EEET2610– ENGINEERING DESIGN 3

Self-reflection and Peer Evaluation

Tutorial Session 2

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Team F

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Table of Contents

ABSTRACT

This report is a brief evaluation of Team F team members as well as the student Truong Tan Gia Huy's contribution to the quadcopter design project. It highlights the individual's contribution, collaborative efforts, challenges encountered and solutions implementation during the semester. The report emphasizes the importance of effective communication, teamwork and technical skills to achieve a common goal. By including constructive peer evaluations that focus on the strengths and areas for improvement within the team, it also provides insights into getting more experience and personal growth of each team member throughout the project. Overall, this report summarizes our experience in turning a concept into a real, working quadcopter and provides insightful visions for better drone designs or similar projects in the future.

SELF-REFLECTION ABOUT THE PROJECT

Throughout the design process of the quadcopter, our team have successfully ultilized all the electrical and other components to create a closed system of the drone. In general, the drone's basic functions such as receiving control signals from the controller (including pitch, roll and yaw maneuvers), and potentiometer signal to increase the motors' speed, work perfectly well. The MPU module is also responsive, along with the PID controller embedded in the ESP32 module. The motors react with the MPU output, combining with the PID gain controller to adjust the motors' speed accordingly towards the changes in its orientation. However, the drone could not balance itself yet during the demonstration due to several issues. Our team was faced with various challenges and difficulties along the process. Firstly, the main reason why proper PID tuning is not ready yet is due to time limit. Since the beginning of the semester, our team had broken some components, including two ESCs, three PDBs and two 3D printed parts as motor holders. In most cases, the electrical components are burnt due to short circuit. These incidents severely delayed our initial plan since soldering back all the wires for the ESCs and PDBs is extremely time-consuming. Secondly, I was careless to drop one of the 3D printed part from table height, moreover, there was a terrible error with the software during the testing in the workshop room with the lecturer that caused quite an accident, leading to two 3D printed parts breaking. Another issue with time management is that none of the members own or could borrow a tripod for testing the drone, therefore, balancing experiment could not be performed. There are also some problems with the drone's design and appearance such as wiring management, PCB design or components placement, all of which could have been carefully researched and improved.

Notwithstanding, thanks to the team's dedication and effort, we still managed to complete the drone assembly and ensure its basic function. The challenges we deal with could be described as follows. In the first half of the semester, the team members are greatly cooperative and the workload is divided equally. However, when we reached the end of the semester, everyone got busy with their assignments and deadlines, which caused job delays and improper work. For instance, when the drone was approximately 80% finished, only four members (Long, Duy, Tu and me) are the only members to continue the finalization of the project, who spent more time having personal meetings on campus for further testing and troubleshooting as well as had appointments with the lecturer for assistance. Meanwhile, the remaining members are busy with their work or do not have significant support for the project, although they are all eager to help.

I have made significant contributions to my team. Being the team leader, it is my responsibility to establish benchmarks, draw out concise insight, formulate project plans, and serve as a role model for others to emulate. At the start of every report, I prepare the template and assign specific tasks to each member, with their arrangement and agreement. I hold weekly group meetings via Microsoft

Teams to check the team's working progress. In the project proposal report, I did half of the introduction, team contract, conclusion, references and did the editing which perfected the report's format by checking for errors in vocabulary and grammar, paragraph alignment, character size, spacing and so on. After completing my tasks in the report, I helped other members by giving instructions and inspiration for the contents of their parts. Next, about the technical contributions, I mainly handled the CAD model and PCB design, as well as assisting other members' tasks.

CAD Design

The 3D model attaching the motors to the drone's arms was originally designed by myself, later, with some advice from my partner – Jeon Mina, I did some adjustments and optimized the model shape and thickness. Although the model design was carefully considered with all the members' opinions as well as approval from the lecturer, the model design was not optimal and rather fragile. For instance, one 3D printed part is broken just from a fall at table height. It could be redesigned to improve its durability.

PCB Design

The PCB is optional since the University does not support PCB printing on campus, however, I decided to have it fabricated outside of campus for convenience purpose. Similarly, the PCB was designed by myself at first, then with Mina's support, also I had an appointment with the lecturer to confirm and consider whether the PCB design was ready for printing. Despite various considerations, the PCB design problem was just discovered after they were printed and the components were installed. Which, this problem could have easily been solved by ensuring its pin layout from other teammates.

Apart from my tasks, I also helped with other members' tasks and spent my effort to complete the drone as soon as possible. I usually arrive at the lab during lecture sessions to ask for assistance and advice from the lecturer. Moreover, I always arrive at the tutorial session before my session to spend more time with the mechanical assembly and look for inspiration from other teams, also to identify whether we keep track of the project's plan so that I could give instructions to my teammates when they arrive later on, make sure we are on track. Specifically, the mechanical tasks include wire connecting, soldering and drilling holes for the propellers. This is crucial since our team broke a lot of the equipment, so I need to attend as many sessions as possible in order to compensate for this issue. I am also in charge of sending emails to the lecturer for components' fabrication, book appointments and inquiry justification.

I was able to effectively lead and direct my teammates throughout the project, completing all of my work and responsibilities. However, I could have been better if my team members had been better informed and connected, especially near the demonstration day, when the drone performance could have been flawless.

Throughout the semester, the University has generally provided adequate infrastructure and equipment. Notwithstanding, there have been some issues that have caused certain inconveniences and time waste, particularly in terms of equipment availability. For instance, the University should have provided with all necessary equipment and components, such as PDB, battery connectors, wires and pins. We had to purchase these items at our own expense from an electronics store, which seems excessive and should have been included in our tuition fee. Additionally, there has been another issue with the lab equipment, particularly the electric drill. While it is convenient that the drill uses batteries to eliminate messy wires, the fact that no one charges the battery after usage means that the next group to use the drill must wait for it to be charged before it becomes available, resulting in loss of valuable time. I should have been more careful and attentive in my approach. If I had asked my teammates more thoroughly and paid closer attention to the details, I could have avoided making avoidable mistakes.

Quadcopters, or drones will always have immense potential for future growth and application, particularly in the context of student projects. Lessons have been learnt from mistakes and learnt from experience to significantly improve their usability and reliability. As technology advances, more technological equipment could be implemented into these drones such as greater range of sensors to enhance flight control, improve stability and maneuverability. Thus, drone innovation will be utilized to extend beyond their traditional applications like commercial or military sectors, to become more creative and socially impactful in areas such as environmental monitoring, natural disaster management or delivery services.

PEER EVALUATION

After more than 10 weeks of collaboration between members, I concluded a few opinions about each member, regarding their work in this project. I give my marks to my teammates their contribution score on a scale from 0 to 10 regarding their contribution this semester.

Pham Trinh Hoang Long - s3879366

- **Contribution Score: 10**
- **Description:** Long is a hard-working member, always follows instructions, and finishes the assigned tasks fast and on time. During the project, Long mostly contributed to the coding for the drone along with two other members, Duy and Tu. He has done testing and integration of IMU and GPU modules, developed a

streamlined communication between the two ESP32 (including sending potentiometer, joystick and buttons signals from the controller to the drone), calibrated 4 motors, done PID tuning and created a response integrating the controller components appropriately. Long is willing to help and has come several times outside class for further testing with the drone, had meeting with the lecturer for advice along with other members. Long also finished his parts in the Project Proposal report the fasted among others.

Huynh Ngoc Duy – s3924704

- **Contribution Score: 10**
- **Description:** Although he is a bit slower in thinking and processing than other members, Duy is willing to cooperate with everyone. Duy worked on the coding along with Long and Tu, including implementing the controller, small contributions in MATLAB visualization and support with drone testing outside class and meeting with the lecturer with other teammates. Duy is also punctual with his tasks and arrival at tutorial sessions.

Tran Thanh Tu – s3957386

- **Contribution Score: 10**
- **Description:** Similar to Duy, Tu is always ready to receive tasks and cooperate with Duy and Long with the coding for the drone, including working with the controller components communication with the drone, especially the IMU and GPS module, is the one did MATLAB data visualization. Although Tu is sometimes absent from tutorial sessions due to health issues, he still keeps in touch well with other members and keeps track of the project.

Tran Truong Son - s3818468

- **Contribution Score: 9**
- **Description:** Son is a cheerful member and has some experience with mechanical tasks such as wire soldering and connecting, and hole drilling. Therefore his main work is mechanical work and assembly of the drone's components. Although Son did finish his tasks in time, he waited until near the deadline to do his work instead of progressively finishing the work. Moreover, Son has a bit of obsessive-compulsive disorder (OCD), and always aims for perfection, therefore it is sometimes troublesome and time-consuming when he does the mechanical work during the tutorial session. Another issue is that Son could not create the switch for the battery as a safety feature, although Son was already informed by the team leader a few days before the meeting with the lecturer for the final testing of the drone.

Vu Thien Nhan – s3810151

- **Contribution Score: 9**
- **Description:** Nhan is a friend of Son and they work together. He also has some experience with mechanical tasks, therefore Nhan did the mechanical work as well. Since there are too many people in our team, Nhan is not well-assigned with tasks, moreover, he is busy for half of the week with personal tutor, so Nhan could not contribute much to this project. Nhan also did not actively ask other members about the project's progress. However, Nhan did give some useful advice for the drone's components setup and did good troubleshooting.

Jeon Mina – s3764040

- **Contribution Score: 8**
- **Description:** Mina is quite a timid member, but she still trying to find every possibility to contribute more to the project. She did complete her tasks well and on time with report writing and support with CAD design. However, she often did not actively ask other members about the project's progress. Our team's main means of communication is through Facebook Messenger, but Mina is usually late at keeping in touch with everyone. She only replies to other members' messages after a few days after the messages are sent.