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**LABORATORY REPORT**

**MECHATRONICS SYSTEM INTEGRATION MCTA 3203**

**SEMESTER 2 2023/2024**

**WEEK 6**

**SUBMISSION DATE:**

**GROUP: 6**

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Abstract

This study demonstrates the integration of Data Acquisition (DAQ) systems with microcontrollers, focusing on using Arduino as a DAQ device. The experiment involves collecting analog data from an LDR and an LM35 temperature sensor and analyzing it using the PLX-DAQ Excel add-in. The objective is to understand the working principle of a simple DAQ system, including sensor interfacing, data conversion, and real-time visualization. Results are visualized and interpreted using Microsoft Excel, showing the feasibility and effectiveness of this method in basic mechatronic applications.

Introduction

Data Acquisition (DAQ) systems are critical in modern engineering for monitoring, recording, and analyzing physical phenomena. A basic DAQ setup typically includes sensors, a DAQ device, and a computer. This project introduces students to the concept of DAQ using Arduino, which captures analog signals from sensors and transmits them for analysis via PLX-DAQ, a Microsoft Excel-based interface. The LM35 temperature sensor and an LDR (Light Dependent Resistor) are employed to collect environmental data, which is then visualized in real-time. This lab serves to reinforce students’ understanding of sensor integration, analog-to-digital conversion, and data logging within a microcontroller-based system.

Materials and Equipments

1. Arduino board

1. LDR (light-dependent resistor)
2. LM35 temperature sensor
3. Resistors
4. Breadboard

1. Jumper wires

1. PLX-DAQ software

Methodology

1. Assemble the circuit seen in Figure 3, which links the Arduino board to the LDR and LM35 sensor.
2. Program the Arduino board to read analogue signals from the LDR and LM35, transform them into digital values, and send the information to the computer in a serial fashion.

1. Open the PLX-DAQ application and confirm that the appropriate baud rate and COM port are chosen.

1. To begin recording the sensor data in the Excel spreadsheet, click the "Connect" button on the PLX-DAQ interface.

1. Watch as the spreadsheet logs the sensor data and provides insightful graphs and insights.

void setup() {

Serial.begin(9600);

}

void loop() {

int ldr\_value = analogRead(A0); // Read the analog value from the LDR sensor float ldr\_percent = (ldr\_value / 1023.0) \* 100; // Convert the analog value to a percentage int temp\_pin = analogRead(A1); // Read the analog value from the LM35 temperature sensor

float temp = (temp\_pin \* 5.0 / 1023.0 - 0.5) \* 100; // Convert the analog value to a temperature in Celsius

Serial.print("DATA,MILLIS,");

Serial.print(millis());

Serial.print(",");

Serial.print(temp);

Serial.print(",");

Serial.print(ldr\_percent);

Serial.println();

delay(1000); }

A diagram of a circuit board

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Fig.3

Results

A screen shot of a graph

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float tempcelc;

int ldr\_value;

int ldr\_percent;

void setup() {

Serial.begin(9600);

Serial.println("CLEARDATA");

Serial.println("LABEL,CLOCK,TEMPERATURE,LIGHT");

}

void loop() {

int lm\_value = analogRead(A0);

tempcelc = (lm\_value / 1023.0) \* 5000.0;

tempcelc = tempcelc / 10.0;

ldr\_value = analogRead(A1);

ldr\_percent = map(ldr\_value, 0, 1023, 0, 100);

Serial.print("DATA,TIME,");

Serial.print(tempcelc);

Serial.print(",");

Serial.println(ldr\_percent);

delay(1500);

}

Discussion

The experimental setup consists of an Arduino microcontroller interfaced with an LM35 temperature sensor and an LDR, both connected to analog input pins. Upon constructing the circuit (as per Figure 3 in the source document), Arduino code is written to read analog values, convert them into meaningful data, and transmit them via the serial port to PLX-DAQ.

PLX-DAQ functions as a data logger, capturing the incoming serial data into an Excel spreadsheet. This allows students to use familiar Excel tools to analyze trends, visualize temperature and light intensity variations, and observe real-time environmental changes. The real-time plots generated from the data offer immediate insights and reinforce the relevance of DAQ in monitoring physical conditions.

The use of the LM35 provides a linear temperature response, while the LDR varies resistance based on ambient light, making both suitable for showcasing basic analog interfacing. Proper handling of serial communication settings (COM port and baud rate) in PLX-DAQ is vital for accurate data logging.

Challenges encountered may include synchronization issues between data transmission and PLX-DAQ reading, as well as signal noise affecting accuracy. However, these issues can typically be mitigated with code adjustments or improved circuit design.

Conclusion

This experiment effectively demonstrates the integration of sensors with microcontrollers for data acquisition and logging using Arduino and PLX-DAQ. Students gain hands-on experience with analog signal processing, serial communication, and real-time data visualization. The simplicity and accessibility of the tools used (Arduino and Excel) make this approach ideal for educational purposes and small-scale DAQ applications. Through this task, learners develop foundational skills necessary for implementing more advanced monitoring systems in future mechatronics projects.

Recommendations

1. Implement Data Filtering Techniques

Using moving average filter or similar basic filtering, is recommended to make the data more accurate. It will help to reduce disturbances resulting from noise and sensor fluctuations, mainly for sensors like LDR and LM35.

1. Expand Sensor Variety for Broader Applications

Experiments carried out in the future should have sensors that measure humidity, detect motion or sense pressure. Students would gain more insight into DAQ systems which would help them examine complex problems such as environmental monitoring or automation systems.

Acknowledgements

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Student Declaration

We, hereby declare that this project is entirely our work except for the documents that were given as references. Any external sources utilized for reference or inspiration have been properly cited and credited.