FRAGWRAP:
Fragrance-Encapsulated and Projected Soap Bubble for Scent Mapping

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Abstract

This paper proposes FRAGWRAP which maps scent to real objects in real-time. To achieve this purpose, we leverage fragrance-encapsulated soap bubble with projection mapping technique. Since human olfaction is known as combined utilization of his/her eyes and nose, we encapsulate fragrance into bubble soap to stimulate the nose and also project 3D image of the fragrance to the bubble soap in real-time. In this video, we present our first prototype which automatically inserts fragrance into a soap bubble and also projects images to the moving bubble. All system is activated by speech recognition.

Author Keywords
Scent Mapping, Projection Mapping

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

General Terms
Design

Introduction
Recently, projection mapping technique is widely used for not only for research area but also for exhibition or commercial use. Since project mapping can augment real

environment by changing its visual surface in real-time, it provides significant dynamic visual impact for users. Meanwhile, projection mapping is only for stimulation eyesight of human. Humans have five senses - touch, taste, hearing, eyesight and smell. Thus, augmenting our environment to stimulate not only eyesight but also the other four senses is very important, and may also promise many applications.

In this paper, we propose scent mapping for stimulating smell part of five senses by mapping scent to real objects. Scent is known as the most difficult sense to express by words. If scent mapping is achieved, it will be most intuitive way to transfer smell information to the real world. In addition, olfactory perception has a strong function to provoke memory compared to the other senses [1]. Thus, scent mapping is also useful for changing users' emotion. For the first approach to realize scent mapping, we propose fragrance-encapsulated soap bubble with projection mapping. In this paper, we present the concept and hardware/software implementation. We also provide future vision of scent mapping by fragrance-encapsulated soap bubble with projection mapping.

FRAGWRAP: fragrance-encapsulated soap bubble with projection mapping

The section presents concept of FRAGWRAP by fragrance-encapsulated soap bubble with projection mapping. The sense of smell is mediated by specialized sensory cells of the nasal cavity of vertebrates, which can be considered analogous to sensory cells of the antennae of invertebrates. The olfactory ability basically consists of two systems. The main olfactory system detects volatile chemicals, and the accessory olfactory system detects fluid-phase chemicals. Thus, FRAGWRAP should map chemicals which is the source of scent of the real objects.

In addition, we consider scent is also related to eyesight. Since humans receives eighty percent of surrounding information by eyesight, providing scent with visual information can drastically clarify the kind of scent. Therefore, we define the requirements of FRAGWRAP as the following:

- Adding a chemical, which is the source of scent, to a real object

- Adding visual information which relates to the scent of chemicals

To achieve these requirements, we focused on soap bubble. Soap bubble is easily created, and it can encapsulate air or smoke. The idea of our first prototype is to add flavored-air into the soap bubble. In addition, we project images related to the scent to the soap bubble. Figure 1 shows the system architecture for fragrance-encapsulated soap bubble with projection mapping. Scent-mapped soap bubble is generated by combining scent inserter, smoke generator, depth camera and projector. Soap bubble itself has a little bit scent, but when the user breaks the bubble by touching it, users can scent an ever stronger flavor. We consider that characteristic of soap bubble is useful for further interaction with fragrance mapped objects.

Prototype Implementation

We implemented a prototype of Fragwrap. The prototype system is mainly composed from soap bubble generate module and projection mapping module. In addition, we created a prototype to interactive with our system by using voice recognition technique.
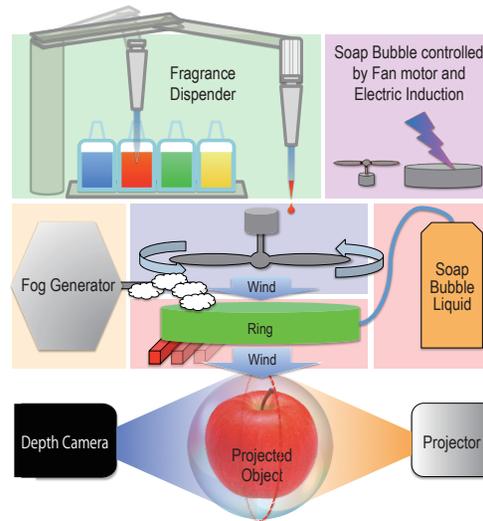
Figure 1: System architecture of fragrance-encapsulated soap bubble with projection mapping

Fragrance-encapsulated Soap Bubble

We designed and implemented a prototype of fragrance-encapsulated soap bubble generator. The overall system is presented in figure 2. The system is mainly composed of two modules: fragrance inserter and bubble generator. Fragrance inserter intakes chemicals as scent sources, and blends it into smoke which is then encapsulated by soap bubble.

Figure 3 shows hardware components of COC:Central Operation Center for fragrance-encapsulated soap bubble. It includes smoke sender, smoke generator, soap buffer, temperature controller, and fan motor. In addition, there is a speaker to announce soap bubble information as well as a main controller to control all of the components in

bubble generator. We also implemented a prototype for controlling soap bubble. We leveraged electrostatic induction and air current created by a fan for controlling the bubble. If we can control soap bubble precisely, we consider that scent-mapped soap bubble display can be realized.
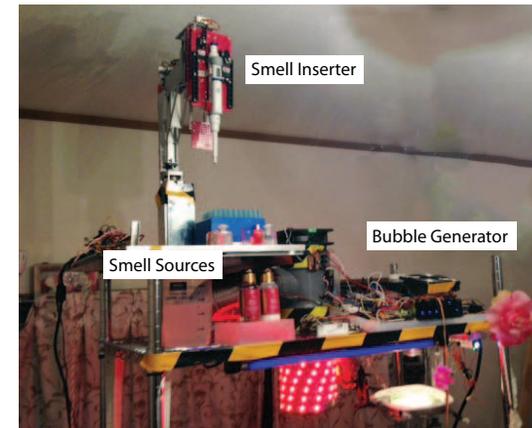

Figure 2: Overall system of Fragwrap.

Projection Mapping

We also implemented a prototype system which projects 3D images to a floating soap bubble. To detect the movement of soap bubble, we utilized RGB and depth camera (Kinnect by Microsoft). We implemented location and form detection with Processing. According to the detected location and form of soap bubble, the system projects a modified image in real-time. Since Processing is busy for detecting location and form, we created 3D image by Unity3D. Processing and Unity3D is coordinated by OSC (Open Sound Control) protocol. As a result, the system creates scent-mapped soap bubble as shown in figure 4.
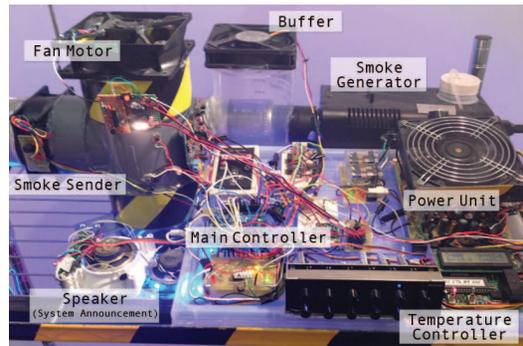
Figure 4: Generated scent-mapped soap bubble.

Figure 3: COC: Central Operation Center.

Interactive System Activation

We used Julius library for speech recognition. This can be a triggered for launching the soap bubble. Thus, once specific keywords are recognized, processing can deal with and transmit to OSC and connect to Arduino by serial, which then activates the dispensing machine and soap bubble system.

Related Work

There are some works which uses bubble for interaction [3, 2]. Bubble Cosmos [2] produces real bubbles containing white smoke and projects CG images onto them. When users break the bubbles, they produce changes in the visual stimulus and sound effects. There are many related works and challenges for projection mapping. For example, LightSpace [4] leverages depth camera to detect both spatial information and users' gesture, which is then incorporated into projection mapping that the user can interact with. Meanwhile, as far as our knowledge, standard technique or research of scent mapping has not been addressed.

Conclusion

We propose the concept of scent mapping, which maps scent and visual information to a real object. To realize the concept, we presented Fragwrap, a fragrance-encapsulated soap bubble with projection mapping. For future work, we target to enhance the accuracy of each function in the system and provide several applications which stimulates our life.

Acknowledgements

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