The Comparison of Stage and Result Processing of Photogrammetric Data Based on Online Cloud Processing

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Abstract. The development of photogrammetric mapping with UAV mode has been generally used in recent years. One of the technologies development is Cloud-based data processing or using internet. There are two platforms providing facilities of cloud-based processing such as Pix4D and Drone Deploy. This research will be conduct comparison processing result of two platforms in terms of uploading process, total product and horizontal accuracy. The result showed that both platforms had each advantage. The result of Drone Deploy has advantage in term of more accurate coordinate, whereas PIX4D has advantage at completeness in processing reports.

1. Introduction

The utilization of Unmanned Aerial Vehicle (UAV) in photogrammetry has been developed rapidly in recent years. UAV superiority in terms of effectiveness, efficiency, safety and good accuracy result are better than other terrestris [1] [2] [3]. a factor that causes of UAV increasing use is speed in photo data processing until becoming map by developing Surface from Motive method. Thus, it accelerates data processing [4]. there are two ways of processing of UAV Photogrammetry data which are processing on desktop and processing on Cloud computing or online processing.

Both methods have each advantages. Processing with Online Processing really helps in data processing without using hardware that needs high specification. Processing principle with online processing is conducting pictures upload to platform, then the result will be sent via email or it can be downloaded in that account. However, the weakness in processing online is lack of control in each step of data processing.

There are two online providers for processing data such as Pix4D Cloud from Pix4D and Drone Deploy Cloud Base from Drone Deploy. Both providers have processing feature in online with process that is easy to use. This research will discuss about comparison of data processing result in online in some aspects, such as convenience aspects and uploading process, product that can be downloaded by users and comparison of value of orthophoto accuracy from both platforms. Processing result of both maps refer to GPS accuracy at the time of acquisition [5]. In accuracy comparison, some objects will be measured coordinate from either Drone Deploy or Pix4d, then it is compared with coordinate result measured with Electronic Total Station (more thoroughly).

2. Method

This research used 48 aerial photos located in football field of Universitas Pendidikan Indonesia. Mode used in this research is conducted to record photo using UAV Multi Rotor type with specification as follow [6]

Table 1 Spesification of UAV and Camera used in Research

UAV Spesification		**Camera Spesification**	
Type	Quadcopter	Sensor	CMOS 1/2.3"
Wight	1.380 gram (including strew and battery)	Lens	FOV 940 20mm
Speed	20m/s	Resolution	12.4 MP
Duration of flight	28 minutes	Photo resolution	4.000 x 3.000 pixel
Energy /Voltage	Intelligent Flight Battery 81.3 Wh / 15.2 V	Photo Format	JPEG, DNG (RAW)
Remote control transmission distance	3.5 km	ISO	100 – 1600 (Photo);

Aerial photo result is then proceed by uploading photo in sites of Drone Deploy (https://dronedeploy.com/app2/dashboard) [7], and site of Pix4d (https://Cloud.pix4d.com/pro) [8]. Processing used in this research is Surface from Motion principle and it is conducted in online. Users can download the result and conducting analysis after obtaining information of both platforms that processing result has done. Comparison conducted in this research is about uploading data, produced product from each platform and horizontal coordinate accuracy test. In resulted product comparison, data processing duration and easiness in uploading become parameter in data processing step. Then processing product will be compared product completeness of each platform such as Orthophoto products, Digital Surface Model and 3 dimensions model. The last comparison is by calculating coordinate value of 8 objects in orthopodo then it is compared by measured coordinate with ETS data. The comparison result is then calculated coordinate horizontal of Root Mean Square value. In order to examine geometry accuracy, RMS value was converted in CE90 [9] value by using formula 1

$$CE90 = 1.5175 \times RMSe \quad \text{.....[1]}$$

RMSe = Root Mean Square Error in position of x and y (horizontal position)
CE90 = value of horizontal position accuracy with level of confidence of 90%

The result of CE90 Value is examined by standard CE90 value based on regulatory chief of BIG Number 15 year 2014 about Guide of Technical Basic Map Accuracy (2014) [7] in table 2.

Table 2 Classification of Map Geometry Accuracy of RBI

No	Scale	Map Accuracy of RBI		
		Class 1 CE90 (m)	Class 2 CE90 (m)	Class 3 CE90 (m)
1	1 : 1.000.000	200	300	500
2	1 : 500.000	140	150	250
3	1 : 250.000	50	75	125
4	1 : 100.000	20	30	50
5	1 : 50.000	10	15	25
6	1 : 25.000	5	7.5	12.5
7	1 : 10.000	2	3	5
8	1 : 5.000	1	1.5	2.5
9	1 : 2.500	0.5	0.75	1.25
10	1 : 1.000	0.2	0.3	0.5

3. Result and Discussion

From Processing conducted by Cloud Processing of Pix4D and Drone Deploy Cloud base, it was obtained the result as follow

3.1. Uploading Stage

Processing stage with Pix4D Cloud and Drone Deploy Dashboard could be done quickly and easily. Both platforms provided upload image feature then users waited for processing result, Figure 1 and 2 show upload feature in each platform.

Figure 1 Display of upload in Drone Deploy Dashboard

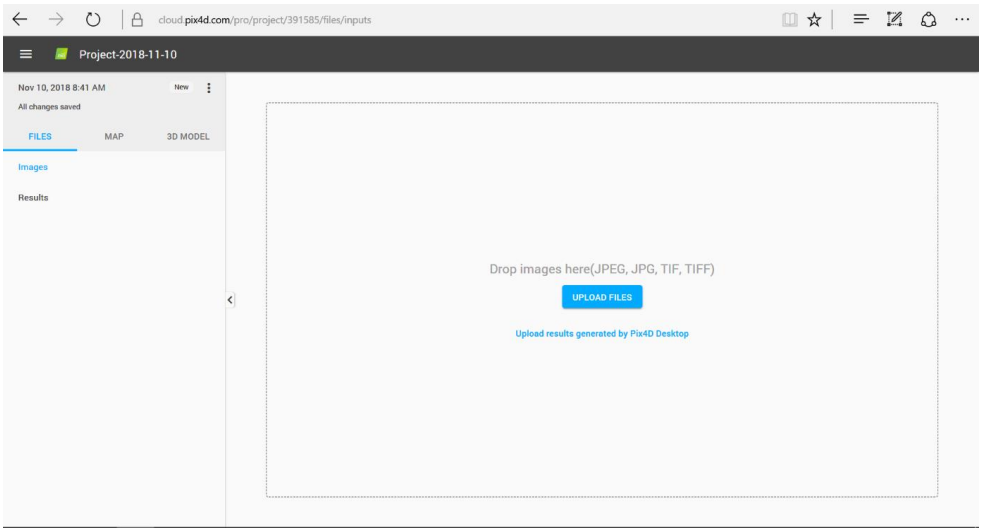

Figure 2 Display of Upload in Pix4D

After conducting process of upload data, users waited for processing. Waiting time of processing 48 photos in this research using Drone Deploy and Pix4D is shown in table 3. Waiting time of processing of Drone Deploy is similar to Pix4D.

Table 3 The comparison of data processing time

	Upload Time	Processing Waiting Time
PIX4D	Depends on internet connection	17 minutes
Drone Deploy	Depends on internet connection	17 minutes

3.2. Completness of Service Feature

After process of uploading photo/image, it was conducted comparison of orthopoto. The comparison is shown in figure 3 and 4.

Figure 3 Ortophoto from Drone Deploy

Figure 4 Ortophoto from Pix4D

In the figure 3 and 4, it can be seen clearly there is a difference in the case of width of area, the image 3 obtained from Drone Deploy focus on the football field, while in image 4 got from Pix4d, width of area includes the condition around the field. If seen from the image brightness, the image from the Pix4d is a little brighter, however both images have the same level of spatial resolution.

There are some differences in the features presented in the Drone Deploy and Pix4D, among others are displayed in table 4

Table 4 The Comparison of Products Completeness

No	Fitur	Drone Deploy	Pix4D
1	Orthomosaic	V	v
2	Digital Surface Model	v	v
3	3D Model	v	v
4	Plant Analysis	v	v (separate)
5	Annotation and Measurement	v	v
6	Report	V (extention)	v
7	Processing Log	-	v

On processing by using Cloud processing, there are some products that can be downloaded by users, Pix4D and Drone Deploy serve some products such as Orthomosaic, Digital Surface Model (DSM), 3D Model. In addition to present the products, Pix4D and Drone Deploy also provide spatial analysis feature such as carry out distance, wide, volume measurement from the images results obtained. One of the advantages of Drone Deploy is the Plant Analysis features in the Dashboard of the map results. Pix4D also has the same feature, but it separate from the Pix4Dfields. One of the products advantages from the Pix4D are report feature and processing log which provide the processing results.

3.3. Horizontal Coordinate Accuracy Test

One of the aspect of analysis of mapping is analysis of accuracy. This study conducted analysis of accuracy by comparing the coordinate from the mosaic and the coordinate obtained from the results of Electronic Total Station measurement. The map obtained from the Pix4D and Drone Deploy in this study is not yet corrected using Independent Control Point (ICP), so the accuracy of the map follows the accuracy of GPS in the Drone. As for the value of accuracy are calculated by using analysis of differences of Root Mean Square (RMSe) among the coordinate in several objects in the football field which then compared to the coordinate of the similar object using the ETS data. Point distribution of GCP then displayed in figure 5

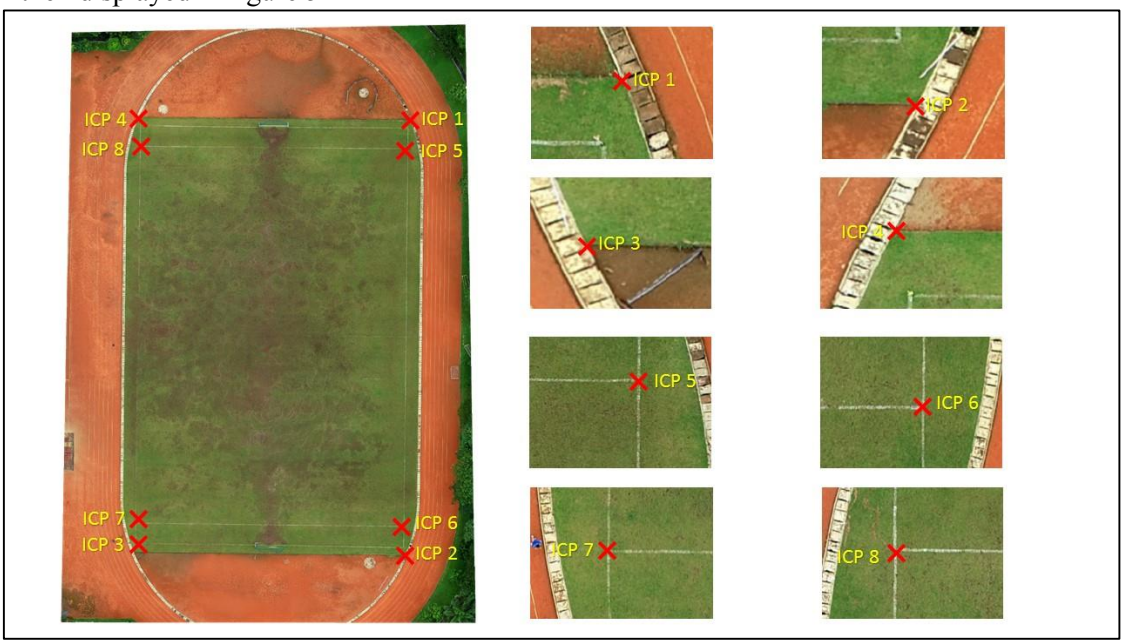

Figure 5 Point distribution of Independent Control Point

The ICP value obtained from Pix4D and Drone Deploy are compared to the measurement results of Electronic Total Station, the comparison value is then averaged and calculated the RMS value, the comparison of the RMS value is shown in table 5

Table 5 Comparison value of RMS in horizontal position

	RMS_X (m)	RMS_Y (m)	RMS_Horizontal (m)
Pix4d	1.665	1.592	2.304
Drone Deploy	1.588	1.592	2.249

The results of RMS calculation in horizontal position shows that Drone Deploy has a better accuracy value, however the accuracy data can not be used for a large scale mapping purposes, to test the geometrical accuracy, first, it calculated value of CE90 using formula I. The results of CE90 value then tested using table classification of RBI geometric map accuracy as in table 2. The geometric accuracy test results which refer to Perka BIG Number 15 Year 2014 [10] about Technical Guidelines of Basic Map Accuracy can be seen in table 6

Table 6 Geometric Accuracy Test

	RMSe (m)	CE 90	Map Scale	Class
Pix4d	1.665	3.496	1:10.000	3
Drone Deploy	1.588	3.413	1:10.000	3

Based on the geometric accuracy test, ortophoto resulted from both Pix4D and Drone Deploy meet the largest scale classification that is scale 1:10.000 class 3. The geometric test results need to be reviewed further especially in the terms of vertical accuracy.

4. Result and Discussion

Based on the study that compared the online data processing results from Pix4D and Drone Deploy, it can be concluded that each platform has advantages and disadvantages, respectively. The superioty of Drone Deploy lies in the feature which is quite complete as well as the results of RMSe which is slightly better (1.588 m), albeit it has weaknesses at the lack information of data processing report. Whereas Pix4D has advantages in the comprehensive report processing. The processing time of both of platform have a similar results, which take 17 minutes to proceed the data. The results of orthophoto accuracy test from Pix4D and Drone Deploy, meet the requirements of accuracy from Perka BIG Number 15 Year 2014 with map scale 1:10.000 class 3.

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