Implementation of Quadcopter for Capturing Panoramic Image at Sedayu Bantul

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Implementation of Quadcopter for Capturing Panoramic Image at Sedayu Bantul

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***Abstract*—The aims of this study to deploy an aerial photography system has the ability to capture panoramic image of specific area. The planned research activities completed within 2 years, with the first year's target is Quadcopter design and manufacture that is equipped with a camera for image acquisition process. Target for the second year is shooting and processing panoramic images thus obtained are accurate. The steps to implement this study are divided into two parts: 1) the design and manufacture of quadcopter and 2) implementation of image capture and processing. The expected results of the study is the automated system that have capability of imaging an area and perform image stitching on the imaging results so obtained image represents an area with a particular area with an adequate level of resolution. Thus this system can be referred for the next advance that is more complex for example: prediction system of agricultural crops with aerial photography, residential density estimation system with aerial photos, and hazard mitigation systems by using aerial photographs. The preliminary result of this research is panoramic images capturing with quadcopter. Quadcopter could flight as high as 6 meters for 3 minutes. Improvement is expected to reach flight capability of quadcopter as high as 100 m within 10 minutes flight time minimum.**

***Keywords*— aerial image, panoramic image, otomatic system, image stitching, quadcopter**

I. Introduction

Aerial photography (aerial photography) is a process of taking a photo or image of an area that is made from a certain height. In general, this process is done with a camera that does not use a buffer which rests on the ground. Camera for aerial photography generally installed on an aerospace vehicle or carried by a person while they are in the aerospace vehicle. The process image is taken with manual control or remote control or automatic control. Rides are often used in aerial photography include aircraft, helicopters, unmanned multirotor rides, balloon, rocket, kite or parachute.

Quadcopter (Quadrotor) is a vehicle multirotor (propellers plural) that has four propellers, located at the four corners of the vehicle. The propeller quadcopter is fixed pitch, which does not change the angle to the axis of rotation during operation. Examples quadcopter as shown in Figure 1 below. Quadcopter aerospace vehicle is one that is currently very popular studied and used in various applications, eg for the purposes of SAR (search and rescue) as well as the purpose of sensing / imaging.

Image stitching or photo stitching is the process of combining multiple images which have overlapping part to produce a panoramic image and high-resolution images. This process is usually done using computer software, the most common approach used is similar to overlap and similar light levels to be able to obtain a smooth result.

II. Objective

The main benefit of this research is expected to contribute to the development of science and technology fields of electrical engineering and in particular for the development of sensing systems based quadcopter aerial photographs which serve to produce a panoramic image of the rice fields in the area of Sedayu Bantul.

III. Literature Review

Changes in the angle of nod (pitch) is affected by changes in rotor speed difference in numbers 1 and 3, as shown in Figure 1, which will result in the movement forward or backward on the quadcopter. If we do the same thing on the rotor numbers 2 and 4 it will produce tumble angle changes, which in turn causes lateral movement (sideways).

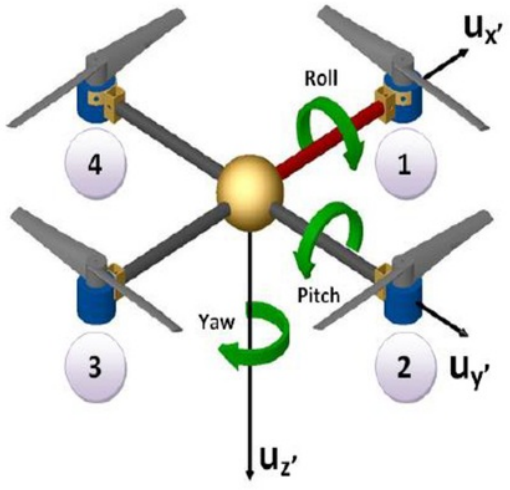

Fig. 1 Angles of *quadcopter*e

As depicted at figure 2, shake can be obtained by altering the aerodynamic torque balance (set to occur on the thrust cumulative offset between pairs rotor rotating in opposite directions, so that by making changes to the third corner (nod, roll and shake), we can arrange for quadcopter maneuvered in all directions [1].

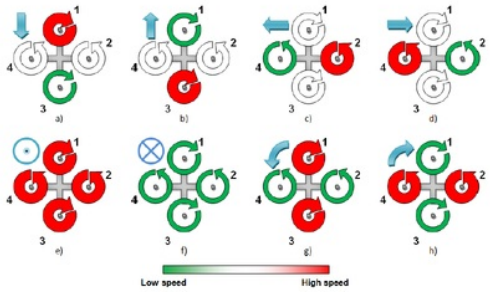

Fig. 2 Manauver of *quadcopter*e

Image stitching process can be divided into three main components, namely component recording (registration) imagery, calibration components and component mixing (blending) [2].

IV. Research Methodology

The materials used in this study are:Module digital camera, component mechanical, electronic sensors and Wifi module. Meanwhile the other instruments used to carry out this research are: Computer with specification Intel Core-i3, 2,7GHz, 2GB DDRAM. This computer is used for image stitching process with Visual Studio 2012.

A. System Design

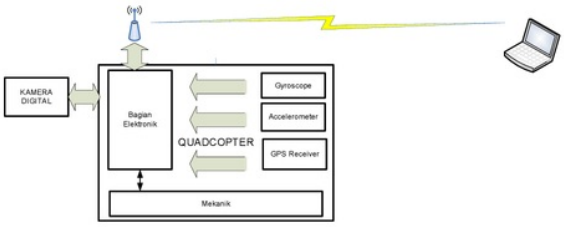

Fig. 3 Aerial System based on *quadcopter*e

Fig 3 shows that diagram block could be defined as follow : Digital camera module is deployed for capturing images from the air and produce a digital image format. Quadcopter is a vehicle carrying a camera and a webcam to the location in a certain height. Data transmission system, is implemented use Wifi Module as media transmission digital image from quadcopter to main processor also data transmission controlling and navigation from main processor to quadcopter. Main processor is arranged by hardware and software.

B. Quadcopter

In this study the quadcopter type is AR.Drone 2.0, with specification as follow : **Main Processor**: 1GHz 32 bit ARM Cortex A8 processor dengan 800MHz video DSP TMS320DMC64x, Linux 2.6.32, 1Gbit DDR2 RAM at 200MHz, Port USB 2.0 , Wi-Fi b,g,n. **Sensor** : Gyroskop 3 axis with a precision of 2000 ° / sec, 3-axis accelerometer with a precision of + -50mg, 3-axis magnetometer with a 6 ° accuracy, thoroughness +/- Pressure Sensor with 10 Pa, Ultrasonic Sensors for measuring height / distance to the soil surface 60 fps QVGA camera mounted vertically for speed measurement. **Capturing Came**: HD Camera. 720p 30fps, wide-angle lens: 92 ° diagonal.. **Motor** : 4 inrunner brushless motors 14.5W 28,500 rpm, Micro ball bearing, AVR microcontroller for each motor controller board.

C. Quadcopter Software Controller

Software that allows the operating system windows things required to make the adjustment and control AR.Drone2.0. Software is widely used feature in AR.Drone SDK 2.1. Facilities that have been successfully developed in this software are: The ability to make a connection with the AR.Drone, make delivery arrangements AR.Drone, exercise control,receive and display navdata, display live streaming video from the AR.Drone, perform a snapshot (image capture), and the simple ability to autopilot settings.

D. Image Processing Software

To be able to compose a picture / image of the panorama, the basic idea is to define the same points in the two images are there and continued projecting one image over another image, so that these points can be met. To be able to determine the location of these points, which is hereinafter referred to as interest points, used corner detection method known as Harris Corners Detector.

To be able to compose a picture / image of the panorama, the basic idea is to uncertain Once detected, the operation needs to be done to make the correlation between those points that exist in the two images to be merged. This operation is done by analyzing a window / area number of pixels that are around the point which has been found in the first image and correlate to the window / area number of pixels that are around the point which has been found in the second image.

The points which has the two-way maximum correlation will be taken as a pair between two existing image. After pairing between the same points on the second image can be found then this is a kind of image transformations that can be used to project an image on top of another image with a given to the points the same on both the image, it is commonly called homografi. This research used RANSAC, random sample consesus.

V. Result

The example of image capturing by quadcopter is shown in figure 4.

Fig. 4 Capturing image before stitching operation

As shown in figure 4, capturing image are in partial form. In the next process, both of the image will be stitched by Harris Corner Detector operation as depicted in figure 5.

Fig. 5 Quadcopter image after Harris Corner Detector operation

VI. CONCLUSIONS

Aerial photography system with image stitching based quadcopter could work well to make the process of aerial photographs. The preliminary result of this research is panoramic images capturing by quadcopter. Quadcopter flight as high as 6 meters for 3 minutes. Improvement is expected to the future so it could fly at 100 m in 10 minutes minimum flight time.

ACKNOWLEDGMENT

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