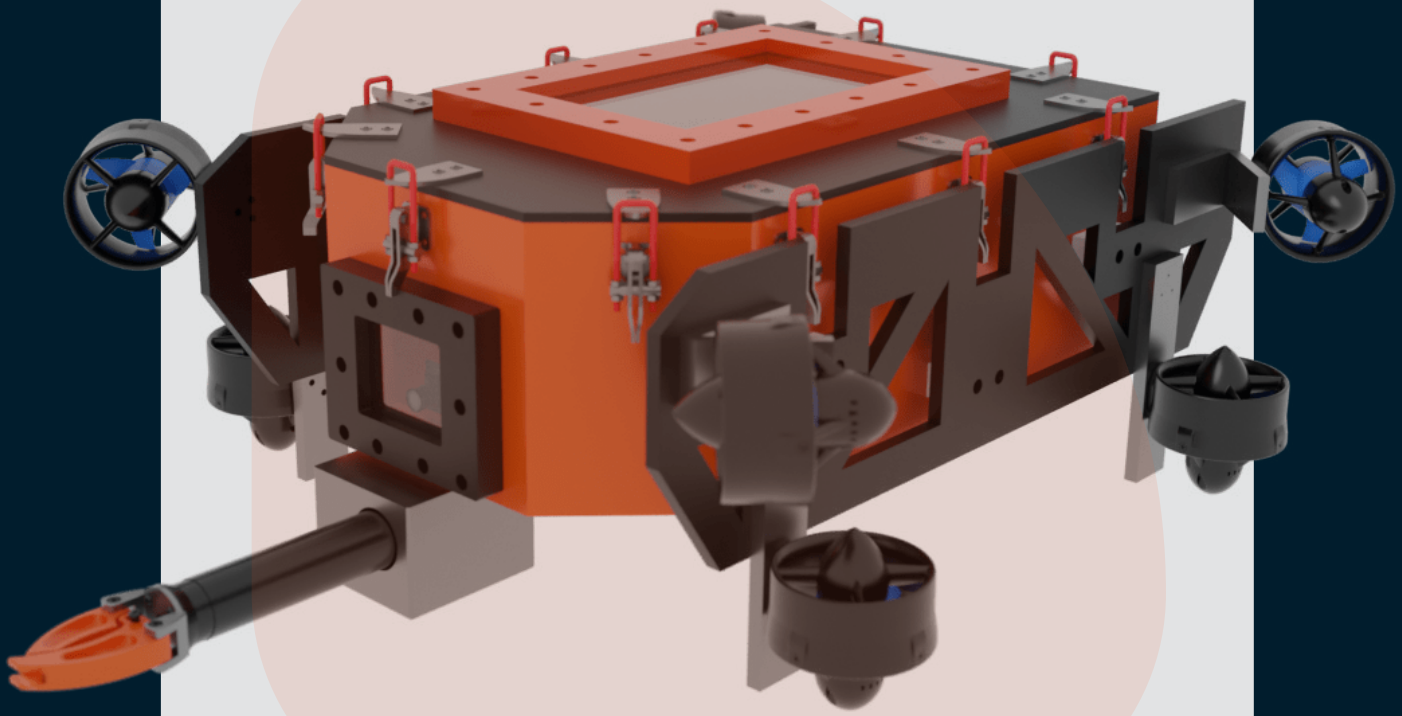
BRACU DUBURI

Project Proposal

by team Duburi



www.bracu-duburi.com

BRACU DUBURI

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Introduction

Vision

The BRACU Duburi team is committed to establishing a vibrant and inclusive community of AUV and ROV hobbyists and enthusiasts who will collaborate to develop cutting-edge, industrial-grade underwater vehicle

The team envisions fostering an environment where individuals can share their ideas, knowledge, and expertise to create innovative technologies that can revolutionize the underwater industry. Additionally, the team aspires to establish a state-of-the-art test facility that will enable the next generation of ROV enthusiasts to hone their skills and advance their knowledge in the field. Through these initiatives, the BRACU Duburi team aims to create a sustainable and innovative ecosystem that will drive the growth and development of the underwater industry in Bangladesh and beyond.

Objectives

Over the past five years, the number of water accidents in Bangladeshhas increased significantly, leading to a pressing need for rescuemissions. To address this challenge, the BRACU Duburi team has developed the First Autonomous Underwater Vehicle in Bangladesh based on artificial intelligence. The vehicle serves as an aid in rescuemissions for drowning victims, as well as a tool for collecting underwater data related to pollution. Through this feature, the team aims to detect victims and swiftly move to evacuate them while simultaneously gathering water body data for research purposes.

The results of the trial demonstrated that the BRACU Duburi, weighing approximately 5 kg with a payload capacity of 96 kg, has an average speed of 0.94 m/s based on 20 trials conducted at varying distances. Additionally, the camera on the BRACU Duburi can efficiently detect victims within a maximum distance of 3 to 4 meters and can transmit data up to a distance of 200 meters. Moreover, the team has participated in international underwater rover competitions to broaden their knowledge and capabilities

Technical Specifications

Weight **(in Air)**
61 lbs/27.7 kg

19"x15"x7"
Hull or waterproof Enclouser

21" x 17" x 8"
Dimensions

Main Computer
Jetson Nano
Developer Kit
GPU: 128-core NVIDIA MaxwellTM
architecture-based GPU.
CPU: Quad-core ARMR A57

Propulsion
8x Blue Robotics T100 Thruster

SubConn Power, Circular, Micro Circular, Ethernet, and **Coax series Cameras**
Underwater Connections

Embedded Computer (Control)
STM32

Power
2x 12V 10,000 mAh LiPo Batteries (in series)

Cameras
Blue Robotics 3x 1080P Low light

Navigation Sensors

Depth Sensor - (Bar 30 Depth Sensor)
IMU - **Vectornav - VN200**
Hydrophones (**2x Teledyne Reson** TC4013)

Sponsorship Letter

[Your Company Letterhead]

[Date]

[Recipient's Name and Address]

Dear [Recipient's Name],

I am writing on behalf of the Bracu Duburi team, which is currently working on an underwater autonomous vehicle project. Our team is striving to create a collaborative environment for engineering students to develop AUVs for competitions and research purposes. As we prepare for the upcoming 2023 RoboNations' RoboSub competition, we are seeking sponsorship to raise funds to purchase the necessary components for our AUV in the 2023-2024 academic year at Brac University.

We believe that [Company Name] would be a great fit to sponsor our project due to your company's commitment to supporting the AUV community. Bracu Duburi is the first-ever self-made autonomous underwater vehicle in Bangladesh, developed by the students of Brac University and participated in the SAUVAC 2018. As a growing non-profit organization, we currently lack the necessary resources to fully support our project to improve upon our previous AUV versions and explore innovative manufacturing technologies. Therefore, we are seeking corporate sponsorships to acquire the electronic components required to realize our mission.

In sponsoring our project, [Company Name] will contribute not only to our organization but also to the community through our mission to conduct maritime research throughout the Bay Area. We would be delighted to provide feedback and review for your components used in our AUV for international-level competitions.

We appreciate your time and consideration in reviewing our proposal. We would be honored to have your support in sponsoring the components required for our project. Thank you for your time and we look forward to hearing from you soon.

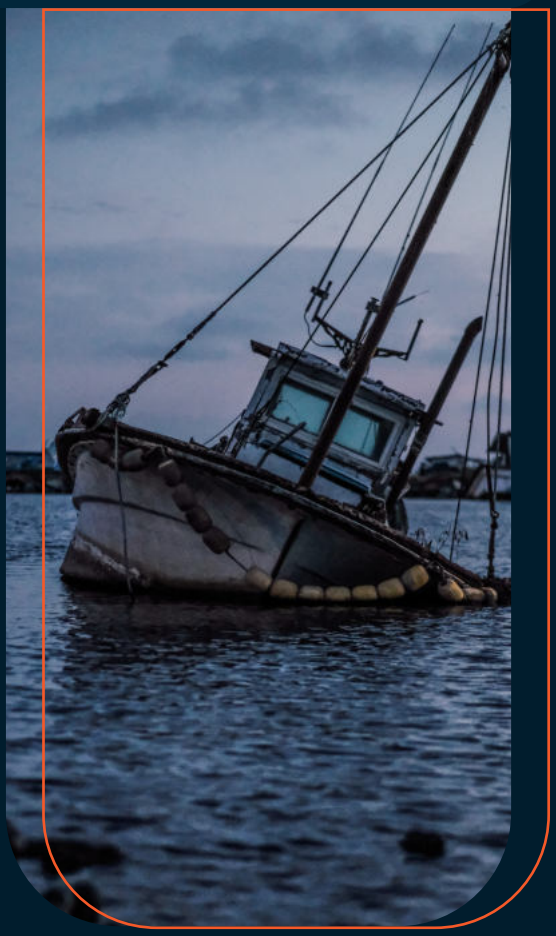
Sincerely,
[Your Name and Title] [Bracu Duburi Team] [Brac University]
[Your Contact Information]

What can We do?

Duburi, with its capability to observe and maintain water bodies, has significant potential for application in the fishing industry. It can be used to monitor underwater infrastructure and water conditions to optimize the breeding of fish, which are highly sensitive to even small changes in environmental conditions. By ensuring proper water conditions for fish, Duburi can contribute to the fisheries industry's economic growth by generating employment opportunities and mitigating hunger.

Furthermore, the technology can help address environmental concerns related to overfishing and support sustainable fishing practices. The potential for Duburi to aid in monitoring water quality and fish populations could lead to more informed decisionmaking and improved management of marine resources.

Duburi can assist in oceanographic and hydrographic surveys, which are crucial for mapping and understanding the underwater terrain, currents, tides, and water quality. This information can be used to plan and execute naval operations, such as search and rescue, maritime security, and environmental monitoring. Duburi can also be used for underwater inspection and maintenance of ships and other naval assets, reducing the need for divers and enhancing safety and efficiency.



Additionally, Duburi can be used for training purposes, such as simulating different underwater scenarios and testing new equipment and technologies. Overall, Duburi has significant potential for enhancing the Navy's capabilities in various areas.

What can We do?

.....continues

Duburi's applications extend beyond military and environmental purposes. It can also beused for scientific research, such as studying marine life and ecosystems, mapping underwater terrain, and investigating underwater archaeological sites. Additionally, Duburi can be utilized for search and rescue missions in the event of underwater accidents or disasters. Its ability to operate in deep water and adverse conditions makes it a valuable tool for rescue teams.

Moreover, it can be used for underwater inspections of oil rigs, pipelines, and other infrastructure. Its high-resolution camera and real-time communication capabilities allow for efficient and accurate inspections. Finally, Duburi can be used in the entertainment industry for underwater filming and photography. Its maneuverability and agility make it ideal for capturing underwater footage that would be difficult to obtain otherwise.

Achievement in Robotics

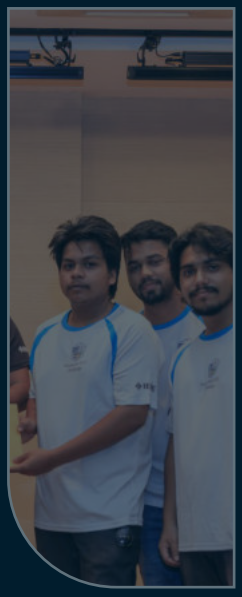
BRAC Onnesha

BRACU Duburi

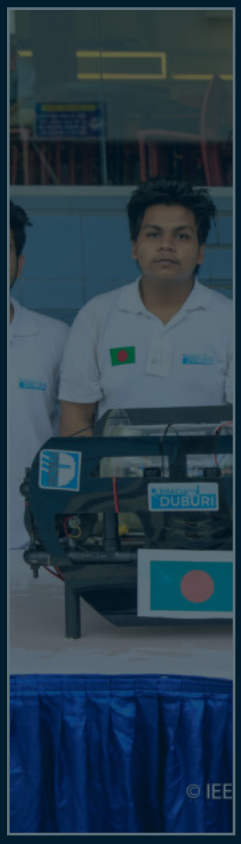
BRACU Mongol-Tori

BRACU Chondrobot

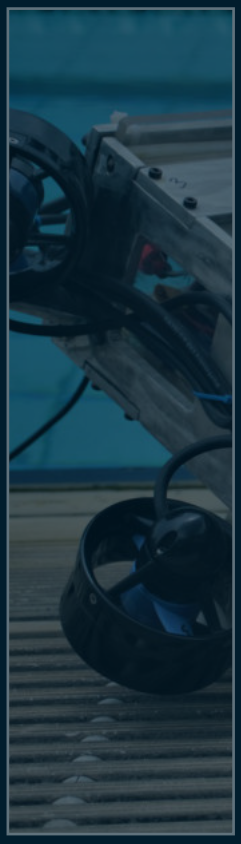
BRAC University



The Team Duburi receiving certificate in **SAUVC 2019**

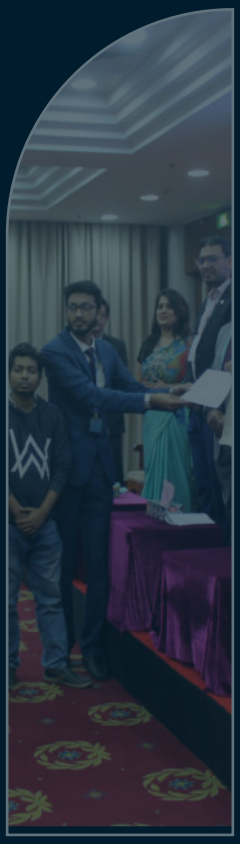


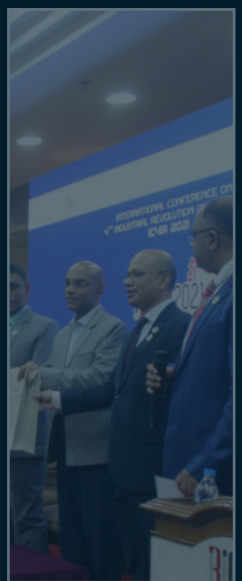
BRACU Duburi participated in **Singapore Autonomous Vehicle Challenge (SAUVC)** and secured **7th position.**



The Team Duburi in **IEEE OES** Singapore Autonomous Vehicle Challenge in 2018

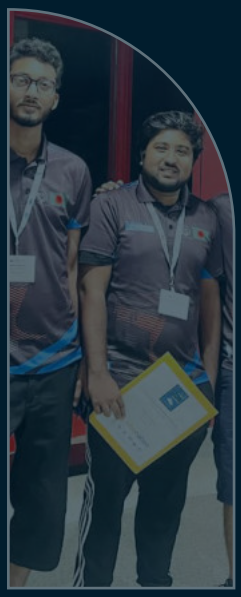
A glance in Our Success

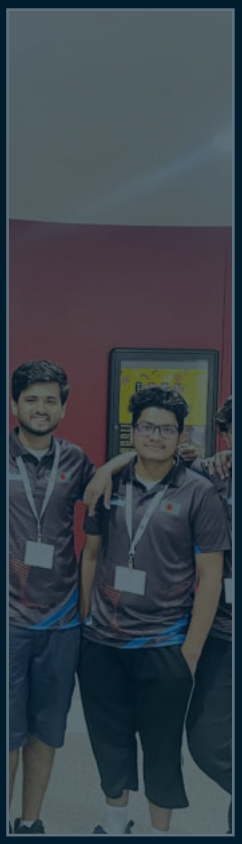




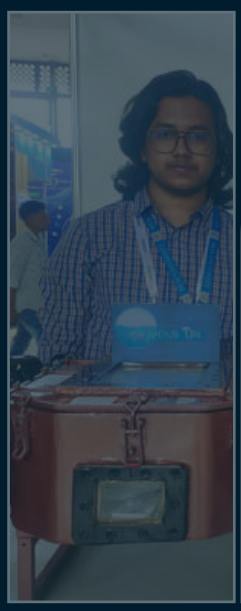
Duburi one of thethe top 5 Projects in **"Mujib 100 Industrial Exhibition"**

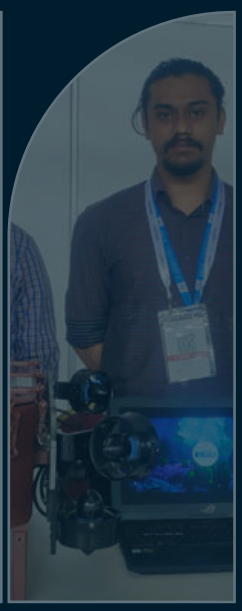
Duburi won the **"Out-standing Rookie Team"** of RoboSub, 2022.





Duburi was awarded as one of the best robotics projects as a "Rescue and Research to be done by a Bangladeshi Rover" at **BASIS SOFT EXPO 2023.**



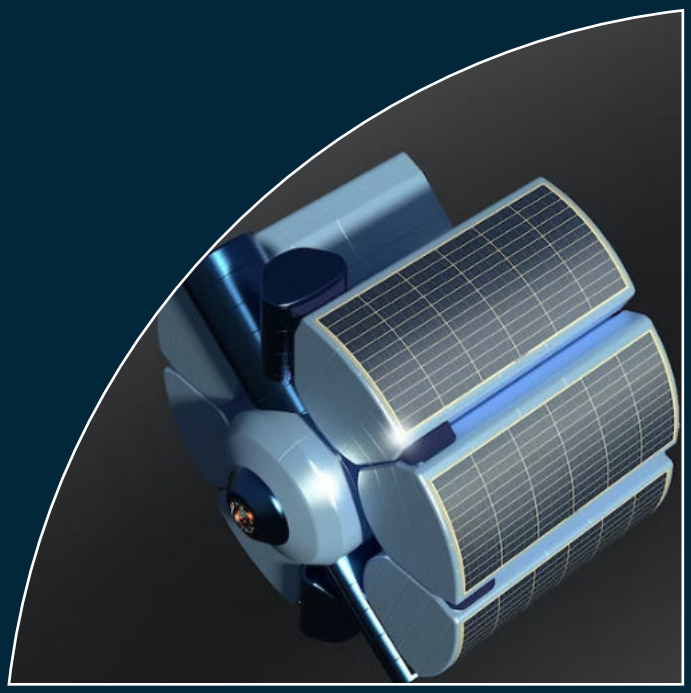


Team Structure

Technical Teamwork

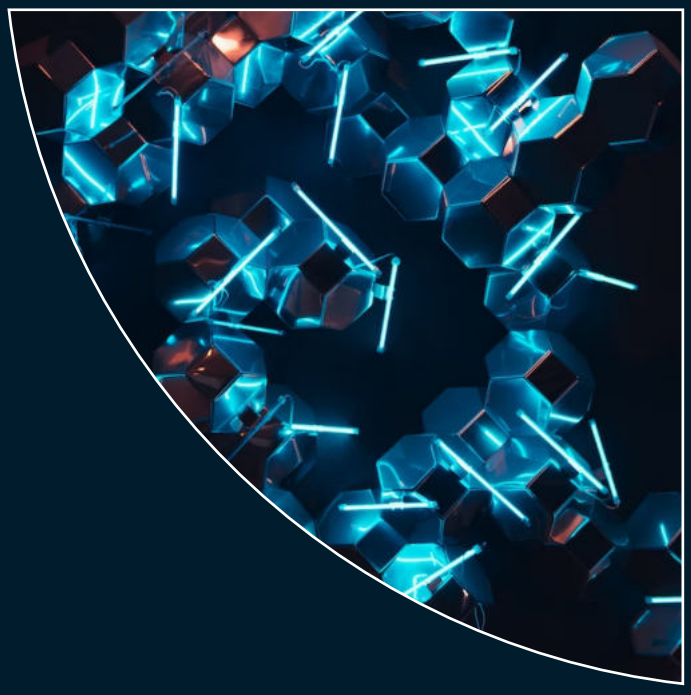
Mechanical & 3d Modelling

Mechanical team members are responsible for designing and manufacturing the physical structure of the submarine. This year, they will be improving the submarine, using 3D CAD, finite element analysis, CNC machining, 3D printing, and more. Mechanical recruits should be able to solve physical problems creatively and be willing to work with their hands as well as their computers.



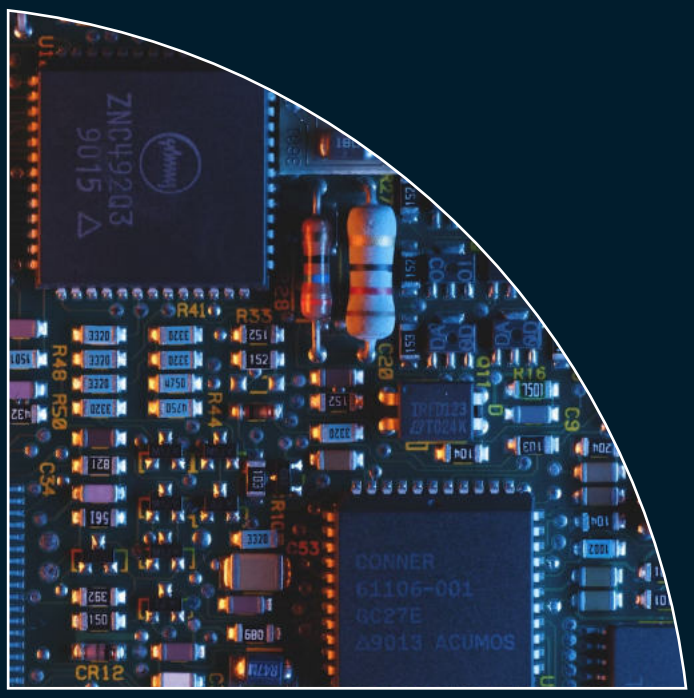
Machine Vision & Autonomous System

The Machine Vision and Autonomous Systems sub-team is instrumental in ensuring the Duburi AUV operates autonomously and effectively. They develop algorithms and systems for obstacle detection, navigation, and machine learning that enable the AUV to adapt to changing underwater conditions. Their responsibilities include designing and integrating machine vision systems that allow the AUV to navigate around obstacles. The team's work is vital for enabling the Duburi AUV to carry out its missions independently and efficiently, making it the first autonomous underwater vehicle in Bangladesh.



Team Structure

Technical Teamwork



Circuit & Electronics

Electrical team members are responsible for designing and maintaining the electrical infrastructure of the submarine. This year, electrical will be improving the current system, which includes incorporating new sensors and circuit boards. Electrical recruits should be interested in learning design principles of circuitry and capable of handling complex systems with many integrated components.

Control & Communications

Electrical team members are responsible for designing and maintaining the electrical infrastructure of the submarine. This year, electrical will be improving the current system, which includes incorporating new sensors and circuit boards. Electrical recruits should be interested in learning design principles of circuitry and capable of handling complex systems with many integrated components.

Team Structure

Administrative Teamwork

Operations & Mangement

The Operations & Management sub-team of BRACU Duburi's AUV team is responsible for ensuring the smooth running of the project as a whole. This team will be responsible for logistics management, procurement, management of team resources, and dealing with university authorities and other stakeholders.

They will work closely with all other sub-teams to ensure that deadlines are met, budgets are adhered to, and communication is streamlined. The Operations & Management sub-team is the backbone of the project, responsible for keeping everything running smoothly and ensuring that the project's goals are achieved efficiently and effectively. Through their expertise and hard work, the Operations & Management sub-team will play a crucial role in the overall success of the BRACU Duburi AUV team.

Design & Outreach

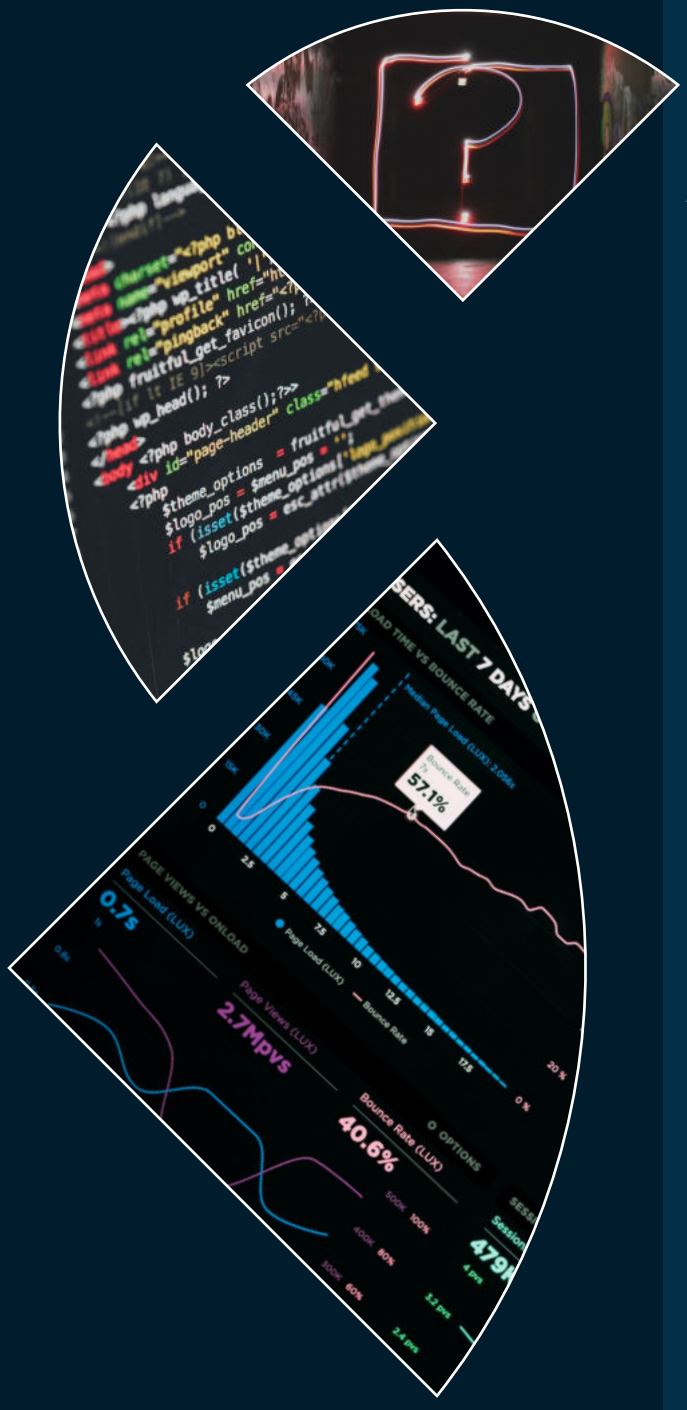
The Design and Outreach sub-teams primary focus is to promote the AUV and its mission through various social media platforms.

To achieve this, the sub-team creates engaging posters, videos, and animations that showcase the AUV's capabilities and progress. The most important responsibility of the sub-team is to seek external sponsorship to support the project's financial needs.

The sub-team members actively engage with organizations and individuals who are interested in supporting the AUV project financially or through in-kind contributions. By maintaining a strong presence on social media and building relationships with external organizations, the Design and Outreach sub-team ensures that the AUV receives the necessary visibility and support

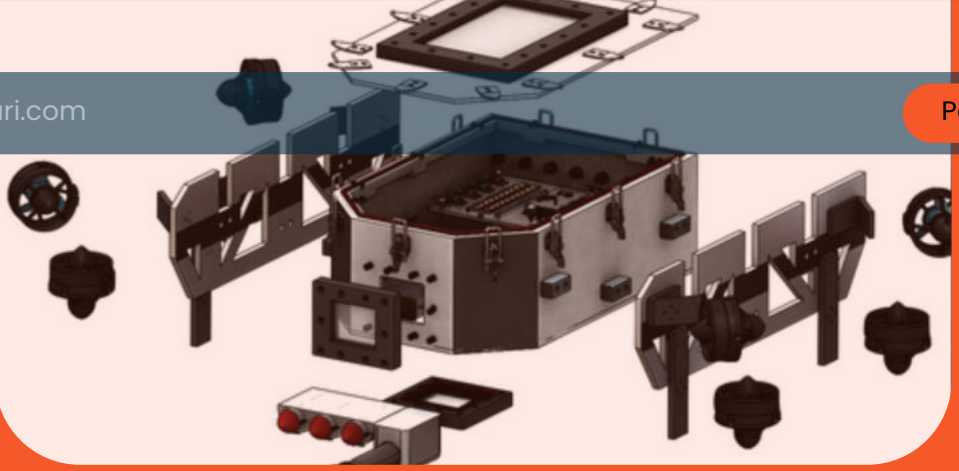
Team Structure

Administrative Teamwork



Research & Development

The Research & Development sub-team of the BRACU Duburi AUV team is responsible for driving innovation, improving the robot's capabilities, and promoting the team's growth. Their primary tasks include conducting research to identify areas for improvement, developing Technical Design Reports (TDR), publishing papers on their findings, leading the team's development efforts, and creating captivating posts and captions to showcase the team's work. They are also responsible for tracking the progress of other sub-teams to ensure that they are on track and aligned with the overall goals of the project. With a strong focus on innovation and continuous improvement, the Research & Development team plays a critical role in driving the success of the BRACU Duburi AUV project.



Hull
design

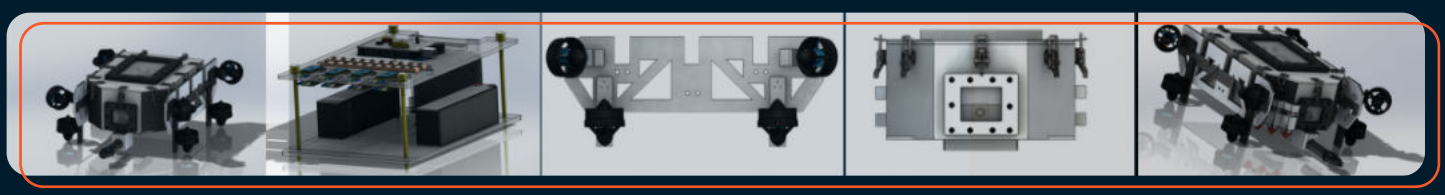
The enclosure is a hollow and rectangular aluminium structure with a tapered end that houses all of the AUV electronic components. Furthermore, since the components will be tightly sealed in the aluminium enclosure, no additional costs need to be borne to make the compartment waterproof. However, it also makes it more susceptible to warping under high pressures.

To compensate for this, the rigidity of the enclosure has been augmented by the addition of interior walls. These walls also serve to isolate the electrically noisy elements (e.g., the ESCs and the IMU) from the sensitive ones, such as the sensors and acoustic systems. Custom-designed clips have also been added to enclosure walls to create a slot-mounting mechanism for the different components. This makes it far easier to attach and remove various components from the enclosure, which boosts the modularity of Duburi's design. Atop the enclosure are small, transparent acrylic windows; these allow operators to observe the internal components. The window thus makes it possible to display critical information such as the internal pressure, temperature, and battery level on the body of the AUV itself. Two external frames have been built for the enclosure that is attached to its sides. The frames are the structures to which the thrusters are mounted.

The benefit of this approach is fourfold:

- Removes the need to drill holes for the thrusters on the enclosure body, which makes the overall design far more water-resistant.
- Reduces the difficulty of mounting the thrusters at exactly 45 degrees away from the enclosure's longitudinal axis, which is important for the AUVs' manoeuvrability.
- Allows for the attachment/detachment of thrusters without exposing the enclosure and

Cooling System: As mentioned before, constructing the hull out of aluminium gives it the advantage of being naturally thermally conductive. This greatly reduces the need for a specially designed cooling system for Duburi, which helps lower its cost. To fully exploit the conductivity of the hull, thermal adhesive tape is used to attach the SingleBoard Computer, the component which generates the most heat, onto the hull. This allows the heat to be directly dissipated via the walls of the enclosure to the water outside.



Computer Vision

For computer vision, we have used multiple machine-learning models and algorithms. Object detection consists of two parts: localization and classification. The detection pipeline starts by extracting the selective features (Haar, HOG, Convolutional layer) and then a localizer or classifier is used to classify the object.

Generally, these localizers and classifiers run over an image based on the region proposal approach or in-sliding window technique over the image. Methods like Deformable Parts Models (DPM) are paradigmatic of the sliding window approach and methods like R-CNN take advantage of the region proposal approach to generate bounding boxes and thereafter, run a classifier over the expounded bounding boxes. Then post-processing is carried out to filter out duplicate bounding boxes

The nature of the pipeline used in these methods is hard to optimize and very complex because in such systems each component is trained separately. But systems like **YOLO** have reformed object detection as a one-step, singleregression problem, by unifying in a single network. Therefore, in such systems as YOLO, the algorithm performs calculations on an image to predict where they are and classify those objects. Also, MobileNetV2 has shown good accuracy with low latency and low power models. Lastly, we have used jetson inference custom object detection using detect-net. And we got tremendously good results than the ssd mobile net and yolo algorithms.

Procedure:

1. First we collected 1000 data of the simulated image of underwater
2. We pre-processed our data using the Jetson Tao toolkit
3. After that, we trained our data using jetson inference
4. For detection we used an open cv.

Sponsorship Mileage Title Holder

As the title sponsor, your company will enjoy numerous benefits, including:

1. The exclusive attachment of your company name and logo to our title and main residence in Duburi showcases your support and collaboration with our project.

2. Prominent display of your company's name and logo on all official posters, videos, certificates, crests, and t-shirts related to our project, providing your brand with extensive exposure.

3. Priority acknowledgment at all national events and club fairs organized by the Robotics Club at BRAC University. As the title sponsor of our club, your com pany will be given special recognition and promotion.

4. Sharing of all posts by Duburi featuring your company's name and logo with the vast audience, providing an excellent opportunity for your brand to gain visi bility.

5. Opportunity for media coverage and promotion through a host or session coordinator in live sessions related to our project.

6. Promotion of your company through Duburi's official Facebook page and web site home page, reaching a wider audience.

7. The opportunity to advertise your company's products at any national and international event Duburi participates in, showcasing your products on global platforms like RoboSub (USA), SAUVC (Singapore), and other nationally recog nized events in Bangladesh.

8. The opportunity to use Duburi free of charge for any advertisement and event is subject to negotiation depending on special circumstances.

9. Collaboration on any company project in the tech field with significant discounts, demonstrating our commitment to establishing a strong and mutually beneficial partnership.

10. Exclusive rights to use Duburi's name and logo, showcasing your involvement and support for our project.

IN EXCHANGE FOR THESE BENEFITS, WE REQUIRE 80%-100% (INCLUDING VAT) OF THE TOTAL TRAVEL EXPENSES FROM THE TRAVEL SPONSOR.

WE KINDLY REQUEST THAT THE PLANE FARE BE PROVIDED BY JUNE FOR ROBOSUB 2022.

PLEASE NOTE THAT THEAUTHORITY WILL ONLY PROVIDE THE LOGOS OF SPONSORS PRINTED BY THEAUTHORITY AND NOT THOSE SPONSORED BY SPECIFIC ORGANIZATIONS.

Sponsorship Mileage Platinum

As a platinum sponsor of Duburi, your company will enjoy numerous benefits and exclusive opportunities for promotion and collaboration. These include:

1. Priority Acknowledgment: As a member of the Robotics Club at BRAC University, ROBU, your company will receive a special promotion as the title sponsor in all national events and club fairs arranged by ROBU.

2. Prominent Branding: Your company's name and logo will be displayed on all official posters, videos, certificates, crests, and t-shirts related to Duburi.

3. Extensive Promotion: All social media posts by Duburi featuring your company's name and logo will be shared with a large and engaged audience.

4. Media Coverage: Your company will have the opportunity to gain media coverage and promote itself through a host or session coordinator in live sessions.

5. Website Promotion: Your company will be promoted on Duburi's official Face book page and website home page, providing additional visibility and exposure.

6. Magazine Advertisement: Your Company will have the opportunity to place a full page, four-color advertisement in Duburi's annual magazine, further enhancing its brand recognition.

7. National and International Exposure: Your company's products will be advertised at any national and international event Duburi participates in, with the chance to brand products on a global platform like RoboSub (USA), SAUVC (Singapore), and many nationally recognized events in Bangladesh.

8. Free Advertising: Your company will have the opportunity to use Duburi free of charge for any advertisement or event, although this offer will be negotiable depending on special circumstances.

9. Collaborative Opportunities: Your company can collaborate on any company project in the tech field with heavy discounts.

10. Exclusive Rights: Your company will have exclusive rights to use Duburi's name and logo, providing additional branding opportunities.

NUMBER OF BENEFITS: 10

TO BECOME A PLATINUM SPONSOR, 50%–60% (EXCLUDING VAT) OF THE TOTAL EXPENDITURE IS REQUIRED. NOTE: PLEASE, BE INFORMED THAT IF ANY FACILITY (ONLINE BRANDING/MEDIA COVERAGE) IS SPONSORED BY A SPECIFIC ORGANIZATION, THE AUTHORITY WILL

Sponsorship Mileage Gold

As a gold sponsor of Duburi, your company will enjoy numerous benefits and exclusive opportunities These include:

1. Priority acknowledgment in every event and competition organized and participated in by the Robotics Club of BRAC University - ROBU. Our title sponsor will receive special promotions in all national events and club fairs arranged by ROBU.

2. Prominent display of your company's name and logo on all official posters, videos, certificates, crests, and T-shirts.

3. Promotion of your company's name and logo on all Duburi posts, reaching a large and engaged audience.

4. Opportunity for media coverage and promotion of your company through hosts or coordinators in live sessions.

5. Promotion of your company on Duburi's official Facebook page and website homepage.

6. Opportunity for a whole page (black and white) color advertisement in Duburi's magazine, providing significant exposure to our readers.

7. Offer collaboration on industrial projects related to technology at a discounted rate, allowing your company to access our expertise and resources.

8. Advertisement of your company's products in any national event that BRACU Duburi participates in, with a chance to brand your products on national platforms such as National Industrial Conferences, Technological Exposures, and Meetups.

NUMBER OF BENEFITS: 08

TO BECOME A GOLD SPONSOR, YOUR COMPANY WILL NEED TO CONTRIBUTE 30% TO 40% (EXCLUDING VAT) OF THE TOTAL EXPENDITURE.

NOTE: IF A SPECIFIC ORGANIZATION SPONSORS ANY FACILITY (SUCH AS ONLINE BRANDING OR MEDIA COVERAGE), THE AUTHORITY IS NOT LIABLE TO PROVIDE LOGOS OF SPONSORS IN THAT TYPE OF MATERIAL.

THE AUTHORITY WILL ONLY PROVIDE LOGOS WHEN THEY ARE PRINTED BY THE AUTHORITY. PROVIDE A LOGO ONLY WHEN IT IS PRINTED BY THE AUTHORITY.

Sponsorship Mileage

Silver

As a silver sponsor of Duburi, your company will enjoy numerous benefits

1. The company's name and logo are prominently displayed on all official posters, videos, certificates, crests, and T-shirts.

2. Promotion of the company's name and logo on all Duburi posts to a large audience.

3. Opportunity for media coverage and promotion of the company through hosts or coordinators in live sessions.

4. Promotion of the company on Duburi's official Facebook page and website homepage.

5.Acknowledgment of the company's contributions to interviews and documentaries of Duburi.

NUMBER OF BENEFITS: 05

A CONTRIBUTION OF 10% TO 20% (EXCLUING VAT) OF THE TOTAL EXPENDITURE IS REQUIRED FROM THE SILVER SPONSOR.

NOTE: IF A SPECIFIC ORGANIZATION SPOSORS ANY FACILITY (SUCH AS ONLINE BRANDING OR MEDIA COVERAGE), THE AUTHORITY IS NOT LIABLE TO PROVIDE LOGOS OF SPONSORS IN THAT TYPE OF MATERIAL.

THE AUTHORITY WILL ONLY PROVIDE LOGOS WHEN THEY ARE PRINTED BY THE AUTHORITY.

Meet the Guardians

Dr. Md. Khalilur Rhaman

Advisor of
BRACU Duburi & Professor,
BRAC University.

Sayantan Roy

Research Assistant, Brac University
Co-Advisor of
BRACU Duburi

Nayem Hossain Saikat

Research Assistant, Brac University
Former Team Lead,
Co-Advisor of
BRACU Duburi

A.T.M. Masum Billah Mishu

Team Lead,
Bracu Duburi

Meet the Main Team

Md Mahfujul Haque

Vice Team Lead,
Bracu Duburi

Nazmul Haque Omi

Sub Team Lead of
Sensor & Circuit,
Bracu Duburi

S M Minoor Karim

Sub Team Lead of
Control & Communication,
Bracu Duburi

Shaownok Sharirar

Sub Team Lead of
AI & Machine Vison,
Bracu Duburi

Meet the Main Team

Umama Tasnuva Aziz

Head of
Outreach & Design,

Samia Abdullah Prapti

Head of
Research & Publications,
Bracu Duburi

Partho Protim Sarker

Head of
Operation & Management,
Bracu Duburi

Thank You!!!

Terms & Conditions

• The sponsor's brand will be declared as the Platinum/Gold/Silver Sponsor of BRACU Duburi by providing the required amount. The sponsor's company name will be acknowledged in every event in which BRACU Duburi participates, at the National and International levels.

• The corporate logo of the sponsor will be on all the official posters and videos of Duburi as the official Platinum/Gold Sponsor.
• The sponsor will have the exclusive opportunity to receive media coverage, and their company will be promoted in live sessions shared with a vast audience. The sponsor will also be promoted on Duburi's Facebook and web pages.

• Details of the team members will not be shared as per the privacy policy. Full payment must be cleared before signing the agreement.

• Official confirmation must be given within seven days of signing the agreement.

• The amount should be paid through bank transactions. Any further conditions may be included by mutual agreement of both parties.

We are eagerly anticipating your response and would greatly appreciate a timely and positive reply. Your favorable response would be of im mense value to us, and we would like to extend our sincere gratitude in advance.