ROBUST CONTROL MODEL FOR AUTONOMOUS FLIGHT STABILITY OF AMPHIBIOUS UNMANNED AERIAL VEHICLE USING LINEAR QUADRATIC REGULATOR BASED ON ARTIFICIAL NEURAL NETWORK

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ABSTRACT

The challenges of disaster-prone locations that are difficult to reach and endanger the monitoring process have encouraged the creation of Amphibious Unmanned Aircraft. Amphibious UAVs have the ability to take off and land on water or land. The amphibious UAV is a modification of an unmanned aircraft with a bixler type fixed wing, where the position of the buoy is placed on the main body of the aircraft. The flight characteristics of this unmanned aircraft are known through analysis and testing of flight characteristics. These flight characteristics will be used to improve aircraft design and control systems.
The next step is to build an autonomous flight system, namely a system that is able to manage the aircraft independently when carrying out missions such as monitoring, mapping, surveillance and others. The essence of building this system is in the flight control of the aircraft, where the aircraft can defend itself from disturbances both internal and external to the system environment. Therefore, this research aims to design and model a control system that is capable of controlling the flight of an amphibious UAV aircraft independently. The object used is the latest version of the Twin Boom model amphibious UAV. The control model approach is planned to utilize the LQR control method with self-tuning, namely an artificial neural network. This method is a method that has been used by the research team to build stability in multirotor and fixed wings UAV models. It is hoped that with this method a control model that is robust and adaptive can be created to adapt to existing environmental conditions.
The results of the experiments that have been carried out show that controlling the stability of the aircraft's attitude using LQR control with artificial neural networks has high stability. This can be seen in the transient response that occurs in the controlled state. The results show risetime = 0.3181s, overshoot = 4.1734%, settling time = 0.8762s and steady-state error = 0.9877deg for roll angle control, while for pitch angle control the risetime = 0.1762s, overshoot = 0.6294%, settling time = 0.2768s, and steady-state errors = 0.9853deg. LQR control is suitable for systems with linear and stable mathematical models, but is less effective in dealing with the complexity and non-linearity of aircraft dynamic systems. In contrast, LQR Neural Network is more adaptive and able to handle changes in system conditions by utilizing the advantages of neural network models in dealing with nonlinear complexity. However, the use of LQR Neural Network needs to take into account the complexity of implementation and large data requirements for model training. The combination of these two methods can be an effective solution for controlling the stability of UAV aircraft.

Kata Kunci: *Amphibious Twin Boom UAV, Optimal Control, Artificial Intelligence*