MCTA 3203 (MECHATRONICS SYSTEM INTEGRATION)

WEEK 6

TITLE:

DAQ interfacing with Microcontrollers

SEMESTER 1, 24/25

SECTION 1 – GROUP 9

LECTURER:
DR. WAHYU

no	Name	Matric number
1	AZMI BIN BASHARUDIN	2211387
2	HAMZAH FAISAL	2219537
3	KHAIRULDDIN BIN ZULKIFLEI	2210527
4	MUHAMAD IZZUDIN BIN MUHAMAD	2219735
5	MUHAMMAD AIMAN BIN MOHD RODZI	2118813

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ABSTRACT

In this experiment, "Data Acquisition" (DAQ) was interfaced with sensors (LDR, LM35) and an Arduino microcontroller. With the aid of specially created software, it is utilised to process sensor data and send it to computers for analysis. The computer's "Parallax Data Acquisition" (PLX-DAQ) program, which uses Microsoft Excel to save the data from both sensors via Arduino, received the output from the LDR, which detects light, and the LM35, which measures temperature. The goal was to use the interface to view the value obtained from both sensors. One of the LM35 and LDR pins was linked to the Arduino's analog pins (A0 and A1), enabling data reading through Arduino code that subsequently communicated with the PLX-DAQ. As a result, the outputs were arranged in Microsoft Excel and the LDR measured values between 0 and 1023 degrees Celsius and the LM35 measured values between 0 and 100 degrees Celsius. In order to communicate between components and get desired output, interfaces were useful. One example of this was the output from sensors that were not directly visible but could be seen after being interfaced with an Arduino.

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OBJECTIVES

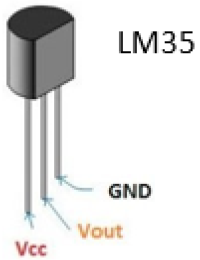
1. Interface LM35 and LDR sensors with Arduino for data acquisition.
2. Process sensor data using Arduino and transmit it to PLX-DAQ.
3. Highlight LM35's precision in temperature measurement, offering a direct correlation between voltage and ambient temperature.

1. INTRODUCTION

The use of an Arduino as a basic Data Acquisition (DAQ) device in the field of data acquisition and sensor-based experimentation offers a flexible and approachable platform for recording environmental characteristics. In order to collect data in real time, this experiment uses an Arduino interface with a 10k ohm resistor, an LM35 temperature sensor, and a Light Dependent Resistor (LDR). The LDR detects changes in light intensity, while the LM35 works on the basis of temperature-dependent voltage across a diode. After that, the gathered data is sent to PLX-DAQ, which makes data logging and analysis easier. By adjusting the LDR's exposure to light or darkness, the experiment also investigates the dynamic regulation of light intensity. The readings that are obtained are shown on the serial monitor of the Arduino.

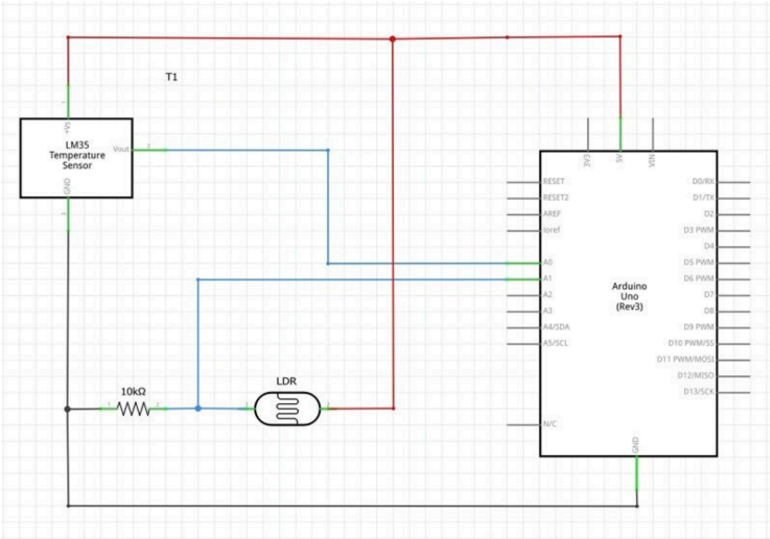
2. MATERIALS AND EQUIPMENT

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

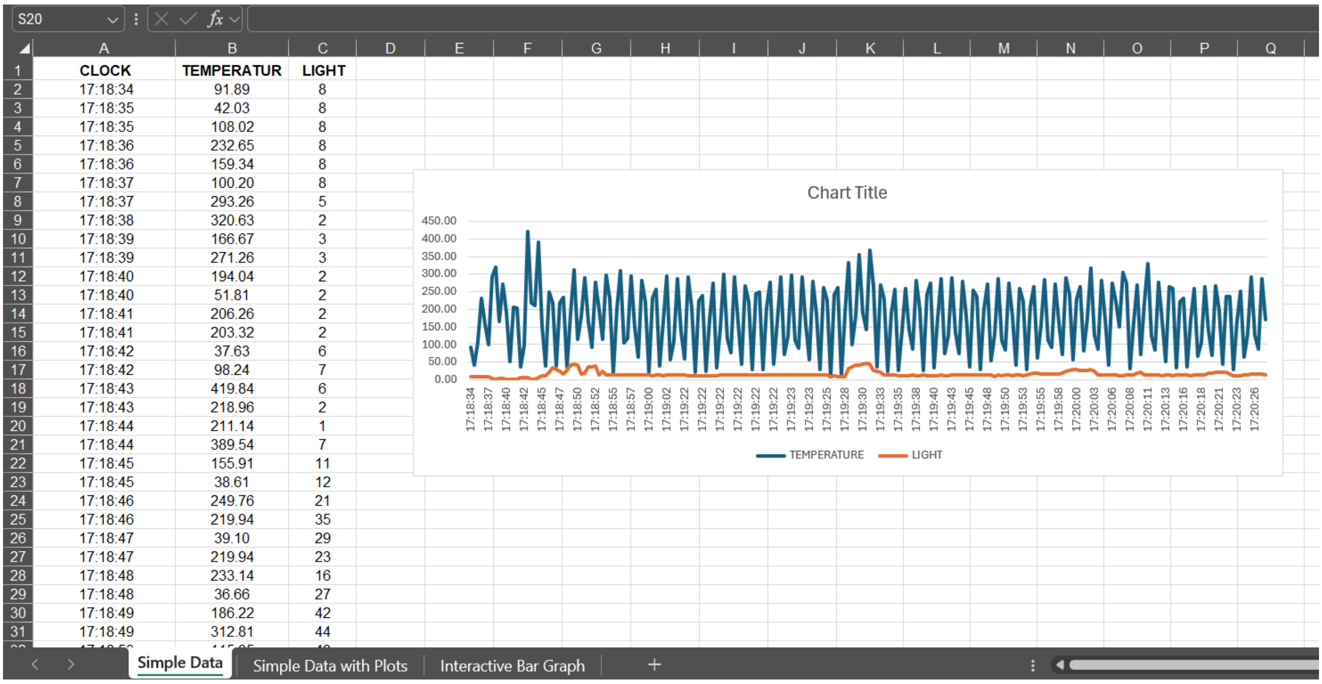


3. EXPERIMENT SETUP

The setup begins by constructing a circuit designed to collect data from sensors using an Arduino as a DAQ (data acquisition device). The components that were used included a LM35 (temperature sensor), an LDR (light-dependent resistor) , an Arduino UNO board, some jumper wires, a resistor, and a breadboard. The LM35 is connected to the Arduino to measure temperature, while the LDR is used for capturing light intensity.



After connecting the components according to the circuit design, program the Arduino with the Arduino IDE. This code, when uploaded to an Arduino board with an LM35 temperature sensor and LDR, allows for continuous reading of analog signals from the sensors. The sensors' analog values are transformed to digital and transmitted to the PLX-DAQ tool. PLX-DAQ logs and visualises data in real-time via Excel spreadsheet.



CLOCK	TEMPERATUR	LIGHT
17:18:34	91.89	8
17:18:35	42.03	8
17:18:35	108.02	8
17:18:36	232.65	8
17:18:36	159.34	8
17:18:37	100.20	8
17:18:37	293.26	5
17:18:38	320.63	2
17:18:39	166.67	3
17:18:39	271.26	3
17:18:40	194.04	2
17:18:40	51.81	2
17:18:41	206.26	2
17:18:41	203.32	2
17:18:42	37.63	6
17:18:42	98.24	7
17:18:43	419.84	6
17:18:43	218.96	2
17:18:44	211.14	1
17:18:44	389.54	7
17:18:45	155.91	11
17:18:45	38.61	12
17:18:46	249.76	21
17:18:46	219.94	35
17:18:47	39.10	29
17:18:47	219.94	23
17:18:48	233.14	16
17:18:48	36.66	27
17:18:49	186.22	42
17:18:49	312.81	44

4. METHODOLOGY

In this experiment, we collected data from an LM35 and LDR sensor using Parallax Data Acquisition (PLX-DAQ) and analysed it in Excel.When you open PLX-DAQ, you will see an Excel spreadsheet and a pop-out GUI window as seen below.

```
int tval;
 float temp;
  int ldr;
  int ldrper;
  int temppin = A0;
  int ldrpin = A1;


void setup() {
  Serial.begin(9600);
  Serial.println("CLEARDATA");
  Serial.println("LABEL, CLOCK, TEMPERATURE, LIGHT");
  pinMode(temppin, INPUT);
  pinMode(ldrpin, INPUT);
}

void loop() {
  tval = analogRead(temppin);
  temp = ((float)tval/1023)*5000;
  temp = temp/10;
```

```
ldr = analogRead(ldrpin);
  ldrper = map(ldr, 0,1023, 0,100);
  Serial.print("ldr value :");
  Serial.println(ldrper);
  Serial.print("Temp Value : ");
  Serial.println(temp);
  Serial.print("DATA, TIME,");
  Serial.print(temp);
  Serial.print(",");
  Serial.println(ldrper);
  delay(500);

}
```

5. DATA COLLECTION

The Arduino board collects data by reading analog signals from the LM35 temperature sensor and LDR. The data collected includes temperature readings from the LM35 sensor and light intensity measurements from the LDR.The Arduino uses the analogRead(LM35_pin) function to read the analog signal from the LM35. LM35_pin refers to the analog pin attached to the LM35. The analogRead(LDR_pin) function reads the analog signal from the LDR connected to the specified pin. PLX-DAQ is a tool for data logging and visualisation in Excel spreadsheets.

6. DATA ANALYSIS

We used an LDR and an LM35 as sensors in this experiment. Sensors were designed to make direct or indirect touch with the target object for measurement. The Arduino DAQ device collects data from sensors and sends it to the PLX-DAQ for real-time monitoring. This app enables easy access and management of Arduino data. In this experiment, temperature and light data were acquired using both sensors. The collected information can be utilised to create useful charts in Excel. We can graph temperature measurements for the LM35 sensor over time. A graph of light data over time can be plotted for the LDR light sensor. The plotted graph illustrates how the light intensity will vary as time increases.

7. RESULT

The Arduino is able to successfully gather sensor data. For data logging and analysis, the data were moved to PLX-DAQ. The circuit was successfully built, and the written code ran smoothly and with few errors. In conclusion, the experiment effectively used PLX-DAQ, Arduino, LM35, and LDR to gather, log, and analyse data, offering important new information about temperature and light variations over time. The effectiveness of the entire experiment was increased by the effective data administration and analysis made possible by the PLX-DAQ user interface.

8. DISCUSSION

- **Arduino UNO**

As the link between computers and sensors, Arduino is utilised as a DAQ device.
The computer's USB slots allow it to be connected to the system. It converts the analog signals it gets from the sensors into digital signals that the computer can comprehend.

- **Sensor**

Two sensors, the LM35 and the LDR are utilised in this experiment. An analog temperature sensor called the LM35 is used to measure the ambient temperature. "Light Dependent Resistor," or LDR for short, is a type of photoresistor whose resistance varies according on the quantity of light it receives. For presentation, the obtained light value was then scaled from 0 to 100.

- **Parallax Data Acquisition**

This tool makes data easily accessible and manageable within Excel spreadsheets, making it easier to analyse data obtained in a variety of scenarios, such as field measurements, sensor experiments, and real-time equipment monitoring.

9. CONCLUSION

To sum up, this project effectively uses an Arduino as a data collecting tool to collect real-time data from an LDR and an LM35 temperature sensor. The project shows how an Arduino may be used practically in environmental monitoring by translating raw sensor readings into useful results. Data logging and analysis are streamlined by the interaction with PLX-DAQ, which also offers an intuitive platform for additional Excel interpretation.
The experiment is a useful learning tool for sensor interfacing with Arduino because of its simple methodology and capacity to control ambient variables.

10. RECOMMENDATION

To guarantee the precision, dependability, and adaptability of the experiment results, development is continuously required. Through constant development, researchers can improve their methods and reduce potential sources of inaccuracy. As a result, the findings gain credibility and produce more precise and accurate results. A few suggestions for future improvements are listed below:

1. **Equipment protection:**
   We should build circuits correctly to guard against overloads and short circuits. To lessen the chance of the equipment burning or breaking, we should utilize more resistors and the appropriate resistor value. This keeps wiring and electrical equipment in good operating condition.

2. **Environmental condition:**
   We must regulate and keep an eye on environmental factors like the surrounding light and temperature during the experiment. This is due to the fact that certain sensors are susceptible to changes in their surroundings, which may affect how accurate they are.

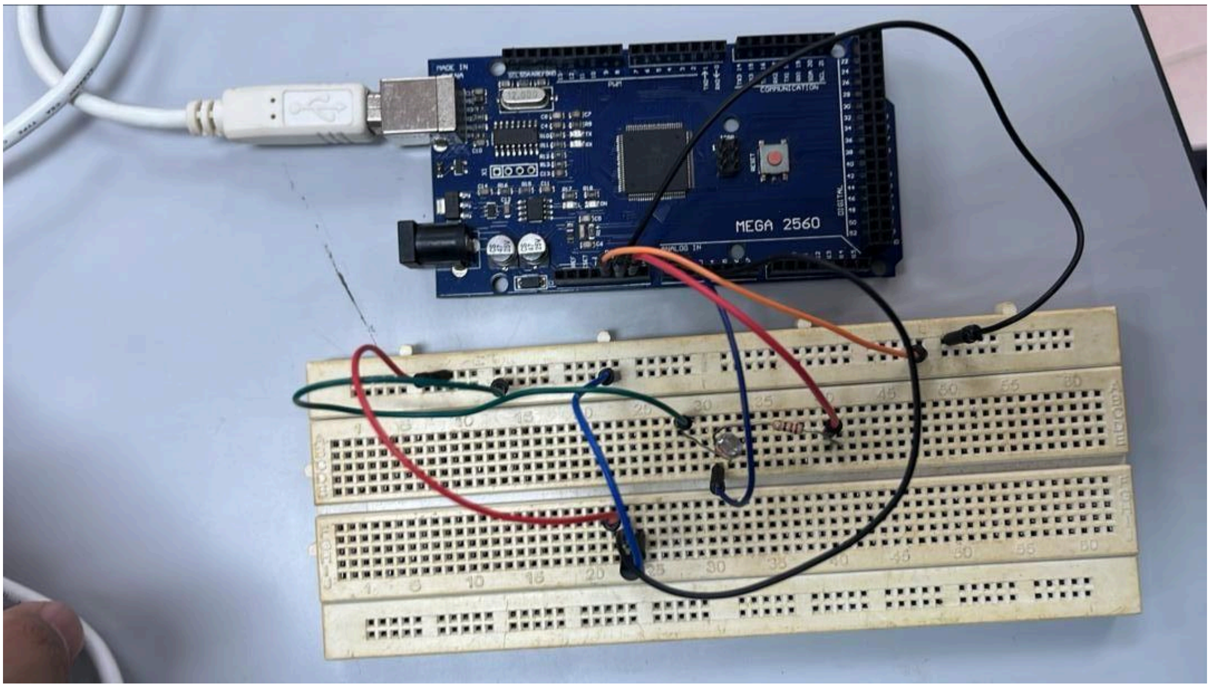
3. **Testing and calibration:**
   In order to obtain more precise sensor data in the future, we should make sure the sensor is calibrated correctly during the experiment. Maintaining and enhancing the system's and its outcomes' dependability also requires testing and calibration.

11. REFERENCES

- Liu, C., Ren, W., Zhang, B., & Lv, C. (2011). The application of soil temperature measurement by LM35 temperature sensors.

- Zulkifli. (2014). Mechatronics Interfacing Lab Manual, (Rev. ed.). Unpublished Class Materials

12. APPENDICES



The final circuit for the task given

13. ACKNOWLEDGEMENT

We want to thank everyone who helped, guided, and supported us throughout this endeavour. First and foremost, we thank Assoc Prof Dr. Zulkifli Bin Zainal Abidin and also Dr. Wahyu Sediono for providing extensive guidance and supervision during the experiment. Their comments, suggestions, and excitement helped us understand Arduino programming.

Our fellow group members deserve special recognition for their teamwork and support. Our conversations, information sharing, and problem-solving sessions dramatically improved our understanding of the experiment's topics and the overall learning experience. Our group members' joint efforts not only enhanced our learning experience, but also greatly contributed to the effective completion of this project.

14. STUDENTS DECLARATION

<u>Certificate of Originality and Authenticity</u>

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 have 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’s 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.**

SIGNATURE		
NAME	Azmi bin basharudin	**Read** ✅
MATRIC NUMBER	2211387	**Understand** ✅
CONTRIBUTION	Introduction, material and equipment	**Agreed** ✅

SIGNATURE		
NAME	Hamzah faizal	**Read** ☑
MATRIC NUMBER	2219537	**Understand** ☑
CONTRIBUTION	Experiment setup, methodology, data collection	**Agreed** ☑

SIGNATURE		
NAME	Khairulddin bin zulkiflei	**Read** ☑
MATRIC NUMBER	2210527	**Understand** ☑
CONTRIBUTION	Data analysis, result, discussion	**Agreed** ☑

SIGNATURE		
NAME	Muhamad Izzudin Bin Muhamad	**Read** ☑
MATRIC NUMBER	2219735	**Understand** ☑
CONTRIBUTION	Conclusion, recommendation, references	**Agreed** ☑

SIGNATURE	aiman	
NAME	Muhammad aiman bin mohd rodzi	**Read** ✔
MATRIC NUMBER	2118813	**Understand** ✔
CONTRIBUTION	Appendices, acknowledgement, students declaration, methodology	**Agreed** ✔