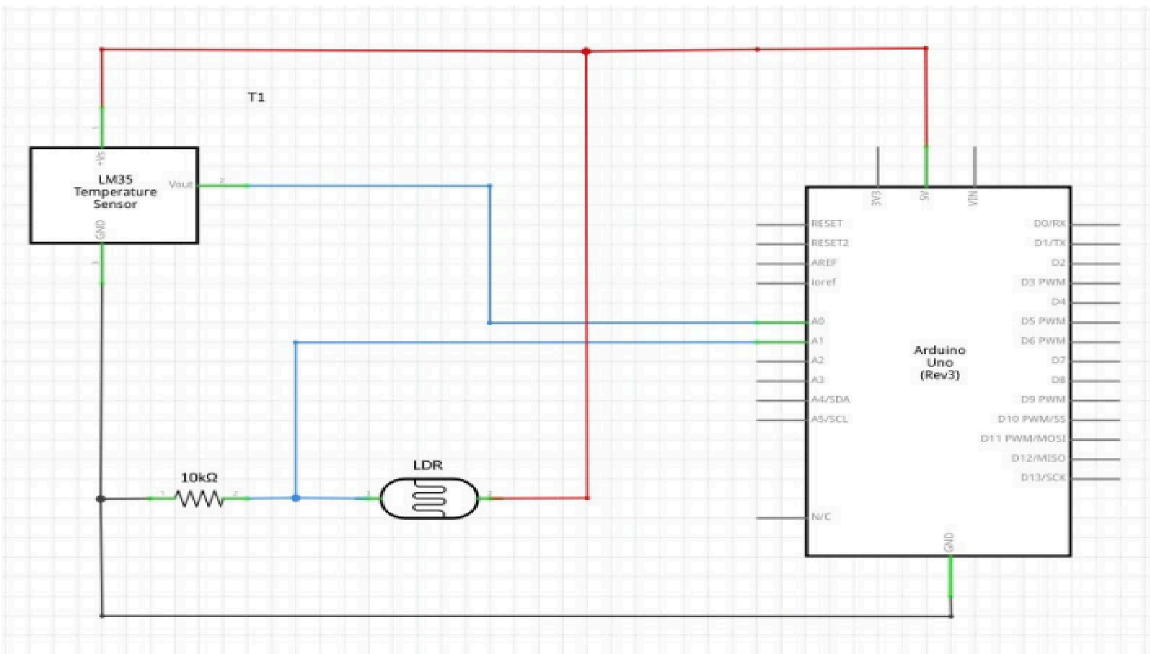
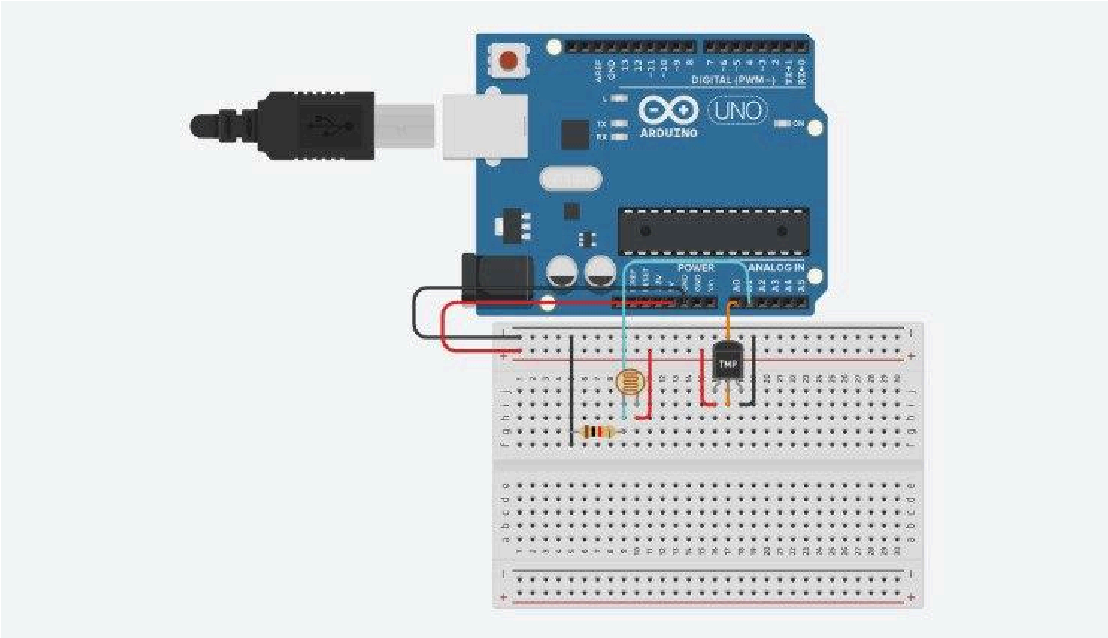


Fig. 3



1. After constructing the circuit, launch Arduino IDE and write code that allows Arduino to read analog signals from the LM35 and LDR and convert it to digital.
2. Complete the example code below. (Alternatively, you may write your own code from the start).
3. Verify the code and upload it to the Arduino board.
4. Launch the PLX-DAQ spreadsheet. Ensure the correct com port is selected and generate the output from the sensors in the spreadsheet.
5. In your report, write the comments to explain each line of the codes and produce meaningful Excel plots from the sensors' data.

METHODOLOGY

This experiment will utilize an Arduino as a DAQ device that acquires data coming from sensors. The sensors to be used during the experiment are the LM35 temperature sensor and LDR, or Light Dependent Resistor. The steps are as follows:

Construction of Circuit:
Constructing the circuit in Fig. 3 where the LM35 and LDR are connected to the Arduino.

Programming Arduino:
Open the Arduino IDE and compose or complete the example code enabling the Arduino to read analog signals from the sensors and convert them to digital format.

Data Logging Setup:
The working software for data logging is PLX-DAQ, which works within Microsoft Excel. Start PLX-DAQ and make sure the proper COM port is selected, with the baud rate set to match the settings in the Arduino code.

Data Collection:
Once the setup is done, click on the connect tab in PLX-DAQ to display the Arduino data in the Excel spreadsheet.

Data Analysis:
After data collection, analyze the data using tools provided by Excel and plot meaningful plots.

RESULTS

DISCUSSION

The circuit constructed for this experiment integrates an LM35 temperature sensor and a Light Dependent Resistor (LDR) with an Arduino Uno board. The LM35 sensor operates by producing an analog voltage output proportional to the surrounding temperature. The LDR, on the other hand, exhibits a resistance that varies inversely with light intensity, forming a voltage divider circuit. The Arduino reads the analog signals from both sensors through its analog input pins (A0 and A1) and converts them into digital data using its built-in ADC (Analog-to-Digital Converter). The converted data is then transmitted via a serial connection to PLX-DAQ for real-time data logging and analysis. This system effectively combines hardware and software to capture environmental conditions, providing insight into variations in temperature and light intensity.

RECOMMENDATION

To make the experiment smoother and reduce errors, start by ensuring all sensors, such as the LDR and LM35, are properly calibrated to guarantee accurate data readings. Add capacitors or use shielded wires in the circuit to minimize electrical noise. Alternatively, implement software-based filtering techniques to smoothen sensor readings. Adjusting the data sampling rate can help strike a balance between responsiveness and data noise. An excessively high rate may produce redundant data points, while a low rate risks missing important changes. For greater precision, consider using an Arduino variant with higher ADC resolution or an external ADC module. Finally, applying statistical methods such as moving averages or median filters in data analysis will further smooth out the data and reduce the impact of noise or anomalies, leading to more reliable experimental outcomes.

CONCLUSION

This experiment demonstrated the integration of an LM35 temperature sensor and an LDR with Arduino to form a simple and efficient DAQ system. The setup successfully captured and logged environmental data using PLX-DAQ, showcasing the feasibility of low-cost DAQ systems for real-time monitoring. While challenges such as noise and calibration errors were encountered, they provided valuable learning opportunities and insights for improving the system. This methodology can be applied in several ways in such applications as environmental monitoring and equipment diagnostics, thus showing the broadness of practical utilization of DAQ systems. Overall, the experiment highlights the potential of Arduino-based DAQ systems for applications in environmental monitoring, automation, and IoT-based solutions.

ACKNOWLEDGEMENT

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STUDENT'S DECLARATION

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 that 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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