GVSU Biology NRM Department
Wildlife Dimensional Probe

Gage Elenbaas, Renzo Garza-Motta, Lam Phung, Jamal Arafat, Evan Newel

Senior Project | Winter 2023 - Summer 2023

Abstract

The GVSU Natural Resource Management department has sponsored this project to address a problem in the current way data is gathered regarding wildlife animal dens in tree trunk cavities. Specifically, a study of the American Pine Marten dens. Obtaining accurate information about the living quarters of animals can be challenging due to obstacles such as nests located in hard-to-reach places, branches, or other obstacles. The proposed device is a dimensional volume estimation device attached to an extendable pole, to measure the volume of the interior of tree cavities where animals may make dens. The device is designed to be portable, water resistant, and easy to use in field conditions.

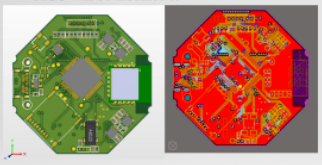
Introduction & Project Scope

Natural resource management (NRM) researchers conduct research on the management and conservation of natural resources, such as forests, water, soil, and wildlife. This research can include studies on the sustainable use of resources, the impact of human activities on natural systems, and the development of management strategies to protect and conserve resources. The GVSU NRM department is specifically interested in studying the dens of the American Pine Marten. The American Pine Martens are native to North America and are primarily found in the boreal forests of Canada, Alaska and the northern contiguous United States such as the Upper Peninsula of Michigan. The desired state of solutions for the GVSU NRM department is a device which takes volume measurements of the homes of various wildlife in total darkness. Ultimately, a device attached to the end of an extendable, retractable, and portable pole which can maneuver into dens high up in the trunk of a tree is desired. This project will focus on the following scope:

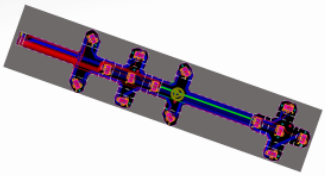
- Development and integration of a system that calculates the volume of a den.
- Integration of a storage system to securely store captured data.
- Implement the volume measuring device to be mounted securely onto a probe stick that is adjustable in length.

Hardware

- Designed a Rigid PCB which the STM32 MCU will be mounted to

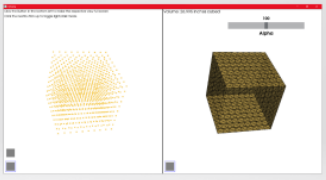


- Designed a Flex PCB which all the Time of Flight sensors will be mounted to

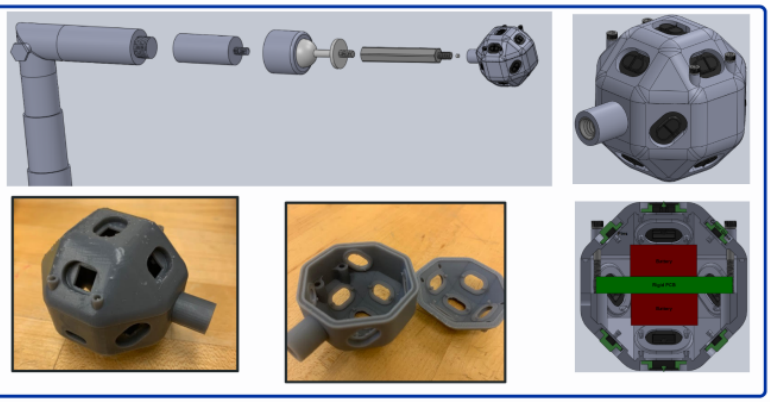


Software

- Custom python application for data analysis



- Custom android application for device communication



Build

The system as a whole consists of the extension pole and its attachments, a tablet, and the device enclosure. The pole has an adjustable length from 6ft-24ft, allowing for easy access to the dens of the American Pine Marten which are generally located up in trees. The device enclosure is 3D printed using Formlabs Tough1500 Resin. This resin is a tough material that simulates the properties of polypropylene. This allows the enclosure to be tough, durable, and have the ability to withstand a drop onto the ground. The material is also waterproof which is an essential aspect since the device will be used in outdoor conditions. The enclosure houses the rigid PCB, flexible PCB, two 500 mAh batteries, along with the 14 time of flight (TOF) sensors. The enclosure was designed in such a way that the 14 TOF sensors are placed evenly around the enclosure. This allows for the most accurate volumetric measurement to be taken.

Team Photo

Left to Right: Lam Phung (CE), Jamal Arafat (ME), Evan Newel (EE), Gage Elenbaas (CE), Renzo Garza-Motta (EE)

Acknowledgements

The senior project team would like to thank

- Dr. Paul Keenlance for the opportunity
- Dr. Bruce Dunne for his encouragement and expertise
- Dr. Karl Brakora for his advice and patience
- Our friends, family, and peers who offered advice on developing the dimensional probe