

Analysis of UAV multicopter of air photography in New Yogyakarta International Airports

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Abstract

The higher the quality of the drone, the longer the drone will fly and the better the quality of the drone's photography. Survey of research location in Glagah Indah Beach, preparation of drone at ground, we plan the height of flying drones, then testing drone at ground, we measure camera calibration, and then result capture in the air and images in the air. Vehicle specifications are as follows: Frame: F450; Flight Controller: DJI Naza M-Lite; Propeller: 1045 Prop; motorbike: brushless sunnsky 980 kVa; ESC: Skywalker 40 Ampere 3s; Battery: Ace 3s Gens 5000 mAh; Remote: Turnigy 9XR with Frsky Tansiever; and camera: Xiaomi Yi 4k International edition. This drone type multicopter can penetrate the high of 100 meters to 200 meters and can air for 30 minutes, can take an area of up to 1 km while payload drones multicopter is 2.8 kg. This multicopter drone has a 12 megapixel sensor; maximum flight time of 15 minutes; speed of 20 m/s, maximum take-up speed of 6 m/s, maximum landing speed of 4 m/s, temperature range when operating drone 0 to 40 C and maximum image size of 4000x3000.

Keywords: DJ I Phantom, drone, mapping, photography, UAV

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1. Introduction

Drone is a plane without a pilot. This study used a drone with a DJI Phantom camera and the advantage of this drone was that it was able to operate for approximately 15 minutes and the camera produced images with the best resolution. This mapping of the prospective new airport areas in New Yogyakarta International Airport is a form of concern for researchers as indigenous people of Kulonprogo and assisting the local government of Kulonprogo in mapping the new prospective entry areas in Kulonprogo. The purpose of this research is to make drone designs with accurate dimensions so that it can function to map the prospective new airport areas of New Yogyakarta International Airports (NYIA). What distinguishes my research from relevant research is that this multicopter design is designed to withstand strong wind speeds and this multicopter keeps flying stable so that it produces good mapping images. As for what distinguishes our research with relevant research is this study uses DJ I Phantom, which has a high level of stability so that the multicopter drone is still able to survive in the air despite the wind and the ability of the battery lasts up to 15 minutes in the air so that the drone is able to find the best position to take aerial photography. The relevant research as follows.

Drone have two types, namely fixed wing and multicopter. Fixed wing as shown Figure 1 [1]. Drone have important functions for remote sensing and mapping as shown Figure 2 [2]. Assembling low priced using photogrammetric methode as shown in Figure 3 [3] Multicopter has software that is integrated with the development of algorithms to test navigation programs [4]. LSA (Light Surveillance Aircraft) supports the development of photography as shown Figure 4 [5]. Flight dynamics of UAV with ICS models and control constraints through estimation of geometry constraints [6]. Research carried out with drones has high-quality cameras to produce high-quality images as well [7]. Multicopter fly with autopilot control using GPS. GPS sensor for flight stability [8].

Research on portable drone design to be easy to carry, lightweight and can be used for mapping. This drone has high power so that the propeller design provides maximum thrust. [9]. Drones can be used to map prospective new airports in Kulonprogo, precisely Congot Beach [10] This drone can be fly with height 100 meters to 200 meters with time 30 minutes. Drone load is 2.8 kg. The result of aerial photograph in Kotabaru, Lampung as shown in

Figure 7. Drone type fixed wing can operate 20 hectare after 50 hectare [11]. UAVs according to their type are quadcopter and octocopter, this study is a drone to test the United States Army wind tunnel [12].



Figure 1. Unmanned Aerial Vehicle fixed wing type [1]



Figure 2. Farmland photographed with UAV [2]



Figure 3. Flying wing assembly [4]



Figure 4. Aerial photos with LSA [5]

This research for the launch of multicopter from a fixed wing UAV for a potential collaborative mission [13]. Drone function to minimize cost and monitor target [14]. UAV with maneuverability in air sampling so that is obtained with spatial resolution having high precision [15]. The location of the drone at a minimum cost with the way of computational studies [16]. Based on the results of the study the validity of the product so that the quadcopter remote control using nRF2410+ was declared valid with a percentage of 80%, with a maximum distance of 95 meters in an unobstructed state and 10 meters in the form of a wall [17]. Large scale mapping using digital SLR cameras placed on a remote controlled unmanned aerial vehicle (UAV) can be possible if the recording of digital photographs can be further processed using the self-calibrating bundle adjustment technique and Image Matching [18]. Quadcopter is able to move automatically according to the waypoint tracking system. Waypoint tracking system is a navigation system based on the position of the GPS and compass, so that the quadcopter can run automatically [19].

The mapping of the Prambanan temple in this study uses a small format aerial photo mapping method with a RC multicopter (quadcopter), making it easier to determine where to take off and land [20]. The small format air photos produced are then processed to obtain orthophoto images and images of DSM [21]. Hexacopter is one type of UAV that has six rotors helping to control intentional air disturbances carried out by irresponsible individuals [22]

Multicopter have swing angle simulation slung load applications depend on the track and the swing [23]. The IMU system has been able to provide slope information [24]. A dynamic simulation model is implemented and used to compare the various configurations [25]. The ArduSim system has the advantage of protecting the minimum distance between UAVs and other aircraft to avoid accidents [26]. The drone has four propellers used for mapping the

southern route to the new airport of Yogyakarta International Airport. Drone have altitude reaching 1,500 m above ground level [27].

The IR Multicopter functions to map surveys in emissions monitoring to measure the longest record of energy yields in Switzerland as shown Figure 8 [28]. Concept multicopter with MATLAB as shown Figure 9 [29]. Development of the VTOL concept to apply aerodynamic designs to test wind tunnels as shown Figure 10 [30].



Figure 5. Drone DJ1 Phantom 3 merk Sony Exmor [6]



Figure 6. GPS drone and GPS Satelit System [10]



Figure 7. Results of fixed wing air photos in Lampung area [11]

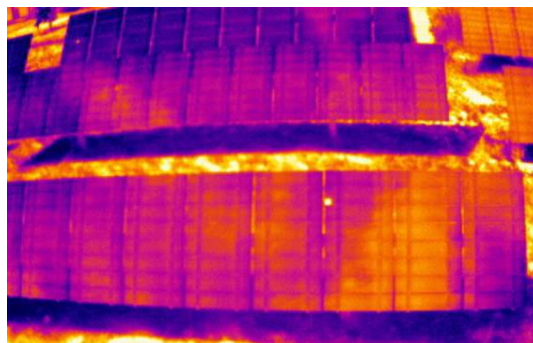


Figure 8. Inspection results of IR-mapping [28]

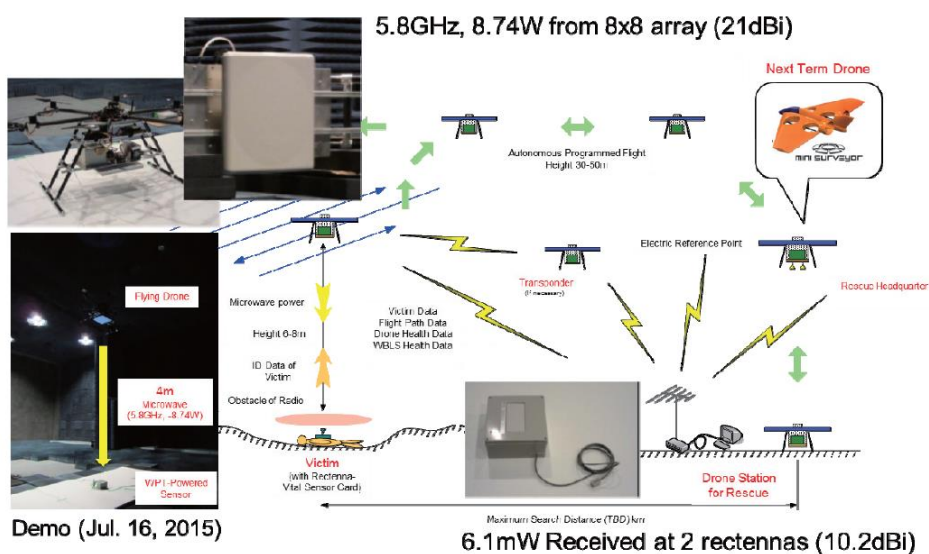


Figure 9. Concepts of Multicopter at MATLAB [29]

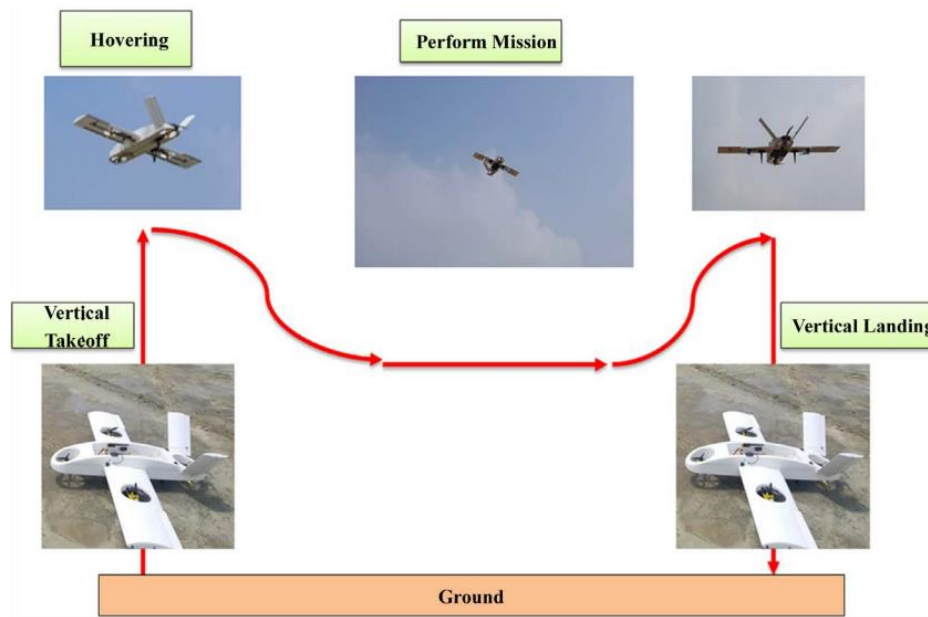


Figure 10. Profile of the VTOL flight experiment [30]

2. Research Method

- Research Area: The entrance to New Yogyakarta International Airports in Glagah, Temon, Kulonprogo.
- Implementations: Drone can fly up to 30 meter and reach area of 1 km.
- Method: Drawing multicopter design with size as shown in Figure 11 after the next research design is to make a multicopter assembly. After being assembled, multicopter is treated with trials. Trials are carried out in the new prospective airport area in New Yogyakarta International Airports at Glagah Beach, Temon, Kulonprogo. Drone altitude until 100 meters, we tested the capability of the 5000 mAH battery to fly for 15 minutes then drone test on land, we measure camera calibration with altitude 100 meters, and aerial photographs obtained.

3. Results and Analysis

Drawing multicopter design with size as shown in Figure 11. The next research design is to make a multicopter assembly. After being assembled, multicopter is treated with trials. Drone in this research has multicopter type used mapping air photo New Yogyakarta International Airports (NYIA) in Glagah, Temon, Kulonprogo. The regional Government of Kulonprogo is very proud of this research because the object of the research is the entrance area to the prospective airport area of the New Yogyakarta International Airports. This is also because the Regional Government of Kulonprogo has cooperated with our institutions in the fields of education, research and community service. DJI Phantom camera classified as stable for the light weight drone class. What distinguishes my research from relevant research is that this multicopter design is designed to withstand strong wind speeds and this multicopter keeps flying stable so that it produces good mapping images. The following is the size of our research multicopter looking sideways as in Figure 12. The following is our research multicopter design as shown in Figure 13, the software used to design the drone multicopter is Corel Draw 3D.

Multicopter drone have altitude until 30 meters, can take an area of up to 1 km, altitude of this multicopter reaches a height of 100 meters above the ground surface and a flight time of 15 minutes. With 5000 mAH battery power, this multicopter drone can get the most for 15 minutes so that it is longer than other multicopter drones. The following is a description of the results of our research. Multicopter have four propeller in this research as shown Figure 14. Figure 15 here is a drone type multicopter is flying in the sky in Glagah, Temon, Kulonprogo.

Aerial photos viewed from the south side of the road to the new airport as shown in Figure 16. The result of the Multicopter Air Photo at the New Yogyakarta International Airport in Glagah Kulonprogo as shown in Figure 17. Field of Glagah, Kulonprogo as shown in Figure 18. West to the gate 35 meters above ground level as shown in Figure 19 and aerial photos are seen from the west side of the road to the new airport as shown in Figure 20.

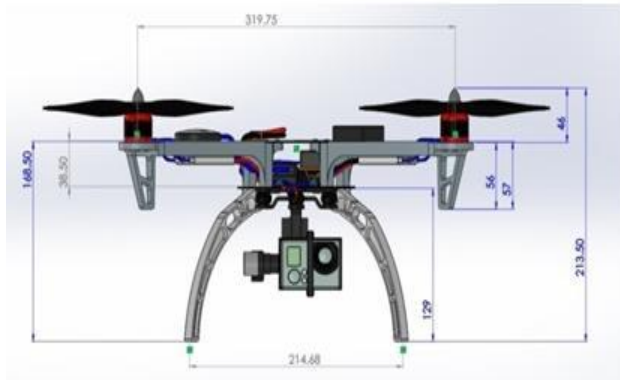


Figure 11. The size of our research multicopter looking forward

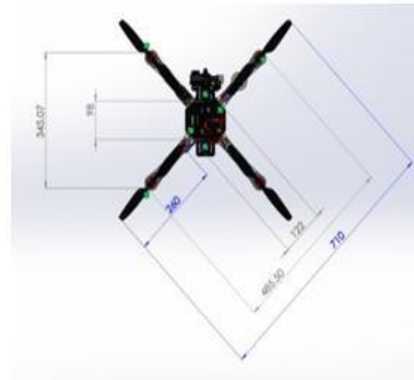


Figure 12. The size of our research multicopter looks sideways



Figure 13. Desain of multicopter



Figure 14. Multicopter



Figure 15. Multicopter is flying in the sky



Figure 16. Aerial photos viewed from south side to the new airports

a. Advantages of using drones:

- The shape is small and easy to carry.
- Drone for mapping flood areas.
- Drone can be used mapping minning area, and agricultural.
- The drones has a shopiscated camera.

- Portable.
- Drones are pilotless aircraft.
- Drone has been studied.
- b. Disadvantages using drones:
 - The price is an expensive.
 - Can not reach remote area.
 - Damage easily.



Figure 17. Results of multicopter air photos in Glagah, Kulonprogo



Figure 18. The field in Glagah, Kulonprogo



Figure 19. West to the gate 35 meters above ground level



Figure 20. Aerial photos are seen from the west side of the road

4. Conclusion

Drawing multicopter design with size after the next research design to make a multicopter assembly. After being assembled, multicopter is treated with trials. Drone has multicopter type used mapping air photo Yogyakarta International Airports (YIA) in Glagah, Temon, Kulonprogo. This drone have altitude until 100 meters to 200 meters and can fly for 30 minutes, drone weight of 2.8 kg. Drone have flight time of 15 minutes with battery 5000 mAH. The quality of the camera drone with DJ I Phantom can provide the results of aerial mapping with good images and able to map the area to an area of 1.5 km.

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