REPORT 5: DAQ INTERFACING WITH MICROCONTROLLERS

GROUP 2

MCTA 3203

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MECHATRONICS SYSTEM INTEGRATION

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ABSTRACT

This experiment explores the interfacing of data acquisition (DAQ) with Arduino Uno using PLX-DAQ. Parallax Data Acquisition is a Microsoft Excel add-on tool used to collect and organise data as it arrives. The real-time logging data will be retrieved from a Light Dependent Resistor (LDR) and LM35, a temperature sensor connected to the microcontroller. The objective of this experiment is to capture light intensity as well as temperature readings and transfer the data to the PLX-DAQ for analysis and visualisation in a spreadsheet. By establishing communication between the Arduino Uno and PLX-DAQ, efficient data logging should be displayed as sensor data is continuously transmitted and displayed in Excel. This setup provides a practical, inexpensive solution for recording environmental data along with the processing and storing of information without any additional hardware.

INTRODUCTION

Data acquisition (DAQ) system consists of a measurement setup and a computer capable of monitoring, analysing, and storing real-world data. In this experiment, LDR and LM35 temperature sensors are interfaced with a microcontroller. The Light Dependent Resistor is a photoresistor that changes resistance based on light intensity. At the same time, the LM35 is a temperature sensor that outputs a voltage proportional to the temperature. The DAQ hardware receives analogue signals from the sensors and changes them into digital signals. Parallax Data Acquisition will display and store the digital signal in real-time. A key part of this experiment is PLX-DAQ as it offers an accessible platform for data logging to be directly displayed into an Excel sheet. Thus, data from both sensors are continuously sampled and transmitted via serial communication. This method showcases how Excel-based tools like PLX-DAQ can streamline data recording and analysis at low cost without any additional hardware.

MATERIALS AND EQUIPMENT

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

EXPERIMENTAL SETUP

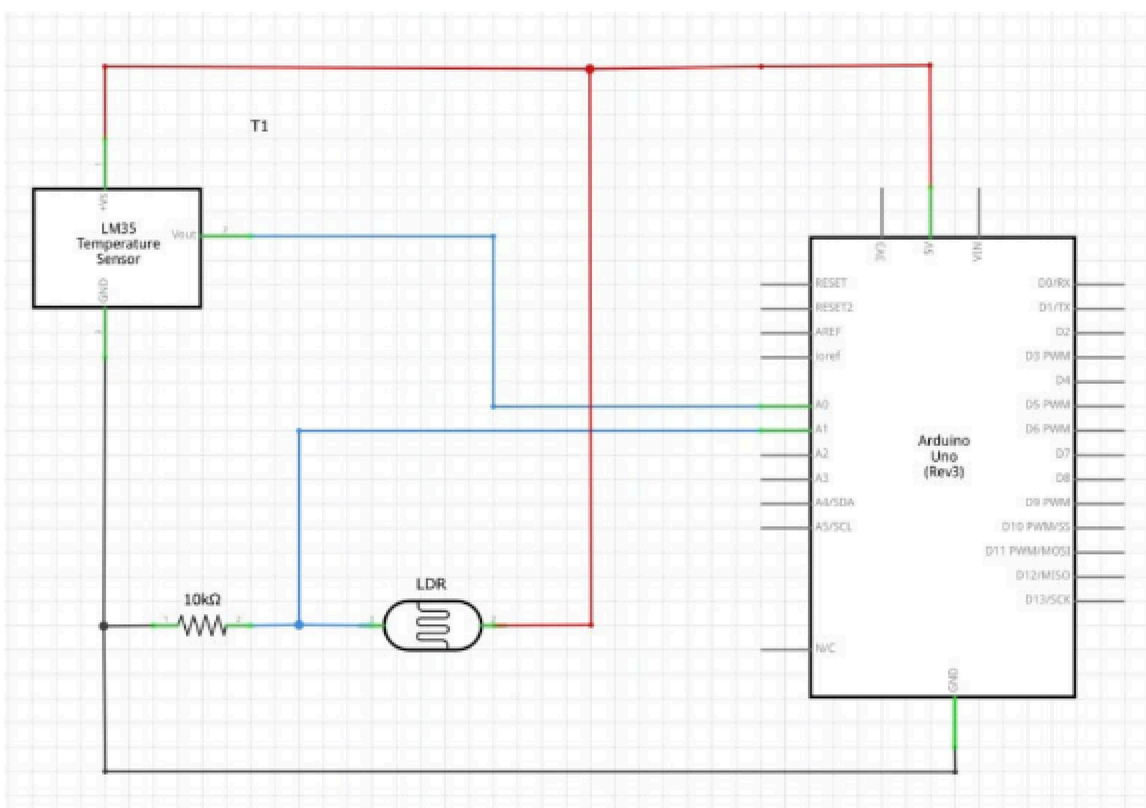


Fig. 3

METHODOLOGY

The experiment aimed to integrate sensors (LDR and LM35) with an Arduino microcontroller for real-time data acquisition using PLX-DAQ software.

System Overview:

- The Arduino board served as the central DAQ device.
- Sensors transmitted analog signals that were converted to digital by the microcontroller.
- Data was sent to a computer for logging and analysis via serial communication.

Software Used:

- Arduino IDE for coding the microcontroller.
- PLX-DAQ as a Microsoft Excel add-on for real-time data visualisation and storage.

Data Flow:

- Light intensity and temperature data were sampled continuously.
- The data was displayed in an Excel spreadsheet, enabling real-time monitoring and visualisation.

PROCEDURE

Setting Up the Hardware:

- Connect the LDR and LM35 sensors to the Arduino board using jumper wires and a breadboard.
- Ensure the circuit is correctly configured, with resistors as needed for the sensors.

- Connect the Arduino to the computer using a USB cable.

Programming the Arduino:

- Open the Arduino IDE and write/upload code to collect analog signals from the sensors.
- Include code to convert these signals to digital values and transmit them to the computer.

Installing and Configuring PLX-DAQ:

- Download and install the PLX-DAQ software on the computer.
- Open the software and configure the COM port and baud rate to match the Arduino's settings.

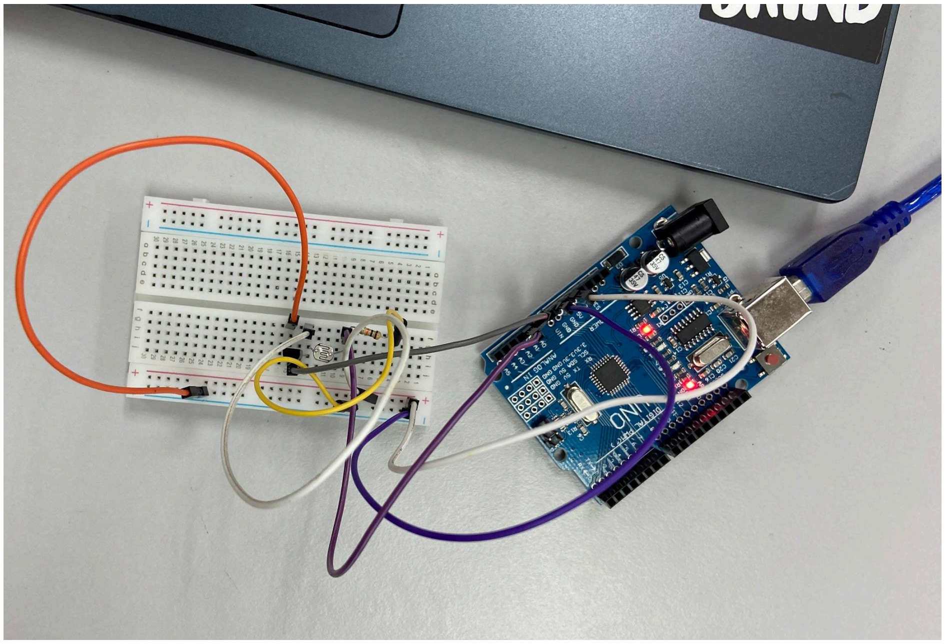
Data Logging:

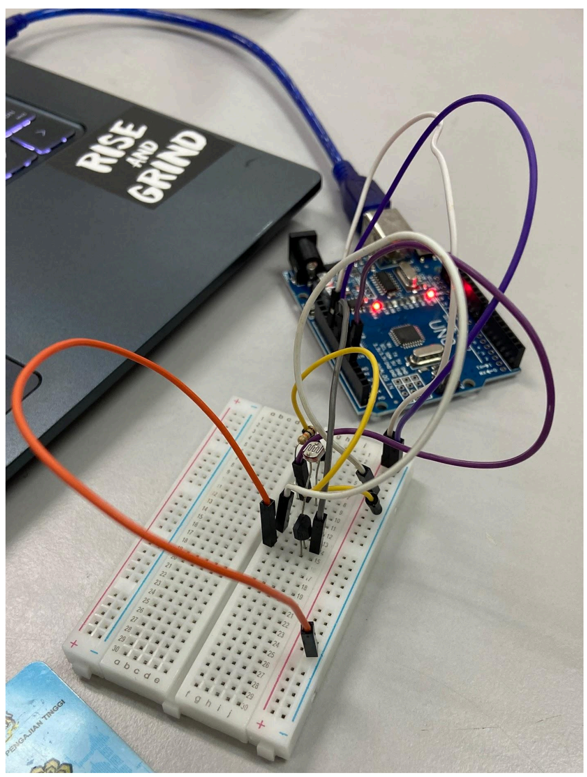
- Run the Arduino sketch and start the PLX-DAQ software.
- Observe the real-time logging of light intensity and temperature data in the Excel spreadsheet.
- Insert a line graph in Excel to visualise the sensor readings over time.

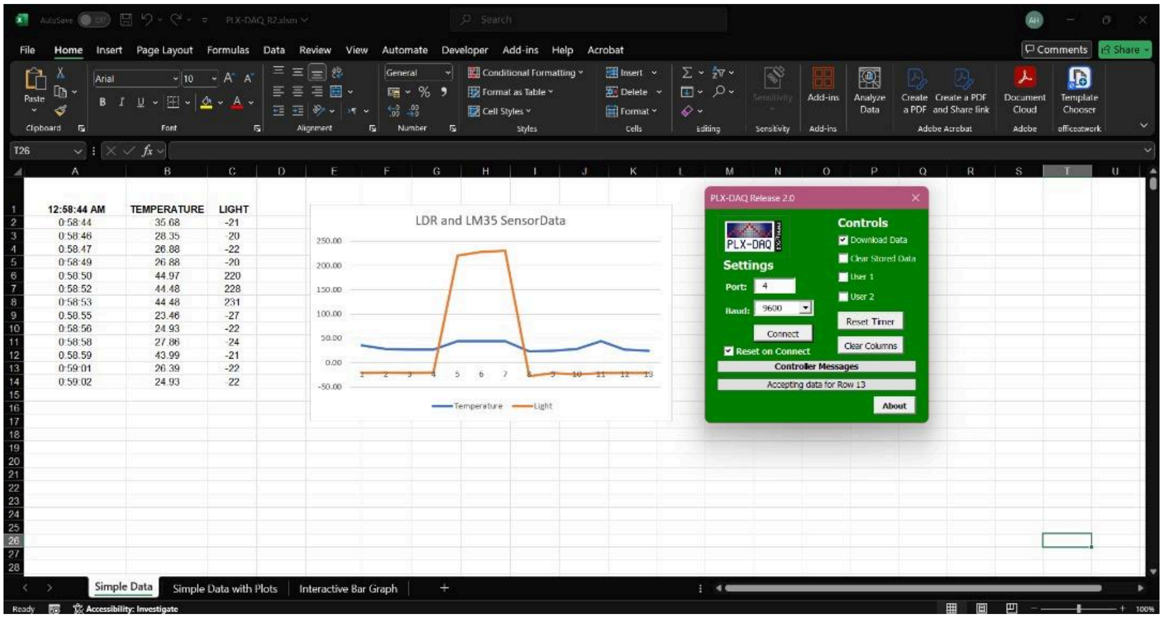
Data Analysis:

- Analyse the collected data to observe trends in light intensity and temperature.
- Verify the accuracy and consistency of the data through graphical representation.

RESULTS

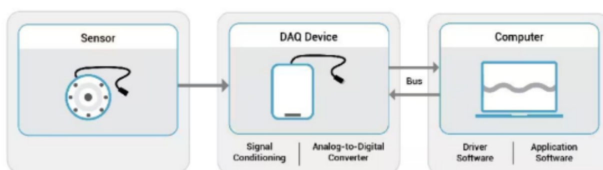


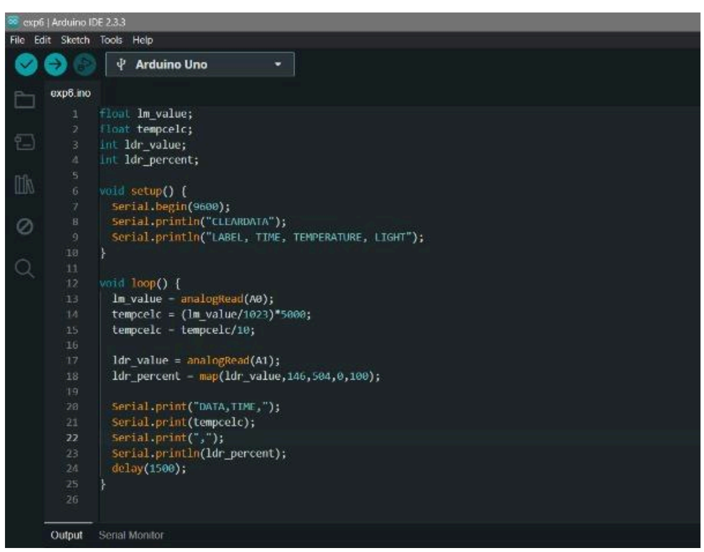




DISCUSSION

- **Software**





In this experiment, Arduino is used as a simple DAQ device to receive and process data from LM35 and LDR and later send it to the computer for analysis. The code is programmed to collect data from the sensors and transfer the data to the PLX-DAQ for data logging and analysis. This allows the Arduino to read analog signals from the sensors and convert it to digital. Parallax Data Acquisition (PLX-DAQ) is to be downloaded on the computer. It is used as a software add-in designed for Microsoft Excel. This software is used to collect data and organise into columns as it arrives. It is easily accessible and manageable within Excel spreadsheets. This tool simplifies the analysis of data collected from the LM35 and LDR. After launching the PLX-DAQ, an Excel spreadsheet and a GUI window will pop-out. In the GUI window, COM port number and baud rate are selected accordingly. The received data from the sensors is shown in the spreadsheet in real-time. Line graph is inserted in the spreadsheet to produce meaningful excel plots from the sensors' data.

- **Electrical**

  The circuit design follows basic electrical principles to ensure proper current flow. A 10 kΩ resistor is connected to both LDR and LM35 to stabilises its input signals. The LM35 is connected to Arduino's A0 analog input while the LDR is connected to Arduino's A1 analog input. Lastly, 5V and GND are connected across all the components. Connections are double-checked to avoid short circuits that could damage the components.

- **Hardware**

  The key electrical components utilised in this project are LM35 and LDR, which are connected to Arduino UNO. The sensors act as an input mechanism as it captures the data of temperature and light. The Arduino functions as a DAQ hardware to read analog signals and transfer the data to the PLX-DAQ. The LM35 and LDR serve as the digital input device. The circuit interconnects the components using male-to-male jumper wires on a breadboard to guarantee accurate wiring for optimal functioning. Throughout the experiment, the circuit exhibited stability with reliable operation of the LM35 and LDR.

CONCLUSION

This experiment successfully demonstrates the use of an Arduino as a simple data acquisition (DAQ) device to collect data from an LDR (light dependent sensor) and LM35 (Temperature sensor) and transfer it to a PLX-DAQ for logging and analysis. By building the circuit and the coding above the arduino read the analog signal from the sensor and convert it to digital value, and send the data to the laptop (PLX_DAQ) for real-time reading. This experiment also generates graphs from the data collected providing a clear view of real-time light intensity and temperature. These shows how accessible hardware and software tools can be integrated to perform real-time monitoring and analysis.

RECOMMENDATIONS

To further improve to optimise the Arduino code for efficiency because some students have issues transferring certain data from Arduino to PLX-DAQ. Other than that, sensor calibration is also important to improve the reading accuracy, random and systematic error can occur. Besides, we also can add some visualisation techniques such as trend lines or dual axis graphs in excel. Lastly, we can add more sensors such as RFID readers and many more for variable data collection and application in our project.

ACKNOWLEDGEMENT

We would like to express our gratitude to Dr. Wahju Sediono, Dr. Ali Sophian, Dr. Zulkifli bin Zainal Abidin, my teaching assistant, and my peers for their invaluable help and support in finishing this project. Their advice, feedback, and experience have greatly influenced the level of quality and understanding of this work.

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 acknowledgement, 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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