DESN2000 MECH // 2022 T3

Project Brief on Energy Harvesting Device

Project Description

Energy harvesting refers to the process of converting ambient energy present in an environment into electrical energy. The harvested energy can be utilized, in innovative ways, to power devices in the environment. In this project, you are tasked to follow the course-taught process and methods to design a new energy harvesting device. For this MECH project, your energy harvesting device is limited to a **mechanical or mechatronic system.**

An energy harvesting device can be designed to harvest various kinds of energies, such as solar energy, light energy, thermal energy, airflow energy, sound energy, and kinetic energy. Some examples of these forms include wind, waves, linear motion, rotation, machinery vibration, and human motion.

Your energy harvesting device shall require three key modules:

1. The **energy accumulation** module functions to derive energy from an external source outside the energy harvesting device.
2. The **energy storage** module functions to store the accumulated energy inside the energy harvesting device.
3. The **energy utilization** module utilizes the harvested energy to power other small devices such as sensors, heating/cooling devices, actuators, and low-power devices.

For this project, you are expected to focus on the **accumulation** and **utilization** modules. No design specification is expected nor required for the energy storage module.

To promote design innovations, you are strongly encouraged to think outside the box throughout your design process. You are allowed some **degrees of design freedom** to freely define the environment from which to harvest energy, what kinds of energy to harvest within your defined environment, and how to utilize the harvested energy to power your chosen device(s). Example environments for energy harvesting may include transportation (e.g., various road, rolling stock, or aerospace vehicles), civil infrastructure (e.g., roads, railways, bridges, and buildings), robotics (e.g., unmanned aerial systems, underwater ROVs, ground vehicles), intelligent supply chains (e.g., factories, production lines, supply chain transport), etc.

You are expected to accomplish this project using design knowledge and technical knowledge gained from DESN2000. On the one hand, it is important to follow the course-taught design process to conduct conceptual design systematically. On the other hand, it is equally importance to address specific technical facets of the energy-harvesting device. You are expected to demonstrate in-depth understandings of both design knowledge and technical knowledge through your project deliverables.

Your energy harvesting device design must comply with a set of design constraints as follows:

- The overall cost of the energy harvesting device should not exceed $10,000 AUD.
- The energy harvesting device shall comply with relevant regulations on safety in Australia.
- Any additional design constraints and risks identified and predefined by each project team.
- The energy harvesting device shall address two technical subsystems taught in the lectures. Options include sensors, fasteners, power transmission, or materials.

A note on teamwork

Engineering design is a collaborative endeavour. You are therefore required to complete the project as a member of a project team, which consists of 6-7 students from your workshop/tutorial session. Your demonstrator will facilitate weekly workshop sessions, where the team work together and progressively on various facets of the project. It is important to work together efficiently as a team to achieve timely deliverables towards a successful completion of this project. Every team assessment will be accompanied by a confidential team evaluation to gauge individual members' contributions. The team evaluation result will be used, as weighting factors, to convert a team grade into individual grades for different team members.

Deliverables

This project will lead to both individual deliverables and team deliverables.

The individual deliverables include the reflection and documentation of each team member's individual design process and project management. The individual deliverable will be materialized into a digital design journal, which should be independently completed by every team member.

The team deliverables include requirement documents, functional modelling, material selection, detailed design of key mechanical components, 3D CAD models of design concepts, 2D mechanical part drawings, and bill of materials. The team deliverables will be materialized into one design report, one interim design presentation, and one final design presentation. Specific deliverables may be required depending on your technical subsystem such as pseudocode, circuit designs, material selection graph analysis, calculations etc.

The project deliverables are encapsulated within the course assessments, which will be detailed in the corresponding assessment guides. You are expected to familiarise yourself with these documents in tandem with this project brief. In general, the deliverables will be assessed on the basis of:

(1) Provision of sufficient design details
(2) Technical robustness of the design solution
(3) Novelty and feasibility of the design solution
(4) Quality and professionalism of documentation

Course assessments overview

The following table summarises the assessments associated with this project. Detailed guidance and rubrics for every assessment will be provided in due course. The design journal is intended for each student to document his/her design process and project management. The interim design presentation is intended for each team to present its progress as a whole and for every team member to present his/her individual progress and planning. The final design presentation is intended for each team to present the final design to the target audience, and the final design report is intended for each team to present the final design with sufficient details in written.

Deliverable	Weighting	Week due
1. Interim Design Presentation (progress review)	20%	Week 4
2. Individual Design Journal	20%	Week 5
3. Final Design Presentation (pitch)	20%	Week 10
4. Final Design Report	40%	Week 11