Title

Establishment of Automatic Information Gathering and Providing Systems
by Using Autonomous Blimp Robots

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全体要旨（英文）

Since the Great Hanshin-Awaji Earthquake in Japan and the 9.11 Terrorism in the US, the rescue robot is recognized to be very important and various researches are proceeding around the world. As the Great East Japan Earthquake occurred, the Japanese archipelago has entered a period of brisk seismic activity and we have to prepare as soon as possible. Especially, 72 hours are very important period after an earthquake for survivors to be rescued and automatic information gathering systems are required to obtain the details of the struck areas because of quick analysis of the situation and rapid rescue planning. Therefore, the objectives of this research are the development of an autonomous blimp robot which can fly safely in the low altitude and low speed, the establishment of the information gathering system which consists of rotational stereo camera and 3 dimensional laser scanner with single camera.

Autonomous flight control systems of a blimp which are suitable for various wind conditions were proposed supposing that the following flight procedures 1) Take-off, 2) Hovering, 3) Flight, 4) Hovering, 5) Landing. This is because a blimp has much effect against wind. We confirmed the proposed systems have good control performance by a blimp flight simulator and real experiments using a 12m length outdoor blimp. Especially, we developed a new control methodology where the coordinate of the blimp is transformed from ground to wind although the wind speed 5m/s is a border to control a blimp. This transformation yielded very nice performance under the strong wind. These control methods including the automatic take-off and landing, and backward flying from the ground view are the world first and very original.

Before real experiments, simulation which uses a blimp simulator is very important. We modified the blimp simulator which was originally developed by JAXA (Japan Aerospace Exploration Agency) to match the simulator's property with the real blimp robot. By tunnel experiments and field experiments, we obtained aero dynamics of the blimp. We also obtain a next blimp design as a real application.

As described above, the platform of information gathering systems, that is the blimp, was almost completed. The blimp can fly in the low altitude and low speed compared with the other aircraft like airplane and helicopter. We developed two information gathering equipment to utilize this property. One is rotational stereo camera and the other is 3 dimensional laser scanner with single camera. We proposed new methods which create a 3D model of a disaster scene using these devices. The 3D model can be easily implemented in GIS (Geometry Information System) and is very useful to understand the disaster area conditions to look at arbitrary areas from arbitrary angles.