DALHOUSIE UNIVERSITY
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GREY WAVE
SENIOR CARE CONSULTING

Department of Mechanical Engineering

Tracking Devices for Those Who Wander

Introduction

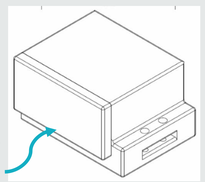
People with Alzheimer's and Dementia are challenging to find when they wander and become lost. Presently, families and caregivers adopt methods that require tracking devices or restrictive methods to monitor and locate loved ones.

Greywave is a Senior Care consulting firm in Nova Scotia. Concerned families contact the firm with the hope of being directed to a great resource for tracking loved ones with these neurodegenerative disorders. The existing devices on the market have their respective drawbacks, includes being costly, detachable, requiring bureaucratic procedure, or having imprecise tracking capabilities.

Our team was tasked with designing a tracking device that can locate a person who wanders instantaneously. The primary requirements are: trackability, lockability, comfort and water-resistance.

Design Process

1) Talk to stakeholders to better understand and identify problem
   - Identify requirements: it shall be trackable within 20m, and it shall not be removable by the user without assistance. Subsequently, the device is required to be simple, compact, water-resistant, and ideally provide geo-fencing.
   - Research available products and technology
2) Generate pre-liminary design concepts
   - Replaceable Tracker to be worn on wrist
   - Re-chargeable Tracker to be worn on wrist
   - Micro-chip to be injected

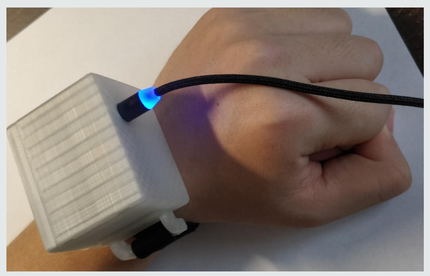


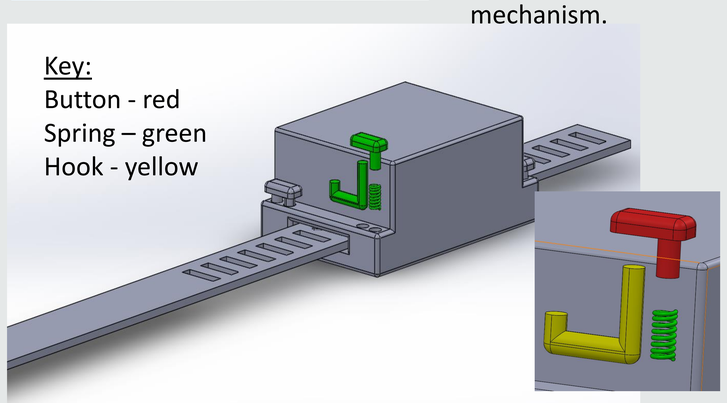
3) Present design concept to client
   - Client preferred the Re-chargeable Tracker
4) Create Technical Design: see image here
   - Create body for an existing Tracker to be inserted into.
   - Would use security screw to lock-on device to user.
5) Adjust design concept based on client feedback
   - Client did not like the idea of using security screws for locking mechanism and were concerned that the design would be too large.
6) Repeat step 5 and 6
   - Decided to proceed with a Form and Functional Design.
   - Form Design: Tests the comfort and extended wear of device without tracking capabilities. This design can be built on in the future.
   - Functional Design: Tests the lockability, water-resistance, and trackability, while the sizing was limited by purchasing an existing Tracker.
7) Prototype design
   - Form Design: Tested different shapes and curvatures.
   - Functional Design: Tested a 4-button release and magnetic locking mechanism.
8) Test and validate design
9) Repeat step 7 and 8 until satisfied
10) Final Design: See “Details of Design” section

Functional Designs

Magnetic Locking System:

A Magnetic locking system was used to lock the tracker to the user. The locking system worked similar to that of a shopping tag. A spring system kept the device locked to the user, where a magnet could compress the spring, allowing the device to be removed. The device had a one time step up of using a screw to fix the strap.

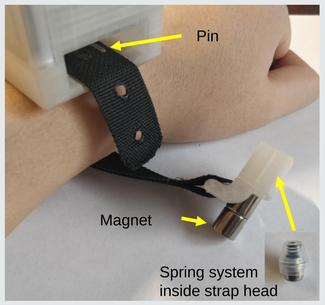


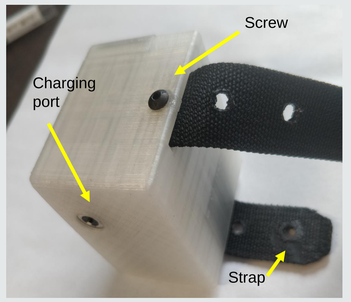


Details of Design

The design was broken into two parts, a functional and form design. A functional design tested the trackability, lockability, and water resistance of the device but was too large for comfort. While the form design tested the comfort and size of the device without the tracking and locking capabilities. This approach was taken due to the students limited knowledge and time to create a new tracking system that could be made into a reasonable size to be worn on the wrist.

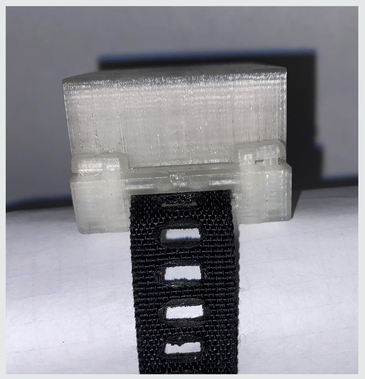
Both the functional and form design prototypes were 3-D printed out of PLA filament. The main chassis was sealed using an o-ring to ensure water resistance. In addition, a nylon strap was punched incrementally along its length to enable size adjustment. The functional design utilized a magnetic charger to further the ease of operation. Tracki was used as the tracking operating system.





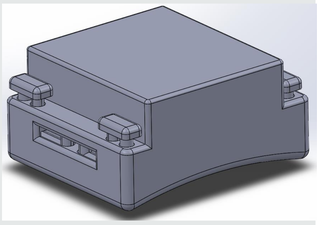
Four-Button Release:

The 4-button release design functioned by requiring two hands to be opened. Buttons were connected to springs, which kept the strap in place using a vertical hook. Note that the seal and charging method are the same as in the magnetic locking system, and that the strap had different hole sizes to account for the alternative locking mechanism.



Form Design

The form design shows a smaller device using the four-button release. This device was designed to house the components necessary for a tracker system to be fitted inside with all its electrical components and hardware. Notice the curved bottom of the chassis to increase user comfort.



Conclusion and Recommendations

After testing and validation, a few main discoveries were made:

- The magnetic locking design functions easily but is bulkier than the four-button design
- The four-button design, functionally works but is challenging for the elderly demographic to release
- Both functional designs (Magnetic & Four-button) lock, are relatively water resistant, and have tracking capabilities
- Tracking capabilities are available and were proven through using Tracki as the operating system
- Sizing of the form tracker is limited by the hardware that needs to be inserted in the chaise
- The form design proved to be comfortable and a reasonable size for the tracking and locking mechanisms to be attached
- Fabricating the wrist strap out of Nylon proved to be cumbersome, not reliable, and rough on the skin
- Prototypes printed in PLA were not waterproof when fully submerged in bodies of water for extended periods of time

Moving forward there are a handful of recommendations. First, the tracking functionality of this device should be looked into by a Software Engineer or another Computer Engineering capstone group. All the hardware necessary for the tracking will fit in the form design. That being said, the functional designs should be tested on more people, including a larger elderly demographic to better understand which locking mechanism is preferable.

In addition, the water resistance of the design can be looked into further. It is recommended to try PETG filament for its water resistance and strength.[1] The wrist strap could also be fabricated using different materials such as silicone, Kevlar, or leather to increase the comfort of the strap and production reliability.

References

[1] BCN3D. (March 2021). *Waterproofing 3D Prints: 5 Easy Solutions*. Retrieved from https://www.bcn3d.com/waterproofing-3d-prints-5-solutions-to-creating-water-resistant-models/?fbclid=IwAR15UMfKDGgTRIH8bdaOpWqRbZrd2Td0cceQBtdE-AIqiPz7iE5WPWqncLo#:~:text=If%20you%20are%20printing%20a,very%20easy%20material%20to%20print.