

Augmented Reality Cooking System Using Tabletop Display Interface

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Abstract—Cooking is the theme that causes interest to everyone as element that is essential in life. Everyone try to cook, but fire and knives are dangerous to handle for children. So children are felt difficult to cook directly. In this paper, we describe about development of cooking system that gives imaginary cooking experience to children. Our cooking system consists of two major technologies (Augmented Reality, Tabletop display) that can interact with user. Using augmented reality technology gives to user more arresting and accessible virtual cooking environment. Using tabletop display that provides multi-touch can provide interaction between user and the cooking system effectively.

Index Terms— Augmented Reality, Cook, Education, Virtual Reality

I. INTRODUCTION

Cooking is subject that excite interest to anyone as action that cook food that is essential in the life. People like delicious food and want to cook with their own hands. In the case of children, because it is dangerous to handle fire or knife in cooking, there is difficulty to cook food with their own hands. Augmented reality cooking system that uses tabletop display is a virtual cooking application for children. Cooking system developed in this paper is applying an augmented reality technology to overlap 3D graphic objects to real world image. So it is more realistic than a normal 3D virtual environment system. Our system uses tabletop display interface that can support multi-touch and multi-users. So we are able to provide intuitive interface for the users and computers.

II. COMPOSITION OF COOKING SYSTEM

A. Configuration of whole system

Hardware of the system is consisted of the miniature kitchen set and a tabletop display. The miniature kitchen is the place to put cards that express kitchen stuff, ingredients and etc. There is a marker used to make augmented reality on Cards and Our system recognize it to demonstrate augmented reality. Tabletop display shows augmented reality image of cooking system on the screen. The user can interact with both tabletop display and miniature kitchen set. Figure 1 shows the overview of our cooking system.

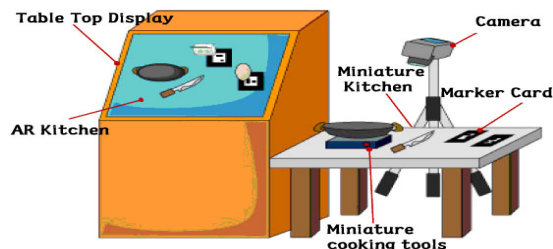


Figure 1 overview of cooking system

B. Interaction system

In the case of general augmented reality system, usually, interaction depends on marker. Generally markers are used as button or manipulator. “3D Pottery Modeling in Augmented Reality [2]” shows such cases. But marker dependent system is affected by camera view and there is restriction that the user must operate the system using real objects like marker. In this way, state of food changes continuously accords to progress of the cooking in the system, so it is impertinent to give interaction by markers which display cooking ingredients. We want to reduce these problems. We use tabletop display to reduce markers dependency and to directly access the augmented reality objects. So we are able to intuitively manipulate augmented reality objects. Our system analyze hand gesture by three steps: hand gesture, command and event. In our system, hand gesture meaning is input that hand touches the tabletop screen.

Tabletop display can provide rich and intelligent interaction through analysis of the touch input [3, 4, 5]. We analyze gesture and create interaction system to use special quality of tabletop display. So our system analyzes and distinguishes hand gesture’s meaning in tabletop display and concludes suitable result. Hand gesture analyses have three main steps that are hand gesture, command and event. In tabletop display, hand gesture is the input generated by hand fingertip touch on the tabletop’s screen. Command is specific meaning that is created by analyzing hand gesture. Event is the result that is produced by analyzing command in our cooking system. Advantages of our hand gesture analysis are as following. First, one hand gesture can used for various interaction interfaces because one hand gesture can be differentiated and variously analyzed by various command according to situation. Second, we can attempt organic composition of the commands and can compose suitable interaction system.

III. FRENCH TOAST COOKING SYSTEM

In this paper, we select "French toast" among various kinds of recipes and compose system. Because French toast is popular food for children and its making process is simple. Process to cook French toast is just roast bread that soaked in mixed egg and milk liquid. So we thought that French toast is suitable for our research. Figure 2 shows French toast.



Figure 2 French toast

A. Kitchen stuff and ingredients of cooking

Table 1 shows Kitchen stuff and ingredients of French toast.

Table 1 kitchen stuff and ingredients of French toast

Main material	Bread, egg, milk, salt, strawberry jam
Sub-material	Sugar powder, Oil, butter
Kitchen stuff	Fry pan, vessel

In this way, to make process simple, we omit sugar powder that is not important between these materials and butter that is putted on the fry pan. We use only important materials that are bread, egg, and milk. Finally we create markers to represent the materials.

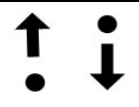
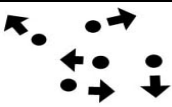

B. French toast manufacture by interaction

French toast is a cooking that is made through process of roast bread soaked in mixed egg and milk liquid. Necessary hand gesture, command and events are shown in Table 2. The "Break egg" command generates an event that changes the state of the egg object to "broken". The "Material mixture" command generates an event that changes state of the objects to "mixed" state. The "Fire on" command generates event that changes state of the bread on fry pan to "roasted bread". Cooking system is run by these gesture commands.



Figure 3 demonstration of cooking contents

Table 2 necessary hand gesture, command, and events

Hand gesture	command	events
	break egg	The egg is broken
First select egg and than up and down.		
	Material mixture	Egg and milk are mixed
Touch the bowl which has material several times.		
	Turn on Fire	Fire on and than roast the bread
One fingertip moves round after two fingertip touch the fry pan.		

IV. CONCLUSION

Our cooking system takes advantage of augmented reality technology and makes user experience cooking process. By using tabletop display interface, we can provide intuitive interaction. Children can imaginarily experience cooking as it is not dangerous to use our cooking system. In present state, we have developed the simple system for cooking. In future research, we will develop intuitive cooking gesture and handle various cooking.

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