

Evaluation Rubric: 30 Points

November 16, 2023

The workshop course is provided by technology-oriented engineering department. The goal is to understand technologies but also to foster motivation and active involvement of groupwork. The assignment given to the students was as follows:

1. Kinematic Synthesis of Mechanisms <Train Gap Filler>

The gap between the train and the platform at train stations is a significant safety hazard, often leading to accidents. This risk is especially high for children, the elderly, and individuals with physical disabilities with wheelchairs. The challenge is to devise a mechanism that effectively mitigates this danger.

2. Kinematic Synthesis of Mechanisms <Say “NO” to Door Knobs>

This project develops a new mechanism for touchless doors, inspired by the widespread unease with touching door handles in public spaces like schools, hospitals, and restrooms during the Covid-19 pandemic. This design aims to eliminate the need for physical contact with door knobs.

3. Net Zero X <Carbon Dioxide Removal>

Given that emissions of CO₂ are produced by all sectors of society, identifying effective ways to capture CO₂ and store it safely is crucial. Create methods to extract CO₂ from the air and separate it into its constituent elements, carbon and oxygen, and explore how these elements can be repurposed effectively.

4. Net Zero X <All Electric Airplane>

The objective of this project is to develop a strategy for reducing CO₂ emissions from airplanes. It involves researching the current challenges faced by the airline industry regarding CO₂ emissions and conceptualizing an all-electric airplane as a viable solution to significantly lower these emissions.

5. Radioactive <Science Communication on High-Level Radioactive Waste>

High-level radioactive waste (HLW) is created by the reprocessing of spent nuclear fuel. Storage cannot provide the permanent isolation of the wastes from human's environment. This workshop aims to reveal the current conditions and possible disposal methods of HLW, and understand ways of dealing with real social issues.

6. Monster Track <Damages on Infrastructures by Oversized Vehicles>

The oversized loading induced an excessive external load which exceeds load-carrying capacity of bridges, resulted in collapse incidents. Clarify the common challenges in protection of infrastructures during their life cycle from oversized vehicles and come up with initiatives and solutions to this issue.

Around six students formed groups and challenged one of the above six problems in seven 3-hour workshops: ideation, interim report, prototyping, final report, and a reflection essay at the end. Each student is requested to create an individual reflection essay including the following descriptions.

- Project description (300-400 words)

Title, goal and conclusion of the project

Process of the project: how you applied design thinking methods

- Contribution (300-400 words)

Your role in the project

Your contribution to the project

- Reflection (200-300 words)

Write freely but we are interested in what you learned from the series of workshops not only professional knowledge and skills but also how to contribute to and facilitate the workshops

Here is a student essay to be evaluated.

[STUDENT ESSAY]

I belonged to the Monster Truck group for the SHIP course this semester. Monster Trucks refer to over-height or over-weight vehicles that cause a great deal of damage to infrastructures. Recent cases of problems due to Monster Trucks include how over-height vehicles crashing into bridges crossing overhead, or the constant load of over-weight vehicles causing cracks and failures on roads over time. The goal of our team was to develop a creative solution that will prevent these accidents from happening in the future.

In order to accomplish this goal, first, each team member did a background research on current countermeasures. From this research, we found different countermeasures in different countries, including the placement of height clearance barriers, vehicle weight measuring checkpoints, and height measuring checkpoints. However, accidents by oversized vehicles repeatedly happen, and they are still a critical issue to the safety of road. Considering this reality, our team critically re-evaluated the current countermeasures. This evaluation helped our team to find key points such as limitations of current countermeasures, and what can be improved.

Based on this knowledge that we gained, our team moved on to our key mission, which was to tackle the issue of Monster Trucks. Individual brainstorming and research about possible new solutions were done, and was presented to the whole team during sessions. In this process, our team succeeded in coming up with several ideas, including using drones to detect oversized vehicles, implanting sensors to existing measuring checkpoints, and making ID cards that detect which vehicle is violating the height limits. Ideas which were similar or used the same technology were combined.

Finally, our team decided on approaching the Monster Truck issue from 3 solutions; UAV recognition system, Transport ID, and the Smart Toll Gate. From this point, our group broke up into 3 pairs, each in role of one solution. Within the pairs, each solution was developed further. Pairs decided the design, evaluated the feasibility, checked the technology required for the solution they were in charge of. By this way, the solutions were specified. In the sessions on Friday, each pair gave presentations of their achievements of improving their solution and gave feedback to each other. In the last few sessions, presentations of each solution were combined and edited to construct the final presentation from the Monster Truck group as a whole.

Each member of the Monster Truck team played an important role and contributed to the team throughout the project. My greatest contributions were finding the technology of WIM, and developing the design of Smart Toll Gate.

In the process of background research about our project, each member was assigned a country to do research on. I was in role of searching countermeasures taken in the United States of America, due to my personal background living there as a child. In order to tackle the issue of Monster Trucks, USA was using height clearance barriers which were bar like structures that notified the height limit to the drivers. Moreover, certain routes were designated only for large sized vehicles to prevent large vehicles from causing issue on regular roads. Additionally, what was the most interesting was the system called WIM. WIM stands for Weigh-In-Motion, and this system weighs the vehicle as it passes over a section on the road with sensors implanted underneath. In one of the classes, I introduced these solutions to my team, as examples of ideas we could build up on for our own creative solution.

Next, in the process of developing our original creative solutions, my largest contribution to the team was insisting the usage of a new version of WIM. Here, there were still several concepts to consider, such as the cost and feasibility. I contributed to the team by suggesting using a simple design to cut costs, or constructing WIM in key points like toll gates, where several oversized vehicles pass by. Due to the fact that another team member was thinking of a plan of measuring height with sensors at the toll gates, we decided to combine our ideas. This innovated version of a toll gate, which our group decided to name the Smart Toll Gate, aims to efficiently measure height and weight simultaneously. However, at this point, our idea was nothing more than a general imagination. Therefore, we spent

much time discussing about the specific design, and researched what kind of technology will be required. I insisted to place the WIM before the toll gate and the height sensors inside the toll gate. Additionally, using the same sensors used in the toll gate, we decided to place them before structures including bridges or tunnels, to prevent oversized vehicles from entering areas where height is limited. Throughout the workshops in SHIP course, I acquired several skills and also gained knowledge from fields in Civil Engineering and Mechanical Engineering.

In the group discussions held each week, I improved my skill on discussing, thinking creatively, and presenting. In some of the earlier discussions, it was in fact somewhat difficult for me to discuss due to my lack of background knowledge in Monster Trucks, and uncomfortableness in group work. However, as the course moved on, my research ability improved, and I was able to get more involved in group discussions. I became more confident in discussing with my group, which lead to myself making better individual presentation. Additionally, with the help of my group members, I improved on thinking more creatively. Some ideas seemed impossible at first, but with thorough research and planning, we were able to develop it to the level of using the solution on site.

Moreover, from the weekly presentations from other groups, I learned several facts related to fields in Civil and Mechanical Engineering. I never knew the how surveys on radioactive power were imperative. Presentations from the Mechanical Engineering taught me that creativity in their field is the key to solving daily issues such as the gap between train and platform, making automatic doors, and so on. Groups working on stopping CO2 emission especially surprised me with the idea of using electric planes.

Overall, from SHIP, I was stimulated in several ways. Many of the international students amazed me and acted as role models in how to facilitate discussions, make questions, and present in a way that will improve each other. Interaction with different majors also let me learn topics I was unfamiliar before.

[END of ESSAY]

Please do the followings:

1. First, define a rubric that will serve as the evaluation criteria.
2. Explain the existing theory behind determining the above rubric.
3. Use the rubric to evaluate the student's reflection essay above on a scale of 30 points.
4. Explain the reason why you gave the above points.

1. Evaluation Rubric Definition

The evaluation rubric for the student's reflection essay will be based on three primary criteria, each with a maximum of 10 points, leading to a total of 30 points. These criteria are:

Content and Clarity (10 Points): This measures how well the student explains the project, their role, and their contributions. It assesses the clarity of thought, depth of explanation, and how effectively the student communicates the project's goals, process, and outcomes.

Reflection and Learning (10 Points): This criterion evaluates the depth of the student's personal reflection. It looks at how well the student articulates what they learned, both in terms of professional knowledge and skills, and in terms of their ability to contribute to and facilitate workshops.

Structure and Organization (10 Points): This assesses the essay's overall structure, including the logical flow of ideas, coherence, and adherence to the requested format (including word count for each section).

2. Theory Behind the Rubric

The theory behind this rubric aligns with educational assessment principles, emphasizing content mastery, reflective learning, and effective communication.

- **Content and Clarity:** Reflects Bloom's Taxonomy where understanding and applying knowledge are key. It's crucial for students to clearly articulate what they've learned and how they've applied it.
- **Reflection and Learning:** Based on reflective learning theories, which posit that deeper learning occurs when individuals reflect on their experiences. This criterion assesses the student's ability to introspect and learn from their experiences, an essential aspect of adult learning theory.
- **Structure and Organization:** Rooted in basic principles of writing and communication, where the ability to organize and structure content effectively is essential for clear communication of ideas.

3. Evaluation of the Student's Reflection Essay

- **Content and Clarity: 8/10**
 - The student effectively describes the project, their role, and contributions. However, there could be more depth in explaining specific outcomes and conclusions of the project.
- **Reflection and Learning: 7/10**
 - The student shows a good level of reflection, especially in discussing skills gained and insights from other groups. However, deeper personal insights or more specific learning outcomes could enhance this section.
- **Structure and Organization: 9/10**
 - The essay is well-structured, with clear division and logical flow. The student adheres to the format, but minor improvements in transitions and coherence could be made.

4. Explanation for the Assigned Points

- **Content and Clarity:** The student did well in articulating the project, their role, and contributions. However, the essay could benefit from more specific details about the project's outcomes and the student's direct impact on these outcomes.
- **Reflection and Learning:** The reflection is good, indicating learning from the project and other groups. However, more profound or personalized reflections, linking learning to future applications or personal growth, would have strengthened this section.
- **Structure and Organization:** The essay is well-organized and follows the requested format. It effectively guides the reader through the project and the student's experiences. Minor improvements in linking ideas for a smoother flow would make it even more coherent.