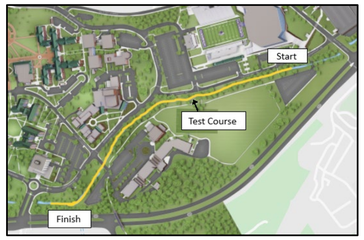
SWIRV (Shallow Water Intelligent River Vehicle)

Mountaintop Endowment

Western Carolina University

PROBLEM STATEMENT

Develop a mobile environmental sensor platform that can remotely or autonomously assess water conditions and navigate through rocky shallow water rivers and creeks, which are unsuitable for human-sized watercraft or other aquatic vehicles.

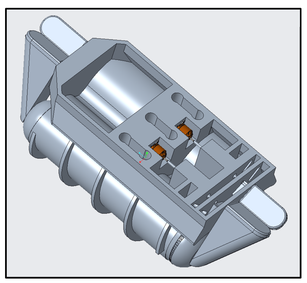


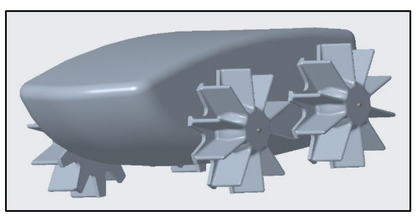
REQUIREMENTS

#	Description
1	45 Minute Battery Runtime
2	Capable of maneuvering around common obstacles in the creek
3	Maintain a stable video line of sight from the front and side points of view
4	Drone should be under 12lbs
5	If the drone is fully submerged, it must return to the surface
6	Ability to hold position for a minimum of 30 seconds

INITIAL CONCEPTS

The team started by developing and testing two concepts, a paddle-wheel-driven and screw-driven chassis type.



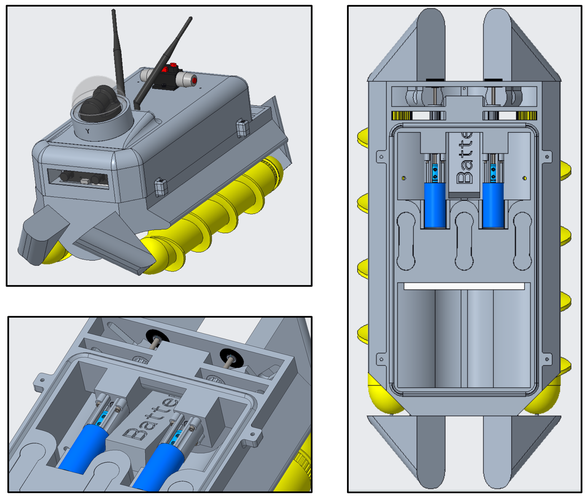


FINAL DESIGN, APPROACH, PLAN

For the final design, the team decided to continue developing the screw-driven chassis, which operates using a skid-steer driving system. This design allowed for faster prototyping due to its modular design.

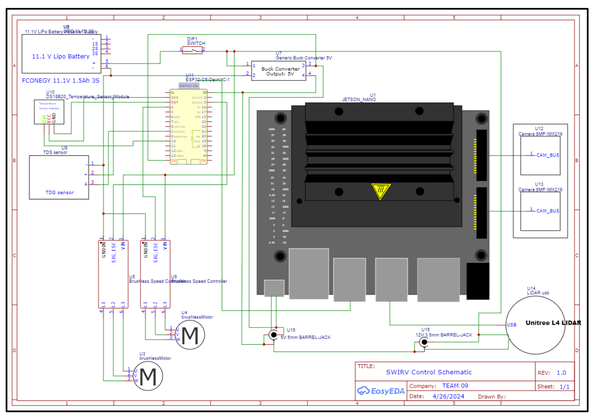
The final design includes:

- A LiDAR module capable of creating a map of the test course.
- A stereo camera for onboard video collection.
- A Jetson Nano minicomputer used to control. the electronic components (LiDAR, stereo camera, sensors, etc.).



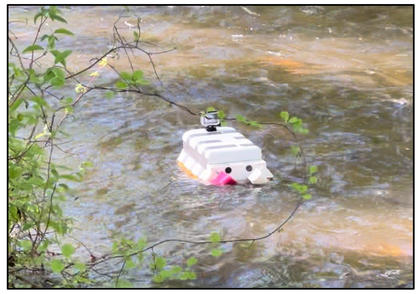
Finalized assembly including complete assembly with lid (top left) close-up of drive train components (bottom left) & an overview of the assembly internals (right).

Wiring Schematic for on board electronics



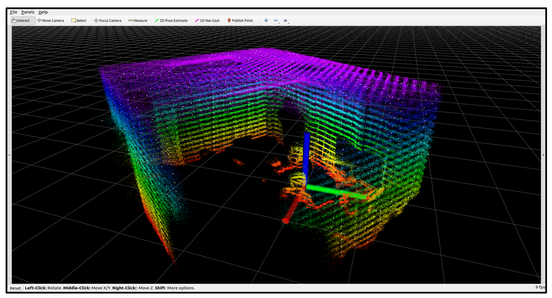
RESULTS

Preview of drone traversing the test course



Completed drone with a laptop to transmit commands from a game controller over Wi-Fi via an ESP32 microcontroller

Lidar scan of the workroom SWIRV was built in



SUMMARY AND CONCLUSIONS

The team worked to design a shallow water intelligent vehicle capable of traversing through a test course with varying obstacles. After designing and testing two different designs, the team was successfully able to produce a screw-drive design capable of traversing through the course under remote control.

FUTURE WORK

- Continue development for waterproofing the new sensors and mechanical components added to the final design.
- Further optimize the screw-driven chassis design for better hydrodynamics and control.
- Utilize the onboard Lidar, GPS, and Stereo cameras to develop an autonomous navigation system.
- Add additional environmental sensors for logging water quality conditions.

TEAM & ACKNOWLEDGEMENTS

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SWIRV GitHub Page

SWIRV YouTube Channel