

# UM::Autonomy Sparton IMU-AHRS 8 User Story



*University of Michigan's Autonomous Boat Team*

UM::Autonomy is an undergraduate student team at the University of Michigan focused on the development of autonomous vehicles for the International RoboBoat Competition. Participation at all stages of our students' college careers offers a wide array of learning opportunities that come with a multidisciplinary design project.



## Problem

Since the RoboBoat's conception in 2008, the challenges and tasks associated have been directly correlated to the maturity of autonomous vehicles research globally. As challenges around autonomous vehicles continues to increase in complexity, so does our competition. As a result, our competition has transitioned away from computer vision based challenges and is increasingly dependent on our ability to localize and map our surroundings.

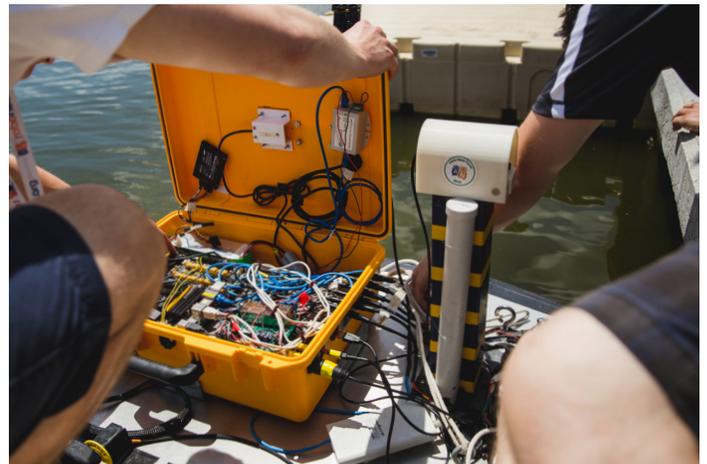


Historically, we localized and mapped surroundings by combining GPS, Gyroscope, Compass, Camera and LiDAR data. However, we were frequently plagued by sensor errors and limited capabilities of our system. This system was unsustainable. However, with the help of Sparten and through the implementation of the Sparten IMU-AHRS 8, we have started to change that.



## Future Improvements

In the future, we expect to transition our localization system into an Extended Kalman Filter based system, which will be even more dependent on the IMU than our current system. As we start to become more dependent on core sensors such as the IMU, we are hoping to acquire a duplicate of our critical components. Currently, our development is frequently stagnated by the need for multiple teams to use the boat and our sensors at any one time. A duplicate of our core sensors would give the ability to have one group testing on the water and a second to be troubleshooting alternative AI or Electrical problems simultaneously. We also run the risk at competition of having a single electrical failure, eliminate our ability to compete. Enabling the UM::Autonomy team to do year round, multidisciplinary, simultaneous testing would be a game changer. The Sparton IMU-AHRS 8 has become essential to our success and we hope to put our members in a position to utilize the full potential of the AHRS 8 and the educational benefit they receive from working with professional equipment.



## IMU-AHRS 8 Application

The Sparton IMU-AHRS 8 has become increasingly critical to the success of UM::Autonomy since we have received it. Due to its high heading accuracy, we have been able to replace our Fiber Optic Gyroscope. This allowed us to decrease weight, condense our electrical systems, and simplify many parts of our codebase.

This year, we have also implemented the IMU into our localization system. In our prior system, we depended purely on a GPS to provide our position, which led to jittery position measurements that caused our boat to navigate incorrectly. By combining our IMU and GPS with a particle filter, we have been able to achieve accurate, smooth localization which enabled us to qualify for finals in the 2018 Robonation Roboat competition.

