1 Introduction

Unmanned helicopters are used in various situations such as crop-dusting and remote sensing. In these tasks, hovering at a fixed-point or operation on a flight path is needed. However, it is difficult to control an unmanned helicopter correctly. One reason of this is that an operator can not know the position and attitude of the helicopter and the destination and flight path correctly intuitively.

In order to solve this problem, we proposed an immersive teleoperating system of an unmanned helicopter. Since an operator can control a helicopter remotely while watching the surrounding views of the helicopter through a head mounted display (HMD), the operation of the unmanned helicopter becomes easy and intuitive[1]. Presently, for correct operation of the unmanned helicopter, we are building a visual interface for an operator by superimposing annotations on the image. To verify the capability of this system, we conducted comparative experiment between conventional operation and proposed one using a flight simulator.

2 Annotation-Based Assistance System

Fig. 1,2 illustrate the overview of the annotation-based assistance system. In this system, an omnidirectional camera, a wireless video transmitter, a GPS, a gyro, and a PC with wireless LAN are mounted at the bottom of the helicopter. The captured video image and position and attitude data are sent to the operator during the flight. On the ground, a wireless video receiver picks up the transmitted image and it is converted into perspective images(Fig. 3), which is displayed on the HMD which the operator wears. The displayed image on the HMD changes depending on the head direction which is measured by the angle sensor attached to the HMD. Additionally, the information such as the destination, the flight path, the position, the posture of the helicopter is superimposed on the image and assists the flight operation.
3 Experiment with Flight Simulator

To verify the effectiveness of the proposed method, a task was given in both mode. The task
given to four subjects is flying over three markers placed in the environment, and returning to
a takeoff point. Fig. 4 shows the allocation of the standing point of the operator(A), the take-
off point(B), and the markers(C,D,E). In the conventional method, circular cones(diameter
1[m], height 1[m]) are used as markers, and in the proposed method, square poles drawn
wire frame(1[m] on a side, height 10[m]) are annotated at the same positions of the circular
cones(Fig. 5).

Since all subjects had no experience in operating a radio-controlled helicopter, the experi-
ments were conducted after making practice for 10 minutes in both modes.

4 Result

Flight paths of all subjects are shown in Fig. 6. All subjects are flying over the markers
more correctly in proposed method than in conventional method. Moreover, in the conven-
tional method, no subjects have passed the marker on D points. The reason is that point D
is far apart from the operator and the operator lost the sense of distance.

As a result, it turned out that all subjects are able to fly correctly when they used the
proposed method.

5 Conclusion

In this paper, an annotation-based assistance system for an unmanned helicopter was
proposed. To verify the capability of the proposed method, comparative experiments using a
flight simulator were conducted. The experimental results indicate the proposed method has
an advantage over the conventional operating method.

6 Reference

[1] Masanao Koeda, Yoshio Matsumoto, Tsukasa Ogasawara, ”Development of an Im-
mersive Teleoperating System for Unmanned Helicopter”, Proceedings of 11th IEEE Int.