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Design and Construction of a Rotary Wing UAV Rotary Wing Anti Jamming Quadcopter Type

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ABSTRACT:

The Rotary Wing Unmanned Aerial Vehicle system is a type of unmanned aircraft that uses a propeller as a driving force, commonly known as a drone. This type of aircraft has been widely used, starting from toys, used by photographers, for aerial photography, and even produced by developed countries to support the military, especially in reconnaissance and combat missions. Rotary wing UAVs are more advantageous for obtaining information in difficult terrain about target objects because their shape and maneuvers enable them in terrain that is difficult to reach by reconnaissance units and maintain confidentiality. In this research, a rotary wing UAV type designed using four frames and four propellers on the lower platform equipped with a rocket launcher is used to launch rockets at targets in manual mode using remote control at a frequency of 2.4GHz with a control distance of up to 2km. This system also has anti-jamming capabilities so it is not easy to lose control due to the influence of foreign frequencies.

1. INTRODUCTION

This anti-jamming Rotary wing UAV system is a UAV system that uses anti-jamming remote control and is equipped with data encryption. This is a development of previous research which was not equipped with anti-jamming and data encryption. The consequence that occurred in research on the first version of the rotary wing system which used a control system that was not equipped with anti-jamming and data encryption was loss of control. This can occur due to the frequency security factor being less guaranteed because it uses 1 frequency and the risk of control being taken over by an enemy party. b. The Copter type UAV is a UAV that uses a Rotor or Copter as a driving force, meaning it purely uses a propeller and motor as a driving force. This type of UAV is also known as Multirotor (many rotors). Types of multirotors include: monocopter (1 motor with 1 propeller), dualcopter (2 motor with 2 propeller), quadcopter (4 motors with 4 propeller), Hexacopter (6 motors with 6 propeller), octacopter (8 motors with 8 propeller).

2. LITERATURE REVIEW

NRS Muda et al (2023) Hexacopter drone research using an anti-tank rocket launcher is a development of hexacopter drone research for pest spraying. In research and development, this type of drone or hexacopter is equipped with a C90 type anti-tank rocket launcher. Hexacopter drones are intended to destroy enemy tanks and support infantry units in optimizing their strength to destroy targets.

W.C Chen et al (2023). This drone system is capable of adaptive target identification, recognizes specific targets and is able to avoid obstacles during flight. The system used introduces the idea of space detection and uses it to develop the so-called contour and spiral convolution space detection algorithm for obstacle avoidance.

Materials and Methods

Materials

The quad copter drone materials used consist of: 4 frame, flight control Ardupilot, ESC 20A, MPU6050, Brushless Motor 2100rpm, GPS Neo 7, 2 Propeller CW-CCW, 11.1 Volt 2000 mAH Lipo Battery, Frsky Receiver 8 Ch, Taranis 2.4 GHz Remote Control, Camera Sender 25mW, 5.8 GHz, Video Receiver, Glass VR. Platform consist of 2 rocket launch diameter 20 mm, launcher long 300mm, and Payload 1kg.

Figure 1. Flight Control Ardupilot

The flight control system (FCS) is used to control drone flights by programming the FCS. Motor speed is regulated by setting the PWM signal issued by FCS via ESC (Electronic Speed Control) to the brushless motor. 4 brushless motors rotate by means of 2 brushless motors rotating clock wise (CW) and 2 brushless motors rotating counter clock wise (CCW) as shown in Figure 1. Flight control system uses the Ardupilot type. As shown figure 2. GPS drone NEO M8N, Global Positioning System (GPS) Neo M8N is a system for providing information about coordinates and height on the earth's surface through synchronization of satellite signals. This GPS is superior to the GPS NEO 6, because only 3 captured satellite signals are able to provide information about GPS coordinates.

Figure 2. GPS drone NEO M 8 N

The brushless motor used for this quadcopter drone is the Brushless Leopard LBP 4274 - 2150KV motor type, where this type has the ability to move quickly and strong liftforce reaching 1 kg per motor. The payload capability of this motorbike means it can lift a total load of 4 kg minus the component mass of 3 kg, so that the remaining payload of 1 kg is used to carry the rocket launcher, as shown in figure 3 Brushless Motor Type 2150KV. In this research, 4 brushless motors were used as driving motors to produce lift force.

Figure 3. Motor Brushless Type 2150KV

Four Electronic Speed Control (ESC) components are used as current drivers and speed regulators for brushless motors where the ESC data input comes from flight control in the form of PWM signals, +5V voltage lines and ground lines. Meanwhile, for the power supply to the brushless motor, the ESC output adjusts the 2150KV brushless motor load of 11.1 V and 20A, as shown figure 4. ESC drone 20A

Figure 4. ESC drone 20A

The four propeller components are placed on top of the brushless motor and when the motor rotates, the propeller rotates clockwise and the clockwise counter is used to generate lift power due to the push from the wind, so that the drone can fly stably, moving according to pitch, yaw and roll.As shown in figure 5. Propeller.

Figure 5. Propeller

As shown in Figure 6, the rotary wing type quadcopter design is equipped with two rocket launchers placed on the bottom platform of the drone. This design uses the Solidwork application which has calculated the dimensions used. The total mass which includes the frame and all components has been calculated with a flight duration capability of 30 minutes.

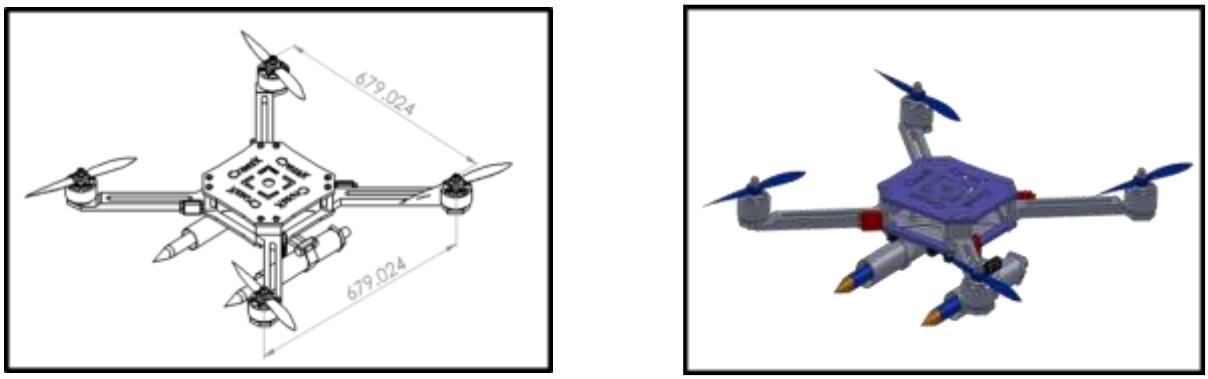

Figure 6. Design of A Rotary Wing Uav Rotary Wing Anti Jamming Quadcopter Type

As shown in figure 7, the rocket design used in this rocket launcher drone, where the rocket used uses composite solid propellant, with a 200 gram TNT warhead, the total weight of the rocket is 350 grams. If 2 rockets are applied to the drone copter, the total mass carried by the drone copter is 700 grams.

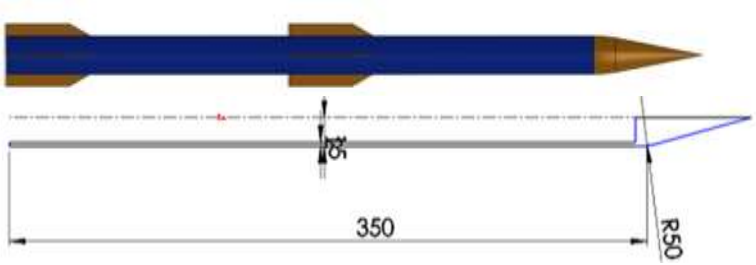

Figure 7. Design of rocket

As shown in Figure 8, the FRsky double frequency receiver component is used to receive command signals from the 2.4GHz TX transmitter. Information signals sent by the RX receiver are forwarded to the flight control system to carry out the throttle function for flight, pitch up for forward motion, pitch down for backward motion, roll left for left roll, roll right for right roll, yaw left for left roll , yaw right to turn right, and the button to fire a rocket.

Figure 8. Receiver Component with Double Frequency

As shown in Figure 9, the anti-jamming component is used to obtain frequency security against the possibility of frequency interference, noise or drone jamming. In this way, the drone will be able to continue maneuvering towards the target and shooting smoothly without being affected by other frequency interference.

Figure 9. Component of Anti Jamming

Figure 10. Ip Camera Long Range

As shown in Figure 10, the long range camera is placed at the front of the rocket launcher drone to see the target, where this camera module will send a video signal and will be received by the video sender at the receiver and connected to a laptop to be displayed on the video application.

The controller section consists of a 2.4 GHz radio control and a laptop that has been programmed by the mission planner. The radio control that is connected to the receiver on the rocket launcher drone has an anti-jamming component installed. Meanwhile, the laptop will monitor the rocket launcher drone's movements during flight and video information is sent by the transmitter camera to the controller and shown on the laptop screen. The target will be known after being captured by the camera and shooting can be carried out at the target from a distance. Destroyable targets such as buildings, vehicles, groups of soldiers, as shown in figure 11. Ground Station Unit and Radio controller.

Figure 11. Ground Station Unit and Radio controller.

Methods

The research method for designing a rocket launcher drone is as shown in Figure 12. The design and manufacture of a quadcopter drone uses an experimental method, where the process of component manufacturing, testing, determining specifications, discussion and conclusions corresponds to the flow diagram.

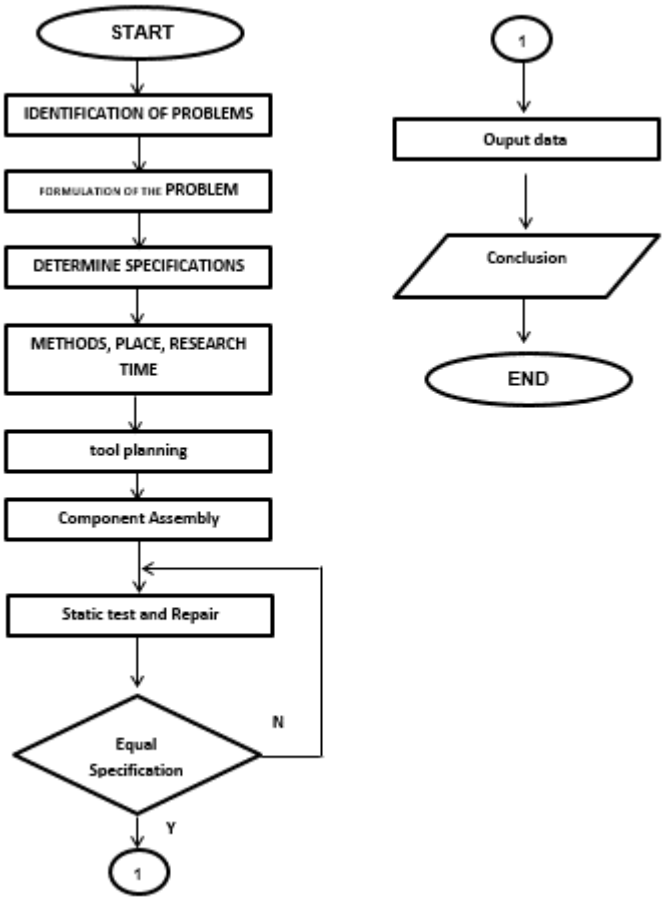

Figure 12. Research Methods Flow Diagram

Results and Discussions

Results

As shown in Figure 13, the results of component assembly are where the component layout is adjusted to the center of gravity of the drone, so that when flying there is balance and stability.

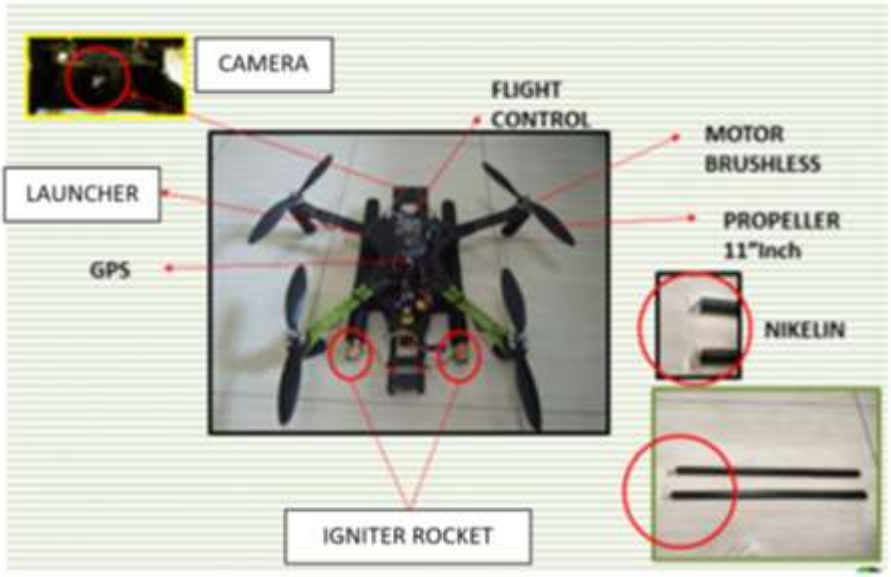

Figure 13. Assembling of All components Drone

Discussion:

As shown in Figure 14, the flight test of a rotary wing drone equipped with two rocket launchers was successful according to the expected specifications. Frequency noise problems during testing did not occur, meaning that the anti-jamming system implemented in the system worked optimally according to the planned specifications. The resulting control distance reaches 2 km, the flight duration reaches 30 minutes, the altitude maneuverability is up to 300 meters, the target can be seen via the camera, and the drone's movements during flight can be monitored via the mission planner application on the laptop. The return to home system can work effectively so that drones that have been flown to the target and fired can return automatically to the predetermined location.

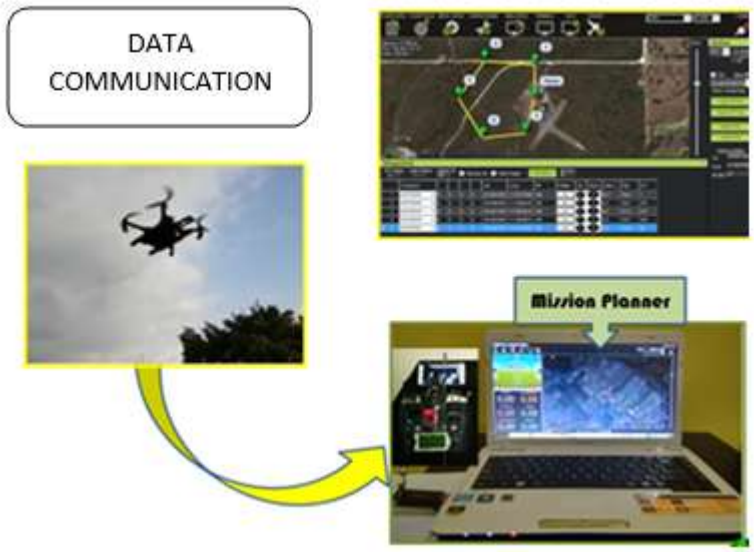

Figure 14. the flight test of a rotary wing drone

Conclusion

This anti-jamming UAV rotary wing rocket launcher system is an unmanned aircraft system that can be used for reconnaissance and combat. This equipment system can provide information about its position and can be monitored remotely, and can be directed to the target coordinates and is equipped with a hopping control system so that it can secure data from possible frequency jamming. This rotary wing system can fire rockets, because the aircraft is equipped with a rocket launcher which can be controlled and fired remotely and the data sent has been encrypted so the shooting data is not easy to intercept.

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