

SELF-DRIVING BOATS ALLOW RESEARCHERS TO STUDY GLACIERS IN DANGEROUS CONDITIONS

At the College of Earth, Ocean, and Atmospheric Science, researchers study glaciers to measure the effects of climate change and glacial melt on the oceans. Glaciers can spontaneously collapse and are surrounded by other obstacles, making directly studying them too dangerous for manned vessels. Due to poor visibility and wireless connections, remotely-operated "drone boats" are infeasible for regular research. To solve these issues, we are designing and implementing a system which enables an unmanned research vessel to autonomously navigate the dangerous waters surrounding glaciers, enabling scientific research.

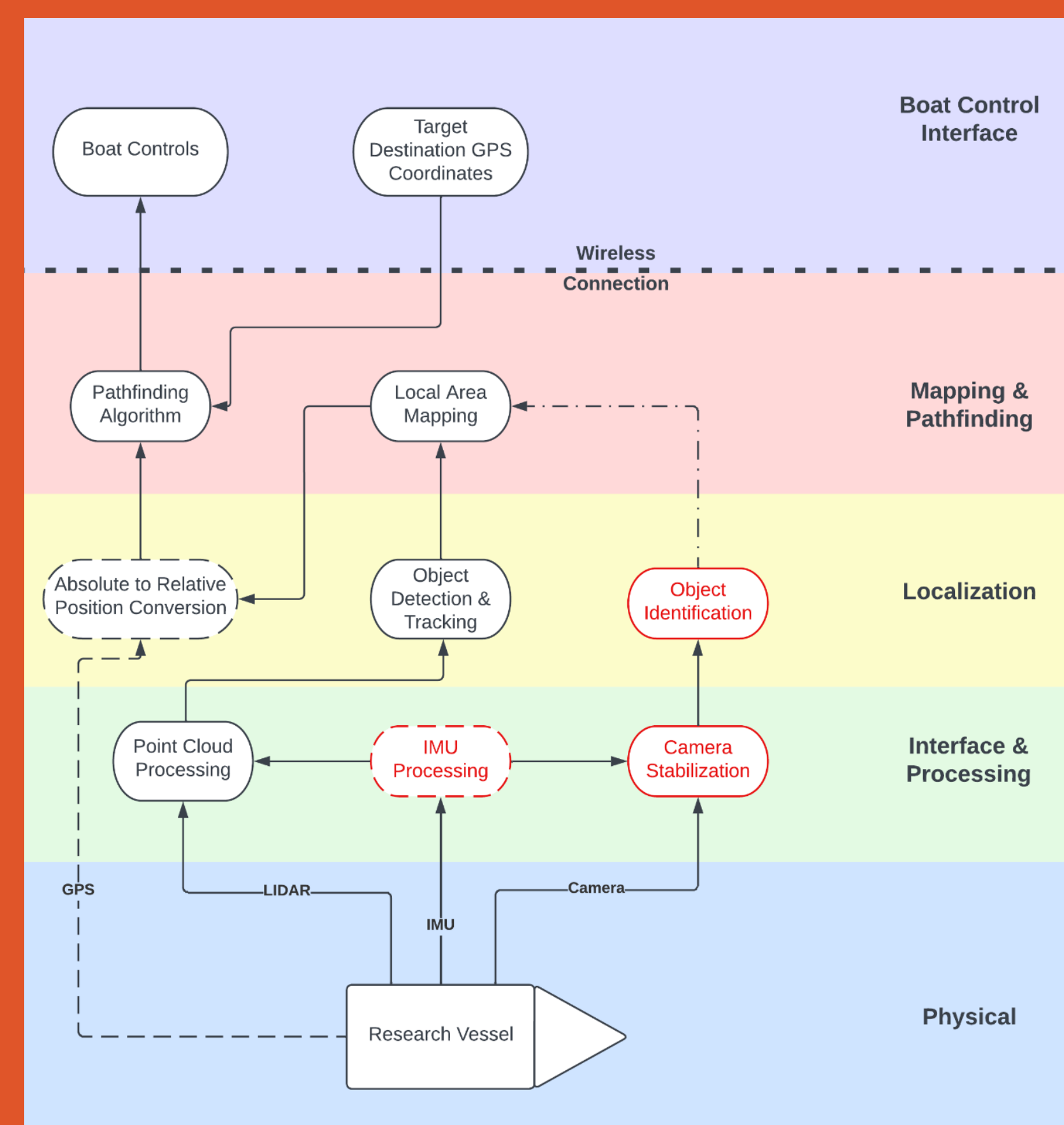


Figure 1: A diagram of key aspects of our control system. Items in red have a preexisting implementation. Items with a dotted border are still being developed.

# AUTONOMOUS RESEARCH VESSEL CONTROL SYSTEM

Helping researchers measure the contribution of glacial melt to rising sea levels.

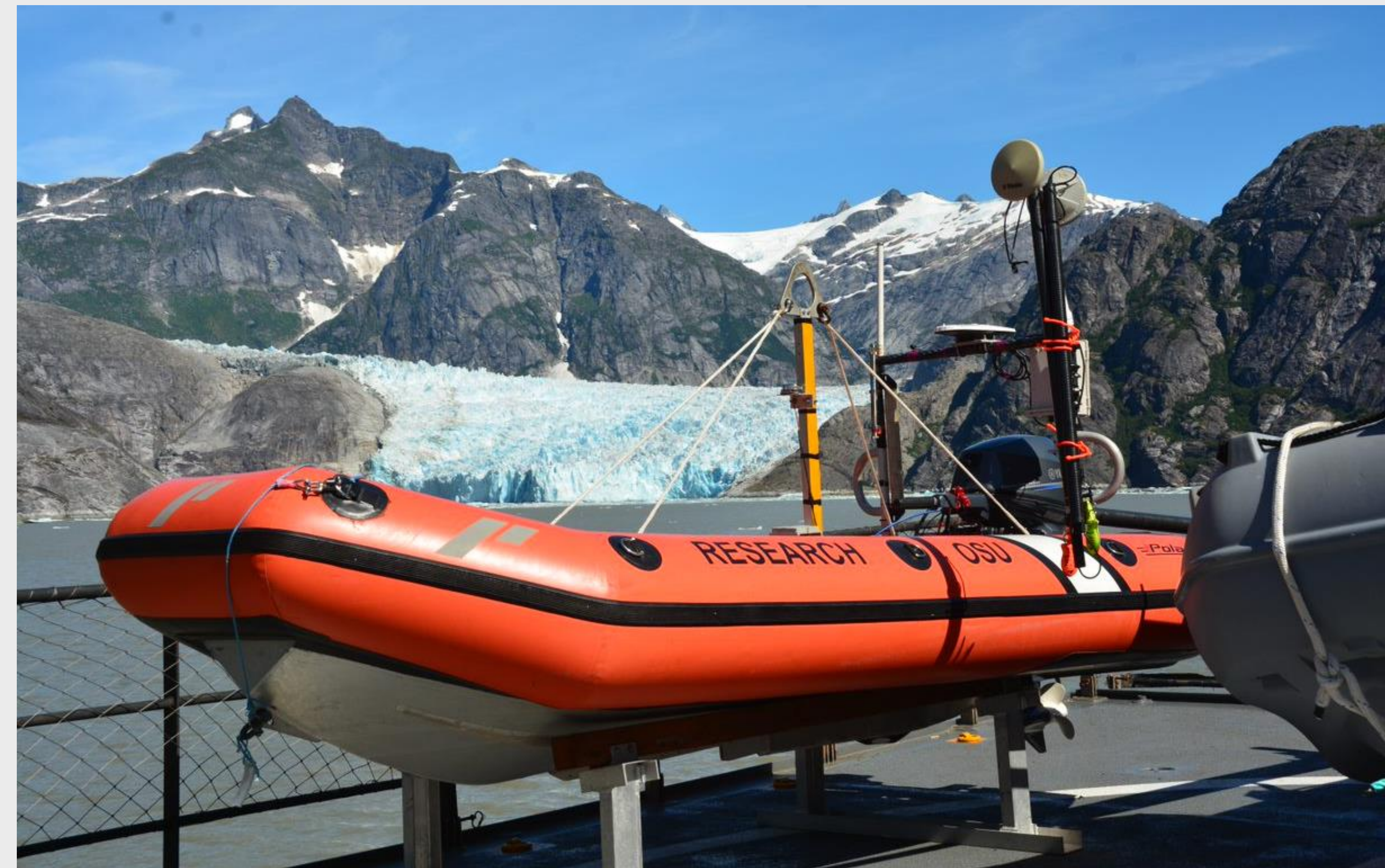


Figure 2: The CEOAS research vessel pictured in front of LeConte Glacier, AK.

## OBJECT DETECTION

- Light Detection and Ranging, or LIDAR, is a technology that allows autonomous vehicles to measure the distance to objects around them using a laser. This laser spins rapidly, measuring the distance to every object in its surroundings and acts as our primary object detection.
- We remove noise and other bad data from the LIDAR system using a Kalman filter. Then, a k-D tree algorithm is used to detect clusters of points that represent objects.
- Future work will combine this object detection system with a pre-existing object-recognition camera system, allowing the boat to know what objects are where.

## PATHFINDING & CONTROL

- In arctic waters, icebergs pose a danger to research vessels. Given the surrounding objects, what is the safest and most efficient way for the boat to get from point A to point B?
- Our solution is a control system that creates and stores a map of the nearby surrounding area using data from our object detection system. Then, it uses a modified A\* pathfinding algorithm to choose the most efficient path to a GPS waypoint that is provided by the user.
- Future work will integrate this system with the existing research vessel to allow the quick and safe navigation to the edge of glaciers, where scientific measurements can be taken.

## ACKNOWLEDGEMENTS






-  Ethan Cline  
clinee@oregonstate.edu
-  Parker Carlson  
carlspar@oregonstate.edu
-  Sam Jadzak  
jadzaksa@oregonstate.edu
-  Dr. Jonathan Nash  
CEOAS Professor
-  Jasmine Nahorniak  
CEOAS Senior Research Assistant



Figure 3: The vessel exploring LeConte Bay, AK. This demonstrates a typical operating environment for the vessel.