

Project Type: Master Thesis

Project Title: Snapshot GNSS Processing Chain & Positioning Algorithm for Sea Turtle Tagging

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Duration: 6 months

Project Details

Knowledge of sea turtle dive patterns is critical for monitoring their biological patterns and environmental pressures. Octanis Instruments is developing GNSS units which will be used to collect various data during a sea turtle's time spent underwater and track the location of its surfacings.

The GNSS tag, while affixed to the turtle, will gather data such as location, temperature, pressure, and collisions the turtle may experience. This project intends to help rescue and research centers better understand sea turtle behavior.

Thesis Details

Turtles may only surface for as little as 10 seconds at a time to get air before diving again. The GNSS module is in a low-power sleep mode while the turtle is diving, and a conventional GNSS cold start may require up to 30 seconds of time to fix the location.

The thesis seeks to address this shortcoming by developing a strategy to avoid or mitigate GNSS cold starts. A solution is the adaptation and implementation of a snapshot or fast-fix positioning algorithm, which reduces the time required for a GNSS fix significantly.

Another challenge of the project pertaining to the GNSS unit is a data limit; only around 20 Bytes can be transmitted per day. All data collected must therefore be summarized into adequately small daily summaries onboard before transmission.

Tasks

GNSS snapshot methods combine estimates of external factors (such as GNSS constellation) with as little of 10ms of raw satellite signal in order to estimate position. The goal of the thesis is to expand upon and adapt existing snapshot methods to the unique external factors of a marine GNSS unit, while minimizing the data which must be transmitted by satellite.

1. Task 1: Literature review:
 - a. Global Navigation Satellite System (GNSS)
 - b. Snapshot GNSS positioning algorithms
 - c. Pertinent turtle behavior

2. Task 2: Recreate existing GNSS snapshot algorithm
 - a. Create a positioning processing chain for computing position
 - b. Select and implement a suitable GNSS snapshot algorithm
3. Task 3: Create/modify snapshot algorithm solution unique to sea turtle tag
4. Task 4: Test the solution on prototype hardware
5. Task 5: Write a report and submit

Depending on the output of the thesis, any code or hardware created may be implemented in the company's next round of sea turtle tags in 2023.

Approximate Timeline

Task 1	Task 2	Task 3 + Task 4	Task 5
1 month	1 month	3 months	1 month