# AUTONOMOUS FLIGHT CONTROLLER SYSTEM OF HYBRID VECTORED TRI COPTER VTOL PLANE USING LINEAR QUADRATIC REGULATOR INTEGRATOR (LQR) CONTROL METHOD

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ABSTRACT

The industrial revolution 4.0 demands accelerated technological developments that are not ordinary and lead to the basis of intelligent and automation systems. One of the rapidly developing technologies is the Unmanned Aerial Vehicle (UAV) or unmanned aircraft. In this revolutionary era, of course, the development of UAVs has more capabilities than UAVs in general. Likewise, the ability to reach a wide area, be easy to operate and be able to take off and land in a narrow area is the fulfilment of the needs sought at this time. The hybrid vectored tri-copter VTOL plane is a UAV model that has this capability. The configuration of this aircraft can be seen in the use of 3 brushless motor engines mounted on the main wing (right and left) and tail with symmetrical installation geometry. In addition, there is also a servo motor mounted on the mounting of the two brushless motors located on the wing, where the servo motor acts as a tilting motor for the transition mode from multi-copter (VTOL) to fixed wing (flying forward, longitudinal motion).

In carrying out flight tasks, a hybrid vectored tri-copter VTOL plane UAV requires a system that makes the aircraft run autonomously. The system is called flight controller. The flight controller accommodates the flight motion of the aircraft independently and coordinates with the control station below. So that the plane is still monitored even though it is far from the station point. Apart from that, the aircraft is also supported in carrying out flight stability which is able to make the aircraft defend itself from unwanted things, such as falling. Therefore, this research focuses on building a flight control system for the hybrid vectored tri-copter VTOL plane UAV model. The aircraft controller is supported by the Linear Quadratic Regulator Integrator control method which makes the system have robust characteristics and is able to minimize steady state errors and multiple overshoots with small errors.

This research is realized in the next few years. This year, the concentration of development is on the VTOL multi-copter mode stability system in which the aircraft can stabilize the anti-rotational attitude of the three axes and maintain a certain position hold or altitude holding. The research method used is through the stages of literature study and data collection, system design both hardware and software algorithms, field implementation of system design and ends with testing and troubleshooting. The results of the research show that the Hybrid Vectored Tri-Copter VTOL Plane unmanned aerial vehicle has been successfully built with specifications of 1150 mm wingspan, 920 mm length, 635 gram weight, 1 degree angle of attack (AoA) and 1.5 maximum take-off weight (MToW). kg. This aircraft is equipped with an autonomous system that was developed with a 160 MHz teensy microcontroller complete with GY86 sensors, GPS and compass. The autonomous system is supported by the LQR Integrator control system which enables the aircraft to fly stably and not experience multiple overshoots and is able to minimize steady state errors. This is evidenced from the characteristics of the three orientation angles that meet the minimum system requirements reference, namely with an SSE error of 0.02 for roll, 0.46 for pitch and 0.80 for yaw.

Kata Kunci: *Autonomous, stabilization, hybrid UAV, flight controller*