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Analysis of Needs Green Open Space Use Unmanned Aerial Vehicle (UAV) at Campus Area Of Musamus University Merauke

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Abstract. Global warming due to the Greenhouse Gas Effect (GHG) occurs due to various sectors including agriculture, forestry, and industry. The forestry sector is the largest contributor to emissions reaching 43.92% in 2013. Musamus University (Unmus) is a state university located in the southern part of Papua, precisely in Merauke Regency. Unmus is a place for students to get education where the need for infrastructure is very necessaryamong themGreen Open Space (GOS) and Public Space. The development of the campus area is increasing. This is evidenced by the increase in the number of facilities and infrastructure built with an area built up to 2022 is ± 24,291 hectares. Unmus complies with the Law of the Republic of Indonesia No. 26 of 2007.

Keywords. Drone, Green Open Space, Musamus University

1 Introduction

Global Warming Effect Greenhouse due to various sectors including agriculture, forestry, and industry. The forestry sector is the largest contributor to emissions reaching 43.92% in 2013 [1]. This is a common concern of both academia and the government. Low emission development is a target that must be achieved in the current development stage of development which is increasingly rapid. The Indonesian government targets to reduce emissions by 43% by 2030 [2]. Musamus University (Unmus) is a state university located in the southern part of Papua Province, precisely in Merauke Regency. Unmus is a place for students to take education where the need for infrastructure is very necessary including Green Open Space (GOS) and public space [3].

The existence of GOS is needed to improve the quality of the environment in urban areas ecologically, aesthetically, and socially. Theoretically, GOS is a space that functions as a place for human life, both individually and in groups, as well as a place for other creatures to live and develop sustainably. [4]. Developments in the campus area are increasing. This is evidenced by the increase in the number of facilities and infrastructure built with an area of ± 24,291 hectares built up to 2022, besides that the number of Unmus academics continues to grow from year to year. education amounted to 514 people and the number of active students amounted to 11731 people. This has an impact on increasing the number of motorized vehicles used as a means of transportation, so the air pollution resulting from this activity is also increasing so that GOS has a greater role not only as an absorber of CO_2 gas but also regarding beauty, coolness, comfort and environmental sustainability as well as the need for oxygen that is needed. free from air pollution. [5]

Campus development and construction that is not carried out synergistically with the use and maintenance of GOS as a campus forest can result in the campus being no longer comfortable for activities. In addition, geographically, the Unmus campus is only 1.4 km from the coastline, this is a common concern in maintaining the GOS ecosystem. GOS forms can be grouped according to their topology. Physically, GOS can be divided into natural GOS in the form of natural wild habitats, protected areas and national parks and non-natural or built GOS such as parks, sports fields, cemeteries or green roads.

Based on land ownership, Green Open Space consists of Public GOS and Private GOS. The proportion of GOS is at least 30% of the total area according to RI Law no. 26 of 2007. [6] Based on its function, green space is divided into GOS with ecological, socio-cultural, aesthetic and economic functions [3]. Unmanned Aerial System (UAS) or known as unmanned aircraft, including Unmanned Aerial Vehicle (UAV) Aerial robot, or in everyday life, namely Drone [5].

The development of drone technology at this time is still considered a new technology in the field of mapping. however, many agencies, both government and private, have used drone technology to conduct

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analysis and studies in mapping an area. In its development, there are many types or types of drones that are often used, including fixed wing, quadcopter, tricopter, single rotor, hexacopter and octocopter. Drone technology makes it easier to make high-spatial resolution aerial photos that are more cost-effective without relying on satellite imagery (CSRT) from certain providers which sometimes require quite expensive costs and are sometimes blocked by clouds.

2 Research Methods

LThe research location is on the Unmus campus. The detailed unmus campus plan is shown in Figure 1.

Fig. 1. Location of Musamus University campus (red polygon)

The unmus campus occupies an area of ± 24.77 hectares. At this location, there are several types of facilities including:BuildingLecturesand Sports Facilities, and Other buildingslikekanti, multi-purpose building andotherother. [7]

The method used in this researchisquantitative descriptive research model by utilizing aerial photographic images which are then analyzed usingsystemgeographic information (GIS). The data used in this study is the result of the acquisition of aerial photo data by utilizing a drone as an aerial photo recording facility. Use of Drones asfacilityaerial photography capable of recording all objects on the earth's surface without being blocked by clouds. In addition, the use of drones is very suitable for mapping scales that have a small area. The drone is flown at a height of 341 meters, so that it covers the entire area of the Unmus campus and all of itobjectaround campus. The following are orthomosaic results from the data acquisition process in the musamus University campus area.[8]

Fig. 2. Orthomosaic University Musamus

Aerial photography is an image recorded from the air using an unmanned aircraft (drone) to obtain an overview of part of the earth's surface with a certain height according to the desired needs and the expected coverage area.[9].

Based on the type, aerial photography is divided into two types, namely upright photos and oblique photos. Upright aerial photography is a photo that results from taking photos where at the time of taking the photo the camera axis is in a position perpendicular to the earth's surface. While oblique photos are photos that are produced from the results of taking photos where at the time of taking the photo the camera axis is in a tilted position. [10]

The type of aerial photography used for mapping purposes is an upright aerial photograph with a 90º position. Aerial photos taken in this study using a DJI Mavic 2 pro drone, recording time on November 21, 2021 with a height of 341 meters, 80% overlap and GSD resolution of 58.2 cm/pix. The application used in the data acquisition process is the PIX4D and GJI Go applications.

Afterconductedcorrection processgeometricThe next stage is the visual interpretation process. Visual interpretation aims to derive information from all objects on the earth's surface in the Unmus Campus area, namely trees. The GOS Criteriausedfor the Unmus campus are trees. Non- GOS Criteria, namely BuildingLectures, Building supporting facilitiesactivityacademic and sports facilities vacant land, shrubs, and ponds. GOS availability is calculateduseequation (1)

$$\boldsymbol{GOS\ Campus} = \boldsymbol{Large\ Campus\ x\ 30}\ \% \ldots..(\mathbf{1})$$

The value of 30% is a GOS requirement thatsetRI Law No. 26 of 2007 concerning Spatial Planning. The calculation results show thatGOSthat shouldfulfilledby Unmus based on the built area is 7.43 hectares. The campus GOS is then compared with the interpretation of the trees in the built area. If the availability of trees is equal to or greater than the GOS, the Unmus campus meets the GOS Criteria in the RI Law on Spatial Planning. For non-GOS criteria, it is calculated based onpercentagearea of Unmus Campus. Flowchart of this Researchshownin Figure 3 below.

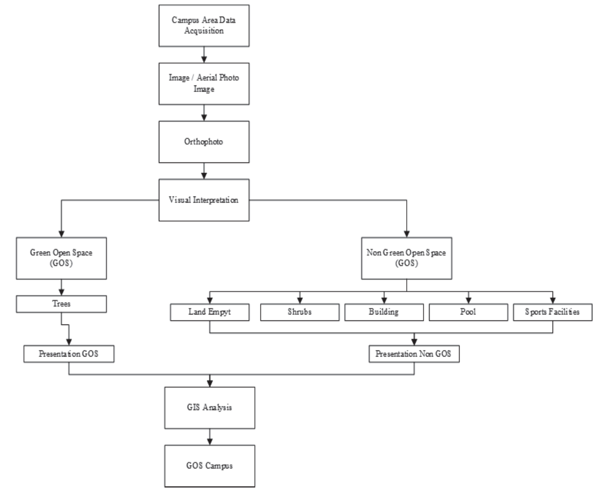

Fig. 3. Research Flow

InformationResearch Flowchart.

The first step in the image data acquisition process is to prepare the device that we will use, in this case the data acquisition process using the DJI Mavic 2 Pro Drone. The condition of the drone is checked first and ensures that other components such as the remote and the battery are fully charged and can be used to support the data acquisition process. The data acquisition process is carried out in the afternoon and in sunny conditions so that the resulting image quality is not disturbed by clouds or rain. Other devices used are the Ipad 2019 pro and PIX4D software for making flying missions. In this study we use the mission of flying Polygon 2D maps.

Fig. 4. PIX4D applications.

After that, the shooting process was carried out using a drone. The report results from data processing reports are as follows. Z error is represented by ellipse color. X,Y errors are represented by ellipse shape. Estimated camera locations are marked with a black dot

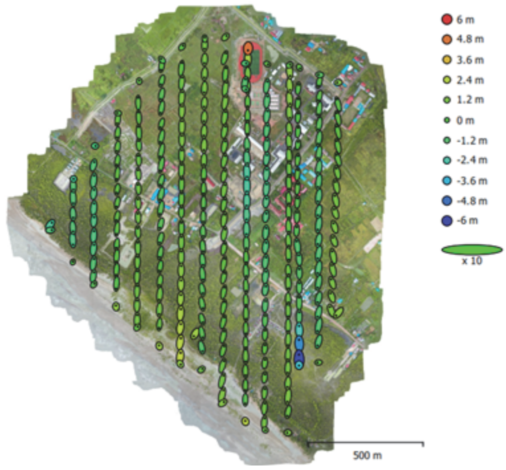

Fig. 5. Camera locations and error estimates.

Table 1. Average camera location error

X error (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
0.571728	3.57444	1.10109	3.61988	3.78363

The next stage is processing aerial photos into Orthophoto. At this stage we use the Agisoft application. In detail the flow of the system is described as follows.

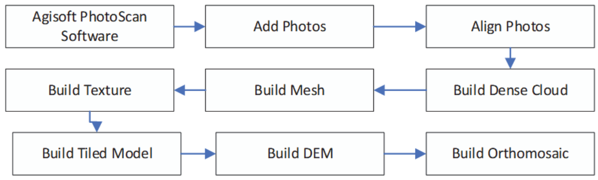

Fig. 6. Aerial photo processing flow

At this stage it is necessary to pay attention to the specifications of the computer used, this is because the time required for data processing is very long so that computer specifications need to be considered. The higher the specification of a computer, the processing process becomes faster, and vice versa

3 Results and Discussion

After obtaining orthophoto data, the next step is to perform a visual interpretation of the Unmus campus built area using the Arcgis application. At this stage it is carried out on a measurement scale of 1: 3000forclarify resolution. The following description shows the image of the report image processing results from aerial photos.

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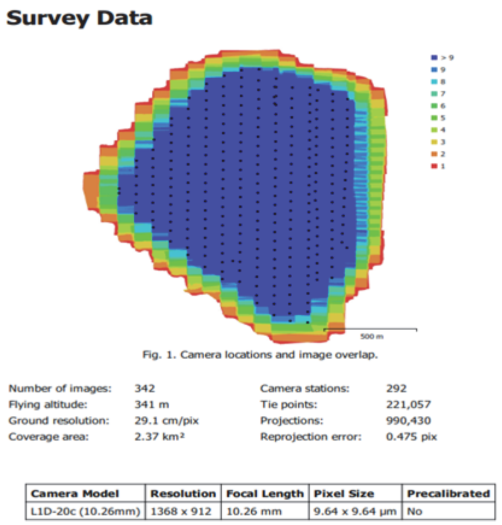


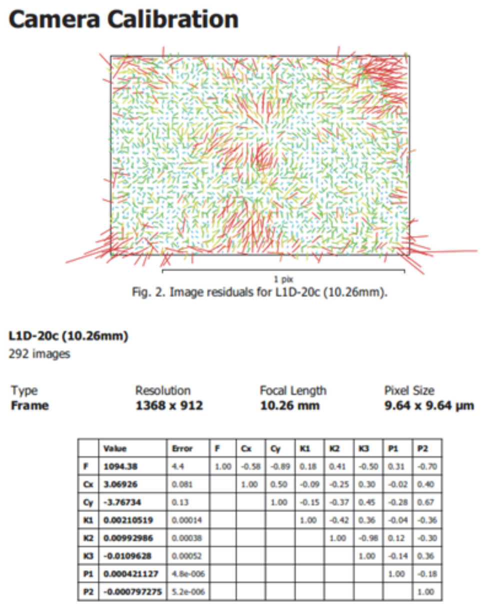
Survey Data

Fig. 1. Camera locations and image overlap.

Number of images:	342	Camera stations:	292
Flying altitude:	341 m	Tie points:	221,057
Ground resolution:	29.1 cm/pix	Projections:	990,430
Coverage area:	2.37 km²	Reprojection error:	0.475 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
L1D-20c (10.26mm)	1368 x 912	10.26 mm	9.64 x 9.64 μm	No

Fig. 7. Cameras



Camera Calibration

Fig. 2. Image residuals for L1D-20c (10.26mm).

L1D-20c (10.26mm)
292 images

Type	Resolution	Focal Length	Pixel Size
Frame	1368 x 912	10.26 mm	9.64 x 9.64 μm

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
F	1094.38	4.4	1.00	-0.58	-0.89	0.18	0.41	-0.50	0.31	-0.70
Cx	3.06926	0.081		1.00	0.50	-0.09	-0.25	0.30	-0.02	0.40
Cy	-3.76734	0.13			1.00	-0.15	-0.37	0.45	-0.28	0.67
K1	0.00210519	0.00014				1.00	-0.42	0.36	-0.04	-0.36
K2	0.00992986	0.00038					1.00	-0.98	0.12	-0.30
K3	-0.0109628	0.00052						1.00	-0.14	0.36
P1	0.000421127	4.8e-006							1.00	-0.18
P2	-0.000797275	5.2e-006								1.00

Fig. 8. Calibration coefficients and correlation matrix.

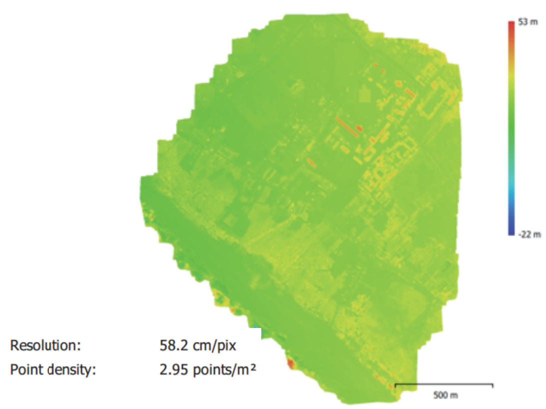


Fig. 9. Reconstructed digital elevation model.

Table 2. Capturing Caption and Time

Drones	DJI Mavic 2 Pro
Pick Up Date	November 21, 2021
Height	341 Meters
Number of Photos	342 Photos
Overlap	80%
GSD Resolution	58.2cm/pix

Furthermore, classification is carried out based on the land use of the Unmus campus. This classification is grouped into 3 parts Building, field and trees. The details are the building area as a whole is 28,431 M². while the area of the sports field is 35606 M² and the area of the trees is 8,481 M². while the open and built area on the Unmus campus is 24.77 hectares.
A detailed description of the area is shown in the following figure.

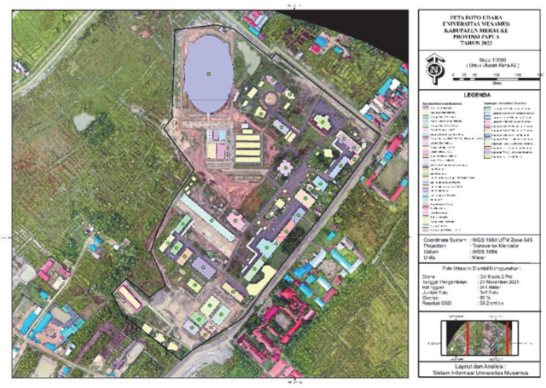


Fig. 10. Musamus University Map Layout Results

The results of the calculation of green open space are shown in the following table.

Table 3. Result calculation of Green Open Space.

No	Name	AREA (H	GOS Factor	GOS Needs Hectare
1	Building_Ar	2.84	30%	7.43
2	Field_Ar	11.71		
3	Green_Ar	8		
4	Area_Ar	25		

4 Conclusio

Based on the results of research conducted by the author can suggest some suggestionsamong them:

1. It is necessary to plant plants that are able to maintain coastal ecosystems.
2. The development process must pay attention toavailabilitygreen open space.
3. In the processacquisitionnext datashouldhave a lot of reservesbattery Drones
4. We recommend that you always get maximum digitization resultsusepro or paid software applications.

The availability of GOS for Unmus Campus has met the minimum requirements stipulated by the Law of the Republic of Indonesia.community utilisegreen open space to maintaincoolnessand the shade of the campus area. It is hoped that the entire academic communityUniversityMusamus can maintain and preserve the existing trees,so that permanentmaintain the shade and beauty of the campus and need to be improvedplantingmore trees considering the distance between campus and the coastline is very close.

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