Computer Systems Architecture Assignment

UFCDS-15-1

Deliverables and Deadline

There are three deliverables:

1. Several programming tasks to be completed and demonstrated in class.
2. A group report on the work done in the programming task.
3. An individual report on one of 5 topics

The latest submission date for this deadline is **19th August 2023.**

Part A – Group Report

A laboratory report on the four programming tasks. There should be a methodology and results section for each of the four programming tasks. Note that diagrams and/or pictures are strongly recommended to be included to help explain the work that was done. The recommended word count is approximately 2000 words.

Part B – Literature Review/ Background Research (Individual)

Write individual report of approximately 500-800 words. Note that the required subtopics to focus on are given for each topic separately.

1. Arduinos
    a. What is a microcontroller? (Especially how microcontrollers differ from normal computers)
    b. A comparison of Arduinos and at least one other microcontroller (E.g., Raspberry Pi, PSOC 5)
2. Serial Communication
    a. An explanation of Universal Serial Bus
    b. A comparison between wired and wireless communication (Pros and Cons)
3. Ultrasonic Sensors
    a. How do ultrasonic sensors work?
    b. What are the use cases, and what are the pros and cons of ultrasonic sensors versus other potential alternatives for those uses?
4. LCD Displays
    a. What is an LCD display and how does it work?
    b. Difference between LCD displays found on modern televisions/similar displays and the LCD display used in the assignment.
5. Light based Sensors
    a. How does an infrared sensor such as in the assignment work?
    b. What is the difference between an infrared sensor such as in the assignment, and a LIDAR (Light Detection and Ranging) device?

Note that students within a group cannot write a report on the same topic. I.e., if a student takes topic 1 in group A, no other student in group A may write on that topic. E.g., if a student in group A chooses topic 1, no other student in that group may write on that topic. Topic choices must be agreed upon and communicated with the lecturer.

The marks for the reports are distributed as follows:

Task Description	Marks
Part A: Lab Report Category: Marks Group organisation: 5 Experiment Methodology: 20 Results and Conclusions: 10 Referencing and Layout: 5	40
Part B: Background Information (Individual) Category: Marks Literature Review: 15 Referencing and Layout: 5	20
Total	**60**

* It is up to the members of each group to divide the background information

Part C – Programming Tasks (Group)

Your will need to demonstrate communications between two Arduino computer systems for the following tasks. It is recommended to use the wire.h library and a wired connection. Instructions on how to make this connection will be given.

The code used for both Arduinos must be uploaded for all tasks.

Task Description	Marks
Task 1: Demonstrate the button on Arduino A turning on an LED on Arduino B.	5
Task 2: Using software, convert an analogue reading from an infrared sensor on Arduino A into a binary value that matches the digital reading. Display the analogue reading and the *software derived* digital reading on the LCD connected to Arduino B.	10
Task 3: Display the ultrasonic sensor reading from Arduino A on an LCD connected to Arduino B. Both the distance, and the "raw" data reading should be displayed in relevant units.	10
Bonus Task: Display the results from Task 2 and 3 on the LCD display of Arduino B simultaneously (5 Marks for completion, 5 Marks for legibility)	10
Completion of any one of the tasks above (Demonstrates communication between Arduinos)	5
Total	**40**