Quadrocopter Options and their Use when Searching for Crews of Aircraft in Distress in Inaccessible Terrain

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Abstract: At present, the rapid development of unmanned aircraft vehicle (UAV) land quadcopter with broad possibilities of their use is observed. This is mainly military use in reconnaissance activities, possibly in combat use, but also in the civilian sector. This is mainly about exploration and monitoring of areas such as forest fires, floods, etc., and the transmission of the data to the central site where the information is evaluated. The new research focuses on intelligent communication with other autonomous sources, the exploration of the unknown environment and the ability to maneuver in the target areas with relatively high speed and accuracy. Finally, the article shows the qvadrokopter options when searching for target objects and explatory tests by the author of the post.

Keywords: Development, Micro Air Vehicle (MAV) – quadcopter, military environments.

INTRODUCTION

Increasingly, it is possible to encounter UAVs that have become very successful and are increasingly used to perform various tasks. Especially in military environments, aircraft use patrolling and other important tasks. It is also possible to carry out the tasks of border protection or search and rescue of persons and the rescue of air crews in need in the air. For these reasons, these resources are becoming more and more important for their great maneuverability, speed of use and operability. Excellent flight characteristics have a relatively new type of Micro Air Vehicle (MAV), which is constantly improving. This new product is commonly referred to as quadcopter, which has several key differences. These differences distinguish it from traditional helicopters and have excellent new features. The four rotors allow for relatively simple production while providing high reliability and simplicity in control. Continuous development further enhances its characteristics and particularly high maneuverability.

The method of content analysis was used during the elaboration of the paper and its own experience gained during MAV work.

1. PRINCIPLES AND POSSIBILITIES OF USING QUADCOPTERS

The quadcopters use a pair of propellers that rotate against each other. Propellers are typically connected directly to individual motors without the use of additional transmission links. The battery shaft, microcontroller and camera are located near the center of the airplane. Changes in climb or descent data and location for flight parameters such as flight velocity, altitude, etc. are achieved by changing the rotor speed. Most quadcopters currently in use have

a total weight of 1.5 kg and a length of about 50 cm. Due to these small dimensions and favorable price quadcopters have a wide application compared to other means.

The qvadcopters are different from conventional helicopters that use rotors. These rotors are able to dynamically change the pitch of the blades during rotation around the rotor hub. Torque-induced steering problems as well as tail-rotor performance problems that do not generate any useful stroke can be eliminated by countercurrent motion. Relatively short blades are much easier to design and manufacture.

Extensive research and many practical tests were needed to create an aircraft that allows vertical take-off and landing. The requirements for a satisfactory response in several key technology areas are discussed and the research focuses on different types of aircraft. This survey shows that, despite many problems, there are ways to find a solution. In the future, it seems necessary to update and improve the technology to ensure satisfactory performance and control before and during the flight. Vertical takeoff and landing capability is set for helicopters that are based on this unique feature. In this area, it is a major advantage compared to conventional aircraft [1].

2. NEW DIRECTIONS IN THE DEVELOPMENT OF MICRO AIR VEHICLE

The quadcopters are constantly developing new applications that are the result of a broad collaboration from many companies. One such application can perform tracking and information about injured people. Various features allow you to detect power consumption information, and replace the new quadcopters with low battery capacity. If the battery reaches the minimum value, the quadcopter can land near the charging station and then replace it with another quadcopter. Such an effective rescue system allows the task to be fulfilled on a continuous basis. The main limitation of this system is the need for a complicated system of high-speed cameras for a communication position. Newer projects can better estimate location and orientation with improved sensors and localization algorithms [2].

The quadcopters and other UAV have additional benefits. The pilot is not on board an airplane, which is particularly advantageous in an accident. Many quadcopters are equipped with on-board cameras for ground viewing. Even with optical management, however, it must take a number of measures to ensure a safe flight, such as flight path planning for terrain obstacles [3].



Picture 1-3. Views of a parts of the city from a quadrocopter camera

There are many mistakes and inaccurate solutions in flight. One of the major reasons why they are so significant is mechanical simplicity. The quadcopters are less stable and less effective than an equivalent helicopter.

We will describe the benefits of greater mechanical simplicity and the disadvantage of lower quadcopter efficiency and stability over conventional helicopters. If we analyze the mechanical part, then during rotation it is necessary to set the angle of the blades of the main rotor of the propeller and the propeller so that the thrust vector is in the required direction. To be able to maneuver together with a tail rotor or a combination of a coaxial or tandem propeller, it must be correctly set. In such a case, the development and construction of such a mechanism is complicated and considerable financial resources need to be expended.

The quadcopter uses four motors which are attached to four fixed bases. The propellers are literally connected directly to the engine and thereby also the simple sum of the stroke. Such a structure is relatively simple from low cost. It is thanks to the high performance electric motors and power semiconductors and therefore also very easy operation [4].

But when you scale it begins to make more sense in terms of cost and complexity perspective. It is preferable to have only a relatively complex mechanism than having four or more separate simple mechanisms. Especiall, when you consider the other disadvantages, so one disadvantage is stability [5, 6].

As can be seen from the analysis of this section, the only disadvantage is the stability of this composition. The quadcopters are less stable than conventional helicopters. In fact, they are so unstable that they have to be equipped with electronic stabilization because no one can actually control an airplane without electronic stabilization. It is one of the conclusions that quadcopters can not fly without electronic stabilization. If we compare the size of the helicopter with the same electronic stability system, we will quickly find that the helicopter is actually much more stable. In order for the quadcopter to remain stable in the air, the settings must allow the control of each engine separately. If the engine on one side generates more torque than the other, the quadcopter leans to the appropriate side. It's the only way to steer the airplane at a steady speed.

The quadcopters uses its engines to accelerate or slow down. This is a time delay. The quadcopter control system reacts with a certain delay, which negatively affects the stability. In these cases, a certain value of inertia must also be taken into account. The larger the weight of the airplane, the more energy is needed to change the speed. For this reason, he expects to drive each engine separately, which greatly increases the weight of the vehicle and the financial costs. On the other hand, variable helicopter helicopters can easily change the height of the flight and the desired pull, which requires much less power. A slower dynamic response means a flight with less stability to the device.



Picture 2. View of the "control center" of the quadrocopter camera

The foregoing brings us to the second quadcopter disadvantage that its efficacy. One conclusion from the research is the fact that conventional tail rotor helicopter does not help to lift and therefore the point of ineffectiveness. The quadcopter at this point is not inefficiency. What is interesting is that such an effect is very evident. The quadcopter were designed so as to be able to carry small payload, climb and fly horizontally.

It can be concluded that quadcopter are mechanically simpler and therefore potentially less expensive, but on the other hand are less stable and certainly less efficient than in conventional helicopters. Mechanical simplicity becomes preferably both increase in size, while inefficiency becomes an impediment, and so will not be used in large scale in transport. It follows that quadcopter are mechanically simpler and therefore potentially less expensive but are more stable than the effective conventional helicopters. Because the mechanical simplicity is a requirement to increase the amount, while inefficiency becomes a bottleneck, they will be used in large-scale transport and probably will never be used for large-scale transportation [7].

The above facts bring the second drawback of quadcopter operation, and that is its effectiveness. An important conclusion from research is the fact that conventional tail rotor helicopters do not help climb and therefore do not monitor efficiency. The quadcopter at this point must be effective. What is important is that such an effect is very obvious. The quadcopters were designed to carry a smaller payload, climb and fly in a horizontal flight.

In addition, it can be stated that the quadcopter is mechanically simpler and therefore potentially less expensive, but on the other hand it is less stable and certainly less efficient than conventional helicopters. Mechanical simplicity becomes an advantage in increasing size, but an obstacle to greater efficiency. For this reason, it will not be used on a large scale in transport. This means that the quadcopter is mechanically simpler and therefore potentially less expensive, but less stable than efficient conventional helicopters. Since mechanical simplicity is a requirement to increase the amount of use, while less efficiency becomes an obstacle. For this reason, qvardrocopters will be used on a large scale, but will probably never be used for bulk transport.

3. **DISCUSSION**

The quadcopters have undergone a long development. Significant improvement takes place on a small scale using sensors, motors and microprocessors that have revived research and development. Although the quadcopters are already being used as an aeronautical exploration tool for private and commercial use, new research expands the quadcopter's application capabilities. Progress in communications, research and control will result in advanced autonomous operations that can not be made with this technology at the moment. However, exploratory work is an important asset. The injured person can be traced at a small and medium distance and rescue help can be sent using the coordinates.

In addition to combat use, there are great opportunities for aerial exploration. Note that when approaching at a height of only 20 to 40 meters suddenly opens the landscape caused by terrestrial objects or otherwise shaded forests. This means that full use of information from the country is not possible and can not normally be obtained by other means than by air exploration. We tried this kind of research in different conditions and in different terrains, and we were always surprised by the high efficiency with which the search object could be found.

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