

# Microprocessor control system of Unmanned Aerial Vehicle

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*The problem of building UAV microprocessor systems and basic directions of its development are considered. The ways of their improvement and construction of new systems with better technical characteristics are analyzed. The standard structure and nodes which is necessary for basic usage of unmanned aerial vehicle are offered.*

Keywords – UAV, microprocessor systems, drone, quad, controller, nodes.

## Introduction

The UAVs is one of the fastest growing IT directions. Unmanned aerial vehicles does belong to the aviation sector that develops very quickly and has great potential for growth and job creation. The term "unmanned aerial vehicle" includes all large aircraft similar to the size and complexity of a manned airplane as well as the small electronic devices for personal use.

Because of the wide deversity of UAVs, their classification is very important. Based on the generalization of known classifications and tactical or technical characteristics of existing unmanned aerial vehicles, their classification is proposed, based on the main features: usage; type of control system; flight rules; class; type; wing type; way of take-off / landing; engine type; fuel system; type of fuel tank; number of uses; category (taking into account the mass and the maximum range of action); range of action; height; functional purpose.

In this work, a "Quadrocopter" UAV type will be considered. That exact branch is becoming more and more popular among people for the racing or video recording purposes. The market is already taken by such brands as DJI, Xiaomi, Syma, etc. These even managed to become some kind of giants in this field.

## Methods

In recent years, the commercial UAVs has become more popular. However, today`s modern drones still got a bunch of serious problems, the existence of which raises the question about the expediency of such a massive conveyor production of these devices.

So, the Achilles` feel in modern drones is far from just one. Still there persist a few things to focus on. For example, connection security, payload and, most importantly, autonomy. Safety in this regard is extremely important, since control signals between the remote control and the device are usually transmitted through an unsecured communication channel. In turn, the development of new protection methods and their applying will only reduce low autonomy of these devices. In addition, over time, the elemental base of such devices does increases. That makes drones much more complex and more expensive to develop, but it opens up the new opportunities. For example, it forces the developer to look for ways of increasing the time, during which the drone may stay in the air.

## Results

A decision was made to develop a microprocessor based computer system which is intended to control the drone. Consider the typical elements of such devices and choose the

optimal configuration for price and quality that will fully meet the needs of the pilot, as well as ensure that the device is safely positioned in the air.

### Discussion

The flight itself is controlled not only by the remote control but also by the main unit of such a device which is the flight controller. The model range of such devices is tens of units, most of them are completely similar by their technical parameters, but many of them belong to the different price categories. However, they all combine the task of ensuring the stable execution of such tasks as the formation of stable communications, stabilization in the air, maintaining height, support for third-party peripheral nodes, etc. Absolutely accurate is the statement that some cheap controllers have the worst set of functionalities.

*Table 1*

Various controller characteristics

Controller	Flight stabilization	Height maintenance	Position maintenance	Checkpoints flight	Telemetry	OSD
MultiWii	+	+	+	+	+	+
ArduCopter	+	+	+	+	+	+
Rabbit	+	+	+	-	-	-
DJI Naza Lite	+	+	+	-	-	-
DJI Naza V1	+	+	+	+	+	+
DJI Naza V1/V2	+	+	+	+	+	+
DJI Wookong	+	+	+	+	+	+
Zero UAV X4/X6	+	+	+	+	+	-
XAircraft	+	+	+	-	-	-
Xaircraft SuperX	+	+	+	-	-	+
FY-DOS	+	+	+	-	-	-
FY-41AP	+	+	+	-	+	+
KK	+	-	-	-	-	-
MicroKopter	+	+	+	+	+	+
GU-344	+	-	-	-	-	-
Autoquad	+	+	+	+	+	+
Matek Sys	+	+	+	+	+	+

Equally important parts are the motors, the current controller, GPS, OSD (On Screen Display - the imposed interface to the FPV-camera image with parameters of height, speed, battery charge), video card, battery, remote control, etc. Previously it was decided to choose and combine the following essential elements:

Flight Controller Matek Systems Beta Flight F405-CTR. Controllers (Fig. 1) are used to provide multiple flight opportunities for the drone. As table 1 indicates, it can execute such operations as flight stabilization, gps navigation, telemetry, video link.



Fig.1. Matek Systems F405-CTR Controller

Turn regulators DYS XS 30A 3-6s Lipo BLheli\_S. These are intended to control the current which heads to motors. Also they are playing a big security role for the aircraft.



Fig.2. DYS XS 30A 3-6s Lipo BLheli\_S

Motors DYS Samguk Series Wei 2207 2300KV 2600KV. Quadcopters generally use two pairs of identical fixed pitched propellers; two clockwise (CW) and two counterclockwise (CCW). These use independent variation of the speed of each rotor to achieve control. By changing the speed of each rotor it is possible to specifically generate a desired total thrust; to locate for the centre of thrust both laterally and longitudinally; and to create a desired total torque, or turning force.



Fig.3. Motors DYS Samguk Series Wei 2207

## Conclusion

The problem of building microprocessor systems of UAVs and the main directions of their development are considered in this article. The ways of their improvement and construction of new systems with better technical characteristics are analyzed. The standard structure and basic nodes necessary for comfortable execution of flights are offered.

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