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Research Problems

Improve navigation during ski trips (both individually and as a group).

Learn about and improve current backcountry devices, specifically with search and rescue avalanche/fall prevention.

Utilize current technology to make backcountry & on piste skiing more accessible and safe.



Related Works

- “The ubiquity of mobile devices, positioning technology, and video-capturing equipment allows skiers and snowboarders to continuously augment their experience on the slope” (*Niforatos 82*).
- “Employ wearables as means to collect environment and user data in order to provide contextualized, personalized services” (*Bujari 2*).
- “Our system consists of sensors integrated into the ski equipment or attached to the skier, measuring devices for sensor signal acquisition, processing devices for sensor data analysis, and feedback devices for communicating the results back to the skier.” (*Kos 536*).
- “so far systematic tracking via distributed GPS loggers is one of the most reliable methods used for visitor monitoring in outdoor leisure settings” (*Taczanowska 12*).
- “Typically, ski patrol and medical personnel are only staffed to patrol the in-boundary skiing... Training and time off-mountain are seen as economic obstacles causing a degree of disgruntlement: the patrollers feel that their knowledge and training are not being best utilized” (*Lischner 100*).



Anticipated Audience

Casual and backcountry skiers:

- Ski patrol

- Search and Rescue

- Touring skiers

- Safety-minded on piste skiers



Design Challenges

Battery life

Reliability

Privacy

Price

Adaptability



Alternative Designs Considered

GPS-object type

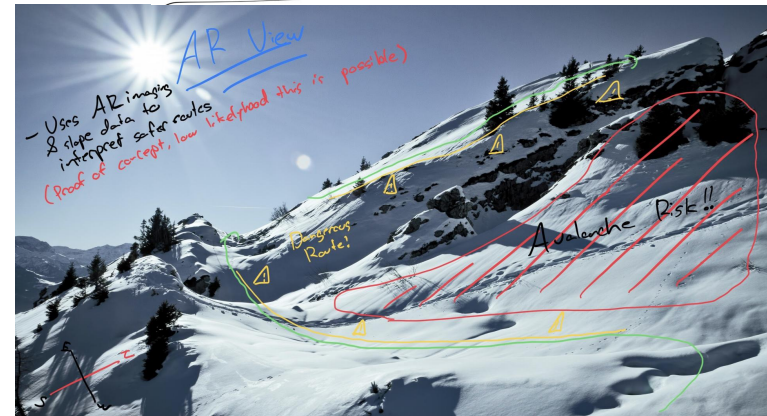
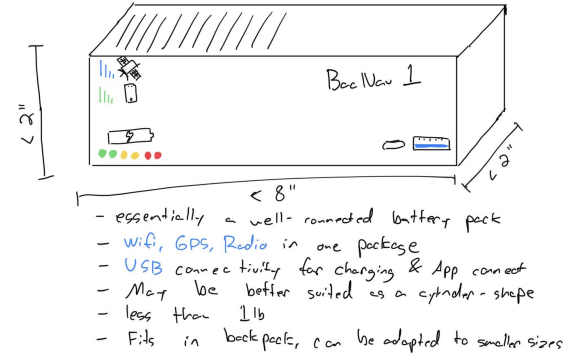
- Redesign of the Avalanche Transceiver currently being used
- Combining multiple technologies (GPS, personal locator, avalanche beacon)

Prediction models

- Attempting to predict likelihood of avalanche based on observations
 - Predicting risks

Comprehensive pack w/ focus on strong battery

- Including things like wifi, GPS, radio, and usb compatible





Final Sketches / Prototypes

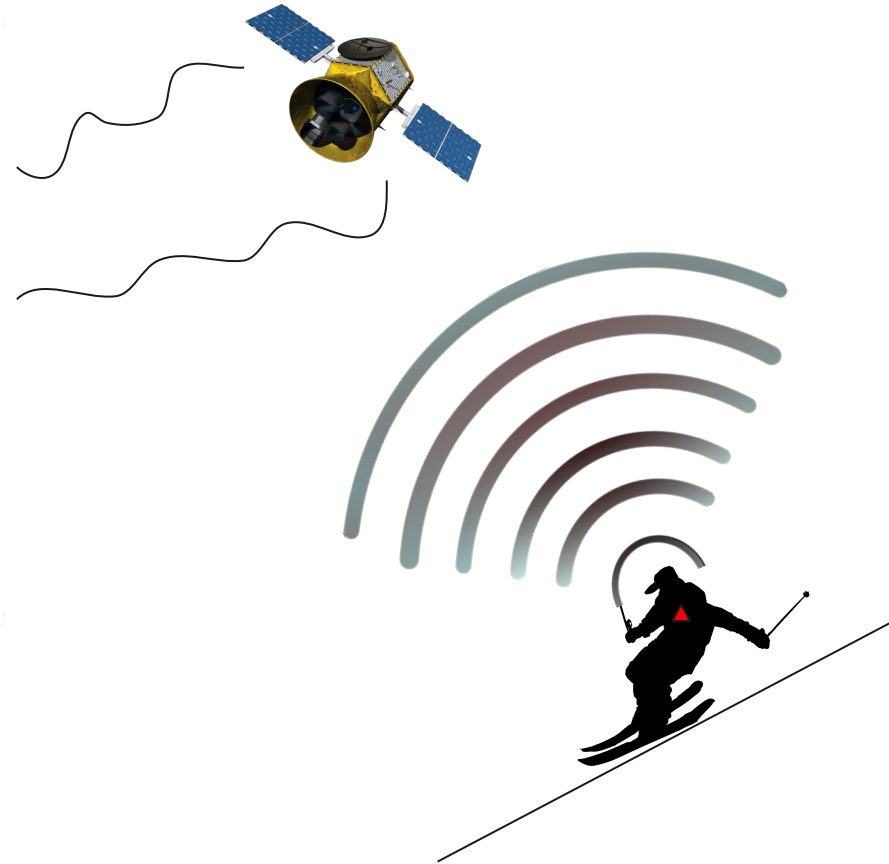
We used hybrid, slidware, and UI sketching to represent our final design ideas.





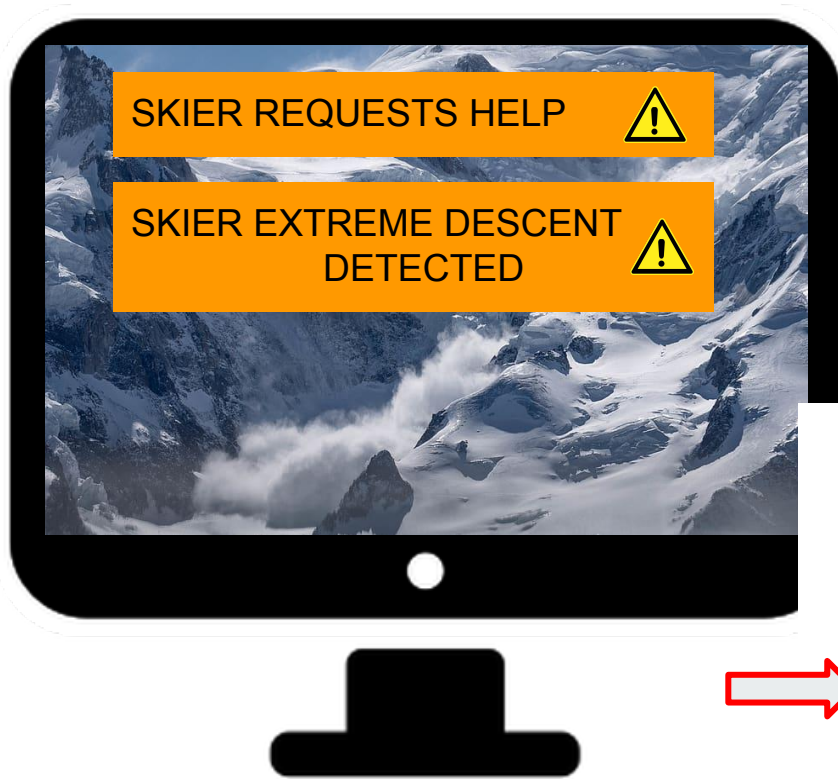
LATER...

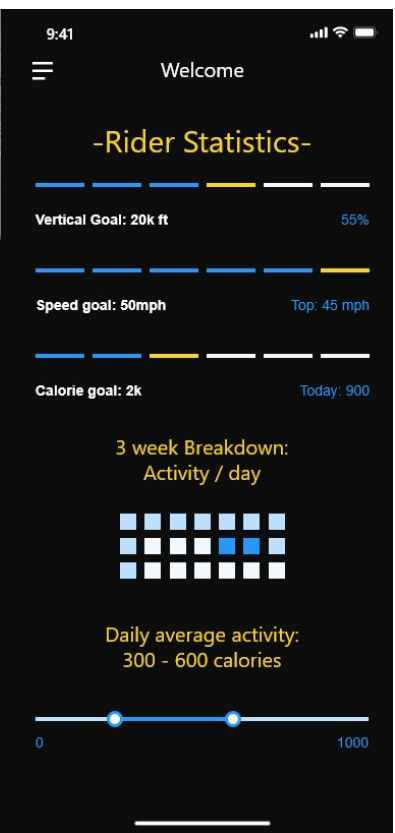
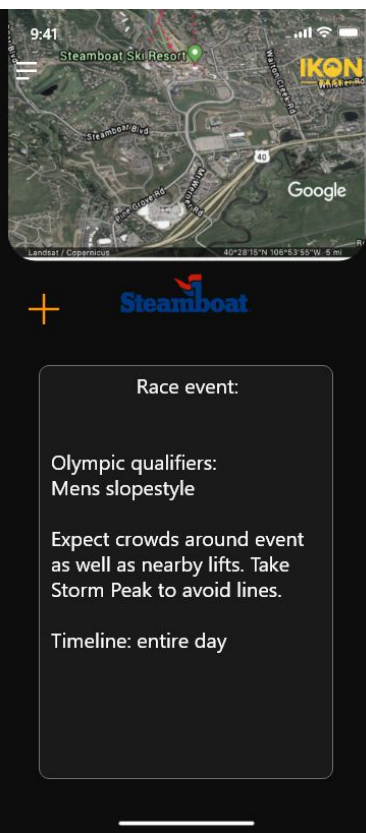
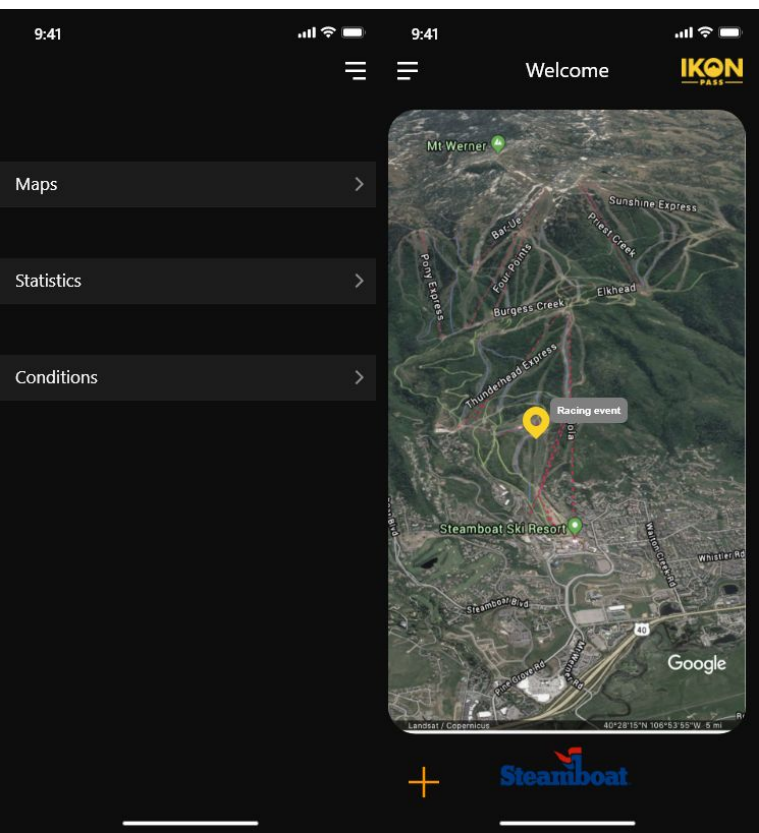
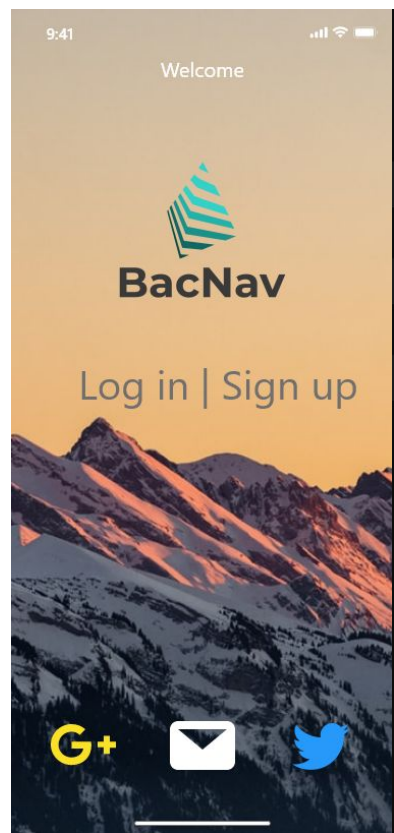
At home somewhere...



On the slopes somewhere...

At a rescue office nearby...







Summary

BacNav aims to make skiing a safer sport through smart & ubiquitous computing devices.

We chose to focus on both resort and backcountry applications.

Our key design features are (per our research:)

- Large Battery
- Easy to use interface
- Robust sensors and construction
- Low cost (~200\$)



Works Cited

Bujari, Armir, et al. "Wearable Sensor Networks: A Measurement Study." *Wiley Online Library*, 23 July 2020.

Hinch, Stephen W.. *Outdoor Navigation with GPS*. United States, Wilderness Press, 2010. https://www.google.com/books/edition/_/Km-eP2RIRxEC?hl=en&gbpv=0

Kos, Anton, and Anton Umek. "Smart Sport Equipment: SmartSki Prototype for Biofeedback Applications in Skiing." *Personal and Ubiquitous Computing*, vol. 22, no. 3, 3 May 2018, pp. 535-544., doi:10.1007/s00779-018-1146-1.

Lischner, Benjamin, MD, FAWM. "Sidecountry and Backcountry Rescues." *Wilderness & Environmental Medicine*, vol. 22, no. 1, 2011, pp. 100-100.

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Taczanowska, Karolina, et al. "Analyzing Spatial Behavior of Backcountry Skiers in Mountain Protected Areas Combining GPS Tracking and Graph Theory." *Symmetry*, vol. 9, no. 12, 14 Dec. 2017, pp. 1-15., doi:10.3390/sym9120317.