

Utilization of Orthophoto Imagery for Mapping The Cultural Heritage Area

(Ijo Temple Complex, District Prambanan, Yogyakarta)

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Abstract—Cultural heritage area have important information to be protected and preserved. Over this time documentation of cultural heritage still in digital photographs form and archival prints. Documentation process by map still not optimal yet. Even though the extraction of information from map need for planning and policy. Spatial data can be used obtain cultural heritage area. Spatial data used are orthophoto imagery have high data acquisition. In this research orthophoto imagery used has high accuracy have horizontal and vertical accuracy of 99.73 and 98.62%. The purpose of this research is for Ijo temple complex's cultural heritage area mapping. The method in this research used key approach to the interpretation of remote sensing to get information on the cultural heritage area of Ijo Temple complex, district Prambanan, Sleman, Yogyakarta. Imagery interpretation key consists of the shape, color and hue, size, pattern, shadow, sites, associations, and texture. The use of image interpretation key to get detail information cultural heritage area and can limit them from orthophoto imagery. Ijo temple complex cultural heritage area map have high spatial resolution with scale analysis of 1: 50. The map information can be limited to the area of cultural heritage and non-heritage. The cultural heritage area consists of all the objects recognized in the conservation area like us the temple, the security office, maintain offices, kitchen, storeroom, toilet, employee parking, courtyard of the temple, courtyard of the main temple, and fences. Areas of non-recognized cultural heritage can be shared among others; trade and services, infrastructure and others.

Keywords—*Orthophoto imagery, Quadcopter, Key Imagery Interpretation, Cultural Heritage Area*

I. INTRODUCTION

Remote sensing photographic system basically uses the natural energy that the sun is the source of primary energy, while the moonlight and artificial light can be used at night. Scanning the object or shooting can be done from the air and space. Remote sensing system photography is remote sensing systems which record objects by using the camera as a sensor,

and using the film as a detector of electromagnetic energy in the form of the visible spectrum and its expansion (Sutanto, 1994). Some advantages of photography system compared with an electronic system that is: (1) more simply, (2) cheaper, (3) good spatial resolution, and (4) either geometric integrity. Electronic systems have advantages in terms of use of the electromagnetic spectrum that is broader, greater capability and more definitively distinguish the spectral characteristics of the object, and process faster analysis (Lillesand and Kiefer, 1979).

The heritage area has objects of cultural heritage on it. According to Law No. 11 of 2010 concerning about the cultural heritage object is man-made objects, move, or not move in the form of unit or group, or part or their remnants, aged at least 50 (fifty) years, or represent typical period and represents the force of at least 50 (fifty) years, and is considered to have significant value for the history, science, and culture. Based on Act No. 11 of 2011 cultural heritage area is a unit of geographic space have two or more of the heritage that is located adjacent and/or exhibit characteristics typical layout. The heritage area is divided into conservation and non-conservation area. Conservation area is a protected area which is objects of cultural heritage contained therein. Non-conservation area means the outside the boundaries of the conservation area. Non-conservation areas such as residential areas, trade and services, and others. Zone cultural heritage is the determination of spatial boundaries of the cultural heritage area in accordance with the needs. Zone cultural heritage consists of a core zone, a buffer zone, development zone, and support zone.

The data have been acquisitioned properly required for mapping. Orthophoto imagery has a variety of positions, orthogonal projection system, and the orientation of the recording has been corrected (Harintaka, 2012). Utilization orthophoto imagery maps can be used to obtain information

heritage area. The purpose of this study for mapping of areas Ijo temple complex by using orthophoto imagery. Remote sensing has important role that can be used to identify, measure, or analyze the characteristics of the object without having direct contact with the object (Kerle et al, 2004). Source of electromagnetic energy from the sun in the form of visible light. Utilization of light is one of the main factors to be considered in the planning of aerial photographs. Warner et al. (1996) to clarify the limits of vertical aerial photographs are aerial photos taken by the axial tilt of 0 ° (perpendicular) to a maximum of 5 °. Photo skew still can be subdivided into two, photo heeling slightly leaning to the value of more than 5 ° and a very skewed picture where the horizon visible in the photo. Vertical photos interoperability technically have a value higher than the photos skew.

According to the American Society of photogrammetry (ASP) - Colwell, 1960, photo interpretation is a job analyze aerial photographs for identification purposes and objects of significance. According to Colwell, 1983 aerial photo interpretation is one part of remote sensing as a measurement, acquisition of information of an object and the phenomenon using a recording device without any physical contact with the object. Photo interpretation has been changed to the image analyst. Aerial photo interpretation can be done visually or manually, and digital interpretation. Visual interpretation depends on the ability, skill, and knowledge of the interpreter becomes subjective factor in the visual interpretation of results. The purpose of this study for mapping of areas Ijo temple complex by using orthophoto imagery. Sutanto, 1994, interpretation key used are the color is can be visible to the eye of the object and hue the level of darkness or the brightness of an object contained in the photo. Size is an attribute which is owned objects consist of distances, areas, high slopes, and volume. Shape is a qualitative picture that is easily recognizable, Shadow is hiding the details of object of dark shadow area. Texture is the degree of roughness or fineness of an object or the frequency of the changes object in photo. Pattern is a spatial arrangement of the man-made object or objects that formed naturally. Site is the location of an object to another object that are nearby. Association is a linkage between one object with another object.

II. METHOD

A. Tools and Materials

- Orthophoto imagery Ijo temple complex, district. Prambanan, Yogyakarta, which has been corrected
- Agisoft Photoscan
- ArcGIS 10.2

B. Image Interpretation

The method used in the introduction and extraction of information using aerial photography is a key approach to remote sensing image interpretation. Interpretation of digital objects used to determine the objects that exist in the temple area contained in aerial photographs.

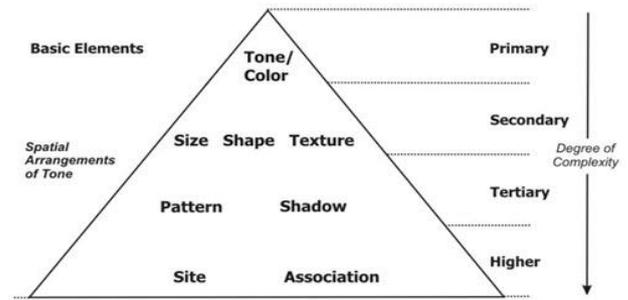


Fig. 1. Interpretation Key

Interpretation key used is:

- The color and hue
Color is a form that is visible to the eye of the object. For example, trees appear green on the waves appear. While the tone or hue is the level of darkness or the brightness of an object contained in the photo.
- Size
Size is an attribute which is owned objects consisting of distances, areas, high slopes, and volume. The size of the objects contained in the form of scale. For example, a sports field, rectangular with a size of 80 m x 100 m.
- Shape
Shape is a qualitative picture that is easily recognizable. For example Volcanic cone-shaped, L-shaped school building, and more.
- Shadow
The shadow is hiding the details of objects that are in the shadow areas are dark. Shadows can clarify certain objects. For example a steeper slope will look if there is a shadow, aerial photographs that skew will also show the shadow of the object more clearly.
- Texture
Texture is the degree of roughness or fineness of an object or the frequency of the changes contained in the image or photograph. Texture is usually measured by the levels of coarse, medium and fine. For example, rough-textured woods, thickets textured and finely textured shrubs.
- Patterns
Pattern is a spatial arrangement that signifies the man-made object or objects that formed naturally. For example, settlement patterns are elongated, trellis patterned river flow patterns, and so on.
- Site
Site is the location of an object to another object that are nearby. For example, the settlement extends

generally flow path, the rice fields are usually located in the lowlands, and others.

- Association

Association is a linkage between one object with another object. For example, the train station will be associated with the railroad (Sutanto, 1994).

III. FINDING AND DISCUSSION

A. Information Extraction from Aerial Photo

Data used aerial photography is the result of recording using quadcopter plane rides. Quadcopter has the ability to fly and recording good so it is more stable in the shooting. Shooting results produces detailed aerial photographs and of good quality. Shooting technique is performed in an upright aerial photography. Spacecraft flying height of 45 meters above the ground. The camera that used was a Canon Powershot S100 has a 5.2 mm focus length criteria, sensor size 7.49 x 5.52 mm (1 / 1.7 ") and a maximum resolution of 4000 x 3000. Based on the results of the processing of aerial photographs showed that the results of photo mosaics produce a spatial resolution of 1.64 cm. Vertical and horizontal accuracy rate of 98.62% and 99.73%. Comprehensive coverage of the area recorded by the spacecraft of 1.2 hectares. Here is a map orthophoto imagery used in object recognition Ijo temple area:

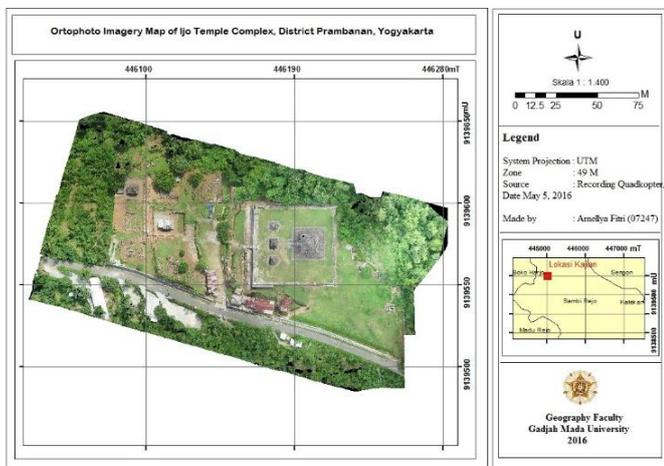


Fig. 2. Orthophoto Imagery Map

The scale of analysis used in the manufacture of orthophoto map is 1: 50. This scale is used for object recognition in detail and for digitization. Objects in detail is recognizable to a scale of 1: 50. The presentation of maps in A4 size paper is presented in a scale of 1: 1,400. Extraction of information from aerial photographs can be identified by using the key image interpretation. Interpretation key sequences used in recognizing objects in the temple area can be recognized from the use of elements of the easiest to the most difficult elements. Orthophoto imagery maps generated a true color image (color according to the object in the field) so that the interpretation of key elements of color and hue is more easily recognizable. The key sequences interpretation in recognizing objects around the

temple area are: the color and hue, shape, pattern, texture, websites, associations, and shadows. Elements of color and hue can recognize the color and hue from rocks making up the outer skin of the temple, temple architecture color especially on the temple's roof.

The temple includes unique building and made of rock composition. Ijo rock temple has gray and brown to gray. Rock component of Ijo temple complex is andesite. Based on the known components can form Ijo temple area. Candi Ijo including the temple complex because it has ancillary temples, the temple yard, the porch of the temple, and others. Based on the pattern layout can recognize the temple as well as the direction toward the temple. The layout of the temple Ijo form a concentric pattern in which ancillary temple was in front of the temple of Parent.

The direction toward the temple Ijo westward ie toward the setting sun. Based on the texture of objects around the temple can be distinguished among the vegetation, soil, buildings, streets, temples, surrounding buildings. Vegetation textures on objects coarser than other objects. Based on elements of the establishment of the temple site Ijo based on topography, soil conditions around the temple, and close to the river. Based on the association element of the temple can be seen that the existence of the temple area is associated with springs and has fertile land conditions. Elements shadow affect the direction toward the temple. Based on the interpretation of key objects bias identified in the area of cultural heritage, among others: the temple, courtyard, trees, roads, irrigation, parking areas, shops, warehouses and offices.

B. Mapping the Cultural Heritage Region

Making a map of the area comes from the temple complex Ijo orthophoto image results. The information extracted on aerial photography is used to divide the region Ijo temple complex. Ijo Temple complex including temples and spacious terraces. Aerial photography is done only include a terrace VIII - XI. Selection of this area for consideration for mapping the area of cultural heritage and non-heritage, consideration of vehicle used, as well as the topography of the study area. Mapping using quadcopter support for shooting from the terrace VIII - XI.

Restrictions heritage area and non-heritage area are bordered by a fence. The objects are located in the area of cultural heritage is protected, conserved, and protected. Areas of non-cultural heritage is used as a means of carrying the heritage area. Conditions Ijo temple at the time of the shooting has six temples that have been restored. Terrace which has been opened and used as a cultural heritage area of the terrace VIII - XI, while the terrace I - VII still owned land. Temple terrace is divided based on extraction of aerial photographs from the DSM (Digital Surface Model) to DTM (Digital Terrain Model). Terrace division by 2 meter interval contour to obtain the patio VIII - XI. Terrace XI is the highest terrace and there is a main temple and ancillary Ijo temple.

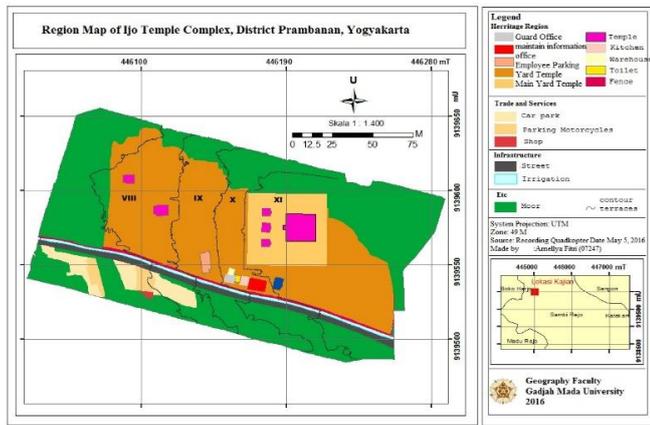


Fig. 3. Candi Ijo Region Map

The map is divided into 4 legend consists of the heritage area, trade and services, infrastructure and others. The classification of the legend are based on the different needs that should be contained in the map area. The heritage area consists of all the objects that can be recognized in the conservation area. Information in the heritage area of the conservation area, like the temple, the office security guards, interpreters maintain offices, kitchen, storeroom, toilet, employee parking, courtyard of the temple, the main temple courtyard, and fences. Visual variables of different colors can be used to distinguish the object.

Information other than the non-heritage region classified into trade and services, infrastructure and others. Trade and services, including non-heritage area because it is outside the fenced area. Attractions will appeal to their trading facilities and services. The existence of stalls, car parking and motorcycle parking already available in Ijo temple. Infrastructure contained in green temple which is a facility of irrigation channels and roads. Irrigation channels are on the south side of the temple after the fence. Irrigation channels follows the length of the fence of the temple. Their irrigation channels will facilitate the flow of water in case of rain, considering that green temples including the temple located on a hill. The water flow will move from a high to a low. The existence of roads that have been paved with a size of 4 meters located on the south side of the temple. Other information in the form of moor and contour. Moor is on the north, west, and south of the temple. The southern part of the temple in the form of a gorge, see the view from the temple is nice because Ijo including Yogya city can be seen from above.

IV. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

Utilization high orthophoto imagery for Ijo temple complex's cultural heritage area mapping have details information. The information from map result cultural heritage and non-heritage area. The cultural heritage area consists the temple, the security office, maintain offices, kitchen, storeroom, toilet, employee parking, courtyard of the temple, the main temple courtyard, and fences. Areas of non-recognized cultural heritage can be shared among others trade and services, infrastructure and others.

B. Suggestion

Region of Ijo temple complex has a large area of the terrace I - XI. The ability of a vehicle using quadcopter not able to record a large area in one recording at a time. It is expected to further mapping may use different rides and complements the area next area of the temple Ijo complex.

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