DEVELOPMENT OF OBSERVATIONAL SYSTEM WITH UNMANNED FLIGHT SYSTEM

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Abstract

The paper explains that authors developed the system to observe that the disaster areas from the sky. The system can be carried anywhere, and can meet various needs of observation such as real time measure of carbon dioxide emissions and radiation dose.
The system can fly till 250 meters high in the sky. Also, it can fly under the situation of blowing through the buildings. The video data that was observed in the sky can be confirmed at the devices on the ground.

1 Introduction

There occurred enormous disasters, such as earthquake and tsunami in Japan in recent years. The person and building are damaged because of the disaster. It is necessary to observe disaster areas to prevent damage being expanded, and to attempt early retrieval from the disaster.
Conventional observational system is the observation by manned helicopter and satellite. The observation by satellite in the condition of heavy weather isn't enough to show accuracy. The observation by manned helicopter when fly at a low altitude in the condition of heavy weather, became strong wind is very danger. So, the authors have developed new observational system with wireless control unmanned helicopter of disk type that has a rotor of eight as an unmanned flight system. The authors also had held field experiment on this system[1)].

2 The construction of the system

2.1 The summary of the system

The radio control helicopter was selected as an unmanned flying robot for the new system. Although a radio control airplane, a balloon, a kite, etc. were examined, the radio control helicopter, which can keep stable flight view with low cost, was found to be the best robot to correct information of the disaster area. The radio control helicopter is equipped with semi-automatic control (feedback control based on displacement of the yaw angle which a gyroscope unit detects) of the yaw angle. The authors also developed real time video data transmitting system through wireless LAN and equipped on the radio control helicopter. A summary of the system is shown in figure 1.

Fig. 1. Summary of observational system

2.1 The design of video data transmitting system

The video camera outputs an analog video signal while doing high vision recording. Next, this system encode analog video signal to digital internet video data and transmitting through wireless LAN. This system can show real time video images of disaster area to ground base station. When the disaster spot is away from the base station, it shows an effect by using long distance specifications access point and added loop antenna for base station. A figure of summary of the data transmitting system is shown in figure 2.

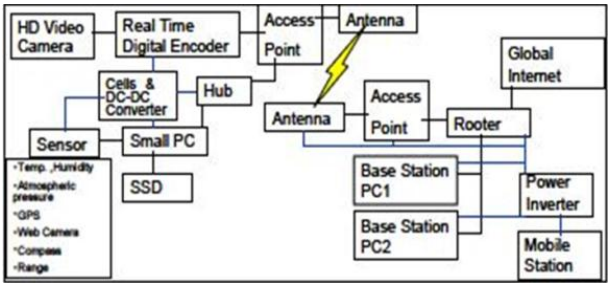


Fig. 2. Summary of the transmitting system

3 Production of hardware

3.1 The main body of unmanned flight system

The unmanned flight system developed by the authors is shown in figure 3. This helicopter has eight blushless motors. It is the disk type that have safety bar outside propeller[2]. The strain of the arm was equalized become to enclose as pull the safety bar. The safety bar was made of soft quality of material, there for it doesn't injure a person, even if this system knocked against the person. Also by effect of the outer frame of the disc-type structure the airflow is stably flows from top to bottom in the body of flight could be found wind tunnel test. Training is required in order to control but it is easier than conventional radio control helicopter.

Fig. 3. Developed unmanned flight system

The specification is shown in Table 1. There is a payload of about 1kg besides the main body of copter weight. It is necessary to produce video transmitting system weight within 1kg, and to equip it. The authors developed the unmanned flight system is unlike conventional radio control helicopter, it excels in lightweight and portable.

Table. 1. The specification

Diameter (mm)	1000
Overall height(mm)	400
Weight (kg)	2.0
A Pay Load (kg)	1.0
Power (mAh)	Lithium polymer battery 3300 (4S)
Flight Time (minute)	10-15
Flight Condition	Velocity of the wind 10 m/s or less

3.2 Production of the observational system

The unmanned flight system developed by the authors have base at the bottom body to place the observational device for meeting various needs of observation and collection of image information from sky. It is shown in figure 4. And, this system equipped with an infrared camera and color camera auto-switching CCD and simple transfer device of video data. The collection data can be confirmed on the monitor output from the receiving antenna. The simple transfer device of video data is shown in figure 5. A camera is shown in figure 6.

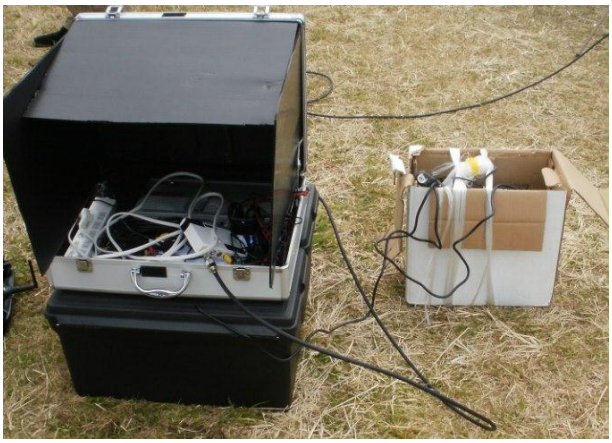
Fig. 4. Equipment part

Fig. 5. Simple video data transmitting system

Fig. 6. CCD camera

The monitor is carried anywhere with a battery. The receiving antenna is shown in figure 7. Also the developed monitor and battery is shown in figure 8.

Fig. 7. Receiving antenna



(a) (b)

Fig. 8. The monitor and battery of system. (a) monitor, (b) battery

4 Experiment of observation system

4.1 Operation experiment A

The authors were done operation experiment of the developed system in Taragi town Kuma-gun, Kumamoto, Japan in December 2010. In this experiment was to test the stability and handling of flight equipment. And the authors experiment the possible flight payload. The authors fix digital camera to the flight system, and we experiment what can be sent picture of taken CCD camera to the monitor. Appearance of experiment is shown in figure 9.

Fig. 9. Appearance of experiment in Kumamoto

4.2 OPERATION EXPERIMENT B

The authors were done operation experiment of the developed system in Tokyo, Japan in February 2011. The authors executed to operation experiment under special winds such as strong winds blowing through tall buildings. Appearance of experiment is shown in figure 10.

Fig. 10. Appearance of experiment under the strong winds blowing thorough the tall buildings.

5 Conclusion

The results of flight experiment can be summoned as follows. The system have payload of 1kg. The observational system was able to transfer images of taken a CCD camera in real time on the monitor. A real time image from sky is shown in figure 11. The observational system can collect of image information from position is higher than lighting of baseball ground. A real time image from sky is shown in figure 12. It can be stability flight under the situation of velocity of the wind 10m/s or less, and special winds such as strong winds blowing through the tall buildings.

Fig. 11. Real-time transfer of the video image

Fig. 12. The picture taken from sky

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