ENG 4001 Project Management Plan

Miniature Underwater Drone

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1 Project aim and scope

Our project aims to develop a reliable, efficient drone that can undertake simple tasks such as underwater exploration in various underwater environments. Our underwater drone should have the capability to dive to an assigned depth, observe the environment with a camera and transmit data, allowing it to operate in shallow water, and confined spaces. Advanced objectives could include recharging in water and collecting samples for analysis. However, this project will only include the basic functions of an underwater drone, further techniques such as monitoring the health or temperature of the sea or water will not be included. After being developed, our project techniques could also be stored for further improvements and other projects.

2 Background

Underwater drones have become an essential tool for exploring and investigating the ocean environment (Mayer et al., 2012). These unmanned vehicles provide a safe, cost-effective, and efficient way for collecting data and performing tasks in deep and shallow water. The development of advanced sensors, imaging systems, and propulsion technologies has made it possible to design and build underwater drones that can operate in challenging conditions, opening up new opportunities for scientific research and commercial activities (Schulz et al., 2019).

3 Technical objectives

Table 1: Objectives of the project and their key specifications and outcomes.

	Objective description	Specifications	Deliverables / outcomes
1.	To design waterproof miniature underwater drone.	To build a submarine model to a miniature size that can sink to certain depth and can be radio-controlled.	The structure is created based on the submarine concept by using CAD Design software and 3D printing system.
2.	To assemble underwater drone with mechanical and electronic application.	To fit the 3D model underwater drone structure with the electronic component free from leakage.	The 3D printing design needs to be created based on the overall assembly of the electronic parts size.
3.	Determine the features and suitable material for the underwater drone.	The features for the project must be radio-controlled, able to sink and float. The material needs to be below the budget allocated and meet the requirements.	The electronic component and material needed is documented and approved by project supervisors.
4.	Demonstrate the miniature underwater drone.	The underwater drone is tested to make sure all the features are working.	The functionality of the underwater drone will be compared to the inspired submarine Lego project. The project will be presented at the expo.

4 Gantt Chart

Figure 1 below shows the plan for the miniature underwater drone project scheduled for both part A and B. A lot of research and progress reports will be done in part A. In the project management plan project background and objectives are defined. Literature reading will be focusing on related communication principles, suitable design, and components. Then in project design, 3D model CAD software will be used to build a related submarine structure. Furthermore, in part B focus on assembling and project testing. The miniature underwater drone will be tested to a certain depth in order to study the radio frequency communication underwater. A seminar and expo are where the project will be demonstrated to show the functionality of all features. This Gantt chart will be updated from time to time as the honours project takes place.

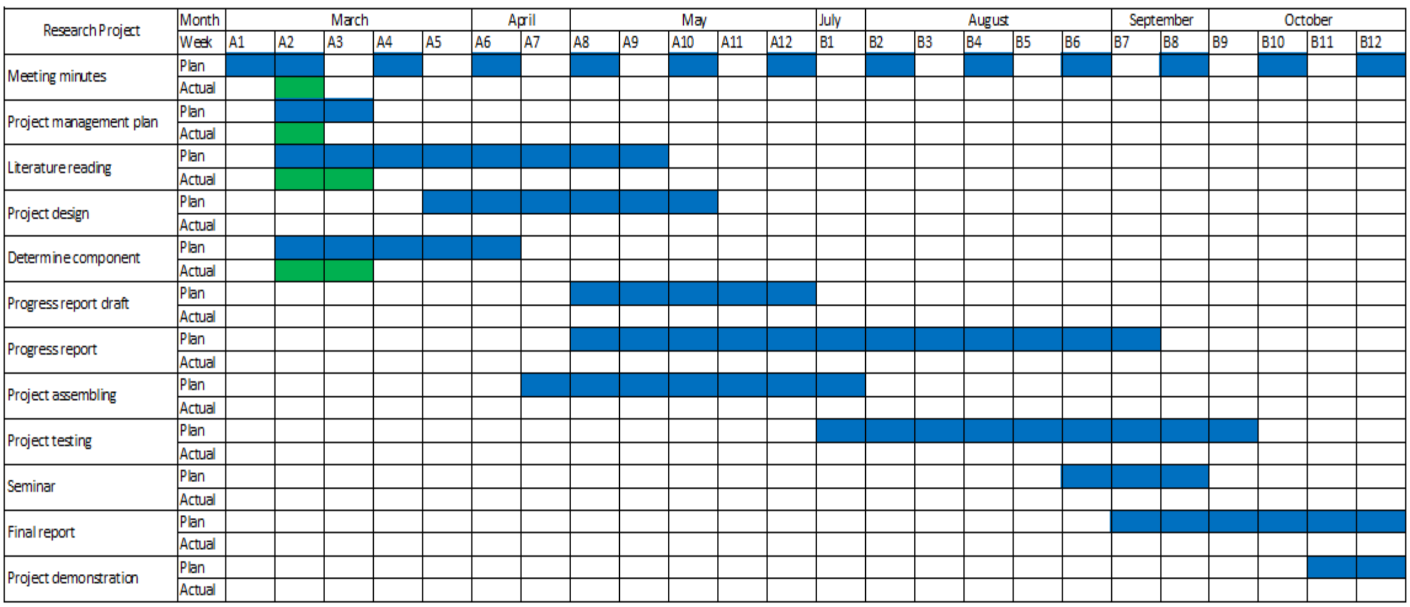

Figure 1: Overview of the main activities of the project.

5 Resources and procurement

The main components for this project are mechanical, electrical and electronic. AutoCAD Software will be the most software to be used for making the prototype through 3D Printing since it supports in designing 3D modelling and then can be exported into STL files. As for the purpose of creating a 3D Design, a 3D printer is needed as additive manufacturing to create a physical object from the digital design, which is a 3D Part. On the other hand, the electrical and electronic components are also needed to complete the whole project as listed in Table 3. Instead of that, Table 3 shows the estimated cost and delivery time for each item to be delivered, which helps to make a plan for the project runs smoothly.

Table 3: Direct costs intended to be spent by the project.

#	**Item (and supplier, if known)**	**Lead time**	**Cost**
1.	Electrical components	7 to 10 days	$150
2.	Sensors	3 to 7 days	$100
3.	Microcontroller	3 to 5 days	$50
4.	Electronic components	7 to 10 days	$100
5.	Li-Po battery	3 to 5 days	$40
6.	Motor	3 to 5 days	$60
7.	Motor Driver	3 to 5 days	$30
8.	Radio controller	3 to 5 days	$50
9.	Acrylic	3 to 5 days	$50
	Total		**$630**

Table 4: In-kind resources that will be used by the project.

#	**Item**	**Source**
1.	Tools	The University of Adelaide
2.	3D Printer	The University of Adelaide
3.	AutoCAD Software	The University of Adelaide

6 Project risks

Project risks as shown in Table 5, lists the risk events which may or may not occur during the completion of the project. Those events are taken to be considered as a preparation for group members to be well prepared with all situations that might be coming during the period of completion for the whole project. Thus, it allows in creating a comprehensive understanding that can be for better project decisions and making. All the impacts, likelihood, consequences, classification and mitigation measures are recorded for each event that supports the explanation in more detail for increasing the success for the project.

Table 5: Identified project risks, their inherent risk classifications before mitigation, and their mitigation measures.

#	Risk event	Impact	Likelihood / Consequence / Classification	Mitigation measures
1.	Software failure	Time for designing and program the prototype will be delayed	Unlikely / Moderate / Medium	Use another alternative such as downloading on our own laptop since some of the software can be downloaded for free.
2.	Pandemic of COVID-19	Students are not allowed to attend the university to conduct any workshop purpose	Unlikely / Major / Medium	Conduct the workshop outside from the university and maybe just from home with own equipment
3.	Miscommunication between group members	Wrong output will be delivered	Possible / Minor / Low	Always double check with group members whether the work done is on track or not
4.	Argument on sharing ideas	Members in a group might not willing to cooperate to give any ideas	Possible / Minor / Low	Solve the argument professionally in order to make everyone in the group satisfy with the result
5.	3D Printer failure	Time for finishing the prototype will be delayed	Possible / Moderate / High	Ensure that the work process always as instructed by the technician or manual
6.	Inaccurate data recorded	The functional for the project will not be as expected	Likely / Major / Very high	Ask for guidance from supervisors to check and discuss about what have been collected / recorded

7.	Project and data lost	Project needs to do from the scratch or might fail the course	Unlikely / Major / High	Put the project in the surveillance area and always backup all the work files into other drives.
8.	Electrical / electronic components malfunction	Troubleshooting should be done and may take extra time to finish the project	Possible / Major / High	Always check all the components by testing each of them with a simple circuit before used in a complex circuit

7 References

Mayer, L. A., Jakuba, M. V., & German, C. R. (2012). Technology developments in deep submergence: advancing exploration and research. Annual Review of Marine Science, 4, 127-151.

Schulz, J., Runge, J., & Dolereit, T. (2019). An autonomous underwater drone for bathymetric surveys and subaquatic 3D modeling. Journal of Field Robotics, 36(6), 1181-1199.

8 Appendices