NanoAR: Mobile AR Application with Microscopic Interaction

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1. Abstract

We propose a novel mobile AR (Augmented Reality) application that uses a microscopic interaction prototype called NanoAR. A user can view the AR content using a USB or an iPhone microscope via NanoAR. The objects that the user can view using this application are related to the magnification rate; in other words, the application resembles a microscope in the real world. This indicates that a user can view two different objects on the same spot of the paper.

In our previous project *MicroAR*, we used the metaphor of familiar actions in order to view small objects in the real world, such as the use of a magnifying glass. This makes the AR tool more natural, leading users to concentrate on the AR world more deeply and easily. NanoAR is the developed prototype of this concept.

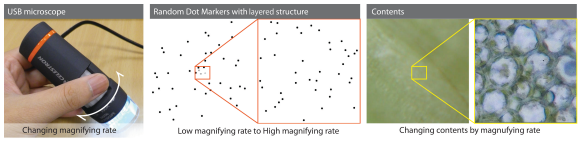

Figure 1. *Conceptual model of layered structural random dot marker and the contents*

2. Description of Our Work

Interaction: We propose a novel mobile AR (Augmented Reality) application from the viewpoint of interactivity. The concept of NanoAR is similar to that of *MicroAR*[4]. In *MicroAR*, we applied the metaphor of familiar actions to the AR application. Originally, AR technology allowed us to view objects or information that we were unable to view with the naked eye or without imagination; however, conventional AR applications focus only on visualizations of the objects or information. By applying the meataphor of familiar actions in *MicroAR*, We added extra value to AR application, which can ignite the imagination of users. As human beings, we have the ability to imagine invisible things and liken one object to another (e.g., children use a stick as a horse while playing)[2]. Since childhood, we are able to enjoy more immersive and creative "play" of this kind by using our imaging ability. IOur imaging ability plays an important role in the concept of our AR application. A user can liken NanoAR to a real microscope. NanoAR further ignites a user's imagination by changable AR content, and it can be used to perform tangible actions by varying the magnification rate.

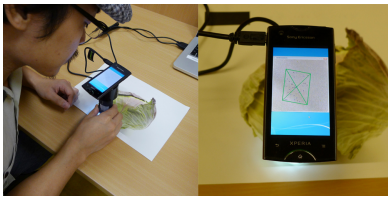

Figure 2. *The scene showing the use of NanoAR*

Hardware: NanoAR can be implemented by using certain hardware such as a USB or an iPhone microscope, paper media, and a random dot marker[4]. In *MicroAR*, a traditional black/white marker can be viewed by the naked eye. However, some users were of the opinion that it was very easy to detect the content. As a solution to this problem, we implemented *Random Dot Markers*[5]. The implementation of a *random dot marker* provided two advantages to our application. (1) The dots made by using the marker can be nearly invisible to the naked eye. (2) The dots can be layered (see Fig1). Owing to advantage (1), the system can be similar to a natural feature detection AR system. Moreover, it can function in low performance devices such as a smartphone and a tablet. Advantage (2) enables microscopic interaction using the NanoAR. We performed some experiments for improving the detection of extremely small dots made using the *random dot marker*. From the results, we found that the position of the dot should correspond to the nozzles of the printer. Otherwise, the shape of the dots collapses and results in blurring (see Fig3). We designed an experimental grid that is divided into 300 dpi in order to determine the position of the dots. After the experiment, the square area of the *random dot markers* was smaller than 3 mm × 3 mm. As a result, most users did not notice the position of the markers. NanoAR will surprise users and encourage their desire of finding something in the paper media.

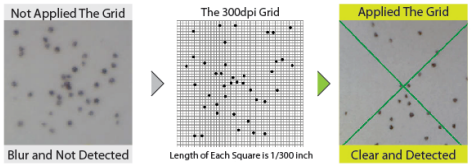

Figure 3. *The grid and its result*

3. Future Work

Currently, our program can display only 2D content. As future work on this technical topic, we intend to build a new program that is enabled to display 3DCG, which would further impress the users. We also intend to make practical application of NanoAR. NanoAR can be utilized for discovery learning, e-learning, and mobile learning.

Reference

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