

Suitability Study in UAV Application for UTHM Golf Driving Range

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Abstract: The course of photogrammetry also plays an important role in the field measurement and map production. This field is parallel with the development of hardware and software technologies. Recently the technology of Unmanned Aerial Vehicle (UAV) system has developed rapidly. Indirectly, it has increased the application of UAV for various application especially in the course of close range topography and mapping application. This method can be used as an alternative to mapping application because it has advantages in term of time, cost and weather constraint. However, the suitability of golf using the UAV system is questionable due to it less ventured. Therefore the aim of this study is to generate a profile for golf UTHM field and to determine the suitability of the area profile as a golf field. In this study, the aerial photographs are acquired using digital camera located on a UAV and controls altitude 50.0 metre to 100.0 metre from the surface ground. The UAV is very suitable for small study area with the limited time and budget project. The acquired aerial photographs were processing using Agisoft PhotoScan Professional software to generate profile and topography. Based on this profile and topography data, the analysis will be performed to determine whether the golf UTHM field is suitable for continued functioning as a golf field. UTHM golf target area is 300 x 90 meters. According to the criteria for the guide to the preservation of nature topography in planning and physical development according Akta Perancangan Bandar dan Desa 1976 says the minimum distance recommended for the distance between the driving point and the target marker is 320 meters. From the analysis, UTHM's golf course could not continue golf activities at the target field.

Keywords: Unmanned Aerial Vehicle, Suitability, UAV

1. Introduction

According to Jabatan Perancangan Bandar dan Desa, development activities in Malaysia are subject to existing legislation such as Akta Perancangan Bandar dan Desa 1976 provides for the authority of local planning authorities to organize, control and plan the development and use of all land and buildings located in its jurisdiction. In Malaysia, every year will increase in the development that takes place. Therefore, the development of the area requires careful planning for the suitability in terms of environmental area and consumer safety.

Apart from that, Universiti Tun Hussein Onn Malaysia (UTHM) also did not miss the development for example has various buildings around UTHM which is UTHM stadium, Tunku Tun Aminah Library, faculties, residential colleges, lecture rooms, offices and so on. Around UTHM also has buildings and courts that are close to the golf target, this is also likely to cause unexpected problems when doing golf activities.

This also includes the development of sports activities for example golf targets. Golf targets are suitable for development around areas away from urban and industrial areas. Industrial areas are not suitable for the development of golf target areas because of the different atmosphere except in industrial areas that do not carry pollution and areas that do not have high traffic congestion. The golf targets are usually located far from the area. Therefore, this study was conducted to see the suitability of golf target field at UTHM.

2. Materials and Methods

The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to obtain the results of the study.

2.1 Materials

Materials that used in this research is unmanned aerial vehicle, handphone and agisoft photoscan professional. Field mapping is one of the applications that can be done using a UAV [1]. The advantages of UAVs compared to other conventional methods have made UAVs an alternative method in the field of large-scale mapping.

2.2 Methods

The research in this study is divided into five (5) main phases. The main phase is about the initial study. In this phase, it covers several processes such as literature review which discusses previous studies that have to do with UTHM golf field target suitability study. Among the focused elements such as methods, techniques, data, study area, final results and so on. Figure 1 shows flow chart for study method of each phase.

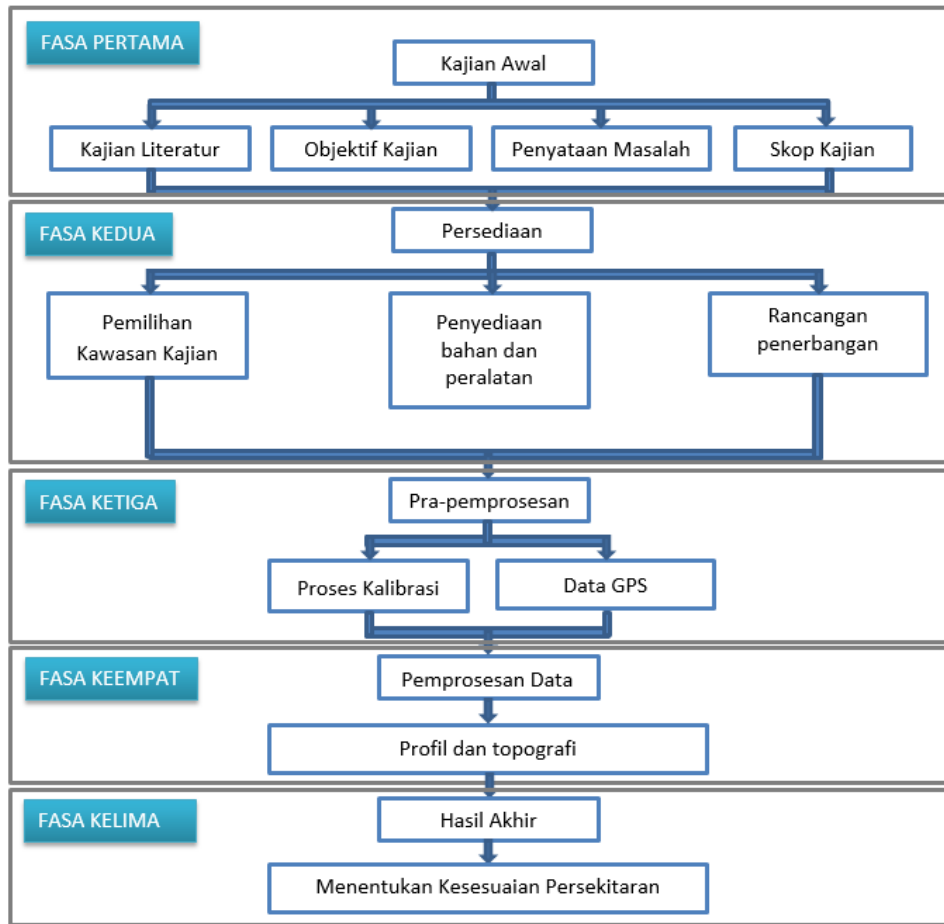


Figure 1: Flow chart for study method of each phase.

In this study will start in the area around the badminton hall fly to the factory, then will be flow to the E14 building and will end in the badminton hall again. Figure 2 shows the area around the badminton hall fly to the factory. So the data that has been processed will be combined which shows the area has a building structure. Figure 2 shows the flight starting and ending at the badminton hall.



Figure 2: The area around the badminton hall fly to the factory.



Figure 2: The flight starting and ending at the badminton hall.

Radio signals and GPS signals are also checked to prevent signals and connections disconnected while the UAV is flying [2]. The aviation plan constructed covers the study area and in parallel with the wind direction is to avoid unstable UAV. Next, the height is set to as high as 50 meter to 100 meter to avoid high barriers besides just covering the study area. It also estimates the flight mission duration which takes around 40-50 minutes to cover all areas of the study. Then, UAV are arranged to take off and fly automatically according to the flight path.

All digital aerial photographs obtained during filming at the UTHM golf target field are processed using Agisoft PhotoScan software [3]. Processing using Agisoft PhotoScan software can be divided into several important sections such as profile, photo alignment and topography.

3. Results and Discussion

Analytical data are required to achieve the objectives of this study. Ground Coordinate Point (GCP) is very important to bind the orthophoto to the ground coordinates and obtain geographically referenced photos as per figure 3. The accuracy of the GCP depends on the project specifications and for this study, it reaches millimeters because the determination of the points is through GPS observations.



Figure 3: Results of golf target field profile.

To prove that the UAV can be used as a reconnaissance tool for determining the profile and topography, the accuracy of the output of the process should need to have high accuracy. From the results obtained for this study, it is analyzed through the methods used to achieve it. There are various analyzes that can be generated from the results obtained from the processing of such data. The study to determine the suitability of the UTHM golf range using this UAV must follow the guidelines set by the Town and Country Planning Department, where one of the criteria is to require the shape of the terrain. Guidelines for the Preservation of Natural Topography in Planning and Physical Development According to the Town and Country Planning Act 1976 have been used as shown in Figure 4 below [4]. The extent of golf course development depends on whether it is developed as a facility on a golf course or separately the structure of the building as well as the components of the facilities provided. The minimum distance recommended for the range between the driving bay and the target marker is 320 meters, refer to Figure 4 below.

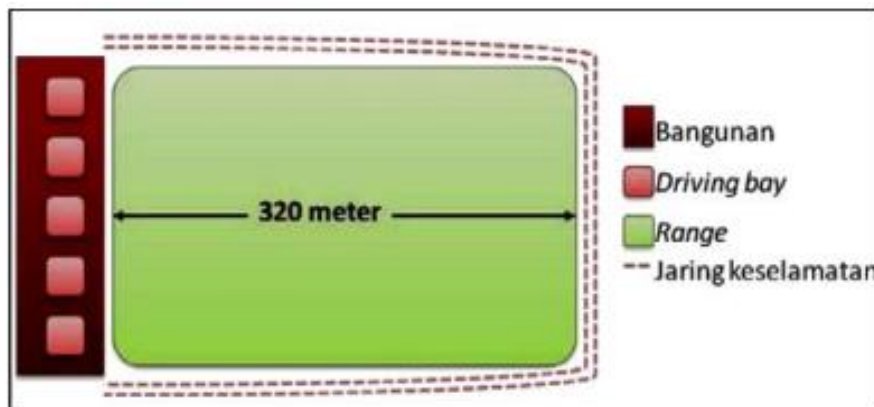


Figure 4: Proposed minimum fairway distance.

The result of the generation of DEM and orthophoto mosaic of UTHM golf target area using UAV with

a distance of 223.50 meters as shown in Figure 5 below. This analysis is elaborated and explained in this section to ensure that the objectives of the study can be achieved.



Figure 5: Area of UTHM golf range

The end of this study is to determine the suitability of UTHM golf target range in the study area using UAV data. These methods are used as a reference for this purpose. The main purpose of this is to verify the suitability of the UTHM golf range using the UAV system. This can also be applied to engineering survey work because modern methods are considered to be the most time shortening methods. Based on the analysis found, the UTHM golf range could not continue golf activities at the target range because there was insufficient golf range in terms of the criteria issued by Act Perancangan Bandar dan Desa 1976.

4. Conclusion

From the results of the analysis, it can be concluded that the use of golf field target area is very high risk, especially on Thursday, which is co-curriculum. By produce the profile of golf field target, can show the situation in the area. Suggestion for improve this study, the results of this study found that there are weaknesses in terms of non-specific criteria issued by the relevant agencies. From the analysis of the study conducted, some suggestions can be given to select more future analyzes special analysis related to the rehabilitation of UTHM golf tart range. For the proposal to do the work of this study is do the target field work not too late in the day because the UTHM golf target field has birds roaming around the UTHM golf target field. This also cannot be done by surrounding UAV activities and UAV data processing requires a stable computer to process a combination of images that have been taken from the UAV. Further research proposals should be minititically focused on the development of databases for sports and recreational areas specifically in structural planning plans as well as design plans for more effective analysis.

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Appendix A

Survey Data

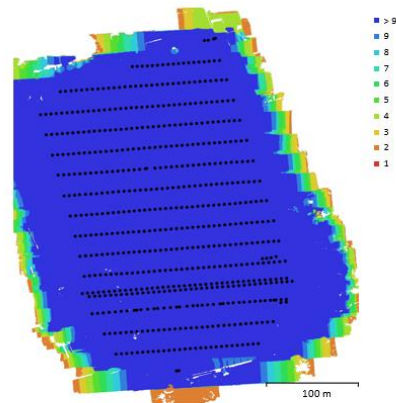


Fig. 1. Camera locations and image overlap.

Number of images:	575	Camera stations:	575
Flying altitude:	67.8 m	Tie points:	212,479
Ground resolution:	1.95 cm/pix	Projections:	1,499,023
Coverage area:	0.0975 km ²	Reprojection error:	1.03 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC220 (4.73mm)	4000 x 3000	4.73 mm	1.57 x 1.57 µm	No

Table 1. Cameras.

Digital Elevation Model

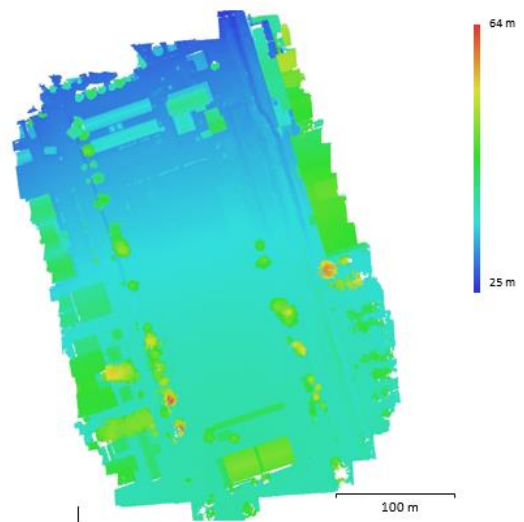


Fig. 4. Reconstructed digital elevation model.

Resolution: unknown
Point density: unknown

References

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