

EE 459 Project - Spring 2017  
Navigation and Emergency Device  
for Outdoor Recreation

## Product Overview

People involved in outdoor recreation like skiing, snowboarding, hiking, trekking, etc. are often spread out over a large area and not able to find others in their group or have access to navigation information. Sometime this is just an inconvenience, causing a person to wait for others to come down the trail when their friends are around the next bend waiting for them. It can also be life threatening if a person is disabled away from others and can't be found.

To help solve this problem, the product this semester is a device that will combine multiple functions into a single handheld unit that can be carried and used when involved in these activities. The basic functions are: navigation, locating others, and sending alerts. This product is intended for use in areas that have limited or no cellular or wireless service.

It will be up to the product development teams to determine exactly what capabilities they want to provide in their product.

**Note:** To save space below we will describe this as being a device for “skiers” but in all instances this should be interpreted to mean anyone wandering around outdoor, winter or summer, in places where it may be difficult to always know the location of others in their group. This includes, but is not limited to, skiers, snowboarders, hikers, campers, hunters, etc.

## Product Requirements

The product must satisfy the basic requirements that are listed below. These can be implemented in a variety of ways and it is up to the design team to decide how to include the features in their product. Design trade-offs in areas such as reliability, manufacturability, ease of use, cost, etc., should be analyzed to determine which is the best way to design the product. The product teams are encouraged to explore any designs that they can dream up and to go beyond these requirements in terms of both additional features and the quantity of each feature. Keep in mind the overall goal is to develop a commercially viable product which may or may not look like anything ever seen before on the market.

It is not required that every single feature that is claimed for the product be implemented in the prototype. Teams should plan to implement in their prototype about 80% of the features they claim for their product but should not make claims for product features that can not be implemented due to limitations on the available technology or the cost of the product. Teams are not required to implement every product feature to the same extent or quantity as would be required in the final product. However, the cost analysis of the final product should reflect any claims made for it, not just what was implemented in the prototype.

Some of the requirements listed below have been added to the product simply to force teams to build a more challenging product that makes use of a certain amount of technology. In some cases teams may have to add features or capabilities to their product simply to meet these minimum requirements. This is to avoid a situation where, for example, if the class product was to build a residential burglar alarm, a team just paints a sign that says “Guard Dog on Duty” and says that's their product.

The main requirement of this product is the ability to enhance the recreational activity by providing useful information and by increasing safety. Some of the product's features are specified below but teams are

encouraged to add others that they feel are technically feasible and would make the product more appealing to consumers. However the team must remember that each added feature will add to the product's cost so adding lots of interesting features may force the price above what many consumers would be willing to pay. Some possible design options can be found by studying the features that other manufacturers have included in similar devices.

You can incorporate any available technology you wish to use into the product (GPS, Bluetooth, RFID, WiFi, etc.), but any technology you use should meet two requirements.

- The cost of the product must reflect whatever technology you include in it.
- Any added technology must be used in some way. For example, don't add a Bluetooth interface to the product and claim it has "Bluetooth capability" but admit during your final presentation that you really never knew what you were going to use Bluetooth for in the product.

In the product requirements listed below, the terms "inputs" and "outputs" refers to whatever devices the product includes that senses conditions (the inputs) or does something to cause some action to happen (the outputs).

- **Not dependent on wireless connectivity** - This device is intended for use by people involved in activities that take them away from cellular and wireless services. At times it may have connectivity and if you wish to take advantage of that for some features that's fine. However the basic functions of the device should work with no connectivity.
- **Location of Others** - This device is intended to be used with multiple similar devices in that all members of a group, such as family members, will each have one in their possession. Each member can use the device to help locate others in their group. Assume you are on the mountain with three other people and each has one of these devices. Whenever you are within a reasonably short distance (100-200 yards) of another member, your devices should communicate in some way so everyone can see where the others are relative to them. How your device determines position, communicates with others, and indicates where the others are located is up to you.
- **Navigation** - Skiers often find themselves in weather conditions with very limited visibility. A less capable skier may inadvertently go in a wrong direction that takes him to a slope that is only suitable for a more advance skier. Can this device be designed so as to alert the user whenever they start to go in a direction that will inevitably lead them to a slope that is beyond their abilities?

In a more general sense of navigation, skiers usually carry with them a paper "trail map" that shows where all the various slopes of different difficulty are located. Unfolding paper maps while wearing gloves in a snowstorm can be difficult. Can you add some equivalent navigation capability to the device so the user won't need to refer to a soggy paper map to find their way around the mountain?

- **Safety** - Boat owners can buy a device for their boat that will alert the Coast Guard if the object goes in the water, perhaps because the boat has sunk. Your product should include some sort of similar feature for skiers. At the very simplest, it sends a emergency signal if the user presses a button. However it should go well beyond that in being able to alert others if the person has become incapacitated. How you determine when it's appropriate to signal for help is part of the design task. You need to study the possible criteria that can be analyzed and implement an algorithm that reduces the number of false alarms to an acceptable level but still provides a level of safety.

**Note:** We won't actually be sending out emergency alerts from the prototypes. It is sufficient in the project to just indicate that the alert has been activated and what information would have been sent. Teams should however do research to find out what method their product would use if we were actually going to implement the emergency signal.

- **Usability** - This device should be usable by a person wearing cold weather gear such as a skier's gloves. Think about how the user will be dressed when trying to use it in an outdoor environment with adverse weather.

- **Reliability** - The devices should alert the user when communication has been lost with others. This could be an indication that they have moved out of range but could also be due to a problem with the local device (low battery, broken antenna, etc.) A user should not think that all is well with his device when in fact it is no longer working.
- **Security** - If the product uses wireless links between the controller and one or more remote units, the design must address the issue of how to prevent inadvertent interference with or from another similar units. The product should only communicate with wireless devices that it is supposed to be associated with. It should not get confused if another group of skiers come by using the same product.
- **Innovative** - At least one of the input or output components of the system must be new to the market in that it can not be found in competing products that are currently on the market.

All teams are encouraged to go beyond these minimum requirements in order to make their product more attractive to consumers. Whenever possible, additional features selected for inclusion in the product should be included in the prototypes sufficiently to show that they can be implemented and would work as planned. Teams should always be aware of how additional features will affect the cost of their product and be prepared to justify the added cost. For example, a team may decide to add a module to their product to give it Internet connectivity when a wireless or cellular signal is available. The cost of this module must then be factored into the cost of the product. Saying that you have added a \$80 module to a project that is supposed to sell for \$60 is not a good idea if you know your consumer will not pay the associated increase in price.