

Undergraduate Faculty-Mentored Academic Grant Proposal

CENG 4391: Independent Study

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Drone Surveying Research

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1. Abstract

This undergraduate faculty-mentored research involves studying the use of a drone in regards to Plane Surveying applications. Furthermore, this opportunity will work towards developing a starter kit that includes the required materials that anyone can use to do their own surveying analysis. The goal for this study is to gather the most useful, cost-effective materials needed for drone surveying; and then put them in a collection along with information on software and directions concerning applications of usage. This specific topic of research has a variety of beneficial operations that a user might be interested in. To name a few, users would be able to monitor plant health for agricultural needs using NDVI (Normalized Difference Vegetation Index), develop contour mapping, produce hydrological models to determine water runoff or even monitor climate change. Ultimately, the vision for this investigation is to connect and introduce people to an affordable and functional way to access this tool not only close to our home, but around the world.

2. Project Context and Description

a. Theoretical Context

Drones are used for a variety of applications in many work fields. The advantages of gathering visual information remotely from miles away are quite broad, and new methods are being uncovered day by day. In regards to plane surveying, the use of a drone allows analysis of a particular parcel of ground without requiring someone to physically go to that specific area and collect data. This results in a much more efficient and easy work process for many surveyors saving time and money, which relates perfectly to our goal for this research. This also means it is

easily executed in both concept, time required, and resources that most anyone can do it with correct instruction.

b. Objective and Hypothesis

The objective of this research will first be to create a set of materials that can be collected in order to begin a drone surveying analysis. Once this is done, direction will be created to guide the user on the possible applications for their drone surveying kit along with instruction for selected software. Ultimately, once the drone is completed and functional, the goal is to suggest a number of issues or alleys that a user can pursue with the use of their drone. This research aspires to investigate ways in which a drone might be applied to monitor climate change through vegetation observation, land surveillance, or even hydrologic analysis. It is quite common to gather data such as water level change or NDVI, as discussed above, to determine the environmental condition of a specific area over time. Furthermore, once a user has collected such data, it will be investigated to see if it is possible that a user can upload their findings to a website that can be viewed world-wide.

3. Methodology

The main tools used for this research will include Open Drone Map's webODM drone surveying software. This software is accessible to anyone with a computer. Once installed, a user can collect data with their drone (flying the drone over an area and taking pictures) and apply those pictures taken to develop things such as orthomosaic photographs (multiple detailed pictures pieced together to result in on large picture of a given area), point cloud surveys (the use of millions of laser beams that return points as they hit surfaces to create detailed three dimensional models of outdoor and indoor spaces), elevation models, contour mapping, and NDVI (Vegetation colorization) as well as a list of other options. In addition to

this, a Flight Planner software will be used to allow for a course to be plotted for the drone to fly itself over a specific area determined for data collection. Additional plane surveying information will be reviewed as needed from Ghilhani's *Elementary Surveying: An Introduction to Geomatics* 15th Edition as needed throughout the course of this project.

The steps for this faculty mentored drone surveying research will include:

1. Gathering needed materials for drone assembly
2. Studying the applications and limitations of webODM software
3. Studying options for depositing potential data onto globally viewable platform
4. Completing needed drone flying certification
5. Testing drone flight ability and boundaries
6. Researching applicable sites for test data collection
7. Testing transferability of data to software and applications once data is collected
8. Gathering and summarizing conclusions
9. Creating final report

4. Experience and Relevance to the Future

a. Role of project in my development

This experience better enables me to pursue my future goals of engineering through its investigation of the application of surveying methods. As a student, surveying has always been a particularly interesting topic, and is something I hope to apply in my career once graduated. I believe that any opportunity to broaden my opportunities to learn is a good way to develop myself as an aspiring engineer. This experience will help me continue to develop myself as a problem solver by working to always pursue the answer to questions I do not know. It is in that

concept that I find the most satisfying results always reside, and I believe it is a fundamental principle of engineering and therefore absolutely necessary for my participation.

b. My experience

In relation to this research topic, I have completed ENGR 1307 (Plane Surveying) along with ENGR 3403 (Introduction to Fluid Mechanics) and am currently enrolled in CENG 3352 (Hydrology and Hydraulics) which I believe all aid in my understanding of concepts needed for this research assignment. I am currently the acting president of the Rams Clay Target shooting team, in addition to working at Goodfellow AFB as a Civil Engineering and Architecture Trainee, I also work as a Marketing Assistant at the Career Development Center here on campus at Angelo State University. All things considered, I believe a combination of skills obtained from each of these current experiences, along with the amount of time management an engineering degree requires, am motivated to pursue this research task.

5. Timetable and Budget

a. Table 1: Timetable for Tasks

Activity/Task	Time to Complete
Define Project Goal	3 Days
Literature Review	2 Weeks
Find Testing Locations and obtain Permission if Needed	1 Week
Purchase WebODM Software	1 Week
Review Software for Applications of Collected Drone Data	1 Week
Review and Communicate with Faculty Member	2 Days

Work on improving drone functionality – time for potential modifications	2 Weeks
Review and Communicate with faculty mentor	1 Week
Drone data collection and software application testing	2 Weeks
Investigate Potential Website Platforms for future subjects to deposit data once collected	1 Week
Gather and Summarize Conclusions/Data Found	1 Week
Create Final Report and Presentation	2 Weeks
Prepare for Conference Presentation	1 Week
Submit Final Paper to ASU Journal	1 Day

b. Budget Form

Supplies				
Item	Purpose	Cost Per Unit	Quantity	Total Cost
Poster Material	Creating poster required for Symposium	\$50	1	\$50
WebODM Software	Analyzation of Collected data	\$200	1	\$200
Flight Planner Software	Programming Drone Flight Path	\$400	1	\$400
Total Cost				\$650

6. Approvals and Funding

- a. Does your project involve human subjects (e.g. interviews, surveys, focus groups, oral history)?

No

- b. Does your project involve animal subjects? (i.e. vertebrate animals)?

No

- c. Does your project involve the use of recombinant DNA or biohazardous materials?

No

References

- S. A. R. (2021, October 29). *What is NDVI (normalized difference vegetation index)?* GIS Geography. Retrieved November 2, 2021, from <https://gisgeography.com/ndvi-normalized-difference-vegetation-index/>.
- WB, O. D. M. (2021). *WebODM drone software*. OpenDroneMap. Retrieved November 2, 2021, from <https://www.opendronemap.org/webodm/>.
- Ghilani, C.D., (2018) *Elementary Surveying: An Introduction to Geomatics* 15th Edition, Pearson, ISBN: 9780134604657.