Research on urban applications based on the development of UAVs technology

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Abstract. With the continuous development of social economy, urbanization activities and urban three-dim ensional and integrated transportation network can achieve rapid development, and the high flexibility and ti meliness of UAVs are more widely recognized. Active development of UAVs to improve sustainable urban transportation and enhance urban green environment.

1 INTRODUCTION

Unmanned aerial vehicles (UAVs) are powered unmanned aircraft that can be controlled to perform various tasks. Recent years have witnessed the widespread use of UAVs in civil and consumer fields, such as public safety [1], emergency search and rescue [2], agriculture and forestry, plant protection [3], transportation [4], disaster rescue, meteorology, and aerial photography [5]. The multiple-rotor UAV is one such UAV model. The multiple-rotor UAV offers advantages over the fixed-wing UAV, such as vertical take-off and landing, low sensitivity to environmental conditions, the ability to hover at a fixed point for special operations, flexible manoeuvrability, and simple operation. The multiple-rotor UAV also offers advantages over the unmanned helicopter. [6,7], such as a simple mechanical structure, high structural reliability, easy upgrading and maintenance, and low cost. The rapid development of microelectronic mechanical systems and low-power high-speed processors over recent years has resulted in the public emergence of multiple-rotor UAVs with excellent performance, a small fuselage and flexible control.

The design of the foldable UAVs can change its structure to adapt to the current changing working environment. As a portable and mobile aircraft, it has strong flexibility and rapid response capabilities, and can meet the special needs of modern engineering, bridges and power construction. With the continuous development and progress of modern science and technology, the application of drones in the field of plant protection has attracted much attention. Drone plant protection has the characteristics of low damage to green plants and high pesticide utilization rate. More and more cities are using drones for plant protection operations, especially for pesticide spraying and fertilizer spraying. With the continuous economic development, the road conditions in cities are getting worse and worse, and traffic jams are a huge problem. This caused huge troubles to logistics personnel, increased the time of logistics transportation, and seriously affected the timeliness of logistics. UAV delivery of items can effectively change the current status of logistics transportation, which can save logistics delivery time and avoid a series of problems caused by traffic jams.

The application and development prospects of UAVs are explored in this paper by reviewing the state-of-the art of these vehicles for plant protection and logistics. Rotor crafts will develop in the direction of low power consumption, intelligence and high reliability. The application of artificial intelligence, modern navigation technology and flight control systems in the UAV field will realize autonomous decision-making and control of rotor UAVs in complex environments. Rotor crafts will play an increasingly important role in economic development and social progress.

2 APPLICATION ANALYSIS OF PLANT PROTECTION DRONES

Unmanned vehicles, drones and other unmanned equipment can be used for spraying chemicals and other

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greening operations, where the use of unmanned equipment has effectively improved the efficiency of urban greening operations. The developed UAV plant protection technology is less harmful to green plants and has high pesticide utilization rate.

Combining small plant protection drone solutions with urban greening work can effectively improve the efficiency of the implementation of related activities, while also reducing the possibility of human error, so that the economic efficiency of such work. The economic efficiency of such work can be significantly improved. However, in the process of application, it is necessary to analyze and solve the problems encountered in the implementation and future application measures, taking into account the basic application structure and advantageous conditions, so as to ensure that plant protection drones can be effectively used in urban greening work.

2.1 Plant protection drone application considerations

Drones working in hover mode to complete spraying or clearing activities over urban green areas have certain safety hazards, while aerial spray drift of pesticides and herbicides will be an environmental issue after plant protection drone work. Exposure to spray drifting pesticides and herbicides can negatively impact residents, livestock, and aquatic ecosystems. Safety is therefore the first issue to be considered and addressed in drone applications. Due to the special nature of urban greening areas, the use of existing spraying methods in urban greening coverage areas will result in long spraying times and uneven spraying. Therefore, how to improve the spraying efficiency and prevent the waste of drugs is an issue that must be considered.

Due to its complex and changing operating environment, urban greening greatly affects the flight accuracy and operation quality of plant protection drones, and even affects the flight safety of drones. Therefore, with the large-scale application of plant protection drones in urban greening, their performance in wind resistance and coping with complex environment is especially important.

2.2 Strategic Approach Analysis

2.2.1 Flight Technology Management

Urban greening teams need to pay attention to the training and control of flight technology. Plant protection drones are relatively powerful and need to refer to the high complexity of flight indicators. In the future, we need to strengthen the management of flight technology and increase the importance of training as much as possible so that plant protection drones can be scientifically applied to solve the problems of the disadvantages that exist in the greening process and ensure basic safety.

2.2.2 Technology Research

Strengthen the research of UAV technology, combine the Internet of Things and electronic information system, detect the real-time status of UAVs, and add key monitoring to UAV operation and UAV working area. Enhance the research on power and structure to meet the working demand of large load and high flight time. For various terrains and working environments, develop plant protection drones with high efficiency, convenient operation and high safety factor suitable for different greening blocks and irregular greening blocks.

2.2.3 Drug application studies

Strengthen the research on drug application, analyze the drug ratios and the economics of carrying the amount of drugs through scientific experiments, improve the ability of the sprayer to deliver and distribute liquid in real time through technical research, and achieve precise maintenance to ensure that the drone device can be ideally applied to improve the maintenance of urban greenery and avoid biohazards to the surrounding environment.

3 RESEARCH ON THE APPLICATION OF LOGISTICS DRONES

Continued economic development is deteriorating road conditions in cities, and traffic jams have become an enormous problem. These conditions have created significant challenges for logistics personnel, increased the time for logistics transportation, and critically affected the timeliness of logistics. Therefore, UAVs have started to be employed for delivering goods to improve logistics transportation, thereby reducing delivery times and preventing a series of problems caused by traffic jams.

The development of logistics UAV has reduced the cost of logistics distribution. The application of logistics UAV has expanded the scope of logistics distribution and improved the efficiency of distribution. UAV has flight advantages, which can break through the restrictions of traffic congestion. At the same time, the continuous development of urban remote sensing and geographic information system (GIS) technology makes the logistics UAV have higher efficiency in urban logistics distribution and achieve safe and efficient urban low-altitude operation. [8]

3.1 The current problems of logistics drones

3.1.1 afety issues

UAV logistics is affected by the restriction of low altitude airspace. Due to the high population density and many high-rise buildings near the city center, the operation and take-off and landing phases of UAV logistics in the city have a certain impact on urban safety. At the same time, the ultra-low altitude operation

of UAV logistics is also affected by many factors such as the protection of sensitive facilities and ecological areas. As the cooperative management mechanism of urban low-altitude space has not yet been established, the flight space of logistics drones in actual operation is constantly compressed. Under bad weather, especially under heavy rainfall, how to ensure the safe flight of logistics drones is also an important issue that needs to be solved.

3.1.2 Communication network construction issues

Logistics UAV development needs a solid communication and navigation system. Logistics UAVs need to collect and store aerial intelligence information such as urban terrain and update relevant weather information in real time when they are in operation. Ensure good communication network effect of urban logistics drones is one of the problems that must be solved.

3.1.3 Range and load capacity limitations

With the rapid development of cities, the scope of urban logistics drones is also increasing, and the needs of customers are also increasing, which to a certain extent challenges the endurance and load index of drones. Due to the weight and volume of the battery, the current UAVs cannot carry large batteries with high power storage in order to reduce the take-off mass of the airframe.

3.2 Strategic Approach Analysis

Further optimization of the drone design. The drone adopts a quadrotor design, which makes the device have a strong power system and an advanced attitude adjustment system to ensure that the logistics drone can operate stably in a more complex environment. Through the UAV mobile platform combined with the application of single sensors and the fusion of multiple sensors, the data collection of the surrounding environment is enhanced to realize the communication between itself and the external environment, and then the collected information is processed so as to achieve the purpose of safe distribution. Strengthen logistics drones combined with 5G technology innovation, so that the drone platform has a high-definition map transmission function to achieve ultra-long-distance real-time monitoring and improve the efficiency of drone mobile platform operations. At the same time, establish a 5G-based intelligent three-dimensional warehouse and smart vehicles to provide stable technical support for the last-mile distribution of logistics drones.

Further improve the scope of logistics UAV distribution to meet the demand of long-distance intra-city distribution. The research on the power performance of logistics UAVs should be strengthened, and the development of new power batteries should be strengthened. At the same time, the power performance of logistics UAVs can be enhanced through the combination of different energy forms to improve the endurance of logistics UAVs.

4 CONCLUSION

The UAV and related technologies discussed in this paper present significant advantages as well unresolved technical challenges.

The modern chemical industry, bridges, electric power construction and other fields present unique operational environments. UAV operation is usually more difficult for these applications because of the harsh geographical and dangerous working environments involved. The inability of low-load and short-endurance UAVs to meet the needs of various industries has created an urgent demand for large-load and long-endurance UAVs. The ordinary quad-rotor UAV has a low payload and short endurance, which cannot meet modern operational requirements. Heavy-duty-rotor UAVs can provide a new platform in special environments for carrying operation equipment. Long-endurance operation can effectively improve operational efficiency. In addition, the heavy-rotor UAV has important application value to the fields of plant protection, express delivery, rescue and disaster relief.

The widespread use and development of plant protection drones has improved the efficiency and quality of work in actual urban greening production. The rapid development and effective processing of big data has affected various industries, including effectively improving the indexing and processing speed of large-scale data from plant protection drones. This saves manpower and material resources.

Integrated navigation will be the main application mode of navigation technology in the future. Accurate navigation is the core premise of many precision agriculture technologies. Integrated navigation technology is key to the application of plant-protection UAVs. Integrated navigation technology can be used to provide precise positioning and accurate navigation for the operation of plant-protection UAVs. Integrated navigation technology considerably improves the navigation and positioning of plant-protection UAVs, for which safe flight operation is ensured through precise operation and control. Integrated navigation technology also provides accurate positioning, improves operational efficiency and provides accurate delivery for logistics UAVs. At the same time, technological innovation is emerging. The development and application of sensor and embedded technology, low-power communication and big data analysis provide the possibility to realize more intelligent UAV services. [9] The breakthrough of artificial intelligence technology that integrates massive amounts of Internet of Things data provides opportunities for the realization of intelligent applications including intelligent identification, intelligent management and intelligent decision-making. It can realize the rapid response and reconfiguration of the drone.

Drone technology has developed rapidly. At present, drones are beginning to play an important role in

logistics, plants, and search and rescue. This article discusses the current UAVs applications and main research areas. In self-designed and commercial markets, UAVs components have been modularized. Integrated navigation technology is a key technology in UAVs applications. The multi-module UAVs combination method can integrate the key technologies of UAVs applications and use them efficiently, which is the main development trend now and in the future. By following a more standard UAVs module component list, manufacturing a specific UAVs is no longer difficult. [10] In this way, the performance of commercial products becomes cheaper and more standardized. The current limitations of drones will also be resolved in a more effective way. Extending the life of UAVs, improving the autonomous navigation capabilities of UAVs during missions, and increasing the payload capacity will be the focus of future research to address these limitations.

UAV will develop in the direction of low power consumption, intelligence and high reliability. The application of intelligent computing and the progress of modern technology will enable autonomous decision-making and autonomous control of UAVs in complex environments [11]. The improvement of power performance will make the UAV have longer endurance and stronger carrying capacity. At the same time, excellent UAV flight control system can ensure stable flight along the planned route under complex conditions. The application of integrated navigation technology can enhance the practicability of plant protection and logistics UAVs [12]. Aiming at the logistics UAV distribution scenario in the urban environment, the route planning model algorithm is used to avoid obstacles, find the optimal flight path, and deliver the transported goods to the destination on time, accurately and safely, so as to realize the intra-city distribution within half an hour, saving 3.4% energy consumption compared with the traditional shortest path scheme. [13] The rapid development of modern technology will make UAVs play an increasingly important role in economic development and social progress.

5 CONSENT FOR PUBLICATION

The authors agree to publish.

6 CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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