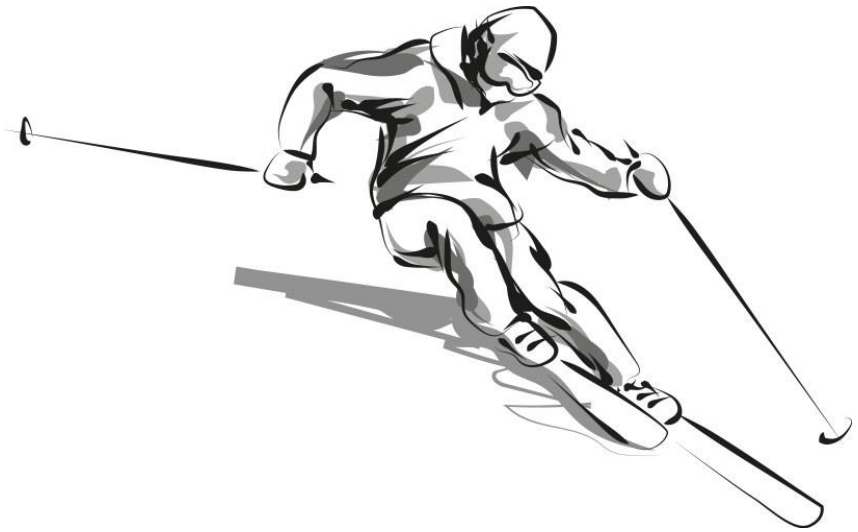
JumpGuard
Kickoff Meeting



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Problem Statement

Problem Motivation:

Many ski resorts today have terrain parks, which are collections of jumps and obstacles that can be ridden by athletes. Depending on the size of terrain park jumps, athletes can't always see the landing area before committing to the jump. So, if an athlete crashes on the bottom of a larger jump, athletes uphill may not be aware of the risk of collision awaiting them at the bottom of the jump.

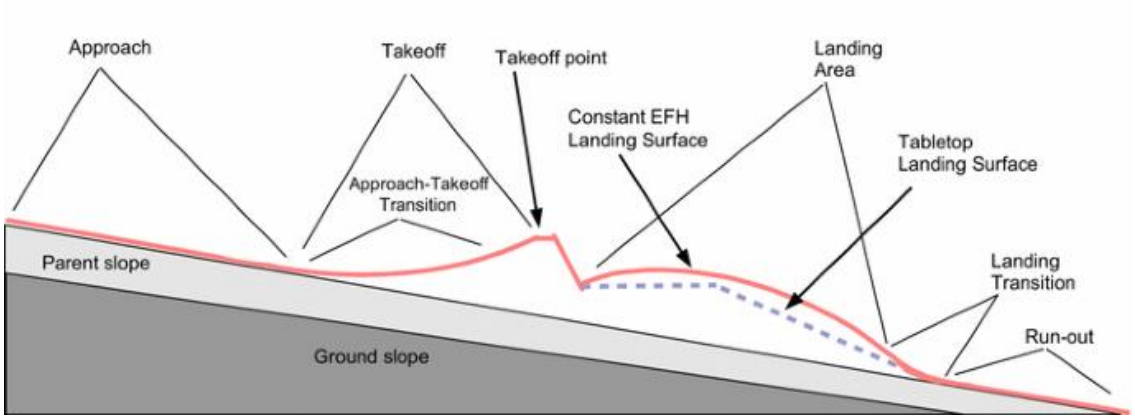
Project Description:

A system will be designed to detect when the landing area is clear before notifying the next athlete that it is safe to proceed from the top of the hill.

Objectives:

This system will determine whether the landing area below a jump is clear, and then report the status to athletes uphill from the landing area. The system must operate in inclement weather throughout the ski-season. The system will operate on a stand-alone power system to avoid running power lines to the system, which could create unnecessary hazards.

Background



Terrain Park Jump Diagram

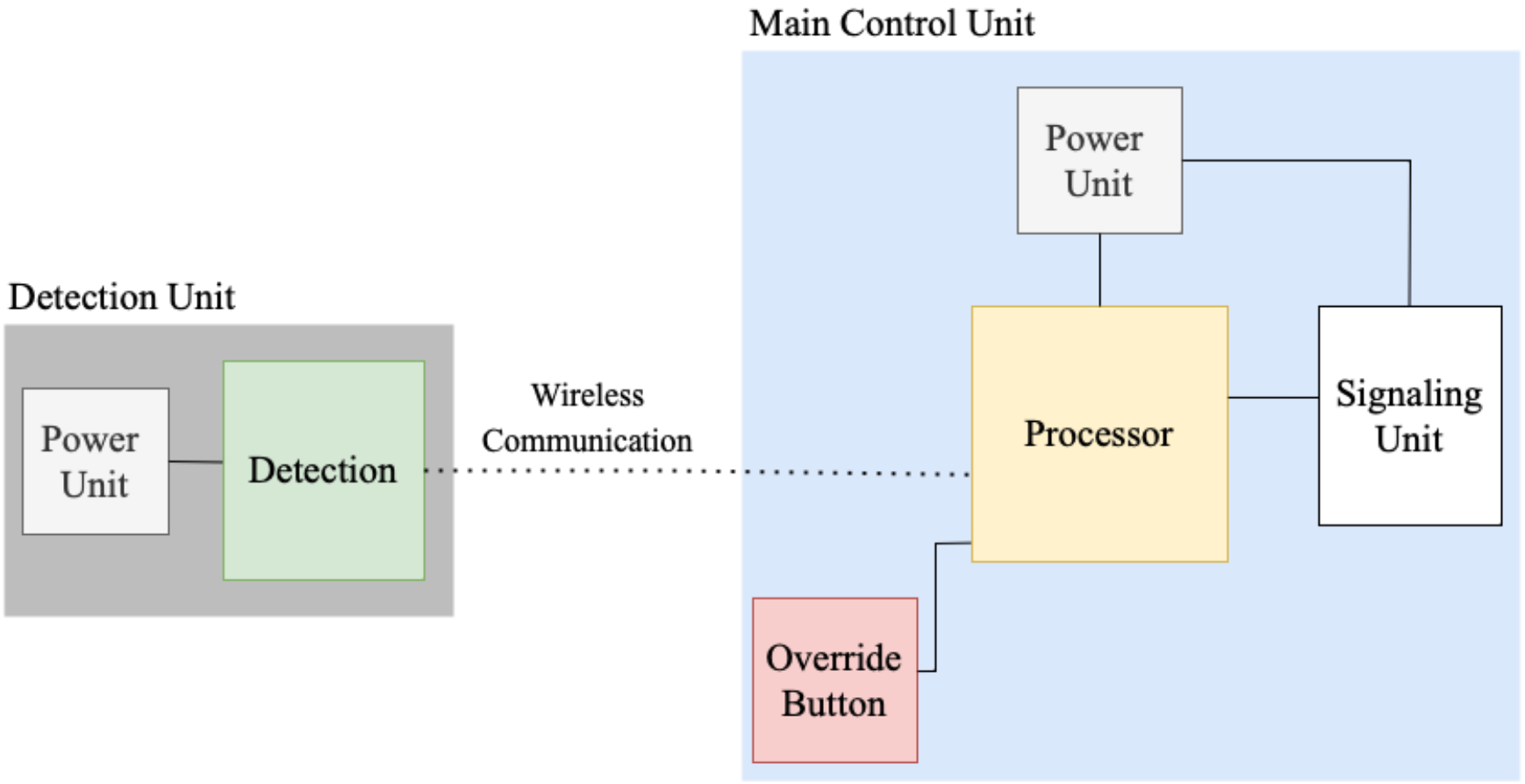
Snowboarder Using Large Jump

Injury Statistics:

- Features in a terrain park that promote aerial maneuvers account for 83% of terrain park injuries
- 63% of terrain park injuries result in a trip to the hospital
- Collisions with other athletes are a primary cause of injury

- Sources:
- Moffat, Craig, et al. "Terrain Park Injuries." *The Western Journal of Emergency Medicine*, U.S. National Library of Medicine, Nov. 2009, www.ncbi.nlm.nih.gov/pmc/articles/PMC2791729/.
- Marketing. "Ski Accident Statistics: How to Stay Safe on the Slopes." *Zinda Law Group, PLLC*, 3 Feb. 2023, www.zdfirm.com/blog/us-ski-accident-statistics/. Accessed 17 Sept. 2024.

Conceptual Block Diagram



Objective 1: Determine whether the landing area below a jump is clear, and then report the status to athletes uphill from the landing area

Req 1.1) System must detect when the landing area is clear

Spec 1.1.1) Detection system must be able to detect athletes in a 30 ft linear distance perpendicular to the fall line

Spec 1.1.2) Must have ≥ 95% detection rate

Req 1.2) Communication between units must be wireless

Spec 1.2.1) Latency from when the sensor triggers to when the signaling unit triggers must be less than 0.5s

Spec 1.2.2) Dropout rate of information must be less than 2%

Spec 1.2.3) Sensors must communicate with signaling unit from a maximum distance of 60 ft away with a direct line of sight

Req 1.3) System must notify the next athlete it is safe to proceed

Spec 1.3.1) Signal must be easily interpreted by the athlete, with clear indications for when it is safe to proceed and when it is not

Spec 1.3.2) The latency of the light changing states after a signal is received must be ≤ 0.05 seconds

Objective 2: Operate in inclement weather throughout the months of December through April

Req 2.1) Must have housing material capable of protecting electronics while ensuring operation in varying weather conditions

- Spec 2.1.1) Must be able to withstand and function in temperatures 0 – 70 °F
- Spec 2.1.2Must be able to operate in winds up to 20 mph

Req 2.2) Signaling Unit must be visible to athletes in varying weather conditions

- Spec 2.2.1) Must be able to see signaling unit from 50 ft away uphill
- Spec 2.2.2) Lights on the signaling unit must produce at least 1000 Lumens

Req 2.3) Must have adjustable height to account for changes in snow base

- Spec 2.3.1) Adjustable between 0 - 5 feet
- Spec 2.3.2) Height increments of 6” for every adjustment

Objective 3: Operate on a standalone power system

Req 3.1) Power source must be reliable in varying winter conditions

- Spec 3.1.1) Must operate continuously for 7.5 hours
- Spec 3.1.2) Must have sufficient backup power to operate normally for 22.5 operational hours

Req 3.2) Capability to recharge

- Spec 3.2.1) Can recharge for a 7.5 hour operational day with 3.5 hours of peak sunlight
- Spec 3.2.2) Backup power can be recharged through an external source in 8 hours for the system to operate for 7.5 hours

Constraints

- Must use solar as primary power source with battery backup
- All components must have a manual adjustability of the height
- Provide a manual override to stop the system in case of emergencies or special events
- Must provide a light signaling unit

Project Concerns

Open Discussion

- Athlete detection in different Atmospheric conditions
- Solar Generation
- Budget Constraints
- Athlete Safety
- Testing

Conclusions

- This system will enhance skier safety by providing real time alerts when a landing zone is clear, reducing the risk of collisions and promoting smoother traffic flow in the park.

- The success of this project depends on our combined expertise, available resources, project scope, and our passion to improve safety in terrain parks.

- The potential to significantly reduce accidents and improve skier safety will make the project worth pursuing. If the system successfully prevents collisions, the impact could far outweigh the risks involved in its development.

Questions or Concerns from the stakeholders?