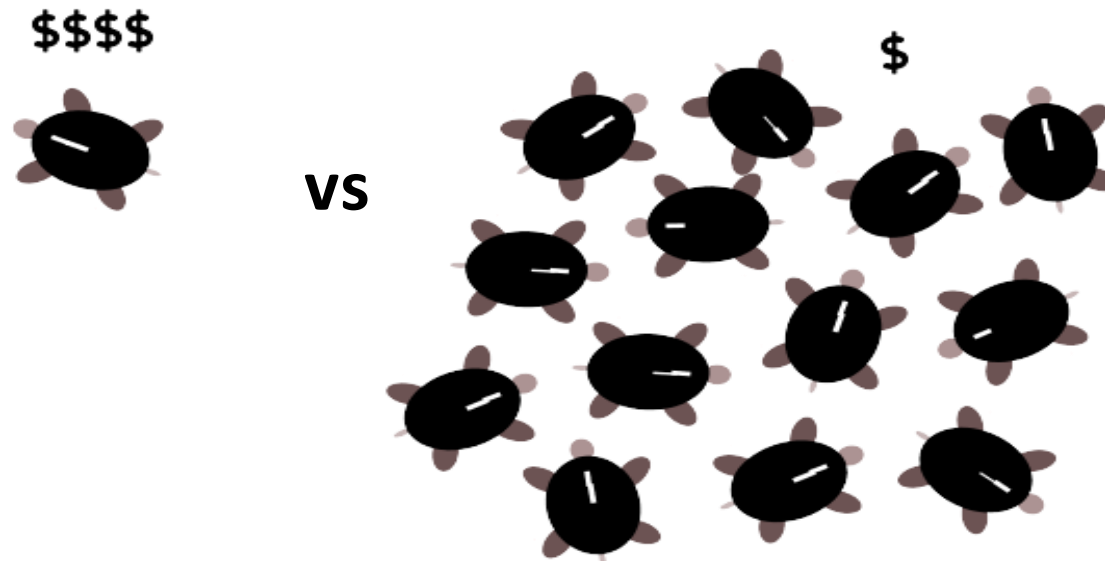


Terrapin Tracker



Problem

- Animal movement modeling is improving but there is a lack of data to understand animal behavior
- Commercial, proprietary animal tracking systems are expensive
- Despite the growing community of turtle tracking biologists creating a higher demand for GPS tracking, there is no one supporting development of accurate, affordable, open source trackers



Solution

The Terrapin Tracker



- Low-cost
- High position accuracy
- Open licenses
- Community engagement
- Readily available technology



- The low-cost Terrapin Tracker (\$100 - \$150) will allow tracking of more animals and our GNSS-based solution provides high position accuracy
- An open source business model will allow people to access, modify and distribute our hardware, software and workflows with few restrictions
- Open licensed assets will provide opportunities for the broad user community to incrementally improve on our assets

Impact

- Understanding animal movement and habitat use is critical to support both human and wildlife needs and minimize risks to both
- Tracking animal movements allows us to model how animals interact with current and future landscapes
- Knowledge of how animal interact with the environment allows environmental resource managers to make informed planning decisions



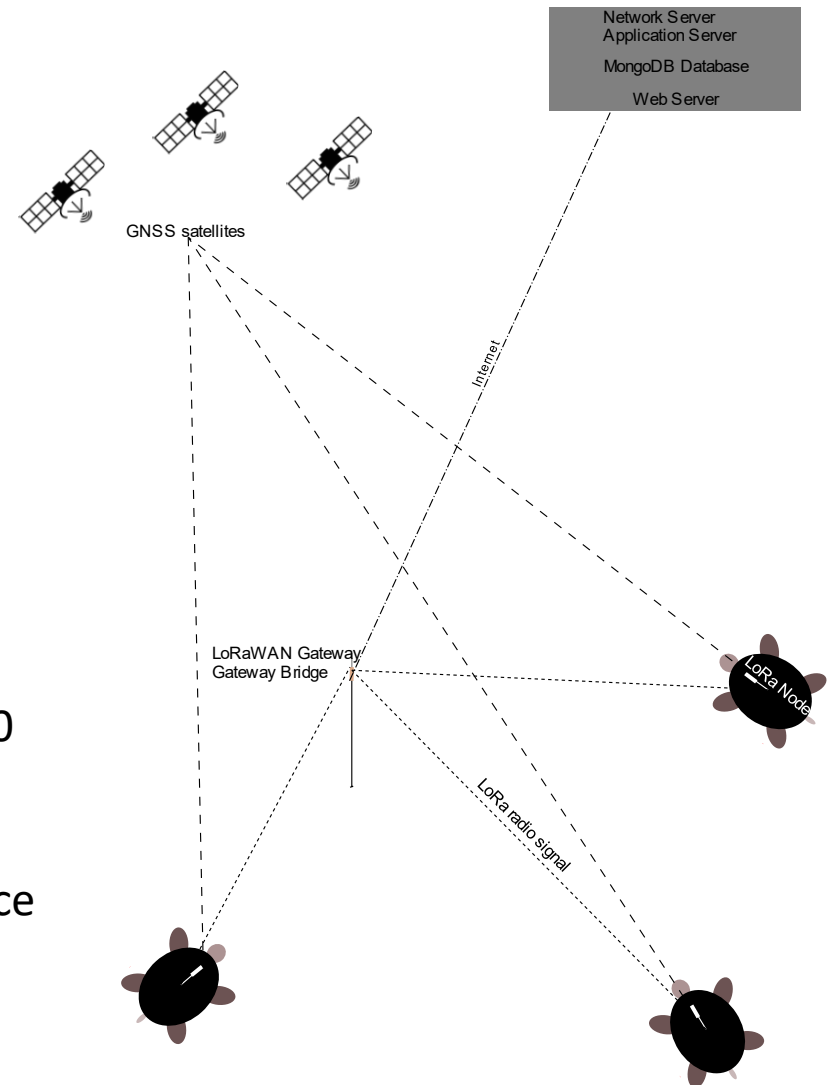
The Terrapin Tracker

Components

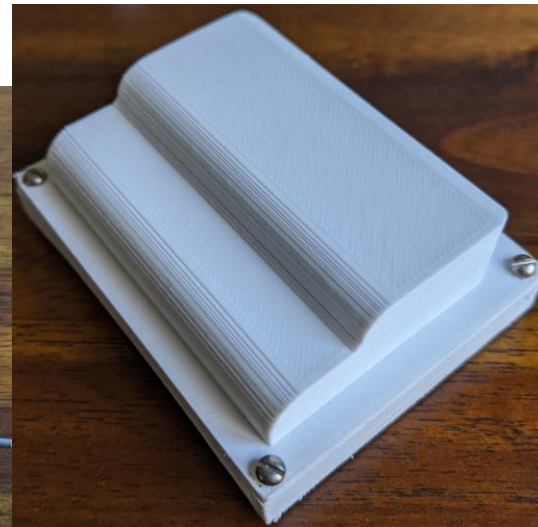
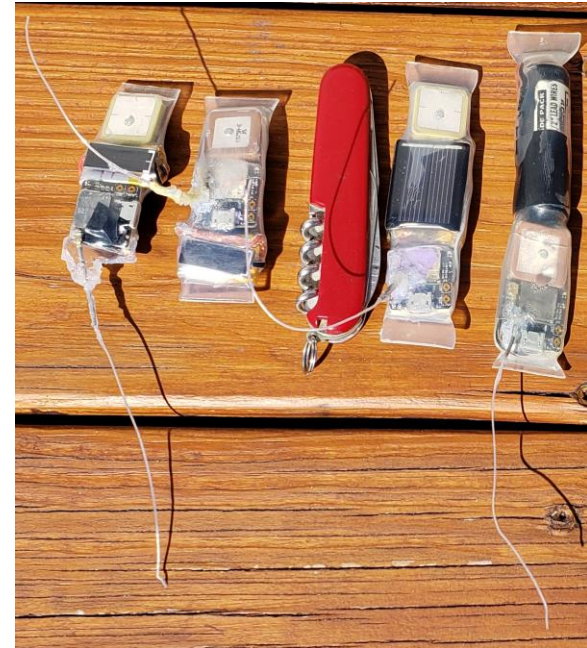
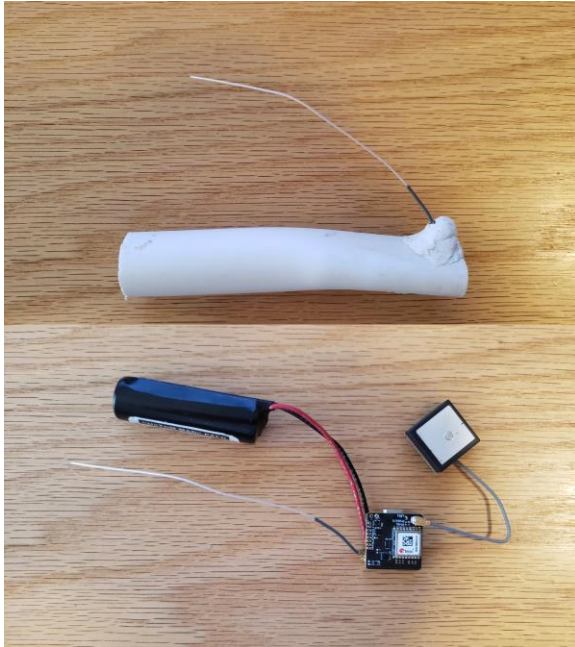
- GNSS receiver to acquire location coordinates
- LoRaWAN node on the turtle sends location data to gateway
- LoRaWAN gateway receives location data from node and sends it to database
- Database stores location data
- Graphical user interface allows users to download and visualize data

Initial deployments

- 15 tags will be deployed in South Carolina in spring 2020
- A request for 20 tags was made to monitor a terrestrial turtle in Viet Nam
- Deployments will be evaluated to assess tag performance and condition of the tags



Prototypes



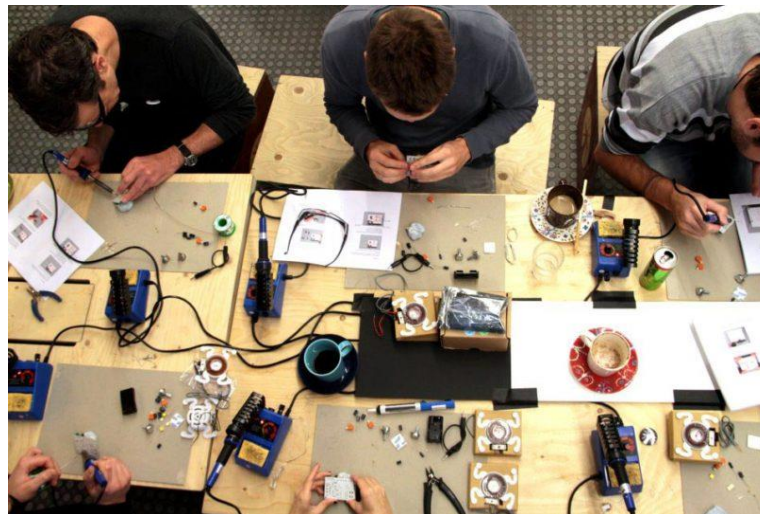
Users

Primary target users

- Biologists studying animal behavior
- Research institutions interested in improving current tracking options
- Organizations interesting in collecting movement data

Secondary target users

- Engineers and makers interested in supporting conservation
- Citizen science projects



Competitors

- Most animal tracking systems use proprietary designs which forces users to be reliant on the manufacturer
- Cost of commercial trackers translates to low use of trackers
- Trackers from other open source developers do not support fine scale movement monitoring
- Open source tracker developers focus on selling units rather than providing open access to their assets – we have been unable to access hardware designs from other "open" developers

Advantage

- The Terrapin Tracker is a low-cost, high position accuracy turtle tracker with a component architecture that will allow it to be adapted to other taxa
- The Terrapin Tracker can be built by anyone with basic electronics skills
- From a consumer perspective our open licensing can reduce price, avoid getting locked into expensive proprietary systems, provide options to customize our software and hardware, and encourage collaboration



Business model

- A business model that supports open source hardware is well adapted to incorporating innovation and creativity from a broad community.
- We plan to follow an open source business model which will be further developed in the next phase of the project leveraging models from successful commercial open source projects.
- Funding to sustain this project will come from private and public grants as well as:
 - manufacturing tracker components
 - providing paid support to develop new capabilities
 - selling custom turn-key tracker packages

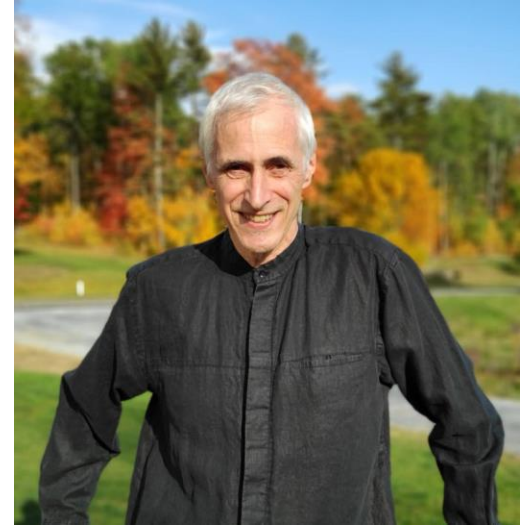


open source
hardware



Team

Kristen Cecala is a biology professor at Sewanee - The University of the South and is interested in how environmental change alters the ecology and distribution of amphibians and reptiles through behavioral mechanisms. Kristen is driving the design of the tracker.



Ned Horning has experience working with many forms of conservation technology including Arduino-based electronics, GNSS data acquisition and software development. Ned is creating hardware and software to meet those design requirements with help from mentors and project members.

We realize developing an open-source product is more than just understanding customer needs and engineering a solution. Logistics and business development are just as important, and we plan to find someone to join our team who can support this development.

Progress

- Exceeded our Tech Challenge goals
- Components and a prototype for a version 2 tracker are being tested
- Developed a product specification for the Terrapin Tracker and started work on a strategic plan to take the Terrapin Tracker to the next step

Tech challenge goals and our progress

Have a tracker package suitable for deploying in the field April 2021

- A working tracker has been designed and will be replicated for the spring 2021 field deployment

Develop and test a prototype tracker system that can be easily deployed in an area with no power and no WiFi connectivity

- Developed and tested a solar powered, cellular-based LoRaWAN gateway for deployments in areas without access to WiFi or the power grid

Develop a prototype for a version 2 tracker that has a sensor to detect when a turtle shell is above or under water

- An innovative, low-power consumption, software-based solution was developed using GNSS satellite signal strength to detect when the tracker is unable to receive data



Potential outcomes

Best-case scenario

- Terrapin Tracker grows and becomes the go-to tracking solution for small and large animals

Likely scenario

- Terrapin Tracker becomes the tracker of choice for small, area-constrained animals
- Over 400 trackers deployed around the globe per year

Worst-case scenario

- Terrapin Tracker remains an online resource for biologists to create their own tracker systems and support provided on an ad-hoc basis

Next steps

- After our first deployment we will progress from prototype to production
- We will improve upon our initial proof-of-concept using off-the-shelf hardware when practical
- Leveraging our prototyping experience we will design and produce new purpose-built boards using newer GNSS, LoRa and MCU components and incorporate solar-charging
- We will develop a business plan around an open source business model
- We will formalize a network of people interested in developing and deploying open source animal trackers and develop a business plan to support that initiative



Financial needs

- Trackers for the first deployment will be assembled in a home office using hardware that is expected to cost approximately \$2,000 which has been mostly paid for
- Designing new boards will almost certainly require hiring a professional design specialist and expected costs are \$10,000 for the next generation board and roughly the same amount for further development work including equipment to support that work
- Costs involved in formalizing a business are difficult to predict at this point, but we will use resources such as those available through the U.S. Small Business Administration

