

# Research on UAV Campus Patrol Monitoring System Based on Deep Learning

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**Abstract:** With the sweeping of the age of science and technology, science and technology has developed rapidly in China. As a common monitoring system, drone technology has attracted more attention. Nowadays, with the continuous improvement of drone technology, campuses have also begun to introduce drone technology for patrol monitoring to ensure students' safety.

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As the country pays more and more attention to youth education, many colleges and universities have implemented closed-type residential learning management, not only providing students with a good educational environment, but also protecting students' clothing, food, housing and transportation. However, in recent years, campus violence has occurred frequently, and the safety of students at school has become the attention focus of parents and the community. In order to ensure the safety of students, the school introduced drone monitoring technology. The research on UAV campus patrol monitoring system was discussed and analyzed in this article based on deep learning with the advantages and application places of UAV security listed. The details are as follows:

## 1 Advantages of UAV technology in campus

Unmanned aerial vehicle (UAV) technology has the automatic positioning function to patrol and monitor the school and the surrounding of the campus for 24 hours, which can comprehensively cover every corner of the campus and strengthen the safety of students. The advantages of UAV in its security monitoring work are as follows:

### 1.1 Intelligently choosing best angle of recording

The UAV monitoring is more flexible compared with traditional fixed monitoring. It can automatically select the best angle for recording during the monitoring process, effectively avoiding the problem of fixed monitoring. It also can clearly record evidence of campus violence, campus bullying to avoid potential tragedy<sup>[1]</sup>. With the 24-hour surveillance of the UAV, you can record all conditions in the school, once something happens, the control teacher in the control room can respond immediately, eliminating campus violence or emergencies from the source.

### 1.2 Monitoring developments

Unlike traditional fixed surveillance, the UAVs shoot vertically, so that the situation above can be better monitored, and the situation of campus conflicts can be monitored in real time to avoid unnecessary casualties. The small and flexible UAV is monitored at high altitude, which can prevent malicious damage. In this way, you can understand the causes and consequences of things more safely and comprehensively.

### 1.3 Broadcasting in real time

Reporting the real-time status of the activities and relaying them to the command staff to provide them with clear and effective pictures during large-scale activities.

## 2 Structure of UAV security defense monitoring system

The UAV security defense monitoring system is composed of UAV camera, remote sensing system background and wireless mobile communication technology. The UAV surveillance camera monitors in high altitude, and transmits the captured pictures to the remote sensing system background with the help of wireless network facilities. Finally, the operator will issue instructions to the UAV through wireless mobile communication technology to guide operation of it<sup>[2]</sup>.

### 2.1 UAV

The UAV camera is mainly composed of the aircraft body and flight control, navigation, power, power supply, data link, high-definition camera and global positioning seven major systems, the UAV structure composition diagram is showed in Figure 1. Among them, the flight control system is similar to the "brain"

of the UAV, and the leader of the entire drone system, directly affecting the flight stability and related data transmission of the command UAV. Ensuring timely and effective image transmission and the accuracy of data transmission at the same time.

The data link system is closely related to UAV remote sensing command transmission and information issuance, mainly including sending the related state parameters, video and image data collected by the UAV to the background, and then receiving the remote sensing commands of the UAV through the GSM, CDMA and LTE network, helping the UAV to adjust the position, altitude and speed<sup>[3]</sup>.

The UAV collects images through a high-definition camera system. The image collected by the flight camera is transmitted to the remote sensing background via a wireless network or stored in a memory card. The main task of the high-definition camera system is acquisition, and for the data link system is image transmission.

The application of GPS global positioning system in the UAV is to ensure the positioning of the UAV, facilitating the background operators to understand the location of the UAV. In this way, even if the UAV crashes accidentally, the contents of the aircraft body can be played back.

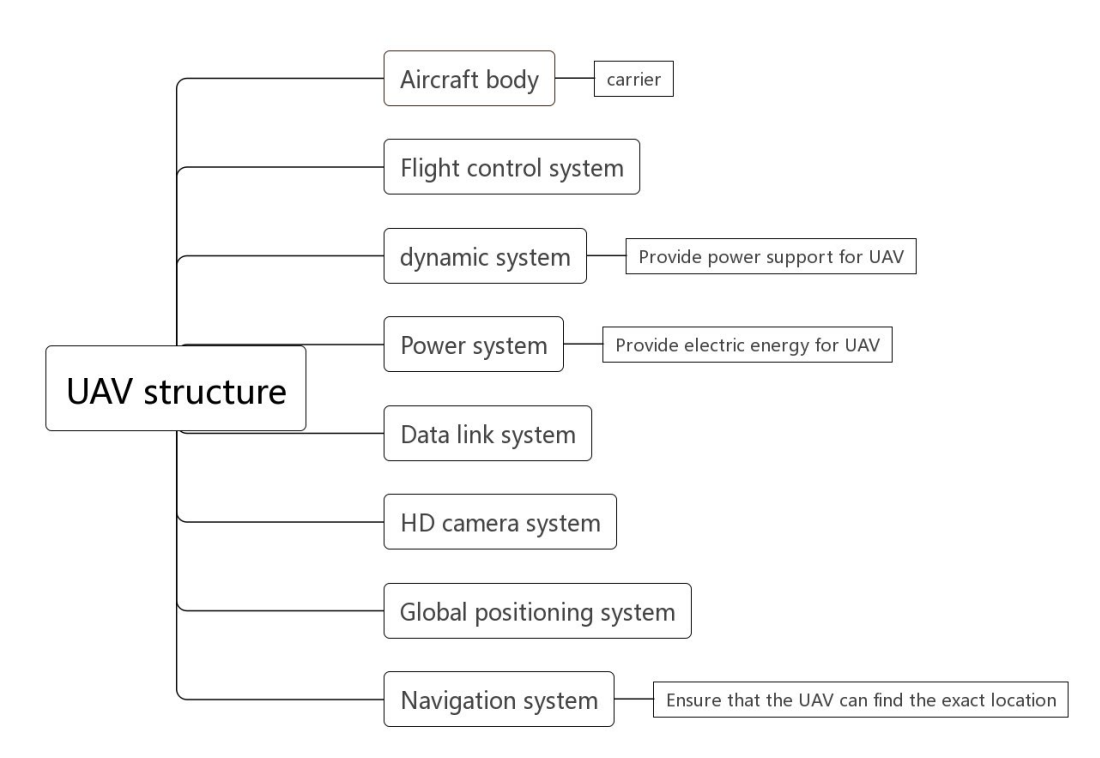


Figure 1. UAV structure composition diagram

## 2.2 Remote sensing system background

The most important work of remote sensing system background is to remotely control, receive graphic transmission and display the position of UAV. The remote sensing system background includes remote control system, mainly including the operator, control circuit, wireless data transmission station and remote sensing receiver, which are shown in figure 2. The UAVs can connect to the Android system, simplify the software control, and realize the automatic management. The staff can return the

image monitoring back to the background through the drone's high-definition camera, and reduce the amount of data for ensuring the picture quality in advance. At present, the background of UAV remote sensing system mostly uses MPEG-4 special coding chip to compress the image and generate MPEG-4 stream, which has real-time and reliability. The operator in the background can realize the position of the UAV through the 3D remote sensing of the background, so that the operator can know the running state of the UAV directly<sup>[4]</sup>.

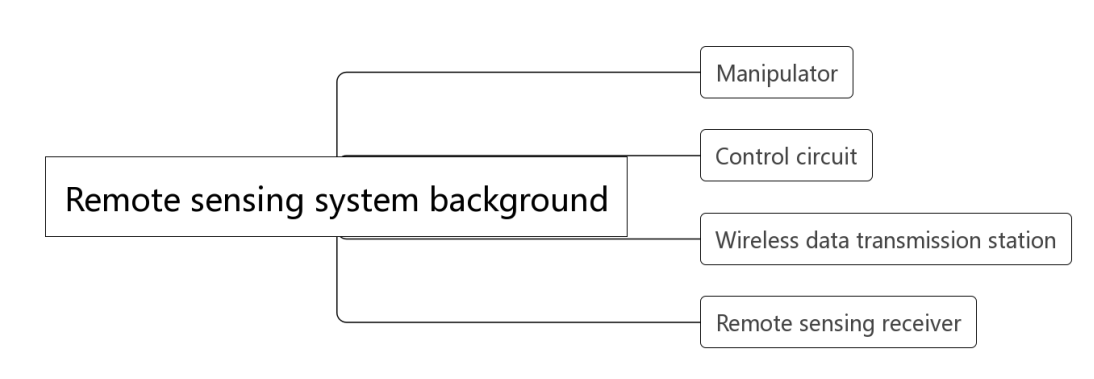


Figure 2. Background composition of remote sensing system

## 2.3 Wireless Mobile Communication

It's only through existing operators can we break the distance control because the UAV is controlled remotely by a 2.4 Hz radio signal. The network speed of existing LTE is very fast, the fourth generation mobile communication system network speed can reach 10 mbps-20 mbps, even 100 mbps, high-speed communication network can ensure high-definition image transmission, reduce transmission speed, make the information quickly respond to the background remote control system.

## 3 Application of UAV in campus security

As flexible surveillance system with a simple take-off and landing, the UAV has been popular in surveillance market for low risk and low cost<sup>[5]</sup>. With development and change of the UAV technology, the campus also starts to use the UAVs monitoring equipment, whose many functions are as follows:

### 3.1 Dealing with campus emergencies

It is the most important for security monitoring system not to be affected by time and space facing with the occurrence of emergencies. It can adjust and react at

any time. The UAV's security monitoring system can do it. In general, campus emergencies usually occur in the remote location that can be usually easily ignored. For example, positions are usually the dead ends of traditional surveillance which is difficult to shot by fixed surveillance. However, when the incident occurs, the drone surveillance can quickly respond, report real-time broadcast of it, collect on-site data analysis and timely feedback the scene of the development. The operators must be ensured to quickly find solutions to avoid campus accidents. Fixed cameras are extremely vulnerable to damage in an accident, while UAVs use high altitude super clean shooting, ensuring own safety while clearly recording what happened. These records can be used as valid evidence to reconstruct the truth in future and avoid misunderstanding. The UAV's high-definition camera is not affected by outside interference, and when it arrives at the scene of a crime, it can take wide-angle photos and record audio and video over a wide area combined with infrared thermal imaging function and visible light detection equipment to track and report the relevant personnel in real time, and transmit information such as the number of personnel and the items carried to the remote sensing background in time, help the operator make the response plan

timely.

### 3.2 Security for major events

When it comes to large scale school events, traditional surveillance equipment cannot cover all the cases because of the large number of people, whereas drone equipment can. The director can know the whole scene of the activity through the UAV camera and redeploy according to these circumstances. The UAV is small and highly stealthy, it can lock onto the target area from the air, track and report the number, density and direction of people on the ground, and shoot vertically at high altitude without blind spots, helping the operator understand the scene more intuitively and make the corresponding command and security measures.

If there are too many people at the activity site causing traffic congestion, the UAVs can upload data in time; making operators command the scene according to video evacuation.

### 3.3 Fire escape and extinguishing and emergency rescue

If a fire breaks out on the campus, the traditional fixed monitoring circuit will be destroyed and the monitoring system will not be able to work, but the UAVs have no cumbersome wiring problems. When a fire breaks out, the operator can view the fire, check the origin, and quickly evacuate students and teachers. By carrying monitoring sensors, the UAV can monitor the temperature of the campus walls, and detect the scene through CCT cameras and infrared thermal imaging in the air, you can also target focus areas for more detailed data collection while obtaining graphics and sound. The location of the fire school is then quickly captured with GPS, and the campus is alerted and monitored using a monitoring system combined with high definition photography and infrared photography. In the event of a fire or other danger, the UAV can quickly arrive at the scene to record and report back to the command center

for devise sensible remedies made by policy makers.

### 3.4 Road safety monitoring

Going to and from school is usually the rush hour of traffic near the school, so traffic safety is also taken seriously. At that time, schools can monitor the roads around the school with UAV equipment to master the road traffic condition, but it needs to contact the traffic department quickly for congested roads. Ask the security personnel and traffic police to cooperate, ensuring the students get to and from school safely.

## 4 Conclusion

UAV has been popular in school in recent years for the advantages of small size and convenient operation. It is recommended that each school introduce a drone monitoring technology to ensure the safety of students at school. Through the omni-directional 24-hour surveillance inspection, may effectively avoid the campus violence and so on malignant event occurrence. And it can also play good command role in major events or disasters such as fire. With the UAVs, students' learning safety factor will increase dramatically.

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