2014 IEEE International Conference on Robotics & Automation (ICRA)
Hong Kong Convention and Exhibition Center
May 31 - June 7, 2014. Hong Kong, China

A Flying Saucer Lifted with Coandă Effect

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***Abstract*— In this work, we present a flying saucer, a kind of unmanned aerial vehicle(UAV), lifted based on Coandă effect. Coandă effect is an interesting fluid dynamic phenomenon that the interaction between the flow and curved surfaces produce attraction, which results in the lifting of the object. The flying saucer adopting Coandă effect is easy to hover while keeping its posture stable, and vertical take-off and landing(VTOL) is possible. Its design procedures via optimization and manufacturing procedures are explained in details, and the preliminary tests in the indoor and outdoor are successfully demonstrated.**

I. INTRODUCTION

Unmanned Aerial Vehicles(UAVs) are one of hot issues in the study of aerial robots. Especially demands on monitoring for military use and disaster areas have been increasing rapidly. Therefore rotorcrafts are needed for them.

There are several types of rotorcrafts, such as helicopter, quadcopter. However, these types need more than two rotors to control their attitude and direction. On the contrary, the flying saucer lifted with Coandă effect needs only one rotor. It means the saucer can have smaller fuselage and needs less power consume[1-4]. In this paper, the flying saucer UAV was designed and developed with reasonable process.

II. BACKGROUND

Coandă effect is a phenomenon that flow and curved surface attract each other when the flow run on the curved surface. The force that the flow pull the surface of flying saucer can be called lift force. By this process, suggested UAV can fly. Moreover, the flow also control attitude and direction of the flying saucer with flaps and fins. Controlling attitude provide stable posture, hovering and vertical take-off landing(VTOL).

III. DESIGN

The flying saucer has curved surface for lift force from Coandă effect. Flow that is generated by an electric motor and a propeller run on curved surface of the flying saucer through a duct that makes better uniform flow.

A precondition of good surface is laminar flow keep to end of curved surface. To determine optimized design of the surface, computational fluid dynamics(CFD) simulation was done. From the results, horizontal and vertical length of curved surface are 160mm and 140mm.

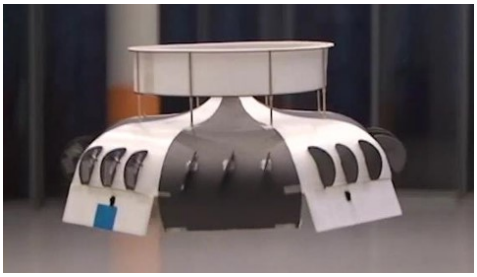

Fig. 1. A flying saucer UAV

The flying saucer has 4 flaps to control pitch and roll. Also, it has 24 fins to control yawing. Flaps and fins are operated by servo motors. Each flaps and fins are feedbacked by gyro sensors to stable its attitude. In case of manual control, fins and flaps are operated by remote controller.

IV. EXPERIMENTS

A manufactured flying saucer UAV consists of several materials as shown in Fig. 1. First, frame of the saucer was made of balsa wood, because of UAV's weight. Second, material of curved surface is expanded polypropylene(EPP). The reasons that the EPP was chosen are its lightness, elasticity and smooth surface.

In field, the flying saucer UAV was tested. It worked normally shown as attached video. It can hover with stable attitude and be controlled as users wanted.

V. CONCLUSIONS

In this paper, flying saucer unmanned aerial vehicle(UAV) was developed through reasonable design process. Also its normal operations were confirmed. In the future, the flying saucer UAV will have more suitable specifications and functions for front field UAV as outcome of research of our team.

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This research was supported by the MKE (The Ministry of Knowledge Economy),Korea, under the Next Generation Robot Actuator/Sensor Research Center support program supervise by the NIPA (National IT Industry Promotion Agency) (H1502-13-1001).

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