Image Mapping Detection of Green Areas Using Speed Up Robust Features

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***Abstract*— Development of mapping and remote sensing to detection of green areas in a wide range can do aerial photography using drones. The aerial photo in question is a small format aerial photo using a camera. The image produced from aerial photographs is still fragmented into separate parts. Therefore, it is necessary to merge each sequential image. Merging is done by detecting the mapping of the area by sewing each image based on the point of similarity in pixels. The method applied with the search for similar features uses the Speeded Up Robust Features (SURF). The results obtained to see the level of similarity in the feature mapping area so that the merger into one detected area does not require a long time. The SURF method is applied, giving the results of the number of images that correspond to the Minimum Mean Square Error (MSE) level of 0.0246. The results obtained are the level of similarity at matched point 32 gives a panoramic view approaching the mapping according to the green area of the aerial photo.**

Keyword – ***aerial photo; drones; green areas; image mapping; surf;***

I. Introduction

Green area is an area that has a lot of dense plants that contain, among others, trees, shrubs, ferns, grass, and so on and occupy a fairly large area [1]. In an area requiring a green area as a counterweight and reducing the degradation of the urban environment caused by negative excesses of development. Apart from having a function of environmental improvement, green areas also have aesthetic functions, and health benefit [2].

One of the green areas that are often used as the lungs of an area is the forest. Judging from the trees, urban forests can be divided into two-strained forests, namely forests consisting of trees that form a high canopy and cover grassland. And many stratified forests consist of trees that form a high canopy, shrubs, lianas, epiphytes, other vines and ground cover like grass. This study chose green areas in Urban Forests in Jember District located in the Ajung area. Lack of management made the condition of the Urban Forest less well-maintained and less noticed and remote monitoring was also difficult. It is difficult to monitor large and large areas directly, making the need for remote mapping to help speed up the process of monitoring the mapping of green areas [3].

Mapping can show position, show the size and present data with the potential of an area. Mapping is done using a drone because it has several advantages compared to the mapping that is usually done with Google Earth, one of which is the image quality produced by mapping with drones is much clearer because it is done with a flying altitude of about 100 meters [4]. The results of the mapping are expected to help in managing the forest or other green areas properly and can be used as interesting objects.

Mapping carried out by remote sensing can produce image pieces that are part of the area of an area. unmanned aerial vehicle that take aerial photography will take several photoshoots in a large area. In this study focuses on processing image data resulting from remote image capture using drones [5]. The obtained image data will be processed to detect the overall image mapping so that it becomes part of the total area of the panorama (panorama). The application of applications with drones to the image to form an object, panorama or other paintings has been carried out many studies. Techniques that can be used in research to combine an image into a complete form using the basis of invariant features in applied techniques implemented [6]. The researcher proposes the use of the Speeded Up Robust Features (SURF) method to test and implement data on images taken from drones [5]. Image data taken in the mapped green area will be processed using the development of the SIFT method to see the results of merging images detected through image mapping [7]. Stages of research conducted in this study include literature review, image data retrieval with drones (image acquisition), data processing, application of methods, trials and evaluation of the results obtained, and conclusions from the research conducted.

II. Related Work

The advantage of the drone is that it can monitor very complex landscape structures, such as shifting cultivation landscapes and forest landscapes, or places with intense habitat fragmentation and small agricultural plots. In many farming systems, trees on agricultural land are often (seen) as hedgerows. But for the Dayak people, for example, on the Borneo-Indonesia, this is a complex mix of grasses, mixed gardens, rubber gardens and forests. Most satellites cannot make a difference because of resolution (10 to 30 m), but with drones, we can map small patterns of landscapes properly. You can use a higher resolution satellite, but it is very expensive and it is often very difficult to get the data. Cloud cover is also a big problem for satellites. In the humid tropics, sometimes you get a good image of an area per year, and sometimes it doesn't. So the use of drones can be an alternative because you can avoid cloud cover [8].

Related research some practical experiences of using Unmanned Aerial Vehicle-(UAV) based platform for remotesensing in supporting precision agriculture mapping. Some of the information for land preparation, cadaster boundary, vegetation monitoring, plant healthy, and stock valuation are required periodically [9]. Drone uses for analysis of avineyard with multispectral photogrammetry technology and UAVs and itdemonstrates its great potential to analyze the Normalized Difference Vegetation Index (NDVI), the Near-Infrared Spectroscopy (NIRS) and the Digital ElevationModel (DEM) applied in the agriculture framework to collect information on thevegetative state of the crop, soil and plant moisture, and biomass density mapsof [10].

Several pieces of images that are cut into pieces can be combined with a simple method. Image detection can be seen from the point of similar and related features. Image detection is done by searching technique for introducing feature points into high-resolution images. The approach can be done with the SURF method. The method used can detect the similarity between features of each image. So that the image pieces of images from different images can be adjusted and find the appropriate panorama [11].

III. METHOD

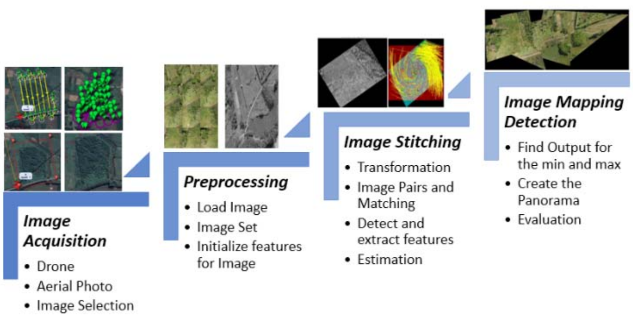

Fig 1. Block Diagram Image Mapping Detection of Green Areas

The steps in general in the research can be seen in Fig 1. The method that is applied includes the initial step. At this stage a flight test is carried out to determine whether the drone vehicle can fly following the waypoint path for mapping that has previously been determined, image acquisition is taken at this stage with aerial photos. The second step, the preprocessing stage of image data is carried out, which has been selected according to the sequence of aerial photography. The third step, the arranged image will be transformed into an identity matrix, comparison, image matching with feature detection and extraction, and estimation. The next step is to map the image by detecting the features that will be mapped into one part (panorama), each area tested will be evaluated for the results of mapping images that have been mapped. The related methods in the research are specifically explained in their respective subsections.

A. Image Aquisition using Drone

The image taking process uses a Fixed Wing type drone with a Pylon model that has wings. This type is used for better processes in making it faster. The type of Drone used has battery specifications that help for flight efficiency, and aerodynamics [7]. The drone used has a Sony DSC-WX220 camera specification. The mapping location of the green area used in the study is urban forest located in Ajung sub-district, Jember Regency, East Java. Geographically the location of the City Forest is at 8˚12’54 “S 113 S39’54” E. The location of the city forest was chosen because it has adequate drone rides and a large area as a green area that can be used as a greening center for Jember district.

The image retrieval process for mapping is done by testing the flight of the drone repeatedly until it gets results that match the required criteria. The waypoint mapping done can be seen in the fig 2. Test flight drone rides produce 312 photos with a height of 100m aerial photos. Aerial photos generated from drone vehicles can be processed through the Align Photos process and a Geotagging process is carried out to obtain GPS data so that aerial photos produced by drones obtain Latitude, Longtitude, and Altitude data so that aerial photos that are processed can produce data that is compatible with graphics.

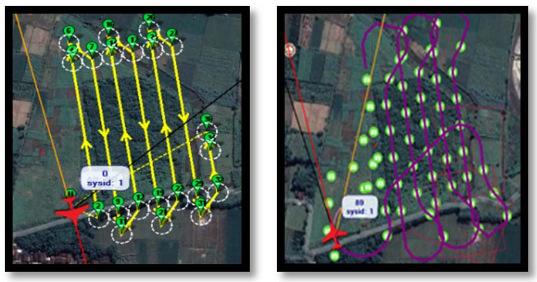

Fig 2. Waypoint Image Mapping

B. Image Stitching

SURF is able to detect local features of an image reliably and quickly. This algorithm was inspired by the Scale Invariant Feature Transform (SIFT) which first appeared in 1999, especially in the Scale Space representation stage. SURF algorithm uses a combination of integral image and blob detection algorithms based on determinants of the Hessian matrix. The point of interest detection (interest point) is used to select points that contain a lot of information and at the same time be stable against local or global interference in digital images. In the SURF algorithm, attention point detectors are chosen which have invariant properties of scale, namely blob detection. Blob is an area in digital imagery that has a constant or varied nature in a certain range. The initial stage in this process will convert the 24-bit RGB format to

32-bit grayscale by calculating the value of integral image representation. Integral bias image representation reduces computing time. Then look for blob-like features with the Hessian matrix. The process of calculating values from the Hessian matrix determinant then looks for maximum or minimum values compared to neighboring values [12]. The Hessian matrix is at the point m = (m, n) of the image M with the scale σ defined in equation (1) as follows:

$$H(m,\sigma) = \begin{bmatrix} P_{mm}(m,\sigma) & P_{mn}(m,\sigma) \\ P_{mn}(m,\sigma) & P_{nn}(m,\sigma) \end{bmatrix} \quad (1)$$

The candidate location of the feature is determined on the scale of the image of the neighbor. Then the extrusion of the Hessian matrix determinant is interpolated at 3x3x3 space scale by the method proposed by Brown. This method will be applied to each prospective feature to search for extreme locations after being interpolated. Quadratic 3D uses Taylor's expansion of the scale-space function, D (m, n, σ), which is shifted so that the origin is used as a test point. The calculated test points will be described using the Haar-wavelet response as vector units. Orientation is done by describing feature points into vector descriptors so that feature points have resistance to rotation, contrast, and changes in point of view. In order to be resistant to the rotation, every feature detected will be given orientation. First, we will calculate the Haar-wavelet response to the x-axis (m) and y-axis (n) with the points in the neighboring environment. Then with the sampling step of each scale s is from each scale as well as the calculation of the wavelet response according to the scale. So that on a large scale the size of the wavelet will also be large. For this reason, integral image calculations will be used for rapid screening. Thus only six operations are needed to calculate the response on the x-axis (m) and y-axis (n) on each scale. For reasons of simplicity, the Haar-wavelet response in the horizontal direction will be called dx and the vertical Haar-wavelet response is called dy. What is meant by "vertical" and "horizontal" in this case is defined according to the orientation of the feature point concerned. To increase its resistance to geometric deformation and localization errors, the response will be weighted with a Gaussian (σ = 3.3s) centered on the feature point [10].

C. *Image Mapping Detection*

Detection carried out at this stage is to map the image of the fragmented area and then combine it into one part. Detection is referred to as a panoramic image from a combination of several or more images that are put together so that it becomes a mosaic of several images. The resampling technique used is RANSAC. The input for the RANSAC algorithm is a set of observed data values and the parameters that are installed for observation involve involving a subset of random points from a data set and calculating the size of the total points consistent with the parameter model formed from this subset with a certain probability. Achieving the best results is done by determining the number of iterations performed. This process is carried out in stages from one image to the next which is matched and sewn into one complete piece. The process carried out creates objects of the same size definition to become a wider shape or size according to the scavenging that has been done with aerial photographs. The 2-D spatial reference formed will be a mosaic image of several images so that a panorama is formed. From the steps that have been done, make a mask for overlay operation and clean the image of the edge in the mask, and change it to a binary image. The layout of the final results will make it a panorama that can be mapped according to the area tested in the study. The evaluation will see the value of the Mean Square Error (MSE) of the transformed image combined with the results of the panorama formed.

IV. EXPERIMENTAL RESULT

In this research, data collection in green areas in urban forests in the city of Jember, because the location of the forest in the city of Jember is the right location, which is a very wide green area in the city of Jember, the first to do is determine the path that will be taken in such a way using a mission planner, so that the drone will fly according to a predetermined path, the drone automatically flies from the location of the start and landing at a predetermined location, during the flight the drone automatically takes a sequence of images at the latitude-longitude point specified in the mission The planner as shown in Fig 2, produced 165 images in one fly with a resolution of 2592x1944, then from the pieces of the picture taken sequentially, stitching was made into an image containing a combination of several images taken separately. The first process carried out was preprocessing the image used as a trial sample by sorting the image according to the results of aerial photography. Preprocessing is done with a pixel size of 350x262.

Fig 3. Image Set For Initialize Features

Fig. 3 shows 12 parts of a picture taken sequentially using a drone, 12 from these photos are images that are specified as samples of other images obtained from aerial photography, then sewing and producing images combined with the results of stitches in the fig.4. Stitch results are used to detect shooting. Detecting image mapping will find the match points of each image tested from several green area trials by calculating errors from stitches in each image.

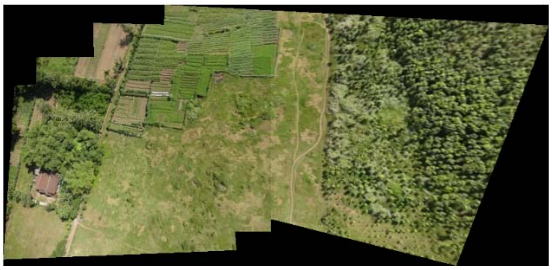

Fig 4. Panorama of Green Areas

Fig. 4 shows the stitch results of the 12 images shown in Fig. 3 using SURF. The detail matching point, MSE value and time processed from the experiments performed are shown in table 1. The results obtained show a minimum MSE value of 0.0246. Measurement of each image calculated by pixels. The results of each unit trial are matched by the stitching results with a large resolution of each pixel. Error value and process based on time per second.

TABLE I. RESULT OF IMAGE MAPPING DETECTION

Area	***Parameter***				
	Height	***Width***	***Matched Points***	***MSE***	***Time (s)***
GA 1	**543**	**1834**	**32**	**0,0246**	**2,868607**
GA 2	398	706	402	0,12903	1,511841
GA 3	316	485	389	0,2466	1,309048
GA 4	389	812	216	0,15813	1,458386

V. CONCLUSION

Green area mapping detection is processed by sewing images using SURF produces a complete image with a clear image density in Fig 4. The original image obtained on aerial photographs with the sample test carried out obtains corresponding transformation points for stitch results. The SURF method is applied, giving the results of the number of images that correspond to the minimum MSE level of 0.0246. If the higher the number of original images, the higher the number of matching points. The results obtained are the level of similarity at matched point 32 gives a panoramic view approaching the mapping according to the green area of the aerial photo. The method of detecting regional mapping can be developed and deepened in determining the suitability of the combined image. So that the results of image mapping are more suitable with better density. So that in the future can be calculated the area of green (panorama) that can be used as the basis for calculations automatically.

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