

ASSESSMENT OF TOPOGRAPHIC
VARIATION IN UMP GAMBANG CAMPUS
USING DRONE TECHNOLOGY

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DIPLOMA IN CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

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ASSESSMENT OF TOPOGRAPHIC VARIATION IN UMP GAMBANG CAMPUS
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MUHAMMAD NAIF BIN SAIDA

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for the award of the degree of
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ABSTRAK

Peta menggunakan tiga teknik berbeza untuk menentukan teknik mana yang paling tepat untuk topografi. Penyelidikan ini dijalankan di Universiti Pahang Malaysia. Di samping itu, adalah mungkin untuk mengemas kini data di kawasan penyelidikan atas sebab pembangunan masa depan. Kajian ini menggunakan dua jenis kaedah dan tiga kaedah yang berbeza, iaitu kaedah konvensional dan moden. Kaedah tinjauan darat, teknologi dron, dan kaedah ketinggian digital adalah contoh (DEM). Ketiga-tiga kaedah ini akan berlaku serentak dan di lokasi yang sama. Di samping itu, lokasi kejadian ini berbeza dari dekat dengan kawasan kajian hingga jauh dari kawasan kajian. Secara keseluruhan, hasil data dibentangkan dengan perisian mereka sendiri mengikut metodologi yang digunakan. Antara perisian yang terlibat ialah Agisoft Metashape, QGIS, Google Pro dan Quick Grid. Aplikasi ini akan memaparkan pemetaan 3D dan 2D. Di samping itu, pemilihan akan menerangkan corak topografi, menjelaskan sama ada ia berbukit atau rata. Dengan menggunakan pendekatan konvensional dan cara semasa, ia akan dapat menentukan kaedah mana yang paling tepat untuk mengira variasi topografi di UMP Kampus Gambang. Melalui penilaian sedemikian, telah ditentukan bahawa kaedah tradisional lebih tepat daripada kaedah topografi. Di samping itu, kaedah ini agak tepat, kerana ia berjalan di atas tanah dan bukannya melalui udara atau teknologi di dunia maya.

ABSTRACT

Maps using three distinct techniques to determine which technique is best accurate for topography. The research was conducted at the Pahang University of Malaysia. In addition, it is possible to update the data on the research area for reasons of future development. This research uses two types of methods and three different methods, namely conventional and modern methods. The land survey method, drone technology, and the digital elevation method are examples (DEM). These three methods will occur simultaneously and at the same location. In addition, the location of this event's occurrence varies from close to the study area to far from the study region. Overall, the data results were presented with their own software in accordance with the used methodology. Included among the involved software are Agisoft Metashape, QGIS, Google Pro, and Quick Grid. This application will display both 3D and 2D mapping. In addition, the selection will explain the topographical pattern, elucidating whether it is hilly or flat. Using the conventional approach and the current way, it will be feasible to determine which method is the most accurate for calculating the topographic variation at the UMP Gambang Campus. Through such evaluations, it has been determined that the traditional method is more accurate than the topographic method. In addition, this method is quite exact, as they run on the ground rather than via the air or technology in a virtual world.

TABLE OF CONTENT

DECLARATION	
TITLE PAGE	
ACKNOWLEDGEMENTS	ii
ABSTRAK	iii
ABSTRACT	iv
TABLE OF CONTENT	v
LIST OF TABLES	viii
LIST OF FIGURES	ixx
CHAPTER 1 INTRODUCTION	1
1.1 Background of Study	1
1.2 Problem of Study	2
1.3 Objective of study	4
1.4 Scope of Study	4
1.5 Significant of Study	5
CHAPTER 2 LITERATURE REVIEW	9
2.1 Introduction	9
2.2 Google Maps Provides Surveying and Mapping Data	9
2.3 Drone Surveying Technology for Terrain Mapping	11
2.3.1 Topographic Surveying	12
2.3.2 Road construction surveying	12
2.3.3 Drone Data Services	12
2.3.4 Usage of Drone Technology for Terrestrial Mapping	13
2.3.5 Types of Drone Technology for Terrain Mapping	14

2.4	Potential Digital Elevation Model (DEM) for Elevation Mapping	19
2.5	The Advantages and Disadvantages of Aerial Drones for the Study of Elevation Profiles	20
2.6	Constraints of Convenience Method on Drone Aerial, DEM, and Google Maps	21
CHAPTER 3 METHODOLOGY		23
3.1	Introduction	23
3.2	Methodology of the Study	23
3.3	Drone Technology Guidelines	26
3.4	AGISOFT Metashape 1.7.3 version Installation set-up	27
3.5	Agisoft Metashape 1.7.3 Professional Manual Processing Introduction	30
3.6	Agisoft Software Set-Up n	31
	3.6.1 Add Photo	31
	3.6.2 Estimate Image Quality	31
3.7	Agisoft Software Set-Up n	32
	3.7.1 Aligin photo	32
	3.7.2 ADD CGPs- Check the accuracy of model	33
	3.7.3 ADD VPS- To check accuracy of model	33
	3.7.4 Gradual Selection	33
	3.7.5 Dense Cloud	34
3.8	Mesh	35
3.9	Texture	35
3.10	Digital Elevation Model (DEM)	36

3.11	ORTHOMOSAIC	36
3.12	Results Process Completed	37
CHAPTER 4 RESULTS AND DISCUSSION		38
4.1	Introduction	38
4.2	Results Images Area 3 Dimensions using Agisoft Metashape	39
4.3	Topografic in UMP Gambang Campus	41
4.4	Comparison with Conventional Method	42
CHAPTER 5 CONCLUSION		45
5.1	Introduction	45
5.2	Conclusion	46
5.3	Recommendation	47
REFERENCES		48
APPENDICES		49

LIST OF TABLES

Table 3.1	Cost Analysis	37
Table 4.1	Area of Topographic UMP Gampang	41
Table 4.2	Results Comparison Conventional method and Modern Method	43

LIST OF FIGURES

Figure 1.1	Drone image of 3D point cloud	2
Figure 1.2	Image 3D Mapping	4
Figure 1.3	Image of Topographic Survey	6
Figure 1.4	Drone technology during mapping	7
Figure 1.5	Image mapping of DEM.	7
Figure 2.1	Land Use Survey on Google Maps	9
Figure 2.2	Drone and photogrammetric surveying combine photos of the same spot on the ground taken from various angles to produce detailed 2D and 3D maps.	11
Figure 2.3	Snap with a drone of road construction surveying	12
Figure 2.4	Market for drone data services in Germany, by kind, from 2014 to 2025 (in US dollars)	13
Figure 2.5	Cadastral map overlaid on aerial images	13
Figure 2.6	The volume of a landfill in the Bahamas, the volume of a stockpile at a mining site, and the volume of a landfill in the Bahamas were all measured.	14
Figure 2.7	Different types of drones	14
Figure 2.8	Drones for surveying and mapping	14
Figure 2.9	The combined marine and land surface data's Digital Elevation Model (DEM), 3D Elevation Model, and 3D Realistic Model show the morphology of the studied area.	19
Figure 2.10	Drone Surveying	20
Figure 3.1	Flow Chart of Methodology	25
Figure 3.2	Agisoft Trial Request	27
Figure 3.3	Professional Edition Installer	28
Figure 3.4	Installation Custom Setup	28
Figure 3.5	Interface of Agisoft MetaShape Software	29
Figure 3.6	Processing Add photo	31
Figure 3.7	Alignment photo process	32
Figure 3.8	Build Dense Cloud Parameter setting	34
Figure 3.9	Build Mesh Parameter setting	35
Figure 3.10	Build Texture Parameter setting	36
Figure 3.11	Build Orthomosaic	36
Figure 4.1	Point Cloud	40
Figure 4.2	Wireframe	42

Figure 4.3	Solid	42
Figure 4.4	Texture	42
Figure 4..5	Image 3D Area UMP Gambang	44

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Awareness of changes in life in the world requires an understanding of how the topography of differences supports different patterns and processes in hydrology, climatology, geography, and technology. With a wide range of terrain features, entirely standard and global multivariate Products can enable a wide range of large-scale research applications. Here we obtain a set of topographic variables such as height, slope, aspect, east, north, roughness, and terrain using GTS-235 height model products, technology drones, and DEM. We acquire a set of topographic variables such as height, slope, aspect, east, north, roughness, terrain roughness index, topographic position index of vector roughness measurement, and tangential/curvature profiles. Roughness index, topographic position index of vector roughness measurement, and tangential/curvature profiles using GTS-235 height model products, technological drones, and DEM. A closer examination of four UMP campus locations showed local variance and scale changes in aggregate variables on various space details. Still, cross-correlation highlights the high interdependence of many variables. Soil covers, and by linking species occurrence with environmental parameters, it is possible to assess biodiversity trends throughout the UMP campus area. For Example, hydrological responses to catchment driving trends, water runoff velocity, water accumulation, soil erosion, and soil moisture are greatly influenced by the slope and terrain of the arch (defined as curve and convex measurements or convergence and divergence). For Example, topography changes significantly impact the accumulation and diversity of the cover of landslides how the accumulation and diversity of the cover of the formation of landslides are greatly influenced by topographic changes. All these factors regulate the availability of water in the soil.



Figure 1.1 Drone image of 3D point cloud

In addition, the topography is the study of the form and characteristics of the soil surface. The topography of a region relates to the shape of the soil and the characteristics or description of those characteristics (especially their description on the map). In the strictest sense, the topography is the recording of relief or terrain, the three-dimensional quality of the surface, and the identification of a particular soil shape. They are alternatively known as Geomorphometry. This involves the creation of digital height data in modern usage (DEM). It usually consists of visual representations of ground forms on maps using various cartographic emission picture techniques, such as contour lines, hypsometric colours, and release shading using drone and satellite flight technology. The elevation is any mountain, hill, or plateau measured from the mean sea level. This topographical sheet contains all pertinent information regarding these landforms, in addition to their precise locations.

1.2 Problem Statement

Drone photogrammetry is the technique of gathering aerial site pictures to generate a 3D map with GPS coordinates and precise measurements, making it challenging to obtain photorealistic topographic surfaces in 3D. Photogrammetry is the study of extracting three-dimensional data from two-dimensional images, typically aerial photographs

collected by drones. The photogrammetry program creates a lifelike 3D depiction of the topographic surface by combining overlapping photos and geotags of the same feature captured from different perspectives. Drone photogrammetry is the process of photographing a site from above to generate a 3D map with GPS coordinates and precise measurements.

Basic surveys and labour-intensive rovers. It takes a long time if a technological drone is not utilized. Every time you fly, time-saving drone mapping creates a digital twin (a computerized reflection of your work site). This allows easy and efficient drone survey flights to replace time-consuming rovers and primary surveys. Software such as Propeller Platform transforms drone photos and flight data into interactive 3D maps with numerous applications.

It isn't easy to obtain precise data on the surface's size, height, and shape, since a photograph taken from the air indirectly affects time. This is because the data gathered by drones in a single flight offers a comprehensive map with GPS locations in 2D and 3D, making it possible to collect a large amount of data from the air, process it quickly, achieve superior results, and acquire detailed aerial photos. This map displays the exact dimensions of distance, area, and elevation. The drone image also assists infrastructure professionals in determining whether the land structure is suitable for construction and what aspects of the proposed project may require modification or attention.

Cost, efficiency, and security will continue to be considered in the absence of technological drones. With the use of drones, time and expense can be reduced, as it is no longer necessary to visit the region and calculate the size of the construction site, etc., in addition to reducing the risk of accidents and enhancing worker safety.

1.3 Objectives of Study

The primary goal of a topographic survey is to determine the location of any feature or point in the horizontal coordinate system, such as latitude, longitude, and altitude. The following are the study's particular objectives:

- i. To determine the height of the terrain of the topographic variant at UMP Gambang Campus
- ii. To compare the current topography mapping of UMP Gambang Campus from the conventional (land survey) and modern methods (Drone technology and DEM)

1.4 Scope of Study



Figure 1.2 Image 3D Mapping

A topographic survey is done to generate a map or plan displaying the natural features and man-made constructions in a place. This survey type is also known as a land survey or a detail and contour survey. Topographic surveys can only be conducted on the Universiti Malaysia Pahang Gambang campus. We employ land surveying, drone technology, and digital elevation modeling (DEM). QGIS, DJI Fly, and Google Earth are among the applications used in all three ways. All three approaches require 8-9 weeks to analyse the data supplied. Data from land surveys, drone technology, and digital elevation models are presented in two and three dimensions.



The final deliverable that we are looking at can be delivered in a variety of formats, ranging from 2D plans and CAD files to 3D data with a digital terrain model (DTM) or even data-rich photo realistic point clouds. The survey can be used for a variety of objectives, including architectural, landscape, and engineering construction projects, 3D modelling, asset location, and documentation. The benefits of a Scopus-provided topographic Survey, Accurate base information for any planning project, allows for accurate calculations of stockpiling and volumes for civil works, and fit-for-purpose solutions provided through our range of different techniques are the topics or theories discussed.

1.5 Significant of Study

The Sustainable Development Goals (SDGs) are the roadmap of the United Nations for a more sustainable future for everyone. Their adoption drew international attention to environmental degradation, sustainability, climate change, and water security. Since 2015, when the SDG compass was launched by the Global Reporting Initiative, the UN Global Compact, and the World Business Council for Sustainable Development, CDP has been actively involved in the SDG agenda, culminating in the report 'Business Reporting on the SDGs: An Analysis of the Goals and Targets'. Throughout the last year of my project, I will be able to correlate the SDGs with SDG 11. SDG 11 aims to make locations more inclusive, secure, durable, and sustainable. In relation to my area of study, the location is suitable for the establishment of a large city. For example, the establishment of a university can make the region safer and more resilient to natural calamities such as earthquakes, storms, and soil degradation.



Figure 1.3 Image of Topographic Survey

Increased boundary accuracy: One of the numerous advantages of land surveying is that it assists civil engineers in establishing exact boundaries for a piece of property. A civil engineering team can better plan building and development if precise property boundaries are set. Accurate borders also assist teams in avoiding legal issues with landowners near their project, saving time and increasing public satisfaction with the project. Improved topographic knowledge: Before beginning a project on a site, civil engineers must first learn about its topography. A land survey provides engineers with a better understanding of topography, such as evaluating whether the land has structural or soil difficulties or if it is prone to flooding. The civil engineering team can assess if their project is practical and safe before beginning development by acquiring a better understanding of the topography of a plot. Better property division: When a civil engineering business submits ideas to municipal governments, it must verify that it is not building on private property. A land survey allows them to better divide their property by clearly identifying where the public property begins and ends.



Figure 1.4 Drone technology during mapping

Reduce field survey expenses and duration. Collecting topographic data using a drone is up to five times quicker and requires fewer workers than traditional approaches. In addition to saving time, PPK geo-tagging eliminates the need to put several GCPs. Finally, you provide survey data more quickly and at a lower cost. And Identify regions that are unreachable by other means. A drone for aerial mapping can take off and flying virtually anywhere. You are no longer limited by inaccessible regions, dangerously steep slopes, or difficult terrain that is incompatible with specialised measuring instruments. There is no reason to close highways and railroads. During operation, data can be collected with little organisational overhead.

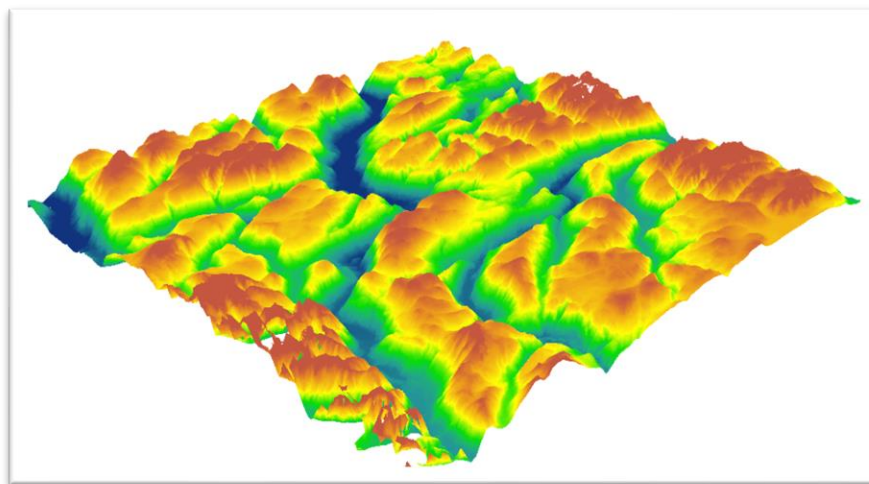


Figure 1.5 Image mapping of DEM

The Digital Elevation Model (DEM) is a digital model that gives surface shape information as raster data, vector data, or other types of data. DEMs contain height and slope information that helps interpretation, allowing them to be used in various contexts. DEM may be utilized to build catastrophic flood or landslide cartilage maps. DEM can be used to protect mining sites. There are numerous other applications for DEM. Aerial pictures are one of the data sources used to create a DEM. Aerial image of stereos or aerial photos of the right and left sides can be used. It is intended to obtain not just X or Y data but also Z data denoting height. The aerial shot utilized is a 1:10,000 scale aerial photo. A DEM created from aerial images of this scale can provide more detailed information about the mapped earth's surface emissions.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter contains information about the explanation of google maps, all uses of Google Maps, Drone technology, satellite technology, advantages and disadvantages of drone technology, constraints of conventional methods, and a summary of the literature review. Moreover, we will describe the technology in google maps, the importance of GPS surveys, and how Google Maps is useful. With a drone, surveyors may collect a greater number of topographical data points, resulting in more precise volume estimations. Additionally, they can do so in a much safer manner than if they had to physically collect the data by ascending and descending a stockpile. In addition, a Digital Elevation Model (DEM) is a representation of the topographic surface of the Earth's naked ground (bare Earth), removing trees, buildings, and other surface items. DEMs are derived from various sources. Historically, USGS DEMs were derived primarily from topographic maps. (Gertler, 2003)

2.2 Google Maps Provides Surveying and Mapping Data

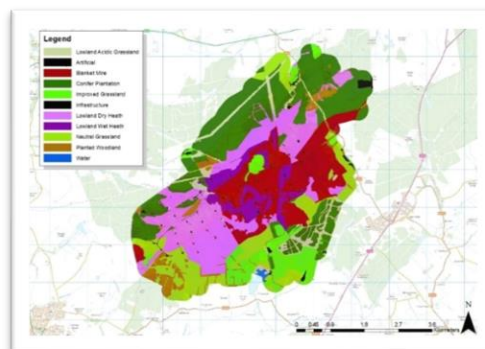


Figure 2.1 Land Use Survey on Google Maps

The surveying and mapping business was one of the first to use GPS because it increased productivity and produced more precise and dependable data. Surveying and mapping operations rely primarily on GPS in today's environment. When applied by skilled specialists, GPS technology provides the most accurate surveying and mapping data. Less equipment and labour are required since GPS-based data collection is faster than traditional surveying and mapping approaches. What used to take a week for an entire team to complete is now completed in a single surveyor's day.

GPS allows for the meticulous mapping and simulation of the real world, including mountains, rivers, streets, buildings, and other resources. On maps and geographic information systems (GIS), which store, analyse, and display geographically referenced data, GPS-measured features can be presented. Globally, governments, academic institutions, and businesses use GPS and GIS technologies to make timely choices and manage resources. The usefulness and productivity of GPS positioning can help any business or agency that requires precise asset location information.

GPS is useful for surveying coasts and rivers when there are few reference sites on land. Using GPS coordinates and sonar depth soundings, survey vessels generate nautical charts that alert mariners to variable water depths and subsea hazards. Land surveyors and mappers can mount GPS devices on their trucks or carry them in their backpacks to collect data quickly and precisely. Several of these devices may wireless communicate with reference receivers, providing centimetre-level accuracy and previously unheard-of productivity benefits.

2.2 Drone Surveying Technology for Terrain Mapping



Figure 2.2 Drone and photogrammetric surveying combine photos of the same spot on the ground taken from various angles to produce detailed 2D and 3D maps

A drone survey consists of collecting aerial data with downward-facing sensors, such as RGB or multispectral cameras and LIDAR payloads, using a drone or unmanned aerial vehicle (UAV). During a drone survey employing an RGB camera, the ground is photographed from a variety of angles, and each image is georeferenced. Photogrammetry combines many photographs of the same location on Earth taken from different perspectives to create accurate 2D and 3D maps..

From these data, photogrammetry software can generate Geo-referenced Orth mosaics, elevation models, or 3D models of the project region. These maps can also extract information, such as volumetric measurements or incredibly accurate distances. Drones can fly at far lower altitudes than human-crewed aircraft or satellite imagery, making the creation of high-resolution, high-accuracy data significantly quicker, cheaper, and independent of atmospheric conditions such as cloud cover.

Numerous businesses require surveyors to provide them with maps of land areas. Drone mapping makes the surveyor's job easier, faster, and safer by enabling the measurement of an area's overall slope and the generation of square-foot-specific maps. Among the most important industries where drones are utilized for GIS surveying are:

2.3.1 Topographic Surveying

Drones significantly reduce the need for human labor in topographic surveys, hence improving their efficiency and accuracy. Drones for surveying can create very accurate 3D models and high-resolution orthophotos. This method can rapidly generate high-precision maps in complex or difficult-to-access environments. Along with their knowledge and experience, surveyors can use these maps to build extraordinarily accurate maps.

2.3.2 Road construction surveying



Figure 2.3 Snap with a drone of road construction surveying

Using road construction drones, councils, transportation authorities, and civil engineering firms may produce large-area linear maps rapidly and accurately. Carrying LiDAR allows them to precisely measure the terrain and subsoil.

2.3.3 Drone Data Services

In 2016, the drone data services industry was worth \$152.1 million. The growth of the market can be attributable to the increasing demand for drone information analysis among enterprises globally in order to remotely perform a variety of crucial jobs, such as automated mapping, cadastral surveying, corridor surveying, volumetric calculations.

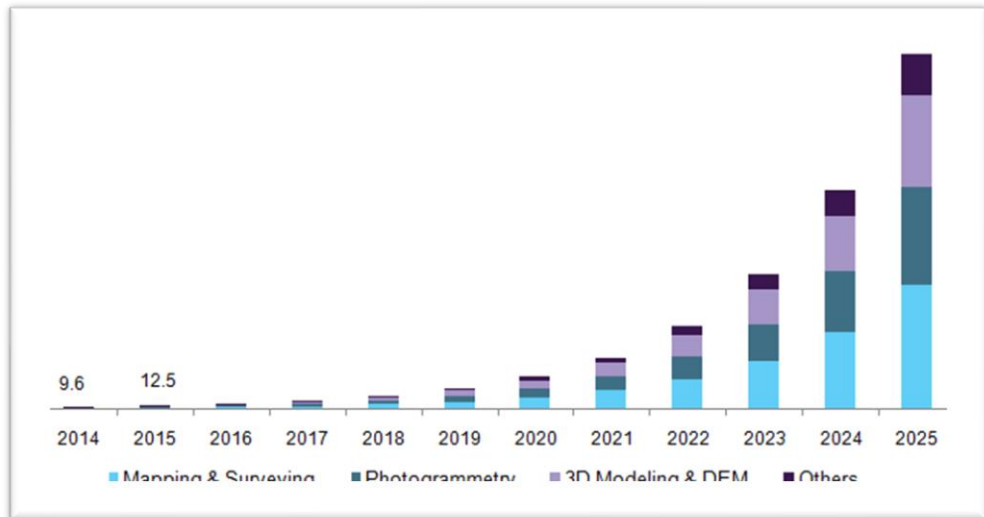


Figure 2.4 Market for drone data services in Germany, by kind, from 2014 to 2025 (in US dollars)

2.3.4 Usage of Drone Technology for Terrestrial Mapping



Figure 2.5 Cadastral map overlaid on aerial images.

In areas with poor data quality, outdated data, or no data at all, survey drones generate high-resolution Orth mosaics and complex 3D models. Thus, they enable the speedy and straightforward creation of highly accurate cadastral maps, even in complex or difficult-to-access regions. Surveyors can also identify items such as signs, curbs, road markings, fire hydrants, and drains using the photographs. After being post-processed with photogrammetry software, the same pictures can generate exact elevation models, contour lines, and break lines, as well as 3D reconstructions of land sites or buildings.

Precise measurements

Surveyors can make extremely precise surface and distance measurements because of the high resolution of orthophotos.



Figure 2.6 The volume of a landfill in the Bahamas, the volume of a stockpile at a mining site, and the volume of a landfill in the Bahamas were all measured.

Using a drone, surveyors can collect more topographic data points, resulting in more accurate volume measurements. Additionally, they can do so considerably more safely than if they were to crawl up and down a stack to collect the data themselves. The data is being collected from above by drones, so site operations will not be interrupted. The short acquisition time makes it possible to capture an image of the location at a certain time.

2.3.5 Types of Drone Technology for Terrain Mapping

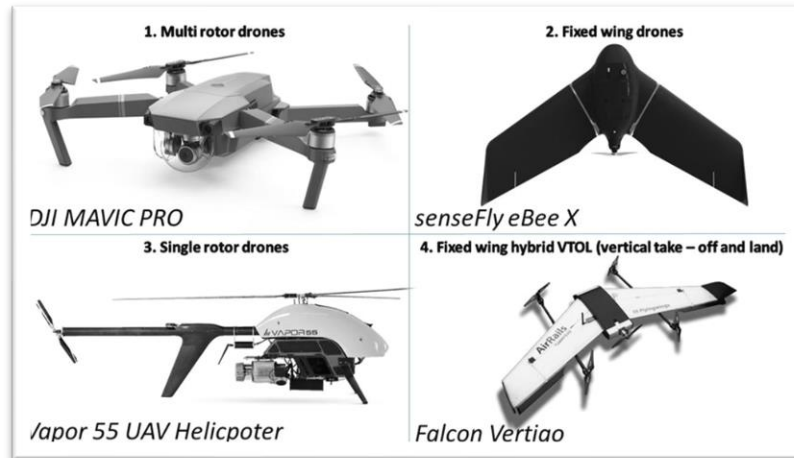


Figure 2.7 Different types of drones

2.3.5.1 Types of Drones

A drone is a remotely piloted aircraft system or unmanned aerial vehicle (UAV). It resembles a flying robot in that it may be remotely controlled or fly autonomously thanks to software-controlled flight plans that are incorporated into the system and work with sensors and a global positioning system (GPS). Drones serve a variety of tasks and come in a variety of sizes and shapes. Then, various drones. Here is a list of the functions, advantages, and disadvantages of the four most common types of drones. Single-Rotor Drones, Fixed-Wing Drones, and Multi-Rotor Drones. System identification, estimation, and control for a cost-effective open-source quadcopter: (Sa, I.; Corke, P. Is Part Of Proceedings International Conference on Robotics and Automation, 2012)

1. Multi-Rotor Drones



Using a multirotor drone is the simplest and least expensive approach for keeping an "eye in the sky." They are perfect for aerial photography and surveillance because they offer greater positioning and framing control. They are called multi-rotor because they have multiple motors. Troopers with three rotors, quadcopters, hex copters, and octocopters with four or more rotors are examples. Applications of technology for 3D scanning, thermal reporting, photography, and videography.

2. Fixed-Wing Drones



Instead of vertical lift rotors, a fixed-wing drone has a single, inflexible wing designed to resemble and act as an airplane. Therefore, this drone only needs the energy to move ahead, not to maintain its altitude. They are, therefore, energy efficient. The next section discusses the technical applications for aerial mapping and drone surveying, such as forestry and environmental drone surveys, pipeline, and coastal UAV surveys, agricultural, inspection, and security.

3. Single-Rotor Drones



Single-rotor drones are durable and long-lasting. They have a similar structure and look like helicopters. A single rotor consists of a single rotor, which resembles a big

spinning wing, and a tail rotor that controls stability and direction. The following are the technical uses for drone surveys, airborne LIDAR laser scanning, and transporting massive payloads:

4. Fixed-Wing Hybrid VTOL



Drones with hybrid vertical takeoff and landing combine the advantages of rotor and fixed-wing systems. This type of drone can hover and make vertical takeoffs and landings due to the rotors linked to its fixed wings. Currently, there are only a handful of hybrids in this new category, but as technology improves, this choice may become much more popular in the coming decades. The Amazon Prime Air delivery drone is a hybrid fixed-wing VTOL example. Next, release of technical applications for drones.

2.3.5.2 The Best Drone for Terrain Mapping.

WingtraOne mapping drone

The WingtraOne mapping drone can handle all of the problems that come up when surveying large and medium-sized projects, such as large surveying areas, difficult or steep terrain, big changes in altitude, bad weather, or the lack of flat surfaces needed for takeoff, and landing. Also, the GSD has 42 Megapixels with a resolution of 0.7 cm/px (0.3 in/px). Because it has a full-frame 42 MP Sony camera, the WingtraOne can fly at high altitudes and still take photos with a low GSD. This makes it possible to survey large areas quickly and accurately. The higher resolution makes it easier to put together an orthomosaic map.



Figure 2.8 Drones for surveying and mapping

2.5.3.3 Other drones for surveying and mapping

Which drone is best for your land surveying project will depend on many factors, such as the size of the survey site, the quality of the output you want, your budget, and your tastes. Read our comparisons of the photogrammetry drones, WingtraOne vs. DJI Phantom 4 RTK, WingtraOne vs. eBee X, and WingtraOne vs. Quantix, for more information on how to make this choice.

2.4 Potential Digital Elevation Model (DEM) for Elevation Mapping

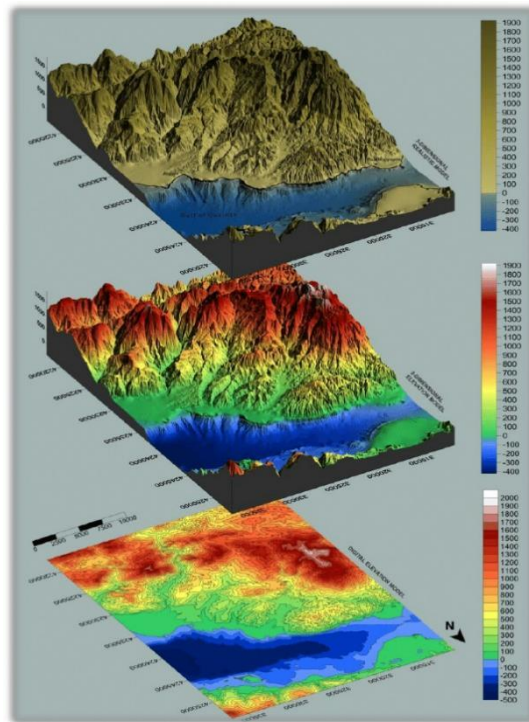


Figure 2.9 The combined marine and land surface data's Digital Elevation Model (DEM), 3D Elevation Model, and 3D Realistic Model show the morphology of the studied area.

A "Digital Elevation Model" (DEM) is a digital cartography file that displays a smooth topographic elevation surface via a grid of pixels. The height (Z) of a feature at each cell position is displayed (X and Y). Digital elevation models depict only the height of geological (ground) features, such as valleys, mountains, and landslides, among others. They have no knowledge of the height of anything above ground, such as plants and structures. Digital elevation models can be used to create both topographic and bathymetric maps of land and sea.

Digital Elevation Models (DEMs), which are raster files, store the height of each raster cell. DEMs are often used to do calculations, manipulations, and more research on an area, especially analysis based on height. A few easy-to-use built-in functions in ArcGIS can be used to turn the DEM into a derivative map.

2.5 The Advantages and Disadvantages of Aerial Drones for the Study of Elevation Profiles



Figure 2.10 Drone Surveying

Drone surveying is an aerial survey done with special cameras and drones with sensors that look down. Most of the time, it is used in the building industry by surveyors and engineers to map and evaluate topography. Surveying can be done 90% faster with drones than with traditional tools. It is used to make maps and survey very accurate sites. Businesses use drone mapping to find mistakes on the job site, track how things are going, predict delays, and so on.

2.5.1 Advantage of Drone Technology compared to Conventional Topographic Method

1.0. Keeping a Safe Environment

Several functions that UAVs can do can contribute to a safer environment. Drones can remotely monitor conditions, report potential dangers, and notify people of potentially dangerous situations, all of which contribute to the establishment and maintenance of a safe environment. Drones equipped with cameras, for example, can assess traffic patterns to assist drivers in avoiding unsafe areas.

2.0 Low-Cost Saving Technology

Because drone technology is constantly developing, the cost of purchasing a drone is cheaper than it was previously. As a result, they grew much more popular, and you can now even find antique drones for sale. This means that the military, law enforcement, and the affluent are not the only groups having access to drones.

2.5.2 Disadvantage of Drone Technology compared to Conventional Topographic Method

1.0 Invasion of Privacy

While drones have many advantages, they are also a technology that is easily abused because UAVs can be used to violate the privacy of a specific target group or individual. Given the multiple justifications for using drones to preserve safety, numerous personal liberties may be violated in the name of providing private or public protection.

2.6 Constraints of Convince Method on Drone Aerial, DEM, AND Google Maps

Uncrewed aerial vehicle (UAV) or drone surveying is the practice of collecting data from the air. An airborne survey is carried out using drones and unique cameras with downward-facing sensors. During a drone survey, the ground is photographed from various perspectives, and each image is geotagged with coordinates. Drone/aerial surveys are used by surveyors and engineers in the construction business for terrain assessments and mapping. Drone surveying may be accomplished 90% faster than traditional methods. It is used to generate exceptionally accurate maps and survey locations. Drones can fly at far lower altitudes than human-crewed aircraft or satellite imagery, reducing the time and expense of obtaining high-resolution, high-accuracy data.

Maps are more portable and easier to use. They can describe the entire Earth's surface, a piece, or even a remote location. Furthermore, benefits include significant productivity gains in terms of time, resources, and labor required, fewer operational

constraints when compared to traditional techniques, accurate positioning of physical features that can be used in maps and models, faster delivery of the geographic information decision-makers require, and centimetre-level surveying results in real-time.

Digital elevation models (DEMs) are required for constructing contour lines and terrain models, which provide an additional source of data for analysis, as well as for performing geometric and radiometric topographical corrections on remotely sensed imagery. It can be represented by a standard vector object + attribute structure and changing node frequency in the slope direction allows for efficient data storage. The main disadvantage of employing a contour-based DEM in a GIS is the need for more knowledge in flat areas. Because of the irregular nature of the data, extra processing (such as calculating slope and aspect) takes longer than other DEM types, making it difficult to highlight breaks in slope appropriately.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Based on the observational study of topographic variations at the UMP Gambang campus using drone technology, the study will be conducted in 2 phases. Phase 1 is an observational study in the ump Mosque Area, student residence 1, student residence 3, JHEPA building, Guest Block, blocks X, Y, Z, FIM faculty ban, FTKA, UMP sports complex, Chancellery building, library, and Block. UMP Advance. Phase 2 will be covered by analyzing data from images taken using drones. Through the analysis will get a picture in the form of 3 dimensions. Apart from that, we will continue to focus on aspects of the point cloud, dense cloud, dense cloud classes, shaded, solid, wireframe, textured, and orthomosaic. Furthermore, through this Agisoft software, the 3-dimensional image is accurate because the longitude and coordinates taken are correct.

3.2 Methodology of the Study

Figure 3.1 illustrates the flowchart of the study. A Drone technology terrain mapping is designed based on the objective scope that can collect the data for topographic variation in the UMP Gambang campus. Drones and UAVs have attracted significant research interest mainly because of their abilities and potential for use in various applications and domains. One of the most critical operations a drone must perform efficiently is navigation in a real-world environment. This usually includes route planning capabilities and a three dimensions (3D) picture of the terrain.

It is important that drones can perform procedures automatically and efficiently related to object evasion while navigating in an environment. In this work, we present a methodology for conducting drones to get a clear picture of the terrain in the study area,

obtain accurate data and analyze map data. This methodology is based on the concept of an environment in which drones will explore the study area only through the UAV system and the Applications that have been set in the system to implement the objectives of this study itself.

The results are exciting and show that the technology drone methodology is efficient and obtains good results to analyze the study area accurately, clearly, and fully and meet the study's objectives.

Drone (UAV) image processing Using Agisoft Metashape

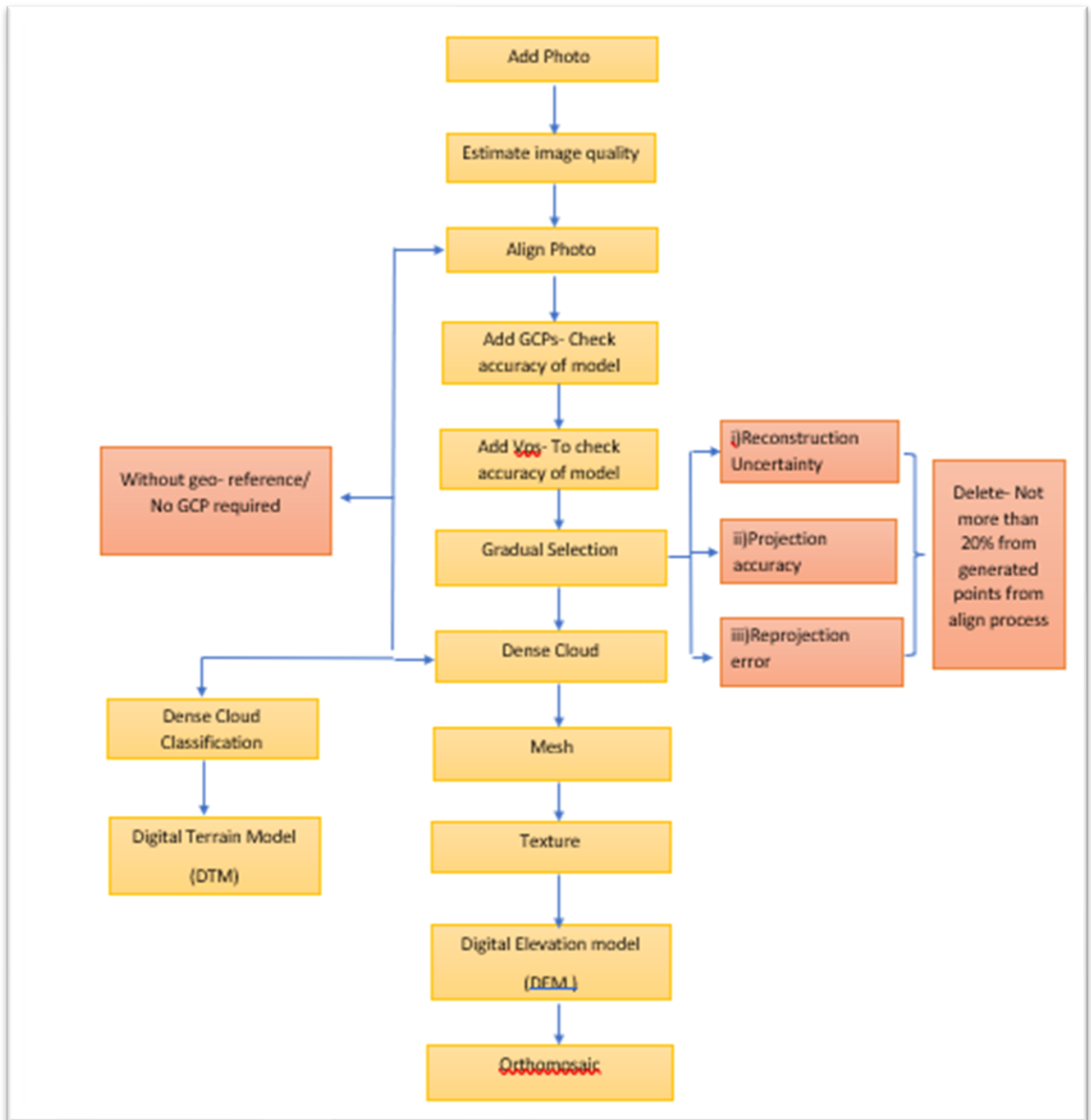


Figure 3.1 Flow Chart of Methodology

3.3 Drone Technology Guidelines

Drone DJI INSPIRE 2

The Civil Aviation Authority of Malaysia is responsible for all aircraft-related affairs in Malaysia (CAAM). Unmanned Aircraft Systems (UAS) are divided into three categories by CAAM. Small unmanned aircraft systems (sUAS), small uncrewed surveillance aircraft, and unmanned aircraft systems weighing in excess of 20 kg are prohibited. You must submit a permit application if you meet any of the following conditions: -You use your drone for aerial operations such as mapping, surveying, inspection, and agricultural spraying. Distributed processing applications for UAV/drones: a survey, by G. Chmaj and H. Selvaraj, in Progress in Systems Engineering.

Even small consumer-grade drones pose a significant safety risk; not only can they fall and injure someone, but their sharp, fast-spinning propellers can easily sever a person's fingers or other body parts. Drones pose a threat to national security and privacy as their design makes them excellent tools for espionage, and have been involved in a number of high-profile incidents around the world, such as closing Gatwick Airport in England for 36 hours, causing approximately 1,000 flights to be cancelled, and crashing in the White House grounds.

Several areas in Malaysia, including Putrajaya, the Kuala Lumpur City Centre (KLCC), the Parliament, and the Istana Negara, have been designated as no-fly zones for security reasons. Other government locations that are not open to the public, such as police stations, jails, government offices, and military bases, may also be declared no-fly zones. Research and Teaching in Robotics-EUROBOT, pp. 172-186, 2011. T. Krajnc, V. Vonásek, D. Fier, and J. Faigl. "AR-drone as a platform for robotic research and education."

Sites where emergency services are present, such as hospitals and fire stations, as well as places where emergency employees work, such as a crime or accident scene, are also off-limits to drone operators. If you fly your drone too close to them, you may

interfere with their duties and find yourself in legal trouble pursuant to Section 186 of the Penal Code.

3.4 AGISOFT Metashape 1.7.3 version Installation set-up

Agisoft Metashape 1.7.3 trial version installation Guideline

1. Go to the link <http://www.agisoft.com/download/request-trial/> and apply for trial Agisoft as shown in Figure 3.2. Fill in all the information and tick the box I'm acquainted and agreed with personal data.

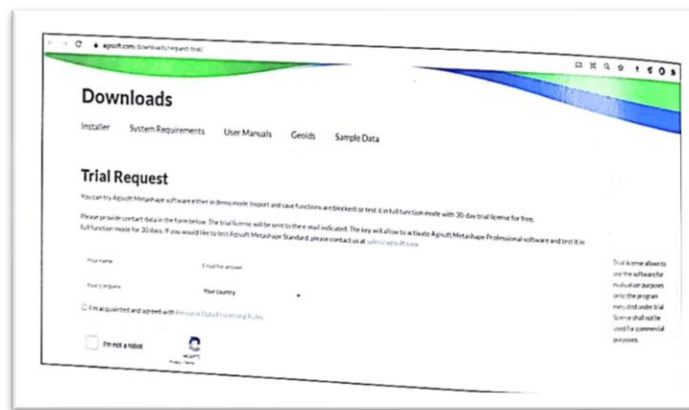


Figure 3.2 Agisoft Trial Request

2. Refer to email request the Agisoft trial. The Agisoft team provides

(i) metashape professional trial license key and

(ii) installer link file (click link <http://www.agisoft.com/downloads/installer/>)

3. Select Windows and download the installer - choose Professional Edition as shown in Figure

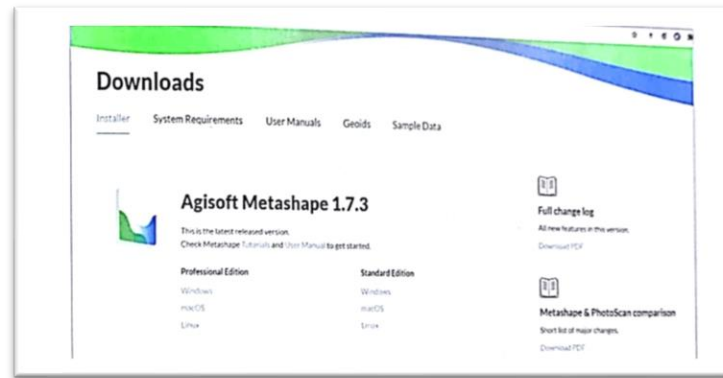


Figure 3.3 Professional Edition Installer

4. Reflect from Figure 3.3, double click the **installer** and click next

5. Tick '**I accept the terms in the License Agreement**' and click **next**.

6. Select Agisoft Metashape and click next, as indicated and for the software installation process.

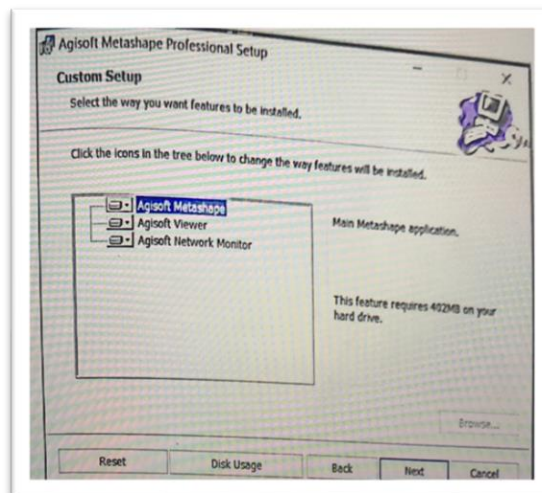


Figure 3.4 Installation Custom Setup

7. Then click **install**. Wait until the installation is completed

8. Open the software Agisoft Metashape and key in the trial license key (refer to an email received from Agisoft team) tick 'start a free 30-day trial' **OK**. If this pop-up does

not automatically exist, click Help and choose Activate Product to key in the trial license key

9. The software is ready to use, as shown in below

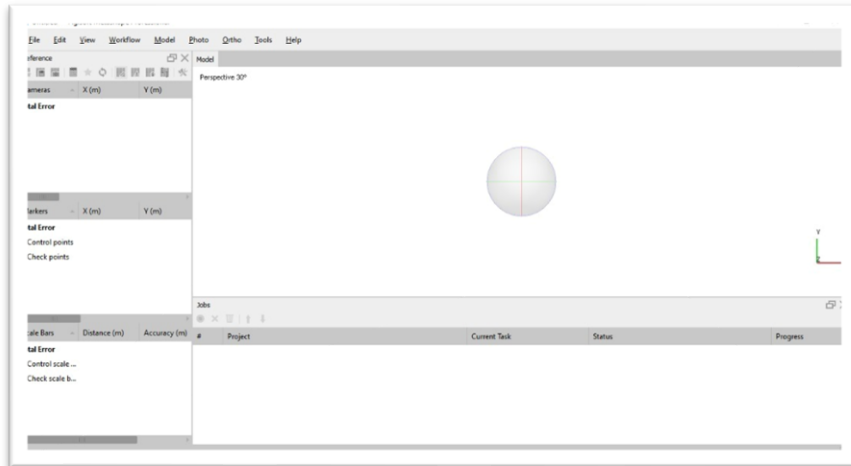
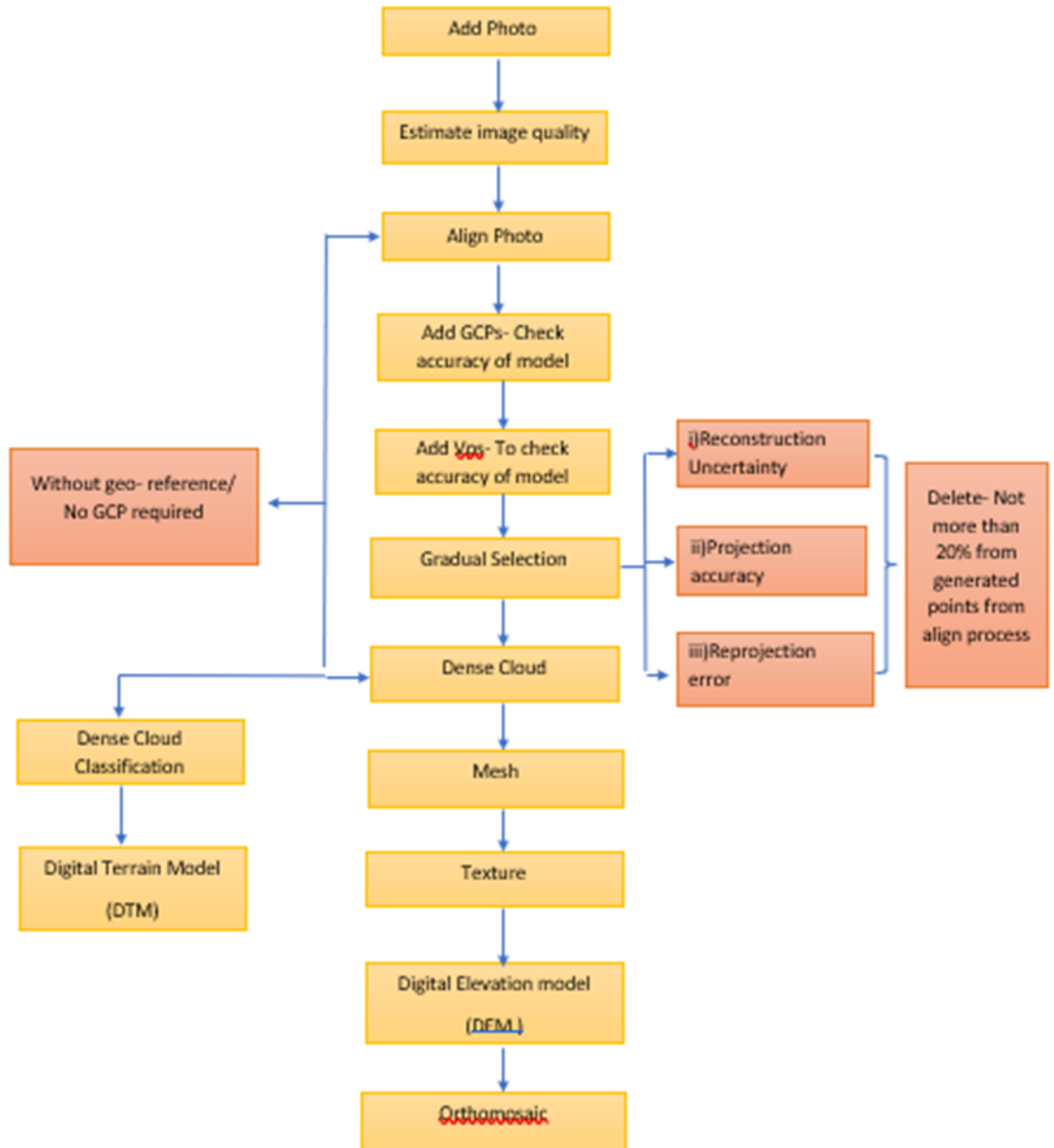


Figure 3.5 Interface of Agisoft MetaShape Software

3.5 Agisoft Metashape 1.7.3 Professional Manual Processing

Drone (UAV) image processing Using Agisoft Metashape



3.6 Agisoft Software Set-Up

1. Indicate the whole process of UAV image processing, starting from Add Image until the production of DEM/DTM and Orthomosaic. The certain process is optional, which depends on the purpose of the UAV image processing.

2. This processing manual is valid for Agisoft Metashape version 1.7.3 only. The format image JPEG, JPEG 2000, TIFF, DNG, PNG, OpenEXR, BMP, TARGA, PPM, PGM, SEQ, ARA (thermal images) and JPEG Multi-Picture Format (MPO) can directly insert in Agisoft, others than listed image format, the image conversion of the image need to be done first.

3.6.1 Add Photo

Start processing UAV image by adding the image in the software, click Workflow in menu pane and select Add Photo, choose your image directory, and add all UAV image.

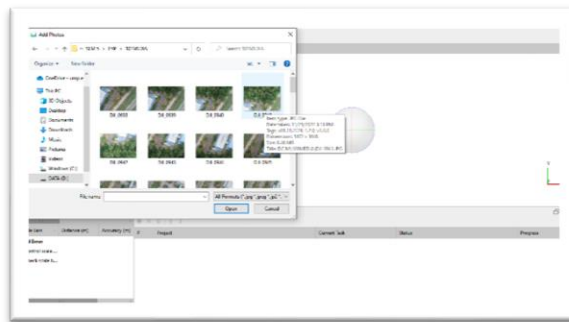


Figure 3.6 Processing Add photo.

3.6.2 Estimate Image Quality

To check the indicated estimated image quality value for the image, in Photo Pane, select Change View and click Details. In the Quality column, the estimation image quality value can be analysed for each of image. Agisoft suggests removing images with

a quality value of less than 0.5, some researchers suggest removing photos with a value 0.6 or lower.

3.7 Without geo- reference/ No GCP required

3.7.1 ALIGN PHOTO

Aerial flight and initial photo alignment process. To perform image alignment, select Workflow in the menu and choose Align Photo, as shown below

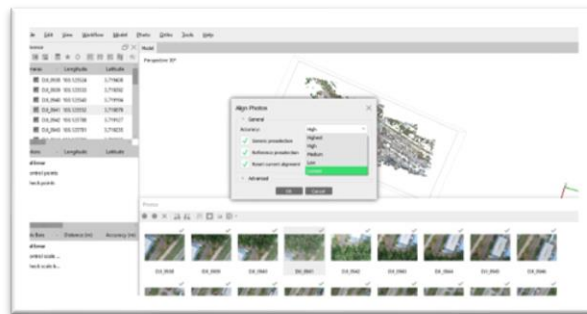


Figure 3.7 Alignment photo process

Uncheck/check box for Generic preselection and Reference preselection:

- i) Source - The overlapping of the photograph is determined based on the measured camera location 8. Set the parameter for Accuracy, Advanced setting as described for alignment photo process.
- ii) Sequential -The correspondence between the image is determined.
- iii) Estimated - Consider the exterior orientation calculation parameters during the sequent of the image.

3.7.2 ADD CGPs- Check the accuracy of model

For Geo-referencing purposes, the use of GCP is essential. To import GCP point, click Import at the reference pane and choose GCP point file. If the format file in (.txt), directly import the GCP point. Import CSV dialog box appears, set:

- i) Coordinate system: WGS 84 (EPSG:4236) or depends on the coordinate system of the user's GCPS
- ii) Rotation angles as Omega, Phi, Kappa
- iii) Set default for others, setting

Make sure the arrangement Label, Longitude, Latitude, and Altitude of GCPs as in the Marker Pane requirement.

3.7.3 ADD VPS- To check accuracy of model

To check/verify the accuracy of the model, the checkpoint can be inserted in the Agisoft to automatically calculate the RMSE value for the validation. Insert CP makers by apply same procedure for GCP markers placement (step no 16-17). Import CP markers in reference pane. Set the Coordinate System as GDM2000/Peninsular RSO (depends on the reference system of the CPs) and click OK.

3.7.4 GRADUAL SELECTION

Tie point error reduction purposely to clean sparse point clouds from large tie point reprojection error, this can be utilized in the Gradual Selection tool. Users can delete the selection points based on the determined parameter value. This allows for the removal of about 10-20% of the total sparse point cloud generated in the photo-alignment process. Choose Model in the menu pane and click Gradual Selection.

The first criteria are Reconstruction uncertainty. In the Gradual selection tool, choose Reconstruction uncertainty as the criterion and set the level at 10-50 by dragging the

cursor. The software will select the points model with a low based to high ratio, this point can be eliminated by deleting the selected point.

3.7.5 DENSE CLOUD

Build Dense Point Cloud. Go to Workflow and select Build Dense Cloud to set the parameter. Set the quality at Ultra height/High/Medium/low.

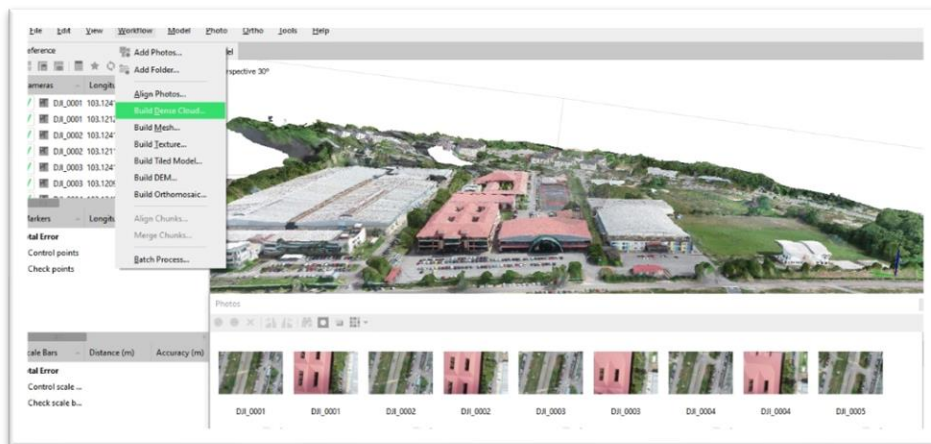


Figure 3.8 Build Dense Cloud Parameter setting

In advanced Depth filtering box select for **Mild/Moderate/Aggressive** for the Build Dense Cloud setting parameter (Figure 53). Choose any suitable Depth Filtering parameter and click **OK**.

- i) Check/uncheck - if the depth map reused for dense cloud generation process
- ii) Check/uncheck - if the point color is required, can save processing time.
- iii) If uncheck the Metashape will calculate the number of depth map been used to generate dense

3.8 MESH

Build Mesh, required if the polygonal model needed as a final product. Go to Workflow select Build Mesh and set the parameter and click **OK**

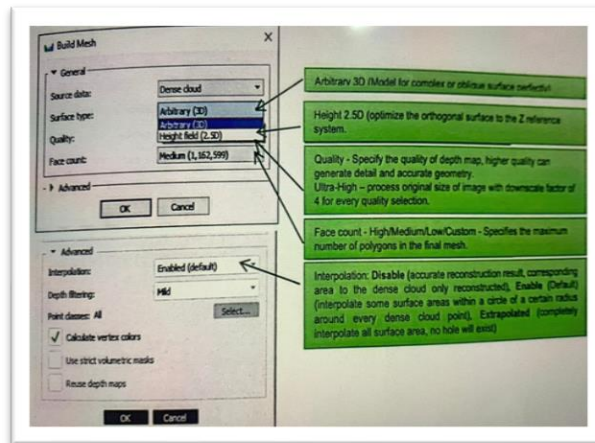


Figure 3.9 Build Mesh Parameter setting

3.9 TEXTURE

Build texture. Go to Workflow and, choose Build Texture, set the parameter:

i) Mapping mode

Diffuse map: stores the colors of the model surface for basic texture. **Normal Map** calculates the lighting of the model from various light sources in the post-processing workflow; **Occlusion map**-contain pre- calculation shading information from background lighting.

ii)Source data

Image- used to generate the color texture of the map, **3D Model** to build normal and occlusion maps based on another model, and the relief of the model.

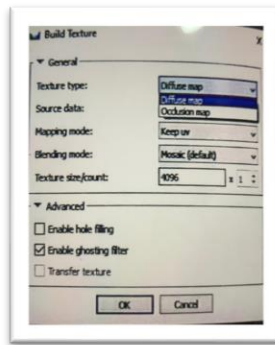


Figure 3.10 Build Texture Parameter setting

3.10 Digital Elevation Model (DEM)

Go to Workflow and choose to Build DEM-this process is possible if the GCPs were used to georeferenced. The dialog box appears to specify:

- i) Coordinate system - must be same as the coordinate system of GCPs/ based
- ii) Source Data-Dense Cloud
- iii) Interpolation - set the same as the build mesh interpolation modes
- iv) Setup boundaries - if required

3.11 ORTHOMOSAIC

Build Orthomosaic - **Go to Workflow -Build Orthomosaic and set the parameter.**

Set parameter:

- i) Coordinate system - must same as the coordinate system of GCPs/based the
- ii) Surface-Dense Cloud
- iii) Blending mode- Mosaic
- iv) Check/uncheck Refine Seamlines, Enable Hole filling, and Enable block-face culling
- v) Pixel size - set the desired pixel size for the Orthomosaic pixel size.
- vi) Setup boundaries - if required

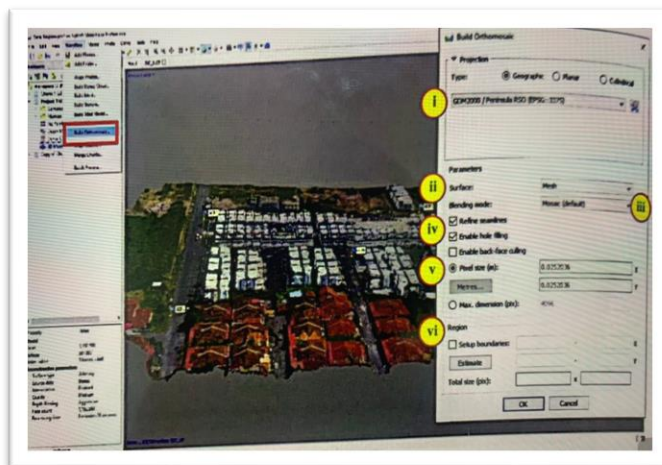


Figure 3.11 Build Orthomosaic

3.12 Table Cost Analysis

Table 3.1 Cost Analysis

Drone Technology	Unit	Price
Drone DJI Inspire 2	1	RM0

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter describes the study areas we have identified and presents the topographic assessment of the University of Malaysia Pahang. The traditional and modern methodologies used in this topographic assessment are being used. Among these are the digital elevation technique, drone technology, and the land survey strategy (DEM). Comparisons of the outputs of the three methods' topographic data will be possible based on their outcomes.

4.2 Results Images Area 3 Dimensions using Agisoft Metashape

To use drone technology to collect results and data. Agisoft Metashape was the software I used. I was able to create a 3D model of the topography of the University Malaysia Pahang Area using this software. I will further divide the 3D picture data into 4 data models using this 3D image. The Agisoft software Metashape software will be used to process the findings of 2000–3000 drone-taken photos to generate the four different sorts of data models. By including the image in the software, UAV image processing can start. Check the Photo Pane image's estimated image quality value, choose Change View, and click Details after that. move to, the initial photo alignment procedure, and aerial flight. Next, GCP usage is crucial for georeferencing purposes. Click Import in the preference window and select the GCP point file to import the GCP point. Finally, create a thick Cloud. Select Build Dense Cloud, Texture, Solid, and Wireframe under Workflow.



Figure: 4.1 Point Cloud



Figure 4.2 Wireframe



Figure 4.3 Solid



Figure 4.4 Texture

Among these, the solid, texture, point cloud, and wireframe models of view mode stand out. In terms of the terrain, color, and location of the structure of the building, four model images produced because of the processing of Agisoft software data have been able to explain the topographic form of the University Malaysia Pahang area so effectively. The model can display different textures in the area with greater specificity in terms of size, location, and colors through four types of this image.

4.2 Topographic in UMP Gambang Campus

Table 4.1 Area of Topographic UMP Gambang

TOPOGRAFIC CATEGORY	ESTIMATED AREA
	DRONE
Nearly Level (flat)	23.12
Gently sloping	31.98
Moderately sloping	30.15
Strongly sloping	22.45
Moderately steep	8.54
Steep	5.23
Very steep	4.35
Total area (UMP GAMBANG)	125.82

Table 4.1 shows the outcomes of the software's data processing. The data display seven distinct topographic classifications. Using these seven different types of data, I was able to conclude that the research location—the University of Malaysia Pahang is a plain

land area. This demonstrates whether the area is suitable for low- or high-infrastructure development. A low gradient in the area also indicates that landslides and soil erosion are unlikely to happen there. The UMP region also has a low danger of floods despite being flat thanks to its excellent water flow gradient. As a result of the analysis of the UMP area data, the region is suitable and secure for infrastructure development and construction.



Figure: 4.5 Image 3D Area UMP Gambang

The Agisoft MetaShape software will provide a 3D image of the area after processing the data. I could see from the image that the data in Table 4.1 matched the data I had previously examined. This is because the 3D image also amply demonstrates the traits of the information in Table 4.1, which include that the area is level, suitable for the construction of infrastructure, and unlikely to flood.

4.4 Comparison with Conventional Method

The comparison of the traditional and modern approaches demonstrates the correctness of the outputs of the area data obtained from each approach. The land survey approach, drone technology, and the digital elevation method are among the techniques (DEM). A comparison of the speed of time needed and the expense incurred when employing the approach can also be taken into account for comparability, in addition to a comparison of the accuracy of the elevation maps. We will be able to determine which approach is best for collecting data to update the data for the present after comparing all parts of the comparison.

Table 4.2 Results Comparison Conventional method and Modern Method

Topographic category	Estimated Area (ha)		
	Levelling Survey	Drone	DEM
Nearly Level (flat)	17.67	23.12	26.65
Gently sloping	31.83	31.98	32.82
Moderately sloping	36.21	30.15	24.62
Strongly sloping	26.7	22.45	19.32
Moderately steep	2.47	8.54	12.97
steep	5.72	5.23	4.50
Very steep	5.13	4.35	2.12
Total Area (UMP Gambang)	126.00	125.82	123.00

We can see from the data in Table 4.2 that the comparison of the outcomes between the three ways of land survey approach, drone technology, and digital elevation method (DEM) reveals the total data for various places. This is because land survey approaches are made on the ground within the study area, but drone approaches are made in the air outside of the study area, and the DEM is far from the drone and land survey approach points. This demonstrates that modern approaches cannot match the accuracy of data obtained by the land survey strategy. To guarantee that the data is accurate and unaffected by natural disasters, this study was also carried out simultaneously for all three ways. Additionally, we can see that each piece of data from the seven aspects of the category is unique; this can be explained by the fact that while the positions of the three methods are different, the land survey approach is the most accurate. Even though each piece of data is unique, the value is not significantly different. As a result, when calculating the overall area, the land survey, at 126.00 ha, comes out on top, followed by drone technology, at 125.82 ha, and then 123.00 ha. Conclusion: The conventional

approach, followed by the current method, is the most accurate way to compute and retrieve data for the UMP area. As a result, the data can be updated using the most recent information from the land survey method.

CHAPTER 5

CONCLUSION

5.1 Introduction

The evaluation of the UMP Area's topographic correctness was the study's main goal. This accuracy allows for the accurate identification of the topographic methodological approach. Furthermore, this accuracy has shown that the most of studies have been carried out using the most accurate traditional topographic study methodology. By comparing the results with the info supplied in Chapter 4's results table, this conclusion was reached.

5.2 Conclusion

The initial goal of being able to map the UMP Gambang Campus variance can be referenced in the conclusions that can be made as a result of the outcomes and data that have been processed. These outcomes also enable them to produce 2D and 3D mapping. Additionally, the comparison of results between traditional and modern approaches shows that the traditional approach is more accurate. The method is time consuming and expensive, though, because we must actually travel to the study and deal with the question of whether the weather will lengthen the time required if the season is wet. The method also requires a professional survey to create the tool. This means that even if DEM and drone technology have provided less accurate data for the topography of mapping data, the method is still relevant, but the marketability can be increased because newer methods are more efficient in terms of time and money.

After then, the state of the area can be determined using the information provided through the category's seven different topographic features. whether it is a steep piece of land, a lowland, or both. The UMP Gambang Campus study area as a result is level and free of soil erosion. The information can also demonstrate the strategic importance of the Ump Gambang campus location and its suitability for infrastructural expansion.

5.3 Recommendation

To make my data and results more accurate in making topographic variants, I need to further expand the study area that needs to be analysed because the drones will fly higher and take more pictures for the analysis. With these methods, the end results will be able to show the terrain pattern in the area. Through the software, Agisoft will make the images 3D and 2D. This means that as the area is expanded, the terrain pattern, or topography, of the variant, becomes more visible after analysis by the software.

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APPENDICES

Appendix A:

Title Helping a group friend make a topographic variation by applying a conventional method.



Appendix B:

Title: Performing drone flights is a modern method

