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Determination of Proposed Road on Rural Reserved Plot Using UAV at Parit Raja

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Abstract: Road will be constructed as well as population growth roads are increasingly needed to identify areas for the purpose of proposed line in road reserve and road profile works, UAV is needed for mapping purpose to survey the proposed area of new alignment access road. This is because there is a line of road reserve that needs to be upgraded. UAV platform are these days a significant source of information for review, observation, mapping and 3D representative issues. The purpose of this study is to observe road reserve, to plot a topography orthophoto map and analyze plot position road reserve in area Parit Raja using DJI Phantom 4 drone. This study provides the image acquisition, quality control and data processing of the road reserve at area and create outline three-dimensional mapping of topography using software analysis. A software application is being used to make 3D topography images and a map of the reserve road in Kg Parit Bengkok and Kg Parit Haji Salleh Ros, Johor in Malaysia. There are 80 data images made with a camera FC6310 (8.8mm) that cover the area's road reserve topography through Agisoft Metashape and AutoCAD. As a result, a resolution accuracy of 1.77cm/pix 3D topography for road reserve modeling has been achieved. Photogrammetric applications, mapping, plot position and 3D displays can all be done with the DJI Phantom 4 drone for the whole process of this study.

Keywords: Road Reserve, UAV, Agisoft Metashape, DJI Phantom 4

1. Introduction

There are many road reserves left by the government that have not been upgraded to ensure the future of the economy [1]. Based on the 10th Malaysia Plan report, there are still villages in the interior that cannot be reached by road while in rural areas the infrastructure facilities provided are still insufficient [2]. The area of land reserve that needs to be provided is in accordance with the standards set out in the residential development guidelines and industrial development guidelines[3].The aim of this research is to observe road using UAV technology, to plot a topography orthophoto map on road reserve using Agisoft Metashape and analyze plot position of the road reserve. The location road reserve used in this

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research prepares to get orthophoto image and 3D modeling by UAV. The study will be implemented in Parit Raja's area which in between Kg Parit Bengkok and Kg Parit Haji Salleh Ros in Batu Pahat, Johor. Data from the UAV can determine the image that has coordinates that can be generated by the photogrammetry solution to produce a topography model of road reserve.

2. Literature review

Road reserve is probably turning into a mixed-use park in an area that is growing and getting more accessible by transportation [4]. Good roads enable rural areas of the country to gain easier access to external products, information, services, and social networks [5]. Drone may be detected if the road runoff is studied, on highlands and construction roads [6]. Most UAVs can take over the short times because to recent developments in lightweight materials and technology, can traverse huge distances in relatively short periods of time, while most UAVs employ environmentally friendly energy sources [7]. A landfill study for road construction among other uses [8]. Other than mapping, UAV systems may be used for surveillance, archaeology, geohazard investigations, monitoring and disaster response [9]. The UAV system has a barometer, a global positioning system which (GPS), sonar and infrared sensors as well as an electronic speed controller (ESC) [10]. 3D mapping may be created for topographic survey using UAVs, which are often used for progress monitoring, disaster management, and agricultural [11]. The benefits of using UAV can create 3D mapping, particularly quadcopters, allow for the replacement of terrestrial surveying equipment in many circumstances [11]. Photogrammetry can be developed for 3D digitization [12]. UAV technology have been completely in mapping utilising a using a three-dimensional mosaic to map land area [13]. Thus, UAVs may be a viable solution for field data collection. UAV photogrammetry, for example, offers up a wide variety of close in range for location study and merging aerial while also providing option for lost cost budget to traditional manned aerial photogrammetry [14]. Included among the standard domains for UAV photos where photogrammetrically produced 3D mapping data or orthoimages in figure 1.

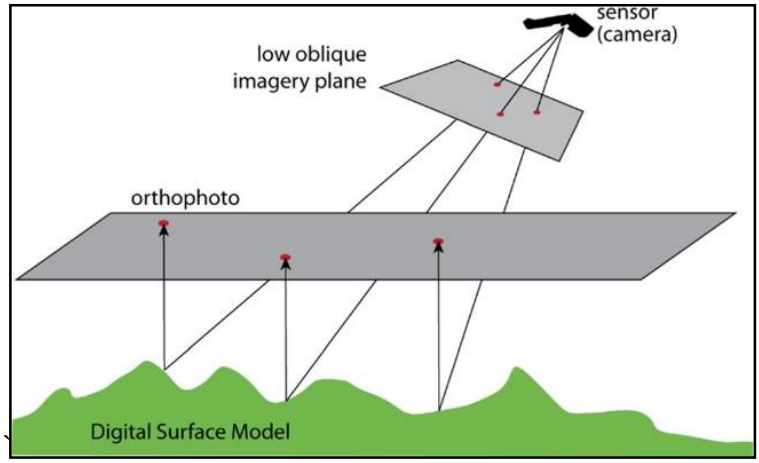

Figure1: Constant scale orthorectification (NCSU,2020)

UAV photogrammetry produced point clouds with a 20 cm absolute point location precision, sufficient for topographic studies [15]. The adaptability, dependability, and reproducibility of Metashape's technique have been usage of UAVs with landscape and architectural 3D models [16]. Orthomosaic horizontal accuracy increases from 5 to 0.6 metres [17], and for digital surface models (DSM) by around 2 metres [18]. These studies often use expensive platforms built for a single purpose [19]. So, it is vital to investigate the most cost-effective way to get a ready-made orthomosaic based on a cost-efficient navigation system with a solid computational algorithm. Advanced photogrammetric software makes it easy to turn data from drones into something useful quickly.

3. Materials and Methods

After collecting information from road reserve surveys and image processing, it is necessary to evaluate it using Agisoft Metashape. This method demonstrates that UAV is the only technology capable of mapping the roads in the studied region. The purpose of this study's planned road in figure 2 is to provide a mapping alternate route that will improve the flow efficiency the road on the road reserve.

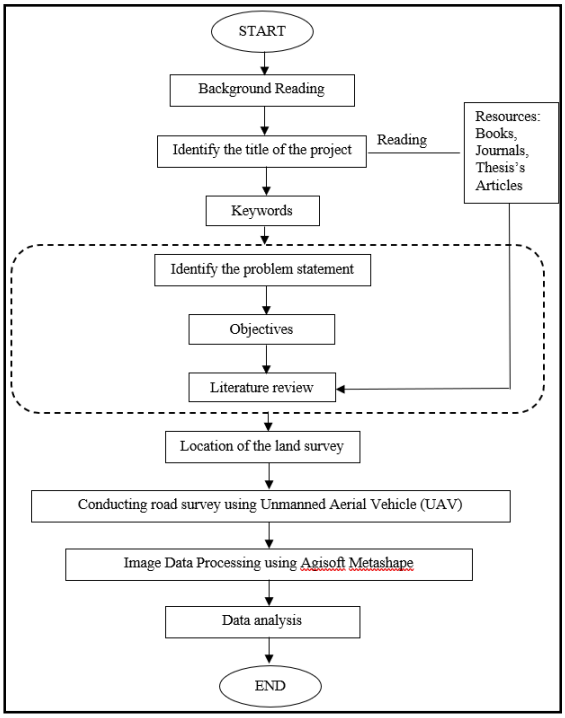

Figure 2: Flowchart methodology of study

3.1 Preparation

Drone equipment needs to be updated and ensure all equipment is complete and in good condition before carrying out the mission to take data at the study site. This ensures that no accidents occur and the data collection process runs smoothly. The installation of drone equipment is one of the important ways to keep the drone in good condition in figure 3.

Figure 3: Line grid collecting data

3.2 Planning

The drone data collection rate in the reserve land area took 9 minutes 15 seconds to record all the data in reserve land area using DJI GS PRO in figure 4. This drone has been set with a speed of 10.7 km/m with a mode (hover & capture at point) involving 80 data points taken when the drone conducts a reconnaissance mission.

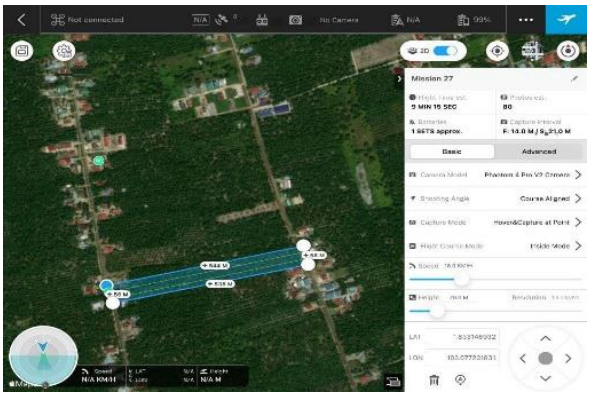

Figure 4: Line grid collecting data

3.3 Image processing

Images from UAV as a data for the designing of aligning road reserves at a specific development reserve location inserted into Agisoft Metashape. To get the best quality photogrammetric for processing in Agisoft, the images obtained with in jpeg format [20]. There are 9 stages during the process in software. The processing time is the quantity of photos, their resolution, and the machine's capabilities It might take minutes or hours. The photogrammetry programmed then estimates the depth of each photo, integrating the data contained in each shot into a dense dot cloud in figure 5.

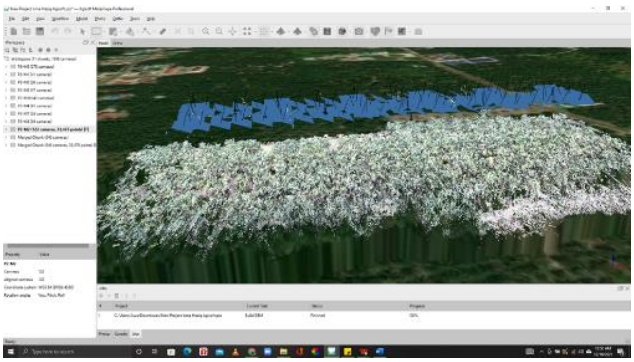

Figure 5: Dense point cloud

The process in figure 6, will be continued for generating model which visualize a digital elevation (DEM) and Orthomosaic. Point clouds, sparse point clouds, depth maps, and mesh data may all be used to create a digital elevation model (DEM). Using dense point cloud data yields the most accurate findings.

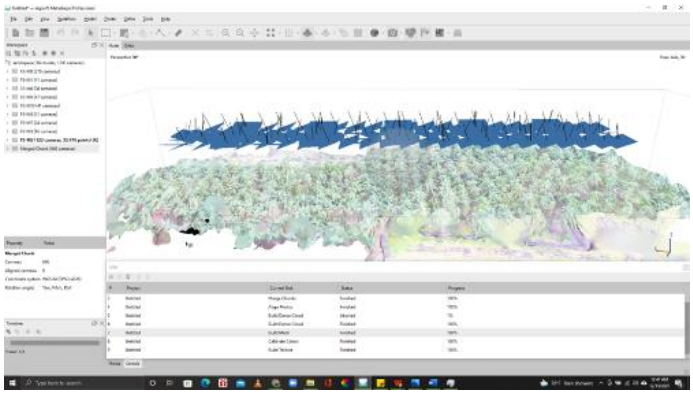

Figure 6: Generate texture

4. Results and Discussion

Drone data have completely collected the road reserve for the 530-meter length of area coverage and 20m for a width, with is the total area reached 10,600 m².

4.1 Results

A list of position of 80 images that have been captured by UAV with its own latitude and longitude in figure 7. The alignment imagery data were successful, which fully identified the reserve land based. The image data that has been taken will be entered into the Agisoft Metashape software, which can be used as a complete 3D image. By evaluating the data, it will be possible to determine the most advanced 3D modeling method for creating high-quality 3D visualization from a photograph. The image data have been aligned on software Agisoft Metashape that match essential point of model and used for the orthophoto generation. There were 80 camera stations and 76,788 points to construct the model.

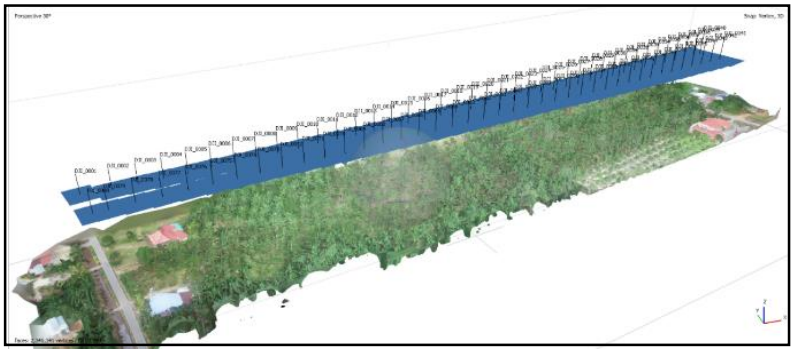

Figure 7: Alignment of image processing result

4.2 Discussions

The camera location and image overlap show the camera position and model which the number of overlaps is displaced in colour in figure 8. Orthophoto and DEM model derived from drone-based data with ground resolution 1.77 cm/pix respectively achieve accurate landcover. The area mapping covered by 3.09 hectares with average 120 meters height above sea level. The mapping will be applied in planning alignment road reserve.

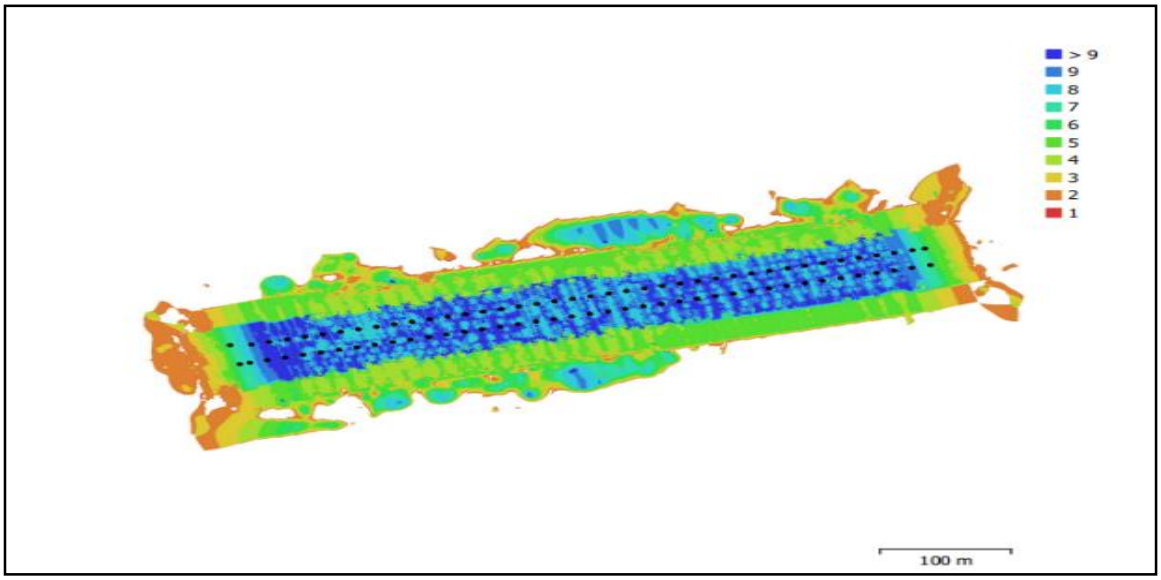

Figure 8: Camera location and image overlap

The elevation of the processing with orthophoto and 3D visualization road reserve was completely analysed. The result has been processing as well as extremely high-resolution image drone data, resulted in a considerable improvement in accuracy in figure 9 and figure 10.

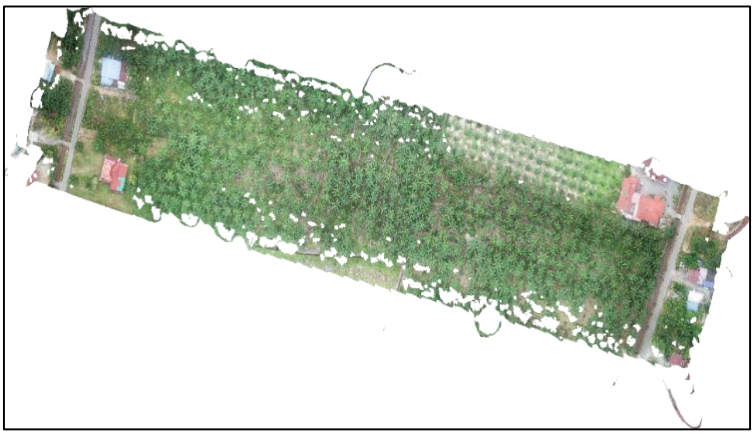

Figure 9: Orthophoto road reserve

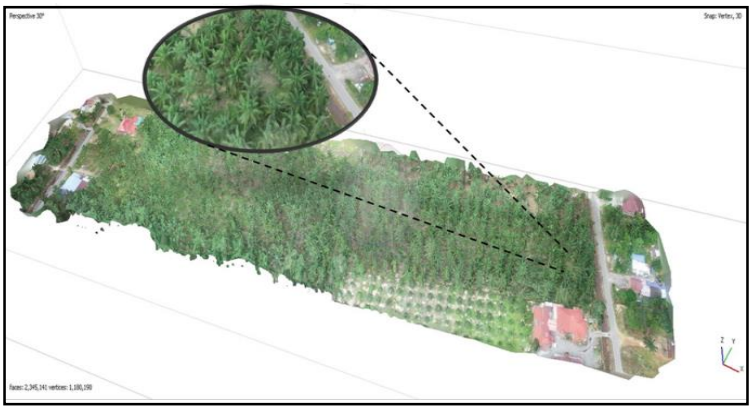

Figure 10: 3D model road reserve

Based on the obtained results, the 3D finished model with alignment road reserve were generated using the selected coordinate in the road reserve that was put in the software. The position of the plotted alignment that has been identified indicate the position of the road reserve. The position of the road reserve alignment has been identified based on the plots that have connected between the 2 village areas in figure 11, namely point P1 and P8 is Kampung Haji Salleh Ros while P4 and P5 are the village area of Kampung Parit Bengkok. P2, P3, P6 and P7 are position coordinate points along the existing road reserve.

Figure 11: Road reserve design on 3D modeling

Road reserve plot position data can be described through coordinates that have been extracted from the software. This proves that Agisoft Metashape can determine the coordinates at each point in the orthophoto plan used to provide road reserve alignment at the field study in table 1.

Table 1: Location point alignment road reserve

Point	Latitude	Longitude
1	1°83’27.62” N	103°07’74.23” E
2	1°83’30.99” N	103°07’95.64” E
3	1°83’32.10” N	103°08’01.84” E
4	1°83’37.33” N	103°08’19.64” E
5	1°83’39.50” N	103°08’18.94” E
6	1°83’34.72” N	103°08’01.24” E
7	1°83’33.66” N	103°07’94.94” E
8	1°83’29.99” N	103°07’73.73” E

5. Conclusion

In this way, UAV applications can be an alternative in completing orthophoto maps which is a more economical and time-saving way. The generation of orthophoto maps between Kg Parit Bengkok and Kg Parit Haji Salleh Ros succeeded in achieving the objective because finally an orthophoto map with an alignment road reserve area was produced and benefited users. The output from the software brings many advantages not only for visual use but also provides benefits in the planning and development of other future economies. Objective 1 is observed road reserve using UAV technology. Using the technology of Dji Phantom 4, it is successfully to observe the topographic surveys of area Kg Parit Bengkok and Kg Parit Haji Salleh Ros as the same quality as the highly accurate quality of the image. This is because this area covered by oil palm tree. The ground is photographed several times as can set in application Pix4D from different angles and the image with coordinated is tagged during the drone

survey using the drone camera. There are 80 captures data image from the drone in chapter 3. Objective 2 is to plot topography map for the access road in reserve land using Agisoft Metashape. Design and learn using software Agisoft Metashape in Chapter 3 and Chapter 4 develop the images using data UAV into the software for processing data to analysis images of road reserve. The process model and orthophoto information from drone data to obtain better analysis result. The objective executed well in to generate 3D model and orthophoto that explained in detail about the setting and process software. It can be best option for this study which in view accuracy required when combining the technology drone with the satellite sensing platform. The objective achieved when 3D mapping and modeling approach that can produce faster and more accurate outputs as can be proven in the evaluation process. And the last objective where to analyse plot position for road reserve. Road reserve mapping that generates from the processing by Agisoft Metashape in chapter 4 was subjected with combination data UAV. The objective was accomplished through the analysis plot position of road reserve was created on the topography model.

5.1 Recommendation

This study can improve this project in a few ways. This section will explore some of the upcoming research and capacity recommendations. Those interested in furthering their analysis on these topics may also improve this project.

Firstly, reserve land needs to be developed by the government in the land reserve during the subdivision of land lots for future use. The reserve land cannot be constructed by the public who are not their property for oil palm cultivation and so on. government can develop the reserve land if the land office makes an appropriate plan to upgrade the economy in the royal ditch area.

Secondly, for the software Agisoft Metashape, a most processing software that a most extreme number files and data, each varies across the different steps involved in using the application to process high-quality images for 3D modeling. In progress for processing this model, the computer will use greater ram for quality setting to process the project.

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