Radio Collar Tracker
Project Specifications

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Project Charter

Project Overview

This project helps to further develop a new method for ecologists and biologists to find radio collar trackers on animals; it was initially started by Engineers for Exploration. We will make modifications to the Global Positioning Satellite (GPS) to increase its accuracy from meter-grade precision down to centimeter-grade. This gives biologists and ecologists better animal location measurements for research.

Project Approach

In order to increase the GPS precision of the system, we will integrate a Real Time Kinetic (RTK) GPS module developed by Swift Navigation. RTK GPS requires an additional base station for functionality, but results in higher accuracy and consistency. Our team will integrate the RTK GPS hardware into the existing quadcopter, make software modifications to ensure compatibility, and then evaluate the performance improvements between the RTK GPS and the existing GPS. Our team members are Corbin Adelman, Ryan Kral, and Sam Hessenauer. For class papers, each team member will write separate sections initially, then we will review and edit the papers as a group. For the RTK GPS work, we will most commonly work together in-step on various milestones. However, each of us have different specialties and will be assigned to different tasks on the fly as we encounter problems.

Milestones	**Due Date**	**Responsible People**
Get up to speed with the Piksi RTK GPS hardware.	4/21/2015	Corbin, Ryan, Sam
Get the RTK GPS working in the field with laptops.	5/5/2015	Corbin, Ryan, Sam
Integrate hardware/software with the quadcopter.	5/19/2015	Corbin, Ryan, Sam
Evaluate performance between GPS and RTK GPS.	5/26/2015	Corbin, Ryan, Sam
Document results.	6/2/2015	Corbin, Ryan, Sam

Note: At this stage in planning, all milestones must be completed in order and cannot effectively be parallelized. Thus, all team members are responsible for all milestones.

Constraints, Risks, and Feasibility

Integrating the RTK GPS module into the radio collar tracker project will provide instant improvements to the system overall. However, the following main risks must be managed:

- Access to hardware for both the RTK GPS module and the quadcopter depend on help from Engineers for Exploration and schedule compatibility
- We plan to modify GPS code which already exists; there is a risk that this code is poorly written or challenging to comprehend

To avoid these issues, we plan to schedule meeting times far in advance, and will be flexible on both weekdays and weekends. We will also gain access to the hardware and software as soon as possible so that time may be spent overcoming challenging code or hardware issues.

Group Management

A major role in our groups management is our ability to spread the work according to each of our specialties, and the checks and balances system that we will have to make sure each of us is putting in adequate amount of work and effort. Our project manager is Eric Lo, but due to his busy schedule we will be working with low supervision. Major decisions that require large parts of the project will be answered by our project manager, Eric Lo. Meanwhile, we will come to a reasonable consensus for other decisions.

Our main forms of communication take place through a group chat, google drive folder, email, and a weekly meeting before class on tuesdays. We plan to have a weekly evaluation to contrast our efficiency and progression predictions. Depending on the team members schedules, some work may be allocated to different team members upon availability.
We hold ourselves responsible for the deliverables and milestones, in which we act a team in the level of professionalism and effort being brought to the table. Meanwhile, we will alternate weeks for the group status report under a common template.

Project Development

There are three main development roles. The first is a Hardware Development role. They are in charge of making sure Piksi RTK GPS Hardware is installed and running correctly and providing accurate data. The second is the Software Integration role. They are in charge of making sure the data can be adapted and used into the pre-existing software and making any changes necessary to do so. If time permits, an easy to use UI would be the next responsibility for this role. The third is the Evaluation Development Role. They are in charge of testing, reporting, and comparing old GPS and the new RTK GPS. Each of us will be active in all three roles as we all desire to learn each part and each role is dependent on the outcome of the prior to be successful. We will need access to the Beaglebone-black, RTK GPS, the quad-copter, and the software repository for the existing GPS coding so we can create adapter classes for the new software. Testing will be initially be done on campus fields and we will walk around with the RTK GPS and test with desired outcomes and see if our results match in two dimension. After initial testing passes, quad-copter integration will be done and we will do similar testing with the help of Eric (who will fly the copter). Each of us will document as we go, hand written or on a computer, but all documentation will eventually be typed up for official record keeping and easier tracking.

Project Schedule

High Level Milestones

#	Priority 1 (low) - 5 (high)/ Class	Milestone Description	Due Date	Responsible People
	Class	Project Specification Due	4/16/2015	Corbin, Ryan, Sam
	Class	Project Webpage Due	4/21/2015	Corbin, Ryan, Sam
1	5	Read Documentation and get up to speed with the Piksi RTK GPS hardware.	4/21/2015	Corbin, Ryan, Sam
	Class	Milestone Report Due	5/5/2015	Corbin, Ryan, Sam
2	4	Demonstrate that the RTK GPS hardware works with two laptops in the field.	5/5/2015	Corbin, Ryan, Sam
	Class	Milestone Report Due	5/19/2015	Corbin, Ryan, Sam
3	5	Integrate the RTK GPS in with the radio collar tracker hardware/software.	5/19/2015	Corbin, Ryan, Sam
4	4	Evaluate comparative performance between the existing autopilot GPS and the RTK GPS.	5/26/2015	Corbin, Ryan, Sam
5	3	Document our results.	6/2/2015	Corbin, Ryan, Sam
	Class	Project Video Viewing	6/8/2015	Corbin, Ryan, Sam
	Class	Final Report Due	6/11/2015	Corbin, Ryan, Sam
6	2	Investigate low cost RTK GPS hardware.	Stretch Goal	Corbin, Ryan, Sam
7	2	Compare the Piksi hardware with the low cost solution.	Stretch Goal	Corbin, Ryan, Sam

Low Level Weekly Milestones

- 1.0 (complete by 4/21) - Read Documentation and get up to speed with the Piksi RTK GPS hardware.
    - Read the user guides from here: http://docs.swiftnav.com/wiki/Main_Page

    - Watch Beaglebone Black and RTK GPS videos
    - Gain access to existing code repository
- 2.0 (complete by 5/5) - Demonstrate that the RTK GPS hardware works with two laptops in the field.
    - Meet with Eric to collect Piksi hardware
    - Identify communication type to use from Piksi to base station and rover (UART/USB)
    - Connect Piksi to two separate laptops and collect stationary data
    - Collect data with one stationary and one moving laptop
- 3.0 (complete by 5/19) - Integrate the RTK GPS in with the radio collar tracker hardware/software.
    - Connect the Piksi hardware to the Beaglebone Black rather than a rover laptop
    - Copy and modify existing GPS software
    - Fully integrate RTK GPS in hardware and software
- 4.0 (complete by 5/26) - Evaluate comparative performance between the existing autopilot GPS and the RTK GPS.
    - Collect test data from the collar tracker using old GPS
    - Collect test data from the collar tracker using RTK GPS
    - Compare and contrast the results using graphing scripts and tools
- 5.0 (complete by 6/2) - Document our results.
    - Update our specification
    - Migrate comparison data to a final report
- 6.0 (time permitting) - Investigate low cost RTK GPS hardware.
    - Read about u-Blox M8 keeping cost and integration ease in mind
    - Search for additional RTK GPS hardware options
    - Purchase hardware if it is cost effective
- 7.0 (time permitting) - Compare the Piksi hardware with the low cost solutions.
    - Perform accuracy testing and compare accuracies, costs, and integration times