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COURSE CONTROLLER DRONES USING THE FUZZY LOGIC

Navigation and Control of Small Unmanned Aerial Vehicles (UAV) provides solving some problems which assure basic functions, such as control and stabilization of the course, position and orientation along the flight path. In order to realize the basic functions of navigation and flight control UAVs should have: the location of the object relative to the starting point, orientation with regard sides of the world, speed, direction of movement and speed of rotation in three dimensions. While determining the course, the target need is to solve such problems as justification for the choice of the mathematical description of disturbing factors, selecting optimal locations of sensors on board the UAV, development of algorithm processing data from sensors. Stabilization of the aircraft in space should provide quenching of elastic waves of the apparatus body during the flight and maneuver.

The current level of aviation technology development is characterized by a significant increase in the requirements placed on the accuracy and reliability of solving problems in navigation and control of the UAV. Automatic flight control system should receive information about the spatial location of the UAV with sufficient accuracy to stabilize the apparatus during the flight and moving at a given point in space. The main sources of information are on-board navigation equipment, including radio systems. Navigation accuracy is increased significantly while implementing global satellite navigation system (SNS) such as GPS. The combination of CHC and radio equipment landing, allows increasing the accuracy of the location of the UAV.

Inertial navigation system has stable flight parameters, but with increasing observation time it was detected the accumulation of errors in determining the coordinates. With the integrated use of the characteristics these systems, radio and inertial navigation system, you can organize obtaining information about UAV deviation from the specified glide path planning with improved performance accuracy. The combination of radio-electronic systems in drones landing mode, inertial and satellite navigation systems can solve the problem of increasing the accuracy control on landing stage and will meet the requirements that are made to determine the parameters of the navigation of unmanned aircraft.

To realize the above piloting tasks it was proposed the structure of control system, shown in Figure 1

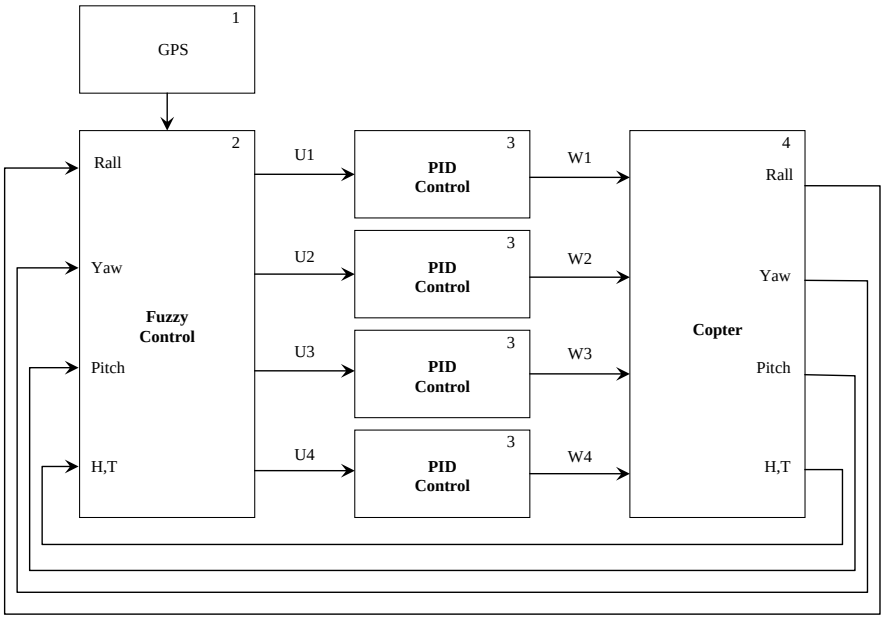

Fig.1. Block diagram of the control UAV

Appointment blocks shown in Figure 1 as follows

Box 1: Dial GPS,creates GPS-coordinate , by which should move the UAV. Coordinates are translated into three-dimensional Cartesian system of UAV and serve for the laying of course along the surface of the landscape.

Box 2: Fuzzy controller, based on the coordinates of the current position of the apparatus generates control signals U for 4 UAV engines. Input is position of the apparatus in the form of Euler angles (Roll, Yaw, Pitch), the current height H of the UAV from sensors and vector direction T along the course.

Block 3: UAV Engines with local regulators. To the input of each motor supplied control signal in the form of voltage U (U1, U2, U3, U4 in the diagram), proportional to the rotational speed W (W1, W2, W3, W4 in the diagram) of each propeller separately for a given flight mode. Stabilization of rotation speed propellers provides directional thrust UAV implemented using PID controller for each motor in separately.

Box 4: UAV as object of control creates the basic flight characteristics of UAV based on current speed of rotation of each propeller, thus realizing the simulation model. Information about the position and orientation are displayed as Euler angles and change of direction vector and altitude UAV. Obtained from the model values are transferred to the fuzzy controller which implements stabilization by the course and implementation of a given flight characteristics.

The structure of the control system has several advantages. Control scheme implements independent control of each motor in separately, fuzzy controller increases the robustness of the flight course control and stabilization regardless of the initial and current state of the system. Orientation in space is determined by using a simulation model of the UAV. Using fuzzy controller makes it possible to avoid the problem of accumulation of errors and compensate for the effect of external disturbances, so how is dynamically calculates the values at each iteration and fuzzy controller generates the actual control signals for UAV engines.

Setup and reprogramming UAV for realization other flight characteristics is performed flexibly by expanding the base of fuzzy rules without hardware restructuring system. Benefits outlined above show the prospects for further study of the proposed control principle while forming new UAV flight characteristics and methods of stabilization with arbitrary number of screws.