

## Microcontroller Applications (EMC3006) AY2023/2024 (Apr Semester)

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### Project

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#### Weightage:

The project contributes 50% of the coursework.

#### Submission Dates:

Week 7: Design Submission	*[29 May – 2 Jun 2023]
Week 11: Checking of Project Board Wiring	*[26 – 30 Jun 2023]
Week 13: Interim Assessment	*[10 – 14 Jul 2023]
Week 17: Final Assessment and Report Submission	*[7 – 11 Aug 2023]

\*To be demonstrated and/or submitted during the lab session of that week.

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# 1 Projects

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Your facilitator will discuss and assign one of the following projects to your group:

## 1.1 Project 1: Hydroelectric Dam

Hydroelectric power is one of the oldest and biggest sources of renewable energy which uses the natural flow of moving water to generate electricity. Hydropower currently accounts for about 30% of the total renewable electricity generation and about 7% of total electricity generation for country such as America.



Hydroelectric Dam [Source: constructionreviewonline.com]

The government has invited companies to tender for a new hydroelectric dam project. Your company HydroGen is keen to participate in the project tender. Your team is tasked to design and produce a prototype for the project proposal. The hydroelectric dam must maintain a safe water level as well as producing a steady supply of electricity for a town near the dam.

A microcontroller system will be used to produce the prototype. The hydroelectric dam should have the following specification:

- Able to monitor and display the temperature of the river or control room.
- Able to monitor the water level in the river.
- Able to open and close the gate of the dam periodically to generate a steady stream of electricity supply.
- Able to automatically open the gate of the dam to release excess water when the water level in the dam reaches a minimum allowable level.

- Able to produce an alarm together with flashing lights before the gate of the dam is opening or closing to warn the people around the vicinity.
- Able to provide a safety overriding feature, so that the operator can open or close the water gate manually in case of emergency.

Additional features should be added if necessary.

## 1.2 Project 2: Aquaculture in Singapore

Singapore aims to produce 30% of its nutritional needs by 2030. This vision includes indoor fish farming.



Indoor Fish Farm [Source: Wikimedia Commons]

In indoor fish farming, the temperature of the water in the containment tanks is monitored to ensure that the fish can thrive in their preferred environment where they will grow well. To ensure the quality of the water, food waste and fish excrement are periodically being removed. The tanks are also aerated or oxygenated to maintain optimal oxygen levels in the tanks. Water recirculation is also a feature in such fish farming systems to minimise water usage.

Your company AquaGen is keen to use technology to support fish farmers in increasing fish production and reducing reliance on manual labour. Your team is tasked to produce a prototype for the automated aquaculture system using microcontroller system that has the following specifications:

- Able to monitor and display the temperature and/or other parameters in the water tanks.
- Able to regulate the aeration or oxygenation automatically when the oxygen level is detected to be low.
- Able to alert the fish farmers through an audible tone as well as to suitably display when the water conditions are not ideal.
- Able to regulate treated water into, and effluent water out of the tanks to exchange water to maintain the quality of the water.

Additional features should be added if necessary.

## 2 Tasks

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To develop the prototype solution for the selected project.

Develop the project prototype using the following microcontroller software features with the hardware components on the project board:

- Software Features:
  - Polling of input pins
  - Interrupts
  - Timer
  - Analog-to-digital conversion
- Microcontroller project board with:
  - Onboard trimmer and/or external potentiometer
  - LEDs, switches, push-buttons
  - Seven-segment display
  - 16 by 2 LCD
  - Speaker
  - Light-bulb and/or motor

e.g. Reading from the analog device through ADC and display the value on the 7-segment or LCD.

## 3 Deliverables

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The project deliverables are broken down into the checkpoints described below:

### 3.1 Design (10%)

Your group is required to submit a project plan which includes the following:

- Problem identification and requirements gathering
- Tasks assignment and integration plan with schedule
- Port pin assignment and block diagram
- Flowchart and program design map

Please refer to the template provided in MCAPP subject's site in BrightSpace.

### **3.2 Interim Assessment (15%)**

Your group is required to demonstrate in class the progress of your project implementation. Your group shall use the project rubric as the guideline. Each team member is supposed to demonstrate his/her portion of the program. Integration of the program with other team members in your group is also encouraged as this will help your group prepare for the final assessment. Each member will need to keep a copy of your individual working program that has not been integrated and demonstrate to your supervisor before you demonstrate the partially integrated program.

### **3.3 Final Assessment & Report (25%)**

Your group will demonstrate the project to your lecturer. Students will be assessed on the project integration (group work), individual's work and individual understanding of the technical details. Each group is also required to submit a project report with supporting details of their project implementation and integration plan. The report template will be provided in MCAPP subject's site in BrightSpace. Please refer to the project rubric for more details.

#### **Other Documents in BrightSpace:**

- Project Rubric

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