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Research on the Teaching of UAV Practical Courses

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Abstract: In recent years, the UAV industry has shown explosive growth. Some colleges and universities have gradually tried to carry out education and training in this technology, and offered UAV application courses. However, there is still a blank in course design, basic technology, and application focus. To improve students' learning efficiency of comprehensive courses, this paper aims to explore how to improve the teaching ability of UAV application courses by introducing practical teaching.

Keywords: UAV; Practical Training; Teaching; Course.

1. Introduction

In recent years, unmanned aerial vehicles (UAVs) have shown a booming development trend in all walks of life [1]. Especially in the fields of aerial photography, agriculture and forestry, disaster relief, and inspection, they have shown unparalleled charm and become a new technological growth point sought after by all walks of life [2]. At the same time, it has also greatly expanded the application range of UAVs. Some colleges and universities seize the opportunity to carry out UAV-related education and training and actively offer UAV application courses. As the basic knowledge and important content of researching UAVs, introducing practical teaching into the teaching of this course can enable students to connect the direct knowledge obtained with book knowledge to obtain relatively complete knowledge, and can also cultivate their independent exploration ability, practical operation ability and scientific research interest, which is conducive to students' more efficient learning and exploration.

2. The Connotation of UAV Application Practical Teaching

UAV applications are extensive and are comprehensive courses integrating motion control, mathematical modeling, trajectory planning, optimization algorithms, and visual programming. Therefore, pure theoretical classroom teaching cannot meet students' requirements for learning UAV technology, nor can it improve and cultivate students' operational abilities. UAV application practical teaching is based on teaching practice equipment. When introducing and explaining various technologies, practical teaching runs through it. By allowing students to operate the equipment by themselves, observe and analyze data to obtain results, students can connect with book knowledge and efficiently understand and master knowledge. In the teaching process, continuously improve teaching methods and teaching quality, provide practical equipment and operation methods, guide students to participate in learning independently, and obtain knowledge, discover problems, solve problems, and communicate and cooperate through practical operations. Complete the teaching of UAV technology courses in practice.

3. The Necessity of Implementing the Practical Teaching Method of UAV Applications

Practical teaching emerged with the development of modern natural science. The rapid development of modern science and technology and practical means has made practical teaching play an increasingly important role. Practical teaching can better reflect students' ability to discover and solve problems and is essential in the teaching process.

1.Practical teaching can improve students' operational ability and thinking ability.

In the process of practical teaching, after the teacher makes preparations in advance, practical activities are carried out in groups to ensure that students can operate by themselves as much as possible. The teacher patrols and guides, discovers and corrects problems in time. After the practice, students write practice reports and think about the problems that arise in practice. This process can more effectively improve students' operational ability and guide students to conduct further exploration and exercise their thinking ability.

2.Practical teaching can stimulate students' interest in the course [3].

UAV application is a comprehensive course with many knowledge points. Only imparting knowledge through theoretical courses will be dull and even teachers may feel unmotivated in class. However, practical teaching will allow every student to participate and be their own protagonist, participate in practical exchanges and discussions, and arouse interest in the course.

3.Practical teaching can cultivate innovation ability and group cooperation ability.

Practical teaching classes mainly lie in students' own hands-on operation to obtain the desired results. Practice is also a process of continuous generation of new problems. In this process, students are continuously guided to analyze and solve emerging problems, continuously study and propose new operation plans, and cultivate innovation ability. The power of a team is immeasurable. In the practice process, team members communicate with each other and express their views. Everyone's ability will be exercised and improved in communication.

4. The Development of Practical Teaching Methods in UAV Applications

In an era of rapid development of modern communication technology and information processing technology, the degree of intelligence of UAVs is getting higher and higher. In recent years, the number and types of college student competitions are increasing. Among them, UAV competitions are becoming more and more popular among colleges and universities. The construction of laboratories and the introduction of theoretical courses into practical tutorials may further increase the school's scientific research capabilities and cultivate a team of high-quality skilled talents. The teaching purpose is to hope that students can truly and intuitively learn and master knowledge through practical teaching; and continuously strive to improve their professional knowledge and level, improve operational ability and cultivate scientific research interest in the practice process.

5. The Application of Practical Teaching Methods in UAV Application Teaching

The learning of UAV technology includes important courses on key technologies such as navigation, communication, and flight. This article takes the flight state of UAVs as an example to introduce practical courses. In the flight state of UAVs, sensors are needed to evaluate its flight state, and the completion of flight tasks is reflected by measuring some data during the flight.

1.Teaching task objectives

Issue task commands and require the UAV to perform tasks at a designated location. According to the task command, the UAV pilot unfolds and installs the ground control station and the UAV, prepares for work, and selects and plans the takeoff, cruise, and landing routes. Design flight route nodes and flight altitude profiles at the ground control station, and design various working modes and procedures during the task execution process. Then load the parameters determined in the task planning into the flight control computer. The UAV flies to the task execution area according to the planned route and performs the established tasks over the task area. The task load subsystem carries out tasks such as searching and shooting, and sends the obtained image and video to the pilot through the wireless data transmission link. After the UAV completes the task, it returns according to the planned route of the task and lands at the takeoff location.

2.Methods for completing teaching tasks

(1) Manual operation method

Students manually send instructions and transmit them to the airborne computer through the uplink channel, and control the attitude and flight trajectory of the UAV through the airborne flight control and management system. It is mainly used in the takeoff and landing stages.

(2) Automatic control method

In the automatic control flight mode, students can operate the UAV to fly automatically according to a pre-programmed program. The airborne flight control system independently completes the control of the flight trajectory according to the predetermined route specified in the program and the actual position of the aircraft given by the positioning system. When the UAV is performing long-distance flight tasks, automatic control is the main flight control method.

(3) Emergency return method

After the UAV takes off, for example, if the uplink and downlink channels of the radio data link are continuously lost for more than a predetermined time and other problems occur, the "emergency return" program is immediately executed automatically, returning to the takeoff location, landing and shutting down the engine. In case of emergencies, students send an "emergency return" instruction. After returning to the airspace above the takeoff location in the "emergency return" mode, if the data link is restored, it can be transferred to the "manual operation" mode, and the landing operation is completed in the "manual operation" mode.

6. Conclusion

UAVs have a simple structure, small size, low flight and maintenance costs, flexible use, and convenient carrying. They are an aerial remote sensing platform that integrates a variety of high technologies and are widely used in many application fields. With the rapid and booming development of the UAV market, UAV application courses will also become new courses. Introducing practical teaching can greatly mobilize students' initiative in learning. Through practice, students are inspired to think independently instead of just remembering the knowledge taught by teachers. They will continuously discover problems, analyze problems, and solve problems. It is one of the ways to cultivate high-level applied technical talents.

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