Oconee River Land Trust Drone Studies

Exploratory Research

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About Our Client: What is the Oconee River Land Trust?

The Oconee River Land Trust is an organization whose aim is to conserve natural lands in Georgia across 32,000 acres and over 30 counties on over 140 different conservation easements.The ORLT monitors these conservation easements to ensure that no illegal development or tampering with the land is occurring and works with the land owners so that both the owners and land trust or government agency are satisfied with their agreement.

A conservation easement is a legal agreement between a landowner and a land trust or government agency that permanently limits the use of the land in order to protect its conservation values. The limitations of an easement are very flexible, where some containing a rare wildlife habitat could prohibit any development, while others on an area of land such as a farm can continue farming and the building of any additional agricultural structures. Additionally, these lands can either be public or private access.

Our team will be working with the ORLT to assist in monitoring a few of these conservation easement properties, gathering footage and data using drones provided by the NMI department (http://oconeeriverlandtrust.org/about-us.htm).

Introduction: Drones and the Process of Capturing Data

The key piece of technology our team will be using to gather data for our capstone project will be drones. The two drones our teams will be using are the DJI Mavic 2 Pro and the DJI Mavic 2 Zoom, which will be provided by the NMI department.

In terms of similarities, both drones have the same flight performance, with a maximum speed of 48 mph, or approximately 72 kph, boast a flight time of up to 31 minutes, and sport a range of 5 miles. Additionally, both can shoot 4K videos at a bit

rate of 100 Mbps. They are also similar weights with the Pro at 907gs and the Zoom at 905 gs. The only major difference between the two drones is found in their cameras, with the specs of the Pro slightly outweighing the performance of the Zoom's camera. The Pro's camera offers a Hasselblad camera with a 20-megapixel resolution and an ISO of up to 12800 in addition to an adjustable aperture and larger sensor than the Zoom. This allows our team to capture higher quality, clearer footage in low-light environments. The Zoom, as the name suggests, offers a zoom lens with a 24mm-48mm focal length, a feature unique to this model, which provides our team with the possibility of shooting 4x lossless zoom for situations in which we need clear shots of smaller objects or objects closer to the ground.

As the process for capturing our drone footage progresses, our team will rotate between the two drones, using one over the other when appropriate to ensure that our footage satisfies the demands of the client (**https://store.dji.com/guides/mavic-2-pro-vs-zoom/**).

To capture the footage and data, our team will capture aerial footage that will be used to manually map out paths for our drones at each area, giving us a level of precision and control in order to ensure that the footage we capture is as accurate as possible. To do so, we'll be selecting a mapping solution for our drones, consisting of a smartphone app and a web platform. Once our footage is captured, we will need to extract the data from the drone's micro SD card and upload the collected data to web-based tool which will then process the data and allow our team to view and analyze the final output. When determining the mapping solutions for our drones, some of the platforms our team has decided between are Pix4D, Drone Deploy, and Data Mapper, as these come with both an app and a web-based tool. Pix4D and Data Mapper are free applications applications, while Drone Deploy has a 14 day trial, charging $99/month afterwards, making Pix4D and Data Mapper the most attractive as of now. They also have a Youtube page with useful tutorial videos that may aid us (https://www.youtube.com/user/pix4dsoftware/videos). We will need to test both applications with an actual drone before choosing which software best fits our needs.

Once our team has decided upon a mapping solution, the basic procedure for drawing out a flight path is generally the same for the platform we choose. We will first need to select our area of choice, then adjust the selected area so its flight path matches our desired path. The images below provide an idea of this process.
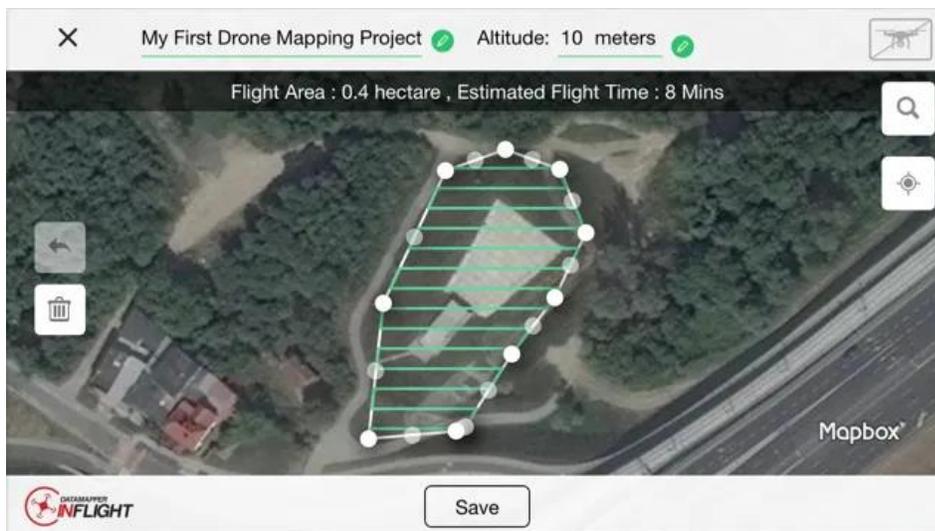
When deciding our flight path, it's important to keep in mind the altitude of our drone's flight. The lower the altitude, the longer it will take as more images will need to be captured. Conversely, a higher altitude will shorten the flight time. Because the drones our team has been provided with have an average battery life of about 30 minutes, this consideration should be especially important so that we prevent any potential damage or are unable to capture all the data required (https://geoawesomeness.com/step-step-guide-complete-first-drone-mapping-project/).

Similar Successful Projects & Benefits from Drone Mapping

In years past, organizations and businesses have spent years and thousands of dollars on mapping landscapes. However, as technology continues to develop, it is becoming increasingly easier for businesses and organizations to map properties using drones. When looking at other projects attempting to map landscapes for similar purposes, we can observe the benefits, cons, potential problems, and technological considerations.

In 2018, a student from American University, Matt Mullins, spent his summer conducting coastal erosion research with drone technology with the hopes of improving coastal erosion mapping done by drones. With our project, we both have goals with conservation in mind. In this project, however, it seems as though they created their own software to do so, and we would like to use an available software. Furthermore, while detailed information is not provided on their process, this project does provide information as to the benefits of using drones for mapping, as well as an idea of what kind of content we may want to bring to this project. The most pertinent advantage of drone mapping is that it reduces the time and cost of collecting data. Meanwhile, in order to track changes on these coastal environments throughout time, similar to our mission, they not only created detailed maps of the areas, but also utilized elevation maps and 3D models. We may want to consider also doing this if our application

provides such features (https://seagrant.mit.edu/2019/02/21/a-bridge-between-the-sky-and-sea-student-maps-coastal-erosion-with-drone-technology/).

Special Considerations for Unmanned Aerial Vehicles aka Drones

When using drones, we must take in legal and technical considerations as well. Drone laws vary throughout the United States and there are some Georgia laws that are crucial to be aware of for this project:

- "Do not operate drones over buildings, crowds, near traffic, or high tension power lines."
- "Direct and unaided visual contact must be maintained with the drone by the Pilot in Command at all times."
- "Do not fly drones more than 400 feet above any physical terrain or water surface."
- "Do not operate drones near aircrafts or airports. A minimum of a 6 kilometers (3.7 miles) horizontal distance must be maintained from any aerodrome."
- "It is prohibited to use a drone for aerial photography of the general public or private property. Violations of privacy rights are subject to prosecution under Georgian law."
- "Drone operators must hold liability insurance."
- https://uavcoach.com/drone-laws-in-georgia/

Of these Georgia laws, the most important few for our group to consider is the maximum flying height at 400 feet, our visual contact, the property laws, and the liability insurance point. We will most definitely have to ensure the properties we drone over are not public and will need to contact owners to get approval to get footage of their land. In addition, as we the students do not personally have liability insurance on hand, we will likely need Chris Gerlach, NMI "drone guy", to assist us in our operations.

In Athens, we may want to make sure the property we are flying over is not within 5 miles of the airport or else we will need to contact them for permission.

Looking at the Athens-Clarke County specific rules for use of drones, there is also a consideration for students and directs us to another site, which provides as follows:

> "As of May 5, 2016, according to a new legal interpretation from the FAA, the use of unmanned aircraft systems by students in accredited education institutions as part of their coursework will be allowed under recreational guidelines for model aircraft, provided the aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization. The interpretation also clarifies that UAS can be operated for demonstration purposes at community-sponsored events, provided that the aircraft operator does not receive any compensation, directly or indirectly, related to the operation of the aircraft.
>
> Students can learn how to design, construct and operate small unmanned aircraft (less than 55 pounds) as a component of a variety of science, technology and aviation-related coursework or for other educational purposes such as in connection with television, film or photography courses. These uses fall under hobby or recreational use, according to the FAA's interpretation, and schools and students should follow all the same protocols as a hobbyist."
>
> (http://knowbeforeyoufly.org/education-use/)

The protocols for a hobbyist are provided at this link, http://knowbeforeyoufly.org/for-recreational-users/, but most relate to those listed above. Furthermore, another site also notes that in drone law, "You can also fly your drone for recreational purposes *if you or someone monitoring you has a valid remote pilot*

license (https://www.droneguru.net/license-to-fly-a-drone/). This important information as we would all like a chance to fly the drones, but will need Chris Gerlach present.

In addition, there are a few other safety precautions we must acknowledge when getting ready to go out on the field. We will want to carry backup batteries, memory cards, and come prepared for any potential technology malfunctions. Testing our technology prior to going out will help us as well. We will also want to check the weather a few days before and keep an eye out for any rain or heavy winds as this can damage our drone (https://blog.nationalgeographic.org/2017/05/17/so-you-want-to-fly-drones-for-conservation/).

Sources

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