

Implementation Photography as a Media and Supports in Construction Era 4.0 at the Civil Engineering for the Construction Design to Face Tidal Floods due to Global Warming

Hermawan S¹, Leman S²

¹Civil Engineering Department and Planning Petra Christian University

²Professional Engineering Programme Petra Christian University

Abstract. Climate change caused by global warming has occurred, and its negative impacts felt in almost all parts of the earth in the era of construction 4.0. Likewise, at the end of 2017, Rob flood disaster occurred at the research location where is a coastal area with very large potential, especially seaweed cultivation along with 90% population depended on income for this cultivation. Thus, the research method needs to be done through a technological approach based on the industrial revolution 4.0 that uses data, internet and human resources. Through photography that is further related to the use of unmanned aerial vehicles and sonar, where the use of this tool is one of the fields in the world of photography, aerial photography. Making topographic and bathymetry maps using the photogrammetric method is done using drones and taking pictures in the area under study, then processing data through MenciAPS software, and ArcGIS. The results obtained have been able to provide information on both topography and bathymetry, but still, need to be improved further through further research. Then, it can use as a reference for related parties, both Government and Private, in designing the construction of civil buildings against the threat of Rob flooding.

Keywords: *photography, construction 4.0, civil engineering, photogrammetry, bathymetry*

1. Introduction

Global warming causes the melting of the polar ice caps so that it shows that rainfall and strong winds will be more terrible, along with hot weather and snowstorms become more extreme, one of the more pronounced impacts is rising sea levels and increasing global temperature variability [1]. In Indonesia, the sea level rise with respect to the Center for Research and Development of Marine and Coastal Resources of the Ministry of Maritime Affairs and Fisheries in 2014 reached 0.73 - 0.76 cm per year [2]. One of the impacts of sea-level rise that occurred was Rob Flood.

On December 6, 2017 dozens of houses in RT 1 and RW 2 RW 06, Kupang Village, Jabon District, Sidoarjo Regency, were flooded as high as 60 to 70 cm, the flood was caused by Rob or tidal seawater [3]. Rob flooding that occurred caused the collapse of embankments in several hamlets which resulted in the loss of fish in ponds and seaweed that failed to harvest resulting in losses of 5 billion rupiah [4].

The use of drones itself is one of the phenomena in the development of photography in industry 4.0, where before the creation of drones, photogrammetry or aerial photography was carried out using aeroplanes or helicopters and sometimes carried out by freefall from existing planes or helicopters, it

certainly requires a significant cost large and threatens the safety of those who carry out these activities. This research will maximise photogrammetry theory and bathymetry mapping using basic photography knowledge and techniques on drone cameras.

2. Material and Method

Photography comes from English: photography, which comes from the Greek words "photos": light and "grafo": painting/writing, thus photography is writing or painting with light media [5]. Photography provides evidence that something exists or an event occurred. In the early days of photography, the main function of the camera was as a natural photocopier, and it closely resembled what the human eye saw [6]. According to Belajar Fotografi [7], the direction of light falling on the subject will greatly affect how the photo looks. The direction of the light determines the character of the light itself as well as determines the impression and dimensions that it wants to cause to the subject, and then as a whole, it forms our photo

In photography skills are needed in adjusting the light or exposure. According to Cooke [8], the exposure triangle is a common way to link the three variables that determine photo light: aperture, shutter speed, and ISO. One must balance all three to achieve the desired results, adjustments that require adjustment from at least one of the others. According to Crisp [9], the size of the sensor the camera has determines how much light is used to make an image (see Figure 1). In very simple terms, an image sensor (the digital equivalent of film negatives that used to be on a camera) consists of millions of light-sensitive points called photosites which are used to record information about what is seen through the lens. Therefore, a larger sensor can obtain more information than a smaller one and produce a better image.

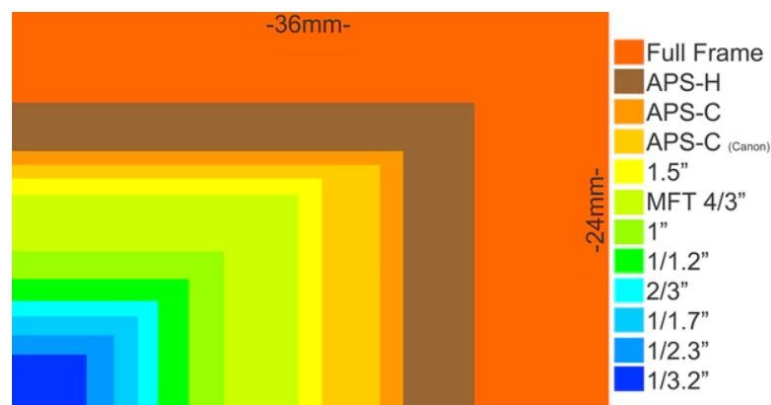


Figure 1. Differences in Sensor Size of the Camera [9]

According to Indarto [10], photographs produced by each person have different goals, but in making a photo that can be said to be successful, one must pay attention to several things. Photography in its use has several purposes, namely: documentative, illustrative and interpretive. Aerial photography is taking photographs using aeroplanes or other flying objects or poles for an area from the air [11]. Photogrammetry, Photogrammetry is the science of making reliable measurements using photography and especially aerial photography (as in surveys) [12]. According to Fisk [13], here are some of the benefits of photography relating to the types of photography in the world of civil engineering: public relations photography, photo documentation of safety equipment, time-lapse photography, and photogrammetry which has a function for mapping. In industrial 4.0, now a photo file can store a lot of information, not only information about light and colour but also information about time, date, and location can be stored in the form of a geotagging location.

In this research, the use of a drone in which the camera sensor on the drone used, namely DJI Phantom 3 Advanced measuring 1 2/3 inch as a tool to obtain data in the form of photographs of the research location, required exposure settings of the drone camera before taking aerial data data of the

research location. This study also uses the Weather Station to obtain data on temperature, wind, humidity, light strength, UV (ultraviolet), and UVI (ultraviolet index) mounted using a tripod on a river embankment. With the research location in sub-district Tegalsari, the Weather Station reads every 5 minutes. ArcGIS is software released by the Environmental System Research Institute (ESRI), a company that has long been involved in the geospatial field. ArcGIS is the platform that consists of the number of software, namely Desktop GIS, GIS Server, Online GIS, ESRI Data, and Mobile GIS.

3. Research results and discussion

To solve the problems that occur in Tegalsari Hamlet in Kupang Village, Jabon Subdistrict, Sidoarjo Regency, East Java Province, of course as Engineers who can develop by studying photography, photogrammetry, bathymetry, drones, and analysis using Menci APS software and ArcGIS software. In the implementation of photogrammetry for bathymetry mapping, the area was divided into 5 segments because the length of the river under study reached ± 800 meters. In the implementation of aerial photo shooting, it should be noted in the existing camera settings, good quality aerial photographs can be obtained by manually adjusting the photo and performing calibration as much as 2 segments once in order to save battery life and time efficiency considering the drones used are only able to fly around ± 15 minutes for 1 battery. This is done in order to obtain a stable photo light in the hope that when combining existing photo images can look good and can be analyzed with software to the fullest. The results of the photos in the study area by dividing into 5 segments are 352 files.

As can be seen in Figure 2, processing research data use Menci APS software to get bathymetry map modelling, so that there can be a map of existing river bed contours. The following is the image combining photos with Menci APS software.

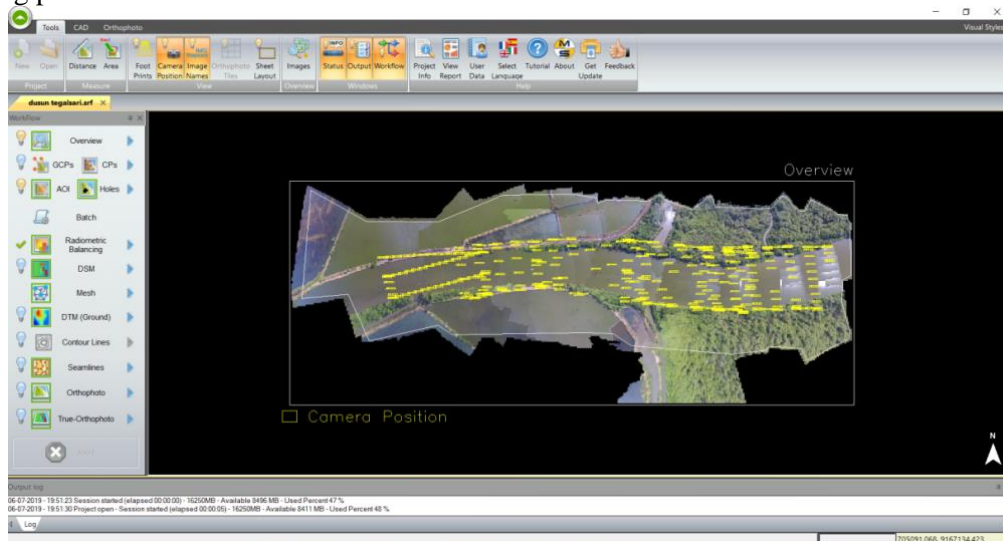


Figure 2. The Results of Merging Drone Photos with Menci APS Software

The understanding of the direction of light and camera settings help this research take photos that quite well controlled and the non-uniformity of light and colour in the image reduced quite a lot, this can be minimized by manually adjusting the drone's camera by understanding the exposure triangle and setting the lightmeter at -0.7. Figure 3 showed that the reflection of sunlight in quite minimum. After merging photos successfully, a Digital Terrain Model (DTM) can be performed. On the results of this DTM, it can be seen that there are some photos of river areas that were not detected by Menci APS software.

From the results of the existing photogrammetric data processing, it still cannot be fully processed even though the quality of existing photos is almost uniformed. This is caused by several factors, namely:

- a. The small camera sensor on the DJI Phantom 3 Advanced drone measuring 1 2/3 inch, the larger the camera sensor, the more light information that can be received by the camera so that the quality of the existing image data can be improved and in the midstream area it is possible to be processed.
 - b. Using sonar, it was found that the riverbed found sedimentation, this sedimentation allows light not to penetrate the riverbed and weaken the strength of the light present in the river.
- Based on photogrammetry results using the Menci APS application through the Digital Terrain Model (DTM) it was found that the deepest river depth was -49.4 meters, and the lowest was -15.5 meters. The difference in the depth of the river that occurs is caused by several things as, the nature of water that is not homogeneous, not clear and the river is quite deep.

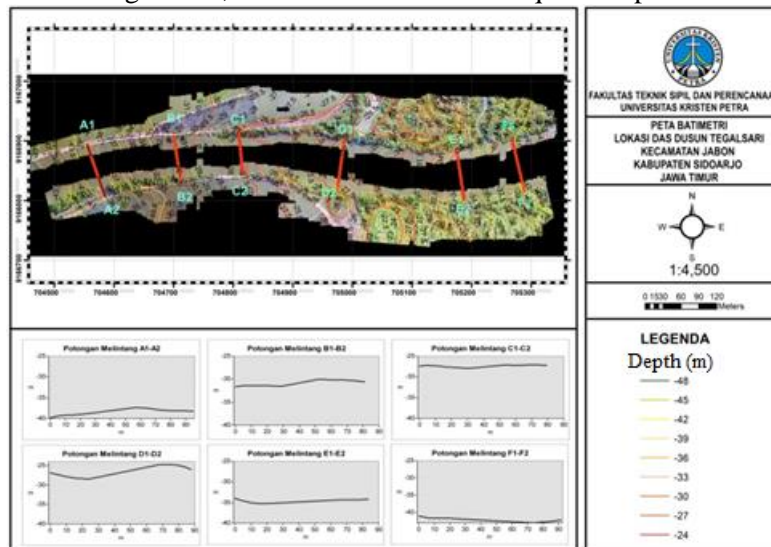


Figure 3. River Contour and Cross Section Map in Tegalsari Universal Transverse Mercator (UTM 49 S)

The results of the DTM in Figure 3. show that the contours in the undetectable area cannot be described and the deepest river depth is -49.4 meters and the lowest is -15.5 meters, then the DTM is processed using ArcGIS software to display existing river pieces and interpolate so that can be seen the existing river bed contours. The result of the isolation can be seen in Figure 3.

The results of the image in the ArcGis software can be seen in the cross-section A1-A2 there is a difference in height of 1 meter, cross-section B1-B2 there is a difference in height of 0.75 meters, pieces of C1-C2 there are differences in height of 0.5 meters, pieces D1-D2 there are differences in height of 2 meters, E1-E2 pieces have a height difference of 0.75m, and F1-F2 pieces have a height difference of 1.5 meters.

In addition to the manual settings of the drone camera, Sun Radiation and ultraviolet (UV) read by the Weather Station have an influence in producing a display of the resulting photo quality, wherein reading the tool every 5 minutes the time period found changes in Sun Radiation that affect the image results by the drone flying, the flying drone itself gets calibrated camera settings every two flights in order to get time efficiency. As well as ultraviolet (UV) which affects the quality of existing images, according to Tjongari one of the effects arising from ultraviolet on photography is to cause images that are not sharp and the emergence of Atmospheric Haze or the number of dust and smoke particles in dry water content makes the photo as if will get foggy [14].

4. Conclusion

1. Making bathymetry maps in watersheds that are critical to Rob's flooding with photogrammetry and using basic photography knowledge and techniques can be done and support existing research.
2. The use of drones, photography, MenciAPS software and ArcGIS can help improve the quality of an engineer because of the self-development that is carried out, where the results obtained can be used as a reference for inter-community planning.

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