TECHNICAL DESIGN REPORT OF MRT Purvi Goes To ROBOBOAT 2022

BARELANG Marine Robotic Team (BARELANG MRT)

POLITEKNIK NEGERI BATAM

Batam Centre,Ahmad Yani Street, Tlk. Tering, Kec. Batam Kota, Kota Batam, Kepulauan Riau 29461, Indonesia.

Ryan Satria Wijaya, Naufal Abdurrahman Prasetyo, Ananda Fairuz Anjab, Nur Syahiran, Aldi Kaputra, Armando Panjaitan , M. Raihan Wildan Zharif, Ferdy M Aldhani, Vany Nuroh Mawati, Muhammad Yusup Parningotan Harahap, Eka Septian Edrianto, M. Rafi Syafiq Aslam, Muhammad Safry A., Santonius, Auliya Djajasasmita, David Putra Simanjuntak, Silvanus Jokhanan Setijoni

***Abstract*-The first step a team needs to enter a competition is preparation. With some of the team's deliberations, we're preparing to enter the ROBOBOAT 2022 competition with enough room and board. Some of the experiences and research from the need to follow a ROBOBOAT 2022 felt maximum and could go in a direction that could turn this movement into something more. The goal of entering the annual in ROBOBOAT 2022 competition is to participate in the development of technology, especially in naval and robotics systems, which currently require the improvisation of student thought, which may later bring significant changes to the development of the naval world and robotics systems.**

***Key Word*-Competition, ROBOBOAT 2022, The goals of entering the annual in ROBOBOAT 2022 competition, Technology, Reference, Participant, Product, Team.**

I. Competition Strategy

Collecting numerous references from several teams who had participated in the ROBOBOAT competition the previous year, making a major investment in the design that this team was working on. The products generated are designed by optimizing the different systems used in the ship, ranging from the hull, the electrical systems, the robotics systems, and other support systems needed to maximize the performance of the vessel's products.

A. Mandatory Navigation Chanel

In the mandatory navigation channel, the boats must navigate autonomously between gates without touching the buoy. And by placing multiple points latitude and compass, GPS, and accelerometers automatically feel navigation information title, longitude, latitude and update changes. In performing planning on this system following the standards or standards given for competing competitions, this could be the principal prerequisite on the ship. With the knowledge and experience this system has in research in such a way as to get the maximum results.

Fig.1. Mandatory navigation trial test.

MRT Purvy was designed with a motion-directional system that allowed the ship to move in any direction, and this could be useful for navigation on the ship, systems were constructed in such a way as to avoid the objects around in accordance with competition regulations. The system-design and algorithm-design deductions were doing on Figure 1. Algorithms created with several considerations can calculate the orientation of the ship by measuring the middle point of two parallel objects, and then the intermediate point is a course reference in MRT Purvy movement.

B. Avoid the Crowds (Mission 1)

Avoid the Crowds follow according to flexible regulations. Testing has been done on several levels to determine the outcome and the best systems of design ever devised. In this section, evidence and validation of the proposed course

approach is presented. Encompassing all of the challenges, except for the object delivery. Focused on evaluating different systems that detect buoys and how the system would perform without augmenting the data-set with synthetic images as done in previous work. The results show that very accurate performance can be achieved as the networks were able to capture important features of objects of interest.

Fig.2. Avoid the crowds trial test.

C. *Find a Seat at the Show (Mission 2)*

MRT Purvy ship was required to be able to position itself into a fixed position before the competition, and some research was urgently needed to create a complex design on the ship in order to complete a perfect notch. Figure 2 describes how the system works to complete the task *Find a Seat at the Show*.

Fig.3. Find a seat at the show trial test.

The system that was built had to be able to read and store data of the objects that had previously been collected and any data stored had a command that could enable MRT Purvy ship to determine the position in accordance with what was already specified. Algorithms designed on MRT Purvy vessels required that the vessel be able to read different patterns of objects and colors in accordance with regulations.

D. *Snack Run (Mission 3)*

To complete the task there are several things or considerations that can be a point for making it easy for MRT Purfy to accomplish well, such considerations are based on the processing of propulsion systems that can facilitate maneuverability according to the need for maneuvering. Figure 4 showed how MRT Purvy finished his snack run task.

Fig.4. Snack run trial test.

The system is designed to identify the assigned object and then maneuver the vessel to maneuver several degrees and also fixed speed of design according to the trajectory read in the design of the system that has been created. With the designation indicated in Figure 9 Ships can maneuver in accordance to the demands of their systems.

E. *Skeeball Game (Mission 4)*

MRT Purvy ship was equipped with a sniper system created with a need for a regulation. So the design of the prototype of the firing system on MRT Purvy ship was in design with considerable calculations. We can used a pneumatic propulsion system of motors designed with wheels at rotation to match the speed of a fixed spin ratio to have a ball launch on a target, Figure 5 features how the device or shooter on MRT Purvy ship, with a system like this it was felt to make the movement of the ball more stable and fit a lock of sight on the ship's designed and workable systems.

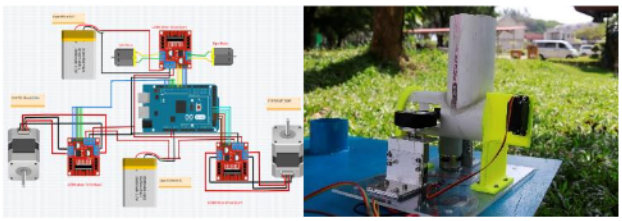


Fig.5. Wiring Catapult system on MRT Purvy.

F. *Water Blast (Mission 5)*

The task needed a good balance on the ship because the target targets was above the water in a stationary condition, so it was an interesting

challenge because there were so many points that became points to get Mr. Purvy to finish the task as expected.

G. Return to Home (Mission 6)

To accomplish our task, we use the sensory (IMU), the unit of gauges (IMU) that employ measuring systems such as acceleration, gyroscopes, and magnetometers that are used to measure changes in the position of a particular object or clue. Three angles (roll, pitch, yaw) a cellular Angle approach would score cartesian from the Angle of x, axis, and z axis.

II. Design Creativity

In order to capture the purpose of what was previously planned, we designed this product with a few considerations and evaluations of some of the ship's products that were previously produced. The selection of concepts and purposes of the design of the ship's products is to find sources of information such as journals, media information, and also with literacy associated with design, to assist the design mechanism and also to give innovative ideas that can be developed to apply to the ship's intended products. Moreover, the concept that we apply to the vehicles that are designed must refer to the regulatory standards that the organizer has established.

A. Boat

In selecting the design on the ship's products, you will need to conduct a study of literature on what you want to target. The design of the ship's hull is important because it will affect the stability of the ship, the speed of the ship's plan, the fuel consumption, the necessary depth in relation to the shipping port pool as well as the depth of the navigation line. Because of the resilience, strength, safety and safety of some of the elements they feel need some of that, with some research and practice being done, the ship USES the fiber-ground materials with a combination of resin and catalyst that gives the materials more solid and resilient, with strength, good security, and sufficient durability for the ship. Figure 6 can be explain about boat dimension

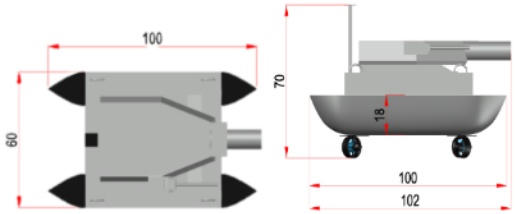


Fig.6. Dimension of boat.

The design of the ship, which we designed according to the scale of the original ship with a ratio of 1:90 and by comparison we have a considerable outline of the property and of its surplus and of our profits in reaching the target previously planned by the tin BARELANG MRT.

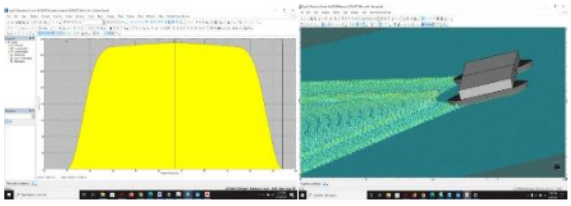


Fig.7. Curve of area and Resistance simulation.

According to Figure 7 the curve of the area chart, the design of the ship has been fairly smooth and curvature of the design vessel, which in turn makes it increasingly useful to us because it reduces the drag of the resulting vessel. On the design of MRT Purvy using the catamaran model, it is the form of the hull used for ships that require a high level of stability and also put the passengers at ease.

The propulsion system used on this ship USES four azimuth propellers designed in such a way as to get movement in all directions. The calculating postulation was thought about and designed to get the correct position and the objective required by four propellers, a setting of call arranged by determining the balance of a vessel and by calculating the distance between the hull and the square in each vessel.

B. Electrical

A propulsion system is a machine that produces thrust to push an object forward. on this boat there is a propeller that rotates cw (clockwise) and ccw (counterclockwise), so that the propeller can function on the boat, a motor is needed to rotate the propeller, namely the brushless motor is a dc

motor. different from other dc motors, brushless motors require an ESC (Electronic Speed Controller) module.

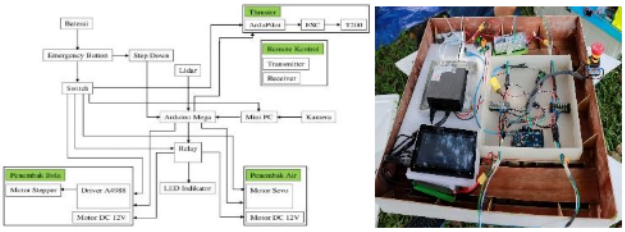


Fig.8. Wiring system in the boat.

The power management system used in this ship we design by using a battery for input to the power controller that allows us to know the condition of the voltage and then to the microcontroller as this power controller is also used for the output to the thruster and also other components.

In the Figure 8, We use 2 batteries lipo 5000mAh 4 cells for the thrust and controller and the fan we use step down for the volt because to turn on the dan need 12v for the power, And for the mini PC we use 1 battery lipo 5000mAh 3cells with step up for the voltage from 12v to 19v because the mini PC need power 19v to turn on.

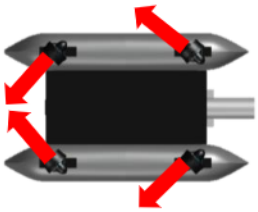


Fig.9. Layout propeller position.

The concept of an upward deployment on MRT Purvy ship was described as figure 9, this concept was used to enable the ship to maneuver in all directions whether it was moving toward the vertical or moving toward the horizontal, this movement system was necessary to enable the vessel to complete many task in regulation. The concept was calculated and experimented with research that had previously been carried out. With the direction of the propeller used, there is not much movement that can reduce the efficiency of the problem, be it time efficiency, power and style.

Figure 10 is Control the sensor optimization in this robot. On this robot. We using camera for input control system. the camera can be see and tracking object on front of robot. We use a camera for the input control system, where this camera will see what objects are in front of the ship. The camera will detect ball objects and gates with the data we created.

Fig.10. The process of reading objects.

In processing the existing data, we use the Cascade GUI Trainer image processing feature in OpenCV where the data we collect will be processed into a file with xml output. Ultra sonic sensor is useful for measuring distance, this sensor will later be used in ship mode for docking so that we know the distance limit from the ship.

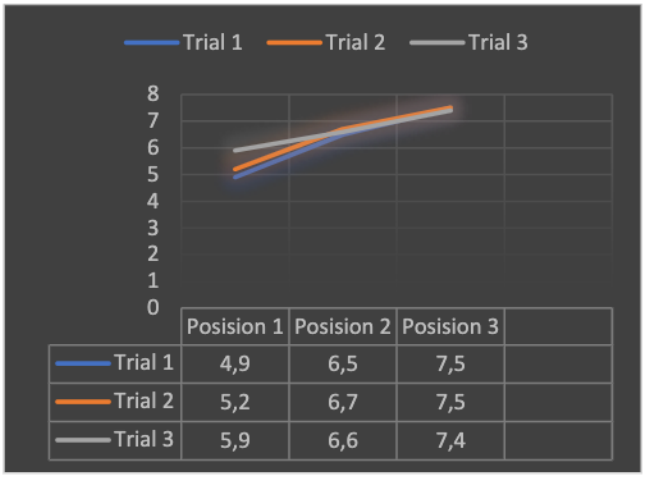
III. Experimental Results

In this competition the team must prepare a strategy carefully which makes the system autonomous and designing the ship as stable as possible. In connection with this competition, there are several obstacles that must be passed in order to get the most points. One of the obstacles that is passed is the ship goes well past 3 objects with different colors, namely red, yellow and green. This obstacle we try to use the srf sensor and lidar sensor to detect the object.

We tried to discuss for a vehicle system that has been designed to be as stable as possible. We will improve our flagship capabilities to create the best possible autonomous system that can be managed when time is limited. Our goal is to participate in the competition to get the most points, so we are satisfied with what we are doing.

There are several concepts for propulsion on a boat. the first concept is that the front and rear thrusters are horizontally positioned as shown in the picture on the side, this concept has been tried but there are drawbacks, such as for right and left movement, right and left rotation, and maneuvers cannot be applied. the second concept is a

horizontal rear thruster and a front thruster in a half cross x position, this concept only has drawbacks such as the right and left movement cannot be applied. And the third concept is the concept of cross x, this concept is the one that will be used, because for movement in all directions it is more efficient than some of the previous concepts. for the speed of movement is not much different about 7,5 km per hour.



	Posision 1	Posision 2	Posision 3	
Trial 1	4,9	6,5	7,5	
Trial 2	5,2	6,7	7,5	
Trial 3	5,9	6,6	7,4	

Tab.1. Ship speed chart.

IV. Acknowledgements

Pride and happiness may not be able to blend in with words. Thank all those involved in the project, thank to Faculty Advisor Ryan Satria Wijaya, and also Naufal Abdurrahman Prasetyo who has led the team to compete in the international sphere, and thanks to those who help provide the necessary tools and infrastructure for the 2022 Roboboat competition. And we are proud to participate in this competition.

V. References

[1] Roboboat 2022 Rules and Task Description, March 2022.
[2] Blue Robotics Product Overview: BlueROV2, Available : https://youtu.be/GY0PfnvzzW
[3] Open Source Computer Vision, Available : https://docs.opencv.org/4.x/d7/d4d/tutorial_py_thresholding.html
[4] Pyton OpenCV-getTrackbarPos() Function Available : https://www.geeksforgeeks.org/python-opencv-gettrackbarpos-function/#:~:text=Python%20OpenCV%20%E2%80%93%20getTrackbarPos()%20Function&text=getTrackbarPos()%20is%20Function%20in,Returns%20the%20trackbar%20position
[5] Simple Color recognition with Opencv and Python, Available : https://www.youtube.com/watch?v=t71sQ6WY7L4&t=1159s

I. Appendix A : Component Specification

Component	Vendor	Model / Type	Specs	Custom / Purchased	Cost	Year of Purchase
ASV Hull Form/Platform	Self Developed	Catamaran	L : 85 cm, B : 60 cm, H : 28 cm.	Custom	$170	2022
Waterproof Connectors	Blue Robotic	WetLink Penetrator	https://bluerobotics.com/store/cables-connectors/penetrators/wlp-vp/	Purchased	$48	2022
Propulsion	Blue Robotics	T200 Thruster kit	https://bluerobotics.com/my-account/view-order/153432/	Purchased	$944	2022
Power System	Lippo	500 mAh 4s, 3s	Voltage : 14.8V 4s1p, Weight : 474g	Purchased	$246,85	2022
Motor Controls	Blue Robotic	Basic ESC	https://bluerobotics.com/product-category/thrusters/speed-controllers/	Purchased	$144	2022
CPU	Asus	PN51-S1-B	https://www.tokopedia.com/ciptamandiricomp/asus-mini-pc-pn51-ryzen-7-nvme-256gb-ddr4-8gb	Purchased	$548,77	2022
Teleoperation	X Flysky	Fsi6 Fs I6	https://www.tokopedia.com/homeware33/x-flysky-fsi6-fs-i6-2-4g-6ch-transmitter-remote-controlaris?extParam=ivf%3Dfalse%26src%3Dsearch	Purchased	$99,39	2022
Compass	-	-	-	-	-	-
Intertial Measurement Unit (IMU)	Tilt Angle	GY-25	https://www.tokopedia.com/freelab/gy-25-tilt-angle-sensor-tiltmeter-3-axis-accelerometer-w-serial-output	Purchased	$17,15	2022
Doppler Velocity Logger (DVL)	-	-	-	-	-	-
Camera(s)	Logitech	Webcam Logitech Brio	https://www.tokopedia.com/luckyelektro/webcam-logitech-brio-1080p-camera-ultra-hd-pro-4k-webcam-pc	Purchased	$205,79	2022
Hydrophones	-	-	-	-	-	-
Algorithms	Internally Developed	Rule-based algorithms	-	Custom	-	2022
Vision	Internally Developed	Haar cascade classifier	-	Custom	-	2022
Localization and Mapping	-	-	-	-	-	-
Autonomy	Internally Developed	Rule-based Autonomy	-	Custom	-	2022