NorthStar

KLIM x NASA

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Introduction

Snowmobiling is a super exciting winter sport enjoyed by millions, however, it also comes with risks. In a recent study by the RideSafe foundation, there was a 40% increase in snowmobiling fatalities recently observed in certain regions. Factors like poor visibility, challenging terrain, and unexpected obstacles are common things that contribute to snowmobile accidents, especially in the backcountry. The current market for snowmobile safety to mitigate these risks is quite narrow. Products that come close to helping the rider navigate difficult terrain come in the form of a GPS Navigation Device. These devices include common GPS features one would see in a car and therefore are not tailored to snowmobiles in the way riders need.

After researching the current market and receiving feedback from riders, our team came up with a device to address the safety concerns of actual riders. We wanted our device to be more than just another GPS on the market with a new skin. The device we created incorporates new NASA technology for the future. By using this technology, our device can offer real-time terrain awareness, emergency alerts, and 3D GPS tracking, setting a new standard in snowmobiling safety equipment.

Rationale

Problem and Opportunity

Snowmobiling has unique safety challenges because of the constant changing terrain, visibility, and the physicality of maneuvering the heavy machine. The high rates of injury and deaths in the sport prove how important a safety device designed to give the rider real-time awareness and alerts would be.

Product Overview

The product we created, seeks to address the safety concerns we were seeing in our surveys. Our product is designed for everyone for use in winter conditions. It is a reliable safety tool for all snowmobilers no matter the experience level.

The device comes in a pair of two units that are mounted to the snowmobile handlebars (Figure 1). It features slope angle detection, terrain mapping, buddy tracking, turn-by-turn route navigation, hazard awareness and emergency alerts. Using NASA technology makes this product reliable, even in extreme winter conditions. The upper unit is the main route navigation and terrain mapping. The lower screen is for a bird's eye view of the terrain and for scrolling through the route using the D-Pad. These settings are fully customizable by the user.

Figure 1 Units on Handlebars

Objectives

The primary objectives of our safety device are:

- **Enhanced Safety**: To reduce snowmobile accidents by providing real-time alerts and terrain information.
- **Improved Navigation**: Using high-resolution 3D terrain mapping for better route planning and slope angle tracking for avalanche avoidance
- **Buddy Tracking and Emergency Alerts**: Allowing group visibility and SOS features in case of an emergency.

Benefits and Outcomes

Using this device can lead to increased safety while snowmobiling and a better overall snowmobiling experience. With a price of around $750, it is a worthwhile investment for anyone who likes to snowmobile, especially when the benefits of this technology are considered.

Material Choices and Integration

NASA Technology

Our device uses NASA technology called Real-Time, High-Resolution Terrain Information Technology (DRC-TOPS-8).

DRC-TOPS-8 is a software to compress Digital Terrain Models (DTMs) into a bitesize, usable format for smaller devices, without any loss of precision. This NASA technology was originally created to be used onboard airplane navigation systems for obstacle avoidance. Our device can harness this technology to use it in a similar fashion.

DTMs are commonly created using Light Detection and Ranging (LiDAR) technology. A LiDAR sensor is attached to an aircraft or more recently a drone and flown over the surface of the earth. Millions of points of lights are directed at the earth and returned to the sensor to create

a very precise (1 meter resolution) model of the earth's surface. A DTM is then created from the LiDAR data, resulting in large file sizes that must be pieced together in tiles. To use these DTMs, a user must download each tile separately and they would be nearly impossible to use on a portable unit. Using the above NASA technology, we can have accurate DTMs on our units without a loss of the 1 meter precision.

Material Selection

To make sure our device is durable and reliable in harsh winter conditions, we selected materials that withstand extreme temperatures and physical impacts:

- **Housing**: PC-EXL9330 Case with TPU-Texin990 overmold
- **Display**: Gorilla Glass
- **Mounting Mechanism**: Carbon Fiber

Integration Process

The data is designed to be compressed and already preloaded on the device, much like an off-the-shelf GPS unit. By having the data preloaded on the device, the user does not need to worry about loading anything beforehand or about lack of service in the backcountry. No cell service or Wi-Fi would be necessary.

Further exploration of UI/UX design is still needed to create a user-friendly environment for menu items, settings, and color choices

Benefits

- **Enhanced Safety**: Provides riders with fast, accurate terrain information, lowering the risk of accidents.
- **Portability**: The compact design means it is easy to use without adding a lot of weight to the snowmobile.
- **Cost-Effectiveness**: Using existing NASA technology lowers development costs, making the device affordable for consumers.

Empathy Phase

To understand the needs and challenges of snowmobilers, we conducted online research of the current market devices and snowmobile rider statistics. We created a survey and posted it to the snowmobile Reddit community to determine a demographic and gather current data of users. The data we gathered helped us create a target market for our product (Figure 2).

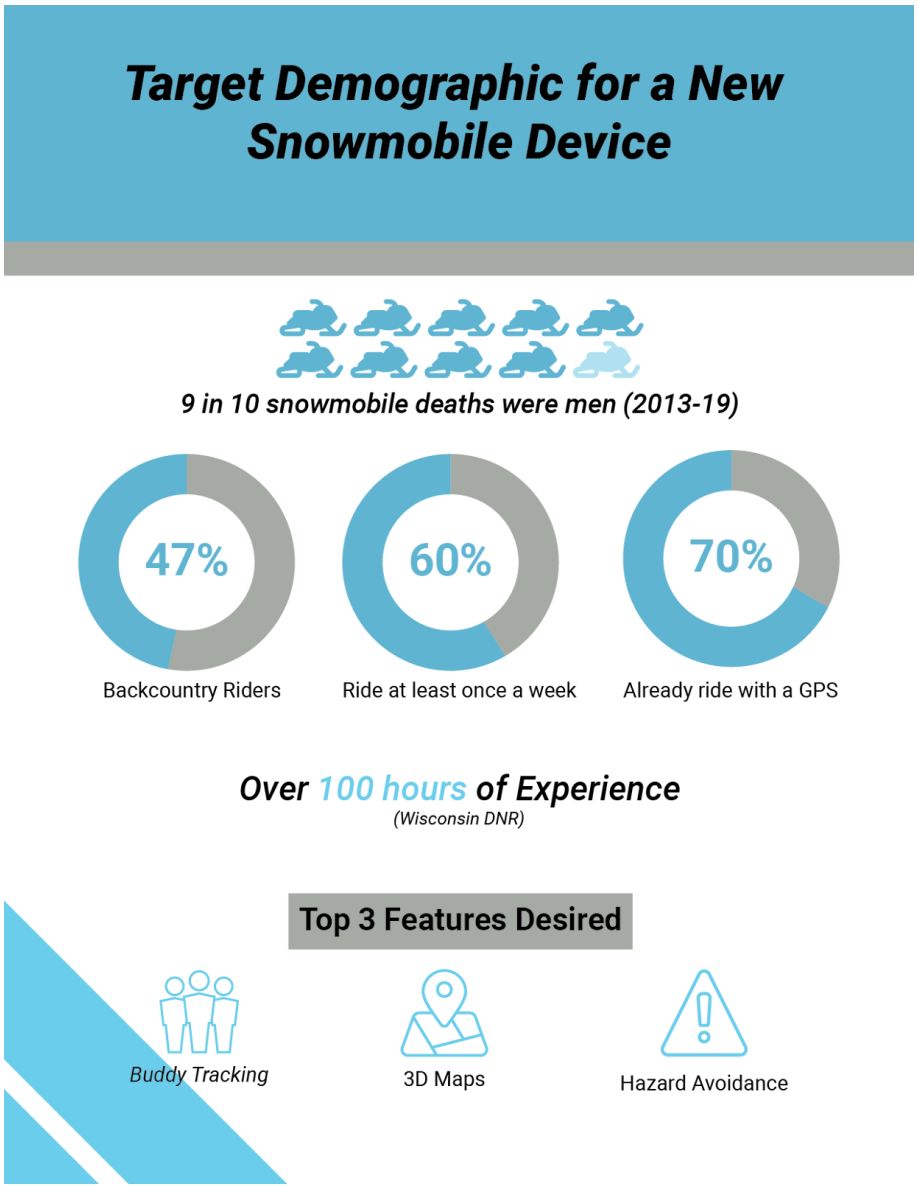

Figure 2 Target Demographic Stats

Our survey showed people are willing to spend money for their safety and they want devices that are going to keep them safe.

A sample of questions we asked other than basic demographic questions are:

What is your experience level?

What kind of terrain do you ride?

Do you use a GPS while riding?

Are there any features your current GPS is lacking?

We relied on this survey heavily to guide our decision making for device features. Using this data, we were able to answer these specific questions:

Who is this for?

This device targets snowmobilers, ranging from amateurs to experts, who ride in the mountains. Using our data we created a user persona for who this device could be for (Figure 3).

GREG HILL

Age: 38
Occupation: Building Supplies Store Manager
Income: $100K/year
Organization: Member of the Top of Utah Snowmobile club and participates in bi-weekly group rides.

Bio: Greg is a motorsports enthusiast who cares about his ***family***. Whenever he particpates in any outdoor activity his main goal is to return home to his them. His top priority is ***safety***.

Frustrations

- Touchscreens are hard to use with gloves.
- Not many safety options in current market.
- Features are subpar for the price paid.

Current Snowmobile Gear


Klim Ripsa Suit


Klim F5 Helmet


Polaris RMK 800


OnX Backcountry

Figure 3 User Persona

What kind of environment?

Mostly backcountry and mountain areas, typically with limited network access, diverse weather, and challenging terrain.

Does the environment provide additional constraints?

Yes, Extreme temperatures, limited connectivity, and unpredictable terrain require a device that is durable, reliable, and capable of operating offline.

Does this already exist in the market? Existing products like Garmin and Polaris systems offer GPS and communication features but lack cross-brand compatibility, real-time updates, and terrain awareness.

What gap are you filling?

The primary gap is the lack of a single device that offers real-time terrain data, cross-brand buddy tracking, and weather integration in a durable, compact form.

How do you know?

Survey responses showed us common issues like not being able to share locations across brands, outdated trail maps, and a lack of emergency communication tools, which emphasizes the need for this device.

Point of View (POV) Statement

No one in our group rides snowmobiles as hobby. We do, however, spend time in the backcountry skiing. There is some safety crossover between backcountry skiing and snowmobilers, but we needed to place ourselves in the position of a snowmobiler. We created a POV statement and journey map (Figure 4) to help us visualize what a rider would need.

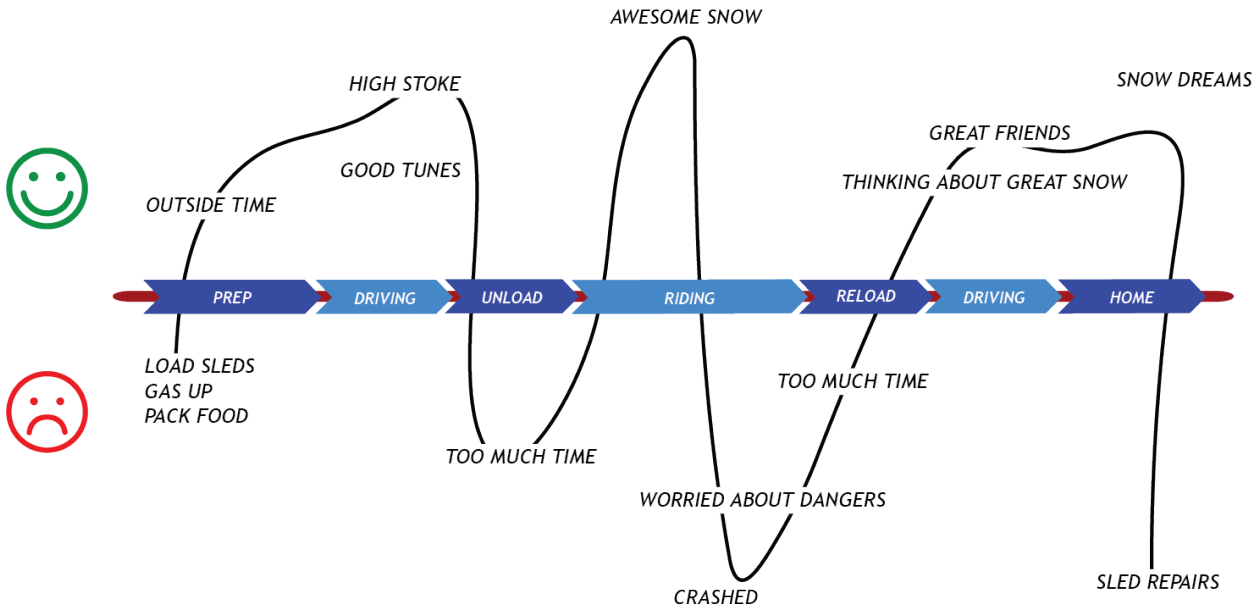

Figure 4 Journey Map

Snowmobilers need a durable, real-time navigation and safety device that provides accurate terrain and location data, enabling them to ride confidently and safely across diverse environments.

Problem Statement

We aim to increase awareness and reduce risk in varying environments for backcountry riders.

"How Might We" (HMW) Questions

- ***How might we use NASA technology to keep snowmobilers safe?***
- ***How might we make snowmobilers more aware in backcountry terrain?***
- ***How might we boost confidence and lower risk in various riding conditions?***

Ask What - How - Why

- ***What are snowmobilers doing?***
  Navigating diverse terrain with limited real-time information.

- ***How are they doing it?***
  Using basic GPS devices or relying on experience, which may not provide good enough safety data.
- ***Why are they doing it this way?***
  There isn't equipment that offers real-time terrain analysis and hazard detection.

5 Whys Analysis

- ***Why do accidents happen frequently in backcountry snowmobiling?***
  Because there are unexpected terrain hazards.
- ***Why do they encounter unexpected hazards?***
  Because they don't have real-time terrain information.
- ***Why is real-time terrain information unavailable?***
  Because existing devices are not designed for snowmobilers' specific needs.
- ***Why aren't devices designed for these needs?***
  Because of technology and market gaps.
- ***Why hasn't this gap been addressed?***
  Because there hasn't been the technology applied to a user friendly design.

Design Process

Every successful design goes through a process and the final design is never the first design. We went through a series of different ideas before landing on our final product. When first creating our product, it was not meant to be two units working in conjunction. It wasn't until later on in the design process that it was decided to be two units.

Product Iteration

We had our NASA technology selected and some ideas of what our device wanted to feature. Before working on UI/UX design for our product, we started with the physical form. We each sketched 15 physical forms on sticky notes (Figure 5) to decide what direction we wanted to head.

We each chose our top three designs we liked and moved forward. It was after this sketching phase when we brainstormed the form and function of how it would fit onto a snowmobile.

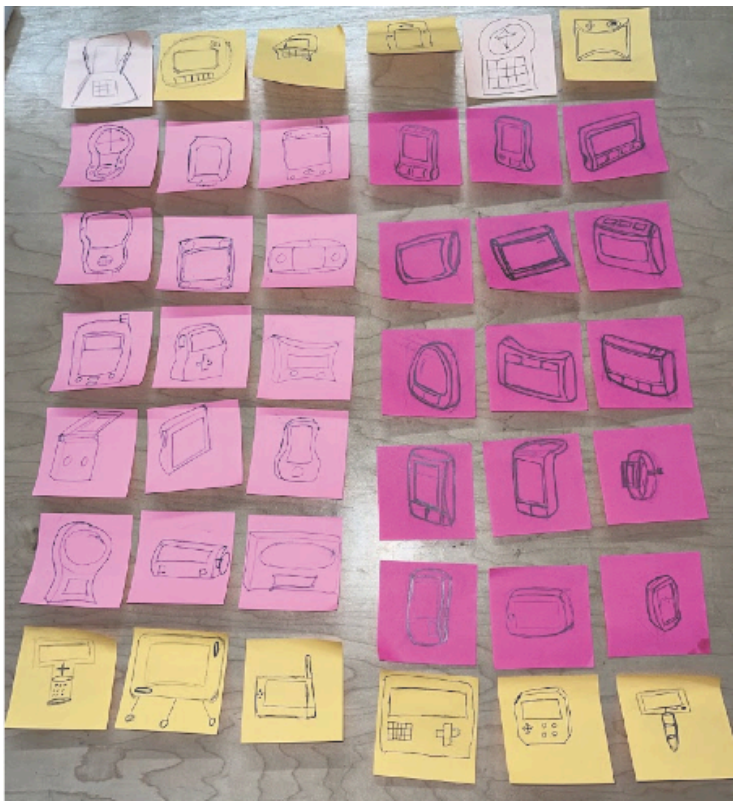

Figure 5 45 Ideation Sketches

Looking at our chosen sketches, we decided it would be best to do a pair of devices that would work together to keep our riders safe.

Combining two forms we liked we landed on a design similar to Figure 6.

To get an idea of how our device could look on a snowmobile we placed our sketch into an AI rendering software to see what it would look like in context (Figure 7).

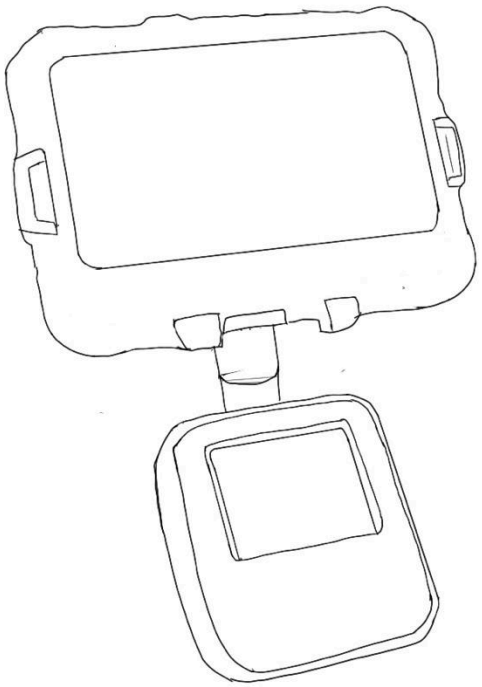

Figure 6 Combined Units

Prototyping Phase

We had a good idea now of what our product wanted to be and the shape that it needed to be. Our next step in the design process was prototyping. We needed to really nail down the exact dimensions of our product.

We had a SolidWorks 3D model that we were able to 3D print to hold the devices in our hands (Figure 8). After 3D printing the model, we decided both the upper and lower screens needed to be taller, so it was back to the drawing board.

Figure 7 AI Rendering

Final Design

After determining the final size of our product, we adjusted the 3D model and did some renderings of them (Figure 9). It is difficult to see in the renderings, but we wanted our unit to have a texturized, rubber housing. The buttons would be textured as well for better durability and feel. Keeping on brand with the partnership, we added the Klim logo

Figure 8 Test prints

Figure 9 Unit Renders

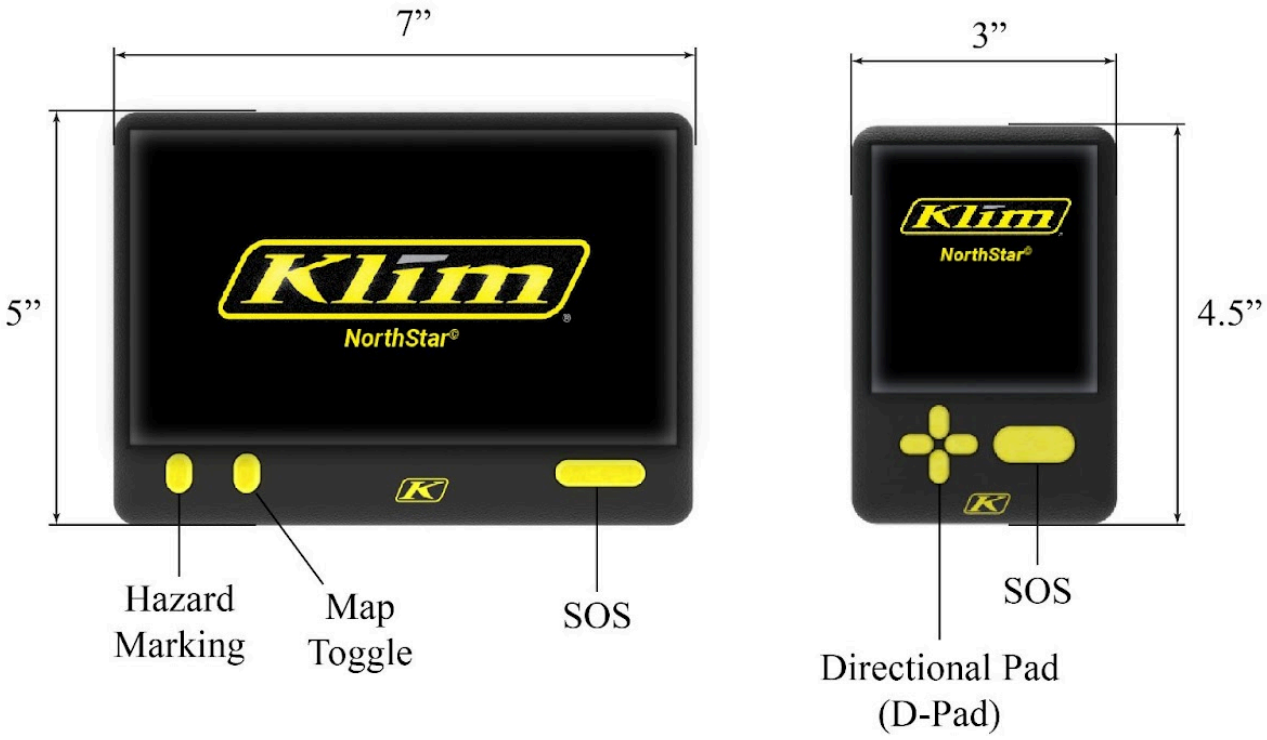

Figure 10 Button Layout

Conclusion

The Real-Time Terrain Scanner for snowmobilers helps increase rider safety and navigation in challenging backcountry environments. By putting NASA's DRC-TOPS-8 technology into a compact and user-friendly device, our design solves the problem of unpredictable terrain which is a leading cause of snowmobiling accidents. This project shows the importance of using technology to provide real-time hazard detection, slope angle awareness, and GPS navigation to riders.

The project is possible if we could actually get our hands on the technology. It is designed for reliability in extreme conditions, it doesn’t require a lot of power. The projected development costs are not too bad because we use existing technologies, and the product's target price of around $700 makes it competitive in the market. The expected return on investment looks good, since there is a big demand for more safety precautions in snowmobiling.

However, there could be some problems such as showing the market about the value of these advanced safety features, and making sure the software works properly in all conditions. To address these problems, we would have to create a functioning prototype and get our hands on the technology to complete these tests and get feedback.

The rationale for this device is clear, snowmobilers need tools to navigate safely and confidently in unpredictable terrain. By designing something to solve this need, the Real-Time Terrain Scanner has the potential to reduce accident rates and improve the overall snowmobiling experience.

In conclusion, the Real-Time Terrain Scanner uses advanced NASA technology and practical safety solutions, making it a needed device in the snowmobiling industry. Moving forward, the next steps would be developing a prototype and using it in real-world scenarios, refinement of key features based on feedback, and exploring partnerships to expand its use to other outdoor sports and industries.

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