School of Science, Computing & Engineering Technologies

Project Tasks

(On – campus Classes)

ENG20009

Engineering Technology Inquiry Project

Semester 2 2023

Unit Convenor: Dr Rifai Chai

Industry:

ThermoFisher SCIENTIFIC

Thermo Fisher Scientific Australia Pty Ltd

https://www.thermofisher.com/au/en/home/

Contact person:

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Thermo Fisher Scientific Inc. is an American supplier of scientific instrumentation, reagents and consumables, and software services. According to company figures, 46% of its sales are in life sciences, 20% in healthcare, and 34% in industrial/environmental and safety. One of their product is data loggers to be used as a monitoring device in various application for example in industry and environmental.

For interfacing with the end sensors, the two most popular communication protocol can be used are SDI12 and MODBUS. Learning to design protocol-based sensor and data logger are very much suitable in ENG20009, Engineering Technology Inquiry Project.

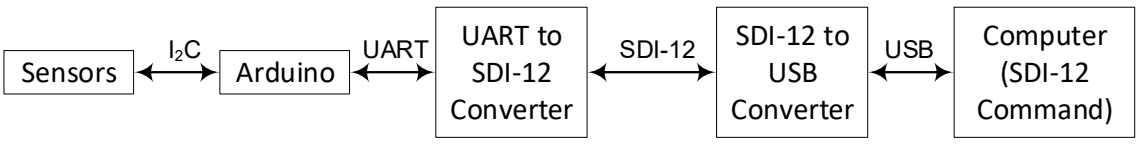
General Information:

This unit of study is a project-based unit in which students work in teams and aims to provide the skills to enquire and solve challenges oriented around engineering technologies.

For the portfolio project, you will work in a group of 5 students. Your team will be formed on the first week of your laboratory class. The project tasks will generally involve planning, design, construction, programming, testing and debugging. When you form the group, discuss allocation of these roles among your team members. Moreover, you should be actively involved in the discussion of each task design and fully understand the design details of your entire project, although some designs do not belong to your main role. It is advised that each team should choose a team coordinator to lead the team and chair group meetings.

1. Block Diagram of the Project

SDI12 Sensor



In the project task, students will work in a group consisting of 5 students to develop an SDI-12 sensor and data logger. The block diagram above shows the diagram of the SDI12 sensor and interface that will be used in this unit. In addition, the diagram also shows the testing of the sensor from the computer. The components are started from the raw sensor with different types including:

- BME680 - Temperature, Humidity, Pressure and Gas Sensor
- BH1750FVI - Digital Light intensity Sensor

Each group use the two sensors and each sensor will be connected to the Arduino via the I2C. As soon as the data is received, this will be put together and transferred to the UART interface with the SDI commands capability.

For testing the sensor:

- For SDI12, we will need UART to SDI-12 and SDI-12 to USB converter. The USB can be connected to a computer and it's ready for testing with the SDI-12 commands.
- A serial port (COM) terminal emulation program can be used to test the SDI-12 commands from computer to the SDI-12 sensor. One of the terminal emulation program can be downloaded from : https://sites.google.com/site/terminalbpp/

Pass: Design Requirement – SDI12 sensor module

- Program the Arduino to read the relevant data from the sensor module
- Use address = 0 for this SDI-12 sensor module by default.
- Program the Arduino based on the SDI-12 communication protocol so it can understand the SDI-12 commands, at least 5 commands below

Name	Command	Response
Address Query	?!	a<CR><LF>
Change Address	aAb!	b<CR><LF>
Start Measurement	aM!	atttn<CR><LF>
Send Data	aD0! . . . aD9!	a<values><CR><LF> or a<values><CRC><CR><LF> a<values><CR><LF> or a<values><CRC><CR><LF> a<values><CR><LF> or a<values><CRC><CR><LF> a<values><CR><LF> or a<values><CRC><CR><LF> a<values><CR><LF> or a<values><CRC><CR><LF>
Send Identification	aI!	allccccccccmmmmmmvvvxxx...xx<CR><LF> Use the following information: a – sensor address (default =0) ll – SDI-12 version compatibility (use = 14) cccccccc – 8 character, use 'ENG20009' mmmmmm and vvv = 6 + 3 character, use your 9 digit student ID. Xxx – ignore this.

A complete SDI-12 protocol/commands can be found at the following link:

https://www.sdi-12.org/current_specification/SDI-12_version-1_4-Jan-30-2021.pdf

Credit: Design Requirement – Standalone data logger

- Create Menu in the system with buttons, LCD to select different sensors;
- Save the selected sensor data and RTC into the SD CARD
- Display the data on LCD with the relevant graphical representation.

Distinction and High Distinction: Design Requirement – Interrupt and Advanced Interrupt

- Applying interrupt service routine to program the SDI-12 sensor above.
- Applying event-driven programming using interrupt and advanced interrupt-driven programming.

Portfolio – Project Assessments:

Portfolio - Project i) Portfolio Project Brief (10%) ii) Portfolio Project Demonstration (35%) iii) Portfolio Project report (15%)	Group/ Individual Individual Group Individual	60%	1, 2, 3, 4, 5	i) Sep 1, 2023 by 23:59pm (End of Week 5); submit in Canvas ii) Your on-campus workshop class in week 12 & project codes due in week 12. iii) Nov 3, 2023 by 23:59pm

(i) Project Brief

- Project planning and task division of each member. Particularly your individual tasks can be explained in more detail.
- Literature review on one of the applications of the SDI-12 sensor. The application of the SDI-12 sensor can be based on selected majors (electrical/electronics, software, robotic &mechatronics and software). This can be included a review of the hardware and software/firmware.
- The structure of the report includes the following:
  - Introduction (project planning and task division),
  - Main body of the review
  - Conclusion
  - References (IEEE style), please ensure there is in-text citation in the main body of the review.
- The report uses the IEEE, two-column format with a maximum of 4 pages. Template can be obtained using the following link: https://www.ieee.org/conferences/publishing/templates.html.
- The report must be submitted as a single PDF, which must be named as 'your group ID-PB'. For example: 12345678-PB.pdf

(ii) Project Demonstration

- To demonstrate project according to the design requirements.
- Each student needs to complete the Peer Review form by Week 12.
- One student in each group must submit a copy of project code demonstrated in class by Week 12.
- The code must be submitted as a single compressed ZIP file, which must be named as 'your group ID-PC'. For example: 12345678-PC.zip.

(iii) Project Report

- Individual submission.
- Flowchart or pseudo code of the project tasks based on the task division. This is only for the codes that you programmed and contributed.

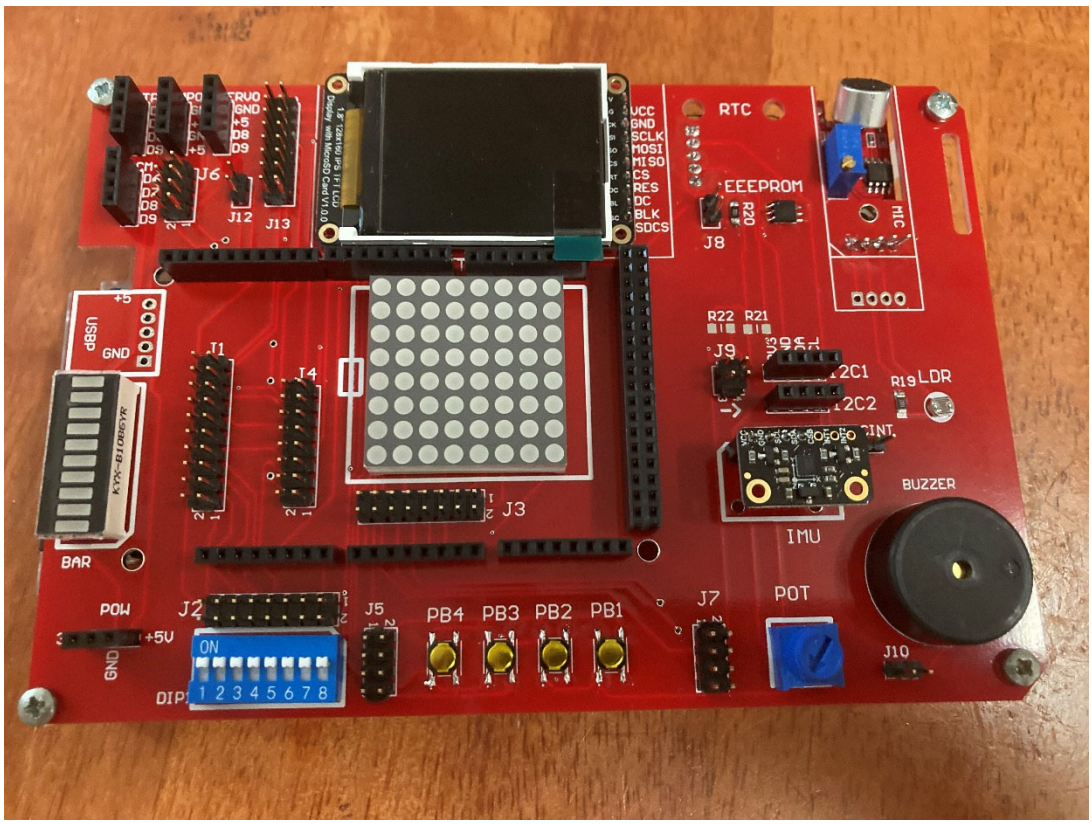
- Risk Assessment for each application of the sensor.
  Please use the information/provided with the General Risk Assessment (Week 8). You can choose to be applied to the project of this unit or one of the applications that you used in your project brief assignment.

- Reflection on the relevant knowledge learned in seminar, facilitation, lab and workshop for project work.

- Reflection on the teamwork according to the unit learning outcomes:
  1) How you function as an effective team member
  2) How you communicate with teams and stakeholders using appropriate verbal, written and technological approaches to get the project done.

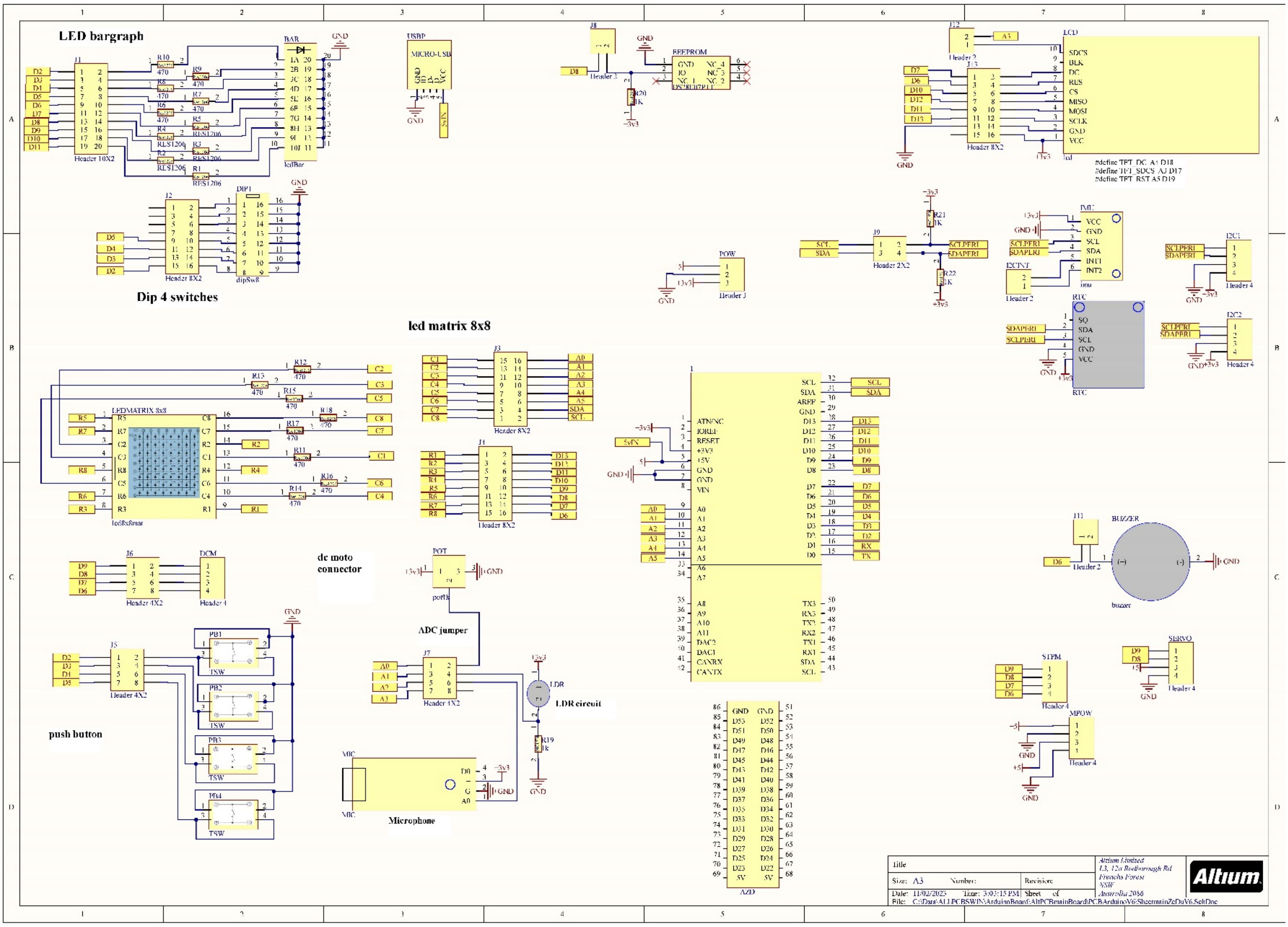
- The report must be submitted as a single PDF.

Hardware - Project Board – Front View:



Hardware - Project Board – Back View (Arduino Due):

Hardware - Project Board – Schematic:


LED bargraph
Dip 4 switches
led matrix 8x8
dc moto connector
ADC jumper
LDR circuit
Microphone
push button
Altium