Designing a Fish-like Robot That Can Swim on Water and Walk on Land

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Motivation

- Chesapeake Bay offers a scenic escape but struggles with excessive algae growth, particularly in forested wetlands.
- Development of a robotic fish with a unique dual-gated drivetrain system could address this issue.
- The proposed drivetrain system allows the robot to navigate both water and land, allowing for easier navigation on hard-to-reach aquatic landscapes.

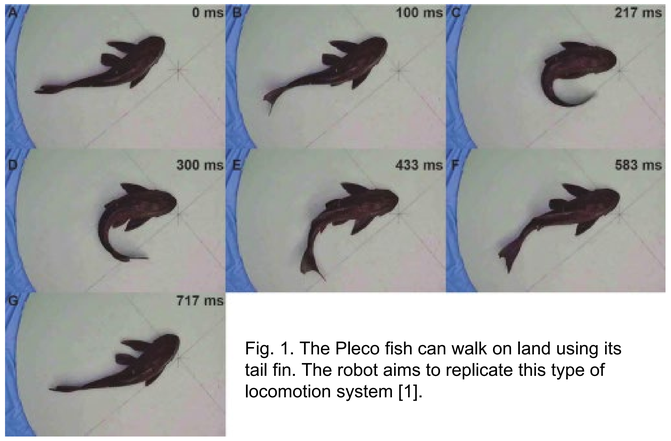


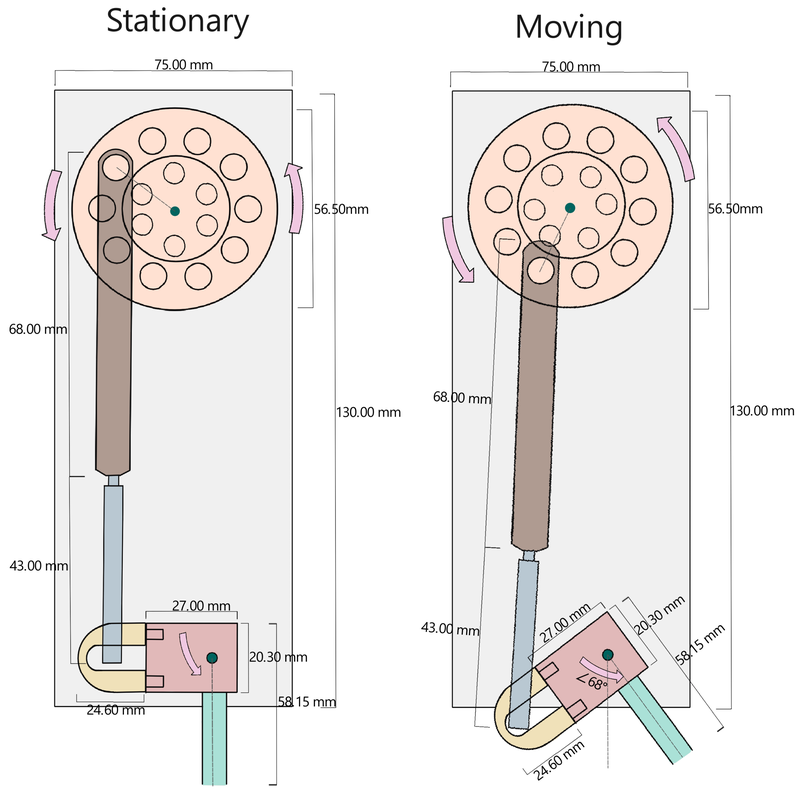
Fig. 1. The Pleco fish can walk on land using its tail fin. The robot aims to replicate this type of locomotion system [1].

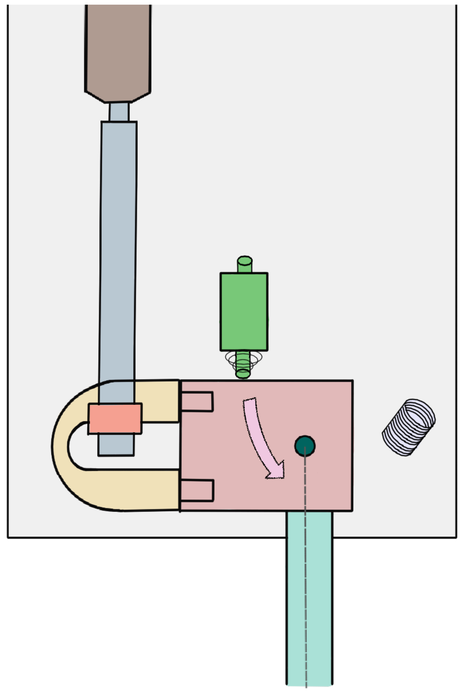
Bio-Inspiration

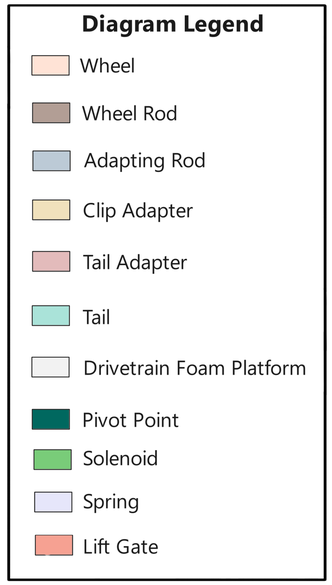
- Preliminary research identified the Pleco fish - a creature that can traverse algae-infested environments.
- The Pleco fish can move on both land and water using its tail fin (refer to fig.1).
- Inspired by the Pleco fish, the drivetrain of the robot aims to replicate the Pleco fish's locomotion behavior.

Goal

The main research goal is to design and develop a dual-gated locomotion system that allows a robotic fish to traverse harsh aquatic environments.







Drivetrain Development

- Robot includes a drivetrain which is powered by an Arduino and encased in a 3D printed body.
- Drivetrain gates are separated into swimming and flapping motions.
- Currently experimenting with spring and solenoid drivetrain designs.

Testing & Results

Testing revealed proof of concept and led to development of a dual-gated drivetrain system

Submersion Test
- The robot body was tested for minor water leakage.
- The body leaked near the tail adapter and part of the body screw holes.
- To fix the leak the robot body was sealed with Flex Tape

Neutral Buoyancy Lab Test
- Tested the robot's ability to swim on water and walk on land.
- The robot was unable to swim much, as the drivetrain would occasionally get stuck with the body.
- The robot had rudimentary walking motion.

Future work

- Experiment with different tail types for effective .
- Develop modular dual-gated drivetrain systems.
- Build a new waterproof body based on the new drivetrain system.
- Experiment with clutch-powered drivetrain systems.

Citations

[1] Noah R. Bressman, Callen H. Morrison, and Miriam A. Ashley-Ross, "Reffling: A Novel Locomotor Behavior Used by Neotropical Armored Catfishes (Loricariidae) in Terrestrial Environments," *Ichthyology & Herpetology*, vol. 109, no. 2, pp. 608–625, Aug. 2021, doi: 10.1643/i2020084.

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