INTRODUCTION
This paper presents our design of blimps for interactive media and arts. Blimps have been utilized as aerial media for a long time. However, their form has not yet changed and it is still static. We propose blimps as a platform of interactive media and arts which people could actively participate in and produce their own representation with.

We have developed two prototypes of blimps: one is the open architectural outdoor blimp [9] and the other is the interactive blimp controlled by voice via mobile phones. The prototype system of the interactive blimp controlled by voice via mobile phones could expand with internet, and OSC interfaces such as musical instruments. We plan to hold an installation where people control the movement and the light of blimps in a dark room via mobile phones and internet [10].

BLIMPS FOR MEDIA AND ARTS
Blimps have been utilized for media such as aerial advertising [8]. They are also used in some artworks. Our research focuses on designing interactive blimps as a platform of media and arts which would provide richer information and communication.

History
From ancient times, illumination in the sky such as blinking balloons has attracted people as media because it could be widely looked at and implies communication beyond a great distance [5]. The first advertising balloons appeared at the end of the 19th century. The advertising messages were directly written on the surface of the balloons [8]. Blimps were also used for media in the 20th century. They were in the form of flying blimps with pictures drawn on their envelopes. The blimps attracted people as media because they were large, slow, and rare.

Traditional Static Media
Most aerial media are currently in the form of flying blimps with pictures drawn on their envelopes. This form is same as it was when aerial advertisements began. It is still static and one-way communication. People could not actively participate in the aerial media. Some blimps are embedded with electrical displays (e.g., Lightships, http://www.lightships.com) and could show videos in the sky. However, they are also static because people could only watch them and could not participate in or affect the media.

RELATED WORK
There are some projects focusing on interactive blimps. Through Vivarium Project at MIT Media Lab, Alan Kay’s research group developed an autonomous blimp that follows a flashlight. Autonomous Light Air Vessels (ALAVs) [2] is a project where blimps flock and roam for lights like creatures. They also interact with people through conversation via mobile phones. People get into conversation with system, and could affect the movement of the blimps. “ProP: Personal Roving Presence” by Paulos and Canny is a project where
people remotely control blimps embedded with camera and microphones through internet [7]. It allows the pilots to feel as if they are traveling in the air. Knowbotic Research exhibited an installation "Naked Bandit/here, not here/white sovereign" [4]. In this installation, people control a blimp using physical controllers to attack targets with it. In one side of these projects (Vivarium and ALAVs), blimps are designed as creatures. People could observe and enjoy the autonomous blimps like their pet. In the other side (PRoP and Naked Bandit), blimps are designed as agent robots. People could pilot the blimps as if they were on board. Our approach is to design blimps as a platform of interactive media and arts. People could produce their own representation with the blimps.

There are also some projects which people could actively participate in using mobile phones and produce a kind of representation with. Sky Ear [3] is an installation in the night sky with a non-rigid balloon structure like cloud. This “cloud” consists of one thousand helium balloons with LEDs and several mobile phones. People dial into these mobile phones and then the light of balloons reflect the change of the electromagnetic field. Akarium Call [1] is an advertising project for the anniversary of famous street illumination. People could change the color and brightness of huge illumination using voice via mobile phones. Mobile phones allow them to take part in the performance without any preparations.

IMPLEMENTATION
We built two prototypes of blimps. Prototype 1 is a Radio-Controlled (RC) outdoor blimp developed with open architectural approach [9]. Prototype 2 is an indoor blimp with which people could interact using voice via mobile phones.

Prototype 1: Open Architectural Outdoor Blimp
We built a RC outdoor blimp developed with open architectural approach (Figure 2). Open architectural approach means that no special material nor process are necessary to build it. The blimp was built with RC airplane parts and hobby kite parts. The blimp consists of four small balloons so that it could be easily taken apart into parts. We have analyzed the dynamics of the blimp in supposed wind model and studied its flying stability against various wind directions.

Prototype 2: Interactive Blimp Controlled by Voice via Mobile Phones
We have developed an indoor blimp with which people could interact using voice via mobile phones (Figure 3). Words and non-verbal features of voice such as volume, pitch, and tonguing are used for the control. The blimp is embedded with Red, Green, and Blue Light Emission Diodes (LEDs). The blimp react to the voice with its movement and color and brightness of the LEDs.

Interaction
People could interact with the blimp through the control of the movement and the light of the blimp. The horizontal (i.e., forward/back and rotation) movement is controlled by the command of words. We employed two words: “Go” and “Spin”. When the system recognizes these words, the blimp moves during the following continuous voice (i.e., we say “Go, Ahhhh,” then blimp goes straight during “Ahhhh”). The vertical movement is controlled by pitch transition of voice. If the pitch of voice is going up, the blimp moves up. If the pitch of voice is going down, the blimp moves down. The light of LEDs reflects volume and pitch transition of voice. The brightness reflects volume. Tonguing is also represented as flashing. The color of the light changes continuously according to pitch transition. When the pitch of voice is going up, the color tinges with green. When the pitch of voice is going down, the color tinges with red.

System Configuration
Our system consists of hardware part and software part (Figure 4). Software part includes Audio Processor and OSC-Serial Translator. Hardware part includes blimp embedded with three propeller motors and LEDs, Arduino IO module (http://www.arduino.cc), and two XBee modules (http://www.digi.com).

The Audio Processor analyzes incoming voice. It calculates volume and pitch transition of voice and recognizes words. The Audio Processor sends the result of analysis as Open Sound Control (OSC) messages [5] to the OSC-Serial Translator. The OSC-Serial Translator translates the received OSC messages to serial messages, and communicates with Arduino IO module attached to the blimp. Arduino handles LEDs and motors according to the serial messages. Two XBee modules are used for the wireless communication between the OSC-Serial Translator and Arduino.
Observation
We have organized an initial observation with the system. It was held in a dim high-ceiling room. Two persons who are not well informed about the system took part in the experiment and observation. The horizontal and vertical movement was controlled by words and pitch transition. The light of LEDs reflected volume and pitch transition of the voice. They could control the blimp with non-verbal voice interface. However, word recognition sometimes had a problem because the voice through mobile phones and Skype included noises and latency. Filters for noises or another method than Skype would be necessary.

DISCUSSION
Our second prototype system (the interactive blimp controlled by voice via mobile phones) could expand with internet, and OSC interfaces such as musical instruments because OSC utilizes Internet Protocol (IP) as its basis (Figure 5). It would allow people to control the blimp with WiFi interfaces such as portable gaming consoles. People could also control the blimp using musical instruments or other OSC interfaces for performance.

CONCLUSION AND FUTURE WORK
This paper presented our design of blimps for interactive media and arts. In our design, people could send messages to blimps in the form of sound, gesture, and text message. Blimps react to the messages from people in the form of movement, illumination, and text message. We described our two prototypes: one is the open architectural outdoor blimp and the other is the interactive blimp controlled by voice via mobile phones. We also described the expanded system where people could interact with blimps using internet and OSC interfaces such as musical instruments. We plan to hold an installation where people control the movement and the light of blimps in a dark room via mobile phones and internet [10]. People could illuminate the dark room through interaction with the blimps. We aim that people eventually feel the two-way communication with the blimps and connection with others over internet. It would contribute to new aerial media and arts where people not only receive information but also actively participate in the communication.

ACKNOWLEDGMENTS
We would like to thank Gunze Limited for supply of plastic film HEPTAX. We also would like to thank the members of A.I.Lab at the University of Tokyo, Kazuhiro Jo and Kumiyo Nakakoji for valuable discussions.

REFERENCE