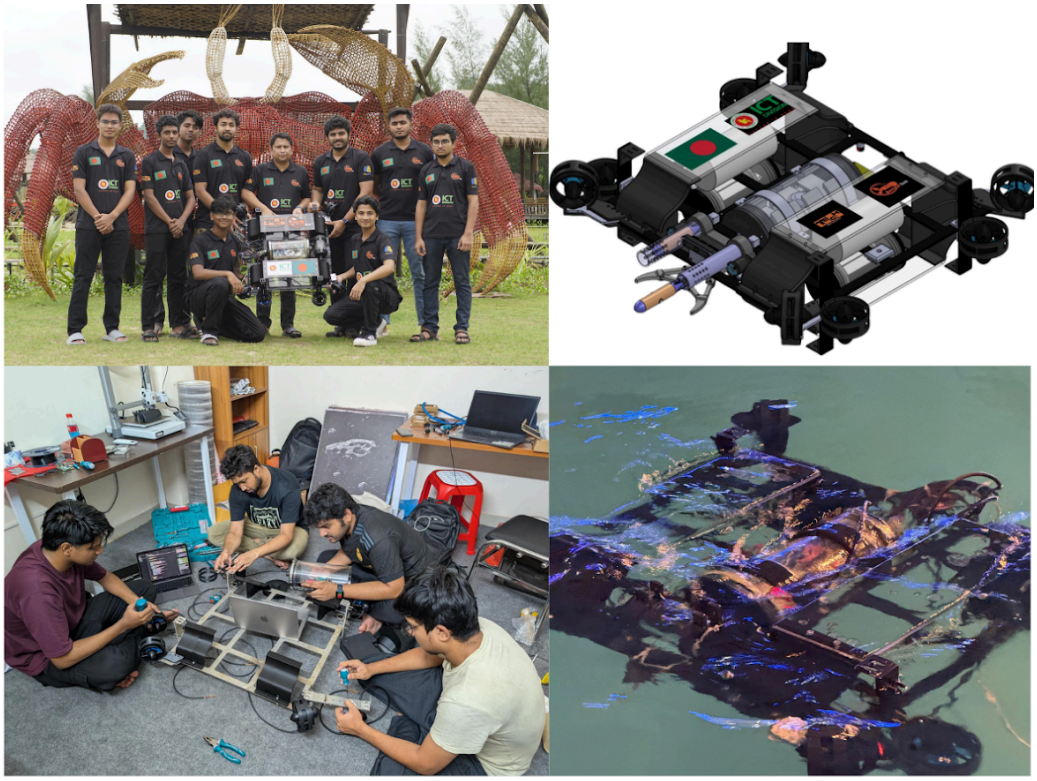
## 🛠️ 1.Bengal Sub Engineering the Future: What Powers Our AUV

At Bengal Sub, we believe that deep-tech innovation is only possible when brilliant minds come together with purpose and passion. Behind our Autonomous Underwater Vehicle (AUV) lies a diverse and dedicated team, each sub-team tackling unique engineering challenges to bring our robotic vision to life.

From building waterproof enclosures to developing intelligent navigation systems, our student-led effort is more than just a robotics project—it's a launchpad for future engineers, scientists, and innovators.



Let's dive into what each sub-team does to make Bengal Sub's AUV mission-ready.

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### ⚙️ Mechanical Team: Building the Body That Dives

The **Mechanical Team** is the backbone of Bengal Sub. Tasked with designing the frame, thruster mounts, sensor pods, and watertight enclosures, their work ensures that the AUV is robust, neutrally buoyant, and hydrodynamically efficient.

From CAD modeling to rapid prototyping and underwater testing, the team works relentlessly to balance strength, weight, and modularity—essential for maintenance and mission flexibility. This year, the mechanical sub-team introduced a **modular frame** and

a **custom battery housing** that supports quick swaps during trials, greatly improving field operations.

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### 🔋 Electrical & Power Systems: Keeping the AUV Alive

The **Electrical Sub-Team** is responsible for ensuring that every component in the AUV receives the right power, at the right time, without fail. They design custom PCBs for thruster control, battery management, and sensor integration.

A key achievement this season was the implementation of a **redundant power system** with overcurrent protection and smart diagnostics. They also integrated **sensor fusion circuits** to help the software team acquire clean data from IMUs, depth sensors, and cameras—critical for autonomous decision-making.

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### 💻 Software & AI: The Brain Behind the Submarine

The **Software and AI Team** brings the AUV to life. Using ROS (Robot Operating System), this team integrates data from cameras, sonars, and navigation sensors to help the vehicle localize itself and make decisions autonomously.

Their highlight feature this year: a **real-time object detection and tracking algorithm** using neural networks. With this, the AUV can now detect buoys, gates, and markers in murky water—without human input. The team is also developing **path planning** and **mission automation modules** so the sub can complete complex tasks autonomously during competition.

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### 🌊 Control & Simulation: Making It Move Smartly

The **Control Team** works closely with both software and mechanical teams to simulate and tune the AUV's movement. Using **thrust allocation algorithms**, **PID controllers**, and **gazebo-based simulations**, they test every motion virtually before going underwater.

This team ensures the AUV can remain stable in currents, rotate smoothly, and precisely align with underwater targets. Their recent work on a **model predictive control** prototype aims to make the AUV even smarter in tight mission windows.

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### 🎯 Mission & Strategy: From Pool to Podium

The **Mission Planning Team** crafts the roadmap from idea to victory. They analyze competition rules, identify scoring opportunities, and define the exact sequence of tasks the AUV must perform. Their close collaboration with all technical teams ensures that every system aligns with mission goals.

This year, their innovation was a **mission-state machine**—a framework that dynamically adapts to partial task completion or failure, giving the AUV a higher chance to finish as many tasks as possible under time constraints.

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### 📣 Outreach & Branding: Sharing the Vision

Beyond engineering, Bengal Sub's **Outreach and Branding Team** spreads the word about the team's work through digital media, university collaborations, and STEM outreach programs. Their efforts helped secure partnerships and sponsorships that fuel the project.

From hosting tech talks to engaging with schools and media outlets, they build visibility and community impact. This is the team behind our stunning videos, clean web presence, and growing social media base.

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### 🧠 Final Thought: United Underwater

Bengal Sub is more than a student project—it's a dynamic ecosystem of learning, innovation, and collaboration. Each sub-team plays a vital role in making our AUV smarter, faster, and more capable. Whether it's hardware design, AI development, or mission strategy, our passion is what keeps us diving deeper.

Stay tuned as we prepare for the next RoboSub competition. The ocean is calling—and Bengal Sub is ready to answer.