

# The Application of Hexacopter UAV in The Field of Climbing Evasion

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## Abstract

With the development of tourism to climb peaks, the safety of high mountain walls plays an increasingly important role. In the past, the terrain of the mountain wall was too steep and too fast, and people could not patrol the mountain wall climbers, resulting in the safety of climbers could not be guaranteed, and the needs of climbers were difficult to solve in time. In order to solve the above problems, the method of real-time monitoring of UAVs and delivery of materials by UAVs was proposed. Hexacopter UAV is an unmanned small aerial vehicle equipment that can carry out vertical lifting, which is expected to improve the safety factor of climbing mountain walls and solve the needs of climbers in a timely manner.

*Keywords:* Hexacopter UAV, real-time monitoring, delivery of materials, mountain climbing

## 1. Introduction

In order to ensure the sustainable development of climbing tourism, it is urgent to improve the safety of high-altitude operations. This study mainly analyzes the feasibility and problems of hexacopter UAV in the field of climbing. The stability and load-bearing capacity of the hexacopter UAV determine the bright future of the hexacopter UAV in the field of climbing. Among them, the most significant application of hexacopter UAVs in the field of climbing is to provide magnificent high-altitude shooting conditions. As climbers conquer steep peaks and climb steep rock faces, hexacopter drones with high-definition cameras can record the scene. Aerial footage can not only be used to monitor the climbing process, but also can be used as promotional material to promote climbing projects and attractions, and attract more people to participate in climbing. In the case of very mature UAV monitoring technology, the real-time recording and monitoring of high-altitude conditions by the hexacopter can play a very good role in the climbing tourism industry.

## 2. Introduction of six-rotor UAV

### 2.1. The concept of a six-rotor drone

UAV is a small unmanned aerial vehicle with the advantages of flexible flight performance such as

vertical lifting, hovering, and loading. The six-rotor UAV has three groups with a total of six motors placed coaxially up and down to provide lift, adjust the attitude by changing the rotor speed, and realize the position control through the change of attitude.

### 2.2. Features of the six-rotor UAV

The six propellers of the hexacopter UAV are distributed in hexagonal vertex positions, with six propeller speeds as six input forces and six degrees of freedom as outputs. The rotation direction of the six propellers is not the same, and when encountering strong external interference or part of the rotor is disturbed, the output of multiple propellers controlling the rest of the propellers can show good stability [1].

#### (1) The flight altitude of the hexacopter

Hexacopter drones typically fly at altitudes between 1,500 and 3,000 meters, but there are some professional drones that can fly to higher altitudes. The technologies that determine the flight altitude of hexacopter UAVs mainly include the following aspects: flight control systems, aviation power systems, communication and navigation systems, and meteorological and environmental sensors. The combined effect of these technologies determines the flight altitude of the drone.

The flight control system is one of the key factors that

determine the flight altitude of the drone, which includes the flight controller, attitude stabilization system, and altitude control system. These systems work together to ensure that the drone can fly stably and maintain a predetermined altitude [2].

The aerodynamic system includes engines, propellers, and power system controls. These systems provide the power needed to fly and influence the drone's climb performance and altitude performance.

Communication and navigation systems also play a vital role in the flight altitude of the drone. Satellite navigation systems (such as GPS) and ground console devices provide precise navigation and positioning information for six-rotor drones in the air, allowing them to accurately control altitude and position.

Meteorological and environmental sensors can detect meteorological factors such as air pressure, temperature, humidity, etc., helping the drone adjust its flight altitude and attitude according to the current environmental conditions.

To a large extent, these technologies have been very mature, especially in the professional field, the flight altitude control technology of UAVs has been very sophisticated, and has provided reliable technical support for various application scenarios.

#### (2) The volume of the hexacopter

The size of drones can generally be divided into miniature, small, medium, and large. The size of small UAVs is generally between 30 cm and 1 meter, and it is suitable for aerial photography, agricultural plant protection, environmental monitoring and other fields. Among them, medium-sized UAVs are between 1 meter and 5 meters in size, which are suitable for use in search and rescue, logistics and distribution, geological survey and other fields. The carrying capacity of a drone is usually related to its size. Medium-sized UAVs have a large carrying capacity and can already carry relatively heavyweight equipment and materials, such as rescue equipment, survey and monitoring equipment, etc.

### 3. The application status of six-rotor UAVs

At present, the application field of hexacopter UAV is expanding day by day, covering military, civilian and commercial aspects. In the military field, hexacopter UAVs can be used for reconnaissance, surveillance, target positioning and strike, providing a new way of intelligence acquisition and combat. In the civilian field, UAVs are widely used in aerial photography, geological survey, agricultural plant protection, weather monitoring and forest fire prevention. Drones also play

an important role in commercial areas such as logistics and distribution, building inspection, and power inspection. With the continuous progress of technology, UAVs are gradually used in emergency medical rescue, disaster monitoring and rescue, providing a new means of ensuring the safety of people's lives and property. The development of hexacopter UAVs has not only enriched the application field, but also provided people with more efficient and safer solutions, becoming an indispensable part of modern society. This study introduces the application of hexacopter UAV in the field of climbing, and solves the gap that there is no hexacopter UAV involved in the climbing tourism industry.

### 4. Analysis of the advantages of hexacopter UAVs in the field of climbing

#### 4.1. High-altitude monitoring function

The high-definition high-magnification zoom camera embedded in the six-rotor drone can clearly see objects one to two kilometers away from the drone. Picture of a high-altitude surveillance drone is shown in Fig. 1. Equipping the six-rotor drone with a stable gimbal stabilization function, coupled with the smoothness and regularity of the drone's flight, can obtain enough stable images and lenses for surveillance even at full zoom. Regardless of the aircraft's movement, the gimbal maintains its orientation and inclination. The drones responsible for surveillance can navigate autonomously. "Waypoints were previously introduced on the map via a desktop computer or tablet, where waypoints were added by clicking on the map and navigation was stored in the drone's memory. The waypoint can be grouped into one or more points of interest. Navigation can be easily initiated via radio control, so there is no need to use a computer or tablet in the field, and the drone can be in the air in a matter of minutes.



Fig. 1 A high-altitude surveillance drone

#### 4.2. Navigation features

Hexacopter drones play an important navigational role in the field of rock climbing. Rock climbers often need to face complex terrain and changeable environments during climbing, and the navigation

function of drones can provide valuable auxiliary information for climbers.

Equipped with high-precision cameras and navigation equipment, drones can see the climbing route, rock wall structures, and the terrain faced by climbers from the air. This bird's-eye view provides climbers with a new perspective and helps them better understand the complexity and difficulty of the climbing route so that they can develop a targeted climbing strategy. Its real-time monitoring function can help climbers timely obtain changes in the climbing route, such as rock collapse, climate change, etc., and provide timely warnings and risk warnings for climbers. This real-time monitoring is critical for the safety of climbers, allowing them to better respond to unexpected situations and reduce the likelihood of accidents [3].

The navigation role of hexacopter drones in the field of rock climbing can provide climbers with a full range of information support, help them better cope with challenges, and improve the safety and success rate of climbing.

#### 4.3. Aerial teleportation function

For the preparation of rock climbing competitions and climbing events, drones can be used as a fast transmission tool to transmit competition equipment and judging equipment to the required locations, improving the work efficiency of organizers and participants. Climbers often need to carry a variety of equipment, food and water during the climb, and drones can be used as a high-altitude teleportation tool to help climbers deliver these supplies to the designated location. For climbers, there are often difficult parts of the climbing route to pass, such as steep cliff walls, inaccessible caves, etc. Drones can carry ropes, gear, and food to reach places that climbers can't, delivering them safely to where they are, providing them with the support they need. Climbers can also be provided with emergency supplies during the climb, such as delivering much-needed clothing, food, and medicine to climbers in case of inclement weather to help them get through the storm. Photos of actual transportation of hexarotor drones is in Fig. 2.



Fig. 2 Actual transportation of hexarotor drones

In general, the high-altitude teleportation function of drones in the field of rock climbing provides convenient material support for climbers, provides more safety and convenience during climbing, and adds new possibilities and innovations to rock climbing activities [4].

#### 5. Development prospects and challenges of hexacopter UAVs in the field of climbing

The application of hexacopter drones in the field of climbing shows great potential, but at the same time, it is also necessary to pay attention to issues such as privacy protection and environmental protection. When using drones for high-altitude shooting, it is necessary to comply with local aviation regulations to ensure that they do not interfere with the flight of other aircraft. In addition, when flying, it is necessary to strictly comply with local environmental protection laws and regulations to avoid affecting the local ecological environment.

#### 6. Conclusion

The application of hexacopter drones in the field of climbing provides more safety and technical support for climbers, expands the possibilities of climbing activities, and brings new innovations to climbing sports. With the continuous progress of technology and the expansion of applications, it is believed that the role of UAVs in the field of climbing will become more prominent, bringing more convenience and safety to climbing sports.

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