Vision and Scope

***Product: RGPS Mesh***

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**Version History**

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| Version Number | Date | Notes |
| 0.1 | October 17, 2017 | ---- |
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**Business Requirements**

Background

Sailboats that race in Bellingham Bay need to be tracked throughout the race. Racers also need to be aware of other racers while in the water. Currently, there is only one boat that follows racers to track position of all of racers. If a racer capsizes or separates from the pack in any way, there is no way to reliably find their position without having some kind of visual on them. With only one boat monitoring the race, the task becomes nearly impossible to monitor every single boat accurately.

Business opportunities

With a GPS-based mesh network of communication devices, boats can communicate to each other as well as the monitoring boat their current location and status. Being able to track this information also allows for racers to view the result post-race, allowing for long term analysis of these events. Apps and other devices accomplish similar results using cellular networks, however these devices would rely on WiFi technologies to communicate information between each other without an internet connection.

Business Objectives

Product is:

* Easy to use for non-technical people
* Rugged and durable
* Reliable at communicating current location to other boats and command boat

Success Criteria

* Multiple units send and receive updates from other units with positional data
* Able to view positional history in a given time period post-race
* Actively monitor current positions of all mobile units from a single stationary unit

Business Risks

Proctors of the races may need training on how to sync devices. If the devices were to be damaged, the positional data of a single boat will no longer be monitorable. This would affect the active and historical monitoring by both the proctor and racers.

**Vision of the Solution**

Vision Statement

For boat race participants and proctors who track boat positions for the duration of a race, the RGPS Mesh devices are a decentralized network of Raspberry Pi Zero Ws that communicate over a peer-to-peer network in order for participants and proctors to track boat locations. Unlike visually monitor every boat from a stationary location, our product will provide accurate and real-time data about racer position.

Major Features

* Water/weather-proof enclosure
* Long-lasting battery life
* Intuitive design
* Real-time monitoring of racers from a stationary workstation
* View positional data post-race

Assumptions

* Majority of boats involved will stay within a certain radius of each other
* All units will be active and powered on throughout the race
* Monitoring boat will have a laptop or other workstation to collect data

Dependencies

* + Python 3.6
* All computers involved will have Python 3.6 and a WiFi adapter with ad hoc mode enabled

**Scope and Limitations**

Scope of Initial Release

We are planning to improve on the current way of determining boat locations throughout a race by collecting data from every device and funneling it to one main workstation. This workstation will collect data and allow for users to monitor both real time and historic data. The initial network will be comprised of about 40 tracking devices, with each device having a 100 meter communication range. To maintain an accurate representation of the racers’ positions, each device will broadcast it’s positional data every 5-10 seconds when in range of at least one other tracking device.

Scope of Subsequent Releases

The next step in the project will be to make the devices able to handle being disconnected for long periods of time. Initial release will handle being disconnected for up to a few minutes, while subsequent releases will support being disconnected for hours at a time as well as being able to recover from power cycle. Another feature would be to add functionality for each device to display positions on a monitor.

Limitations and Exclusions

* WiFi adapter will only support a certain radius
* No intention for mobile app. All monitoring done through Raspberry Pi.
* Communication protocol will be fairly primitive and insecure
* Each Raspberry Pi is rated for ~100 meters
* Initial network capacity will be about 40 tracking devices
* Raspberry Pi will need to be mounted to specific part of boat for best range

**Business context**

Stakeholder Profiles

Racers will need to operate the devices at three different points in time. They will power on the device power on the device before the race, keep the device powered on throughout the race, and power down the device at the end of the race. Racers will not be connecting the device to the mesh network as this will be handled by the device itself.

Proctors monitoring the race will be using software on a computer to collect data from the Rasperry Pis. Collection of data will depend on how close at least one of the devices is, so it is possible a proctor will not receive any new information for a short period of time. The proctor will also be able to view the race in real time through a user interface while collecting data. Restrictions to positions will also depend on distance between proctor's workstation and closest device.

Project priorities

* Communication of current GPS location from one device to another
* Update shared data structure safely
* Send accurate state of all positions to one monitoring workstation
* Well organized and easily displayed results

Operating Environment

First environment is on a racer's boat. Each device will be assigned its own boat to track and will communicate information about its boat to all other boats' devices.

Second environment is on the proctor's boat/stationary monitoring position. Laptop will be setup and configured in this area to collect data from the closest Raspberry Pi.