Semi-Autonomous Duck Decoy

Timothy Dobie, Alejandro Castillo, Carson Giefer, Kelby Kramer

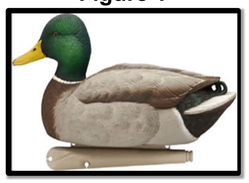
Faculty Mentors: Dr. Puteri Megat Hamari and Dr. Pavan Karra

ECET Department, Minnesota State University, Mankato

BACKGROUND

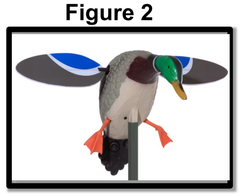
Waterfowl hunting is a billion-dollar industry in which the decoys that are currently used are static and not very realistic. There are products that exist that are powered and move around, however, none of them are very affordable or even able to be controlled by the user from a distance.

Figure 1



Unreliable Power Supplies

Figure 2



With further advancements in technology due to the drive to get better batteries for public use, it is still difficult to get a high-quality, lightweight battery. Current models utilize lead-acid batteries but those need to be held up by a pole due to their weight. Due to this, our project utilizes a lithium battery which is half the weight and equal current output.

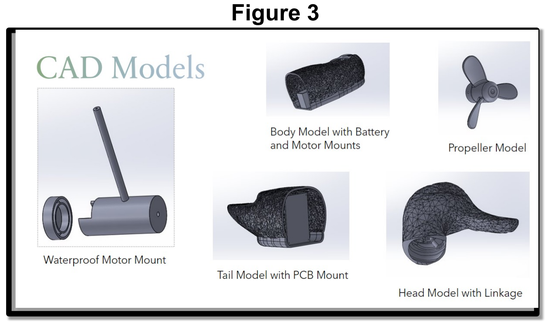
Quality Control of Components

The quality of inexpensive components necessary to create an attainable and affordable product is very poor. To get the total price lower for the project, inexpensive products are very necessary. However, the motors that you end up with are not accurate or reliable for an automated system like this.

PROPOSED SOLUTION

Our proposed solution shown in Figure 3 is all of the CAD models that will make up this project. To reduce costs and make this more attainable, all the files can be printed from a standard 3D printer that utilizes filament. This project will also use inexpensive and easy to replace components to ensure that the decoy can be fixed by consumers in the future.

Figure 3



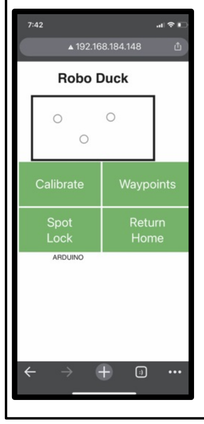
SYSTEM DESIGN

GPS Module

GPS is used for determining the position of duck decoy +-3 ft. Determining position is a vital part of controlling the Duck Decoy's movements.

Power Management

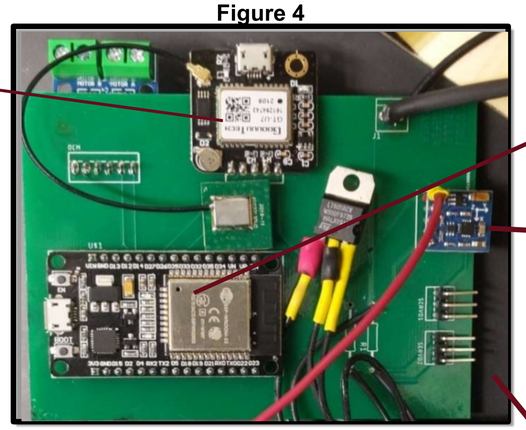
a 6.4 V 6AH rechargeable battery that runs through a 7805-voltage regulator provides 5 V to components. This battery is estimated to last approximately 3-4 hours of run time. A switch allows power to be cut off to components when not in use.



Web Application

The application that was created for this project is utilized for calibration, setting a location for the decoy to stay, creating waypoints for the decoy to follow, and for returning to where it was released in the water. This application communicates with the ESP32 and provides information from various components on the Duck.

Figure 4



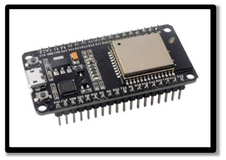
Printed Circuit Board

Figure 5

Outer Shell of Decoy

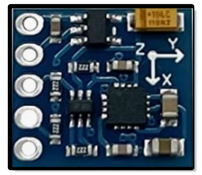
ESP32

ESP32 contains a Wi-Fi module that can be configured to act as an access point. This allows devices to connect and utilize its web app for control of the duck decoy. Additionally, it is small, lightweight and has a large number of I/O ports.



Magnetometer

A magnetometer is a scientific instrument used to measure the strength and direction of the magnetic field. This component allows the duck decoy to have a reference for North. This allows for a waypoint guidance system to properly control propellor direction.



Driving Motors

Two servos and one DC motor are used to create all the functions of the Duck Decoy. The first servo motor is used for bobbing the head, and m second is for spinning the propellor. The DC motor is utilized for moving the duck by spinning a propellor.

PLA Plastic Casing

The electronics are housed in a case made of Polylactic Acid (PLA) plastic. This casing is weatherproof, highly impact-resistant, and does not interfere with wireless transmission.

Rotating Head

Rotating of the head is used to simulate the bobbing of heads that real ducks do in the wild. This action is performed by a pully system and a servo motor rotating back and forth.

FUTURE DIRECTION

- Explore different casing options to reduce size and increase buoyancy
- Reconfigure casing for easier battery accessibility
- Scale up and test system with multiple decoys
- Reconfigure design so decoy can flip up vertically in the water

REFERENCES

[1]Minnesota Department of Natural Resources

ACKNOWLEDGEMENTS

We would like to thank Dr. Pavan Karra and the Mechanical Engineering department for their help with this project.

We would also like to thank Dr. Puteri Megat Hamari and the Electrical Engineering department for their assistance and ideas for the project.

CONTACT INFORMATION

Feel free to contact us at Timothy.Dobie@mnsu.edu, Alejandro.Castillo@mnsu.edu, Carson.Giefer@mnsu.edu, and Kelby.Kramer@mnsu.edu with any questions or comments.