

Cooking Support with a Robotic Agent —Mincing an Onion—

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Abstract: Cookbooks and cooking videos briefly teach cooks how to cook. On the other hand, their instructions are often unclear for cooking novices. In addition, they rarely take into consideration cook's safety. This research aims to provide the cooking novices with easy-to-understand and safe cooking instructions. To this end, we developed a cooking support system with a robotic agent, information overlay and ingredient recognition. The combination of these three elements enables to provide easy-to-understand and safe cooking instructions. In this paper, we introduce the cooking support system for mincing an onion.

1 Introduction

Cooks often cook with a recipe on cookbooks or cooking videos when they make a first-time meal. Cooks who have some cooking experiments can make it with only the texts and pictures, or videos. However, cooking novices cannot do the same because only the texts and pictures, or videos are not enough explanations for them. This is because they cannot imagine the correct way to cook due to the lack of cooking experiences. In addition, the cookbooks and cooking videos rarely take into consideration cook's safety.

The purpose of this research is to provide cooking novices with easy-to-understand and safe instructions. We developed a cooking support system with three novel approaches; a robotic agent, overlaying cooking instructions and recognizing ingredients.

2 Design of Cooking Support

It often happens that cooking novices cannot understand cooking instructions of cookbooks and cooking videos. This is because they leave out the concrete explanations. In addition, the cooking novices have to translate the context before starting cooking because a situation in the pictures or videos and a situation at hand are completely different. We look toward removing these problems for cooking novices in our cooking support. Therefore, we designed a cooking support system with a robotic agent, information overlay and ingredient recognition.

2.1 Robotic Agent

A robotic agent assumes a role like a cooking teacher. The role is to provide cooking instructions, receive directions, keep an eye on the cook and encourage the cook. The real robot on a cooking table enables not only to have a conversation without a sense of emptiness but also to provide cooking instructions utilizing

the embodiment of the robot. For instance, when the robot teaches the cook the ingredient or when there is a potential danger for injuries or burns, the robot points with a finger toward a needed ingredient or a dangerous place. The cook easily gets to understand the ingredient by the robot's action.

2.2 Information Overlay

Information overlay is a function to overlay cooking instructions over a cooking table and ingredients. This enables to directly show the way of cooking on the target. Therefore all the cook needs to do is to follow the presented instructions without the context translation. In addition, the safety of cooking is improved because the cook gets to keep an eye on hand.

2.3 Ingredient Recognition

Ingredient recognition is a function to recognize the position and the direction of ingredients on the table. This is used to judge the type of ingredients and adjust the position of the information overlay. This function realizes the automation of the cooking process. The ingredient recognition can reduce the cook's burden because this helps to translate the context on the table. This also contributes the improvement of the safety because the cook gets to keep an eye on hand.

3 Support for Mincing an Onion

We introduce the cooking support system for mincing an onion. The reason why we adopted this is that the usage way of hands and a knife is important although mincing an onion is a basic cooking.

3.1 Cooking Instructions

Mincing an onion has 10 steps. We introduce the cook's work and the support from the system of some steps.

Step 1: cooking start

This is a step that the cook starts cooking after preparing ingredients and utensils. S/he prepares an onion and a knife.

The system encourages the cook by a text projected on the cooking table and a robot's speech.

Step 2: cutting off the root

This is a step that the cook cuts off the root of the onion. S/he puts the onion on the cutting board and cuts off the root.

The system gives instructions to put the onion on the cutting board by the projected text and the robot's speech. The robot also points a finger at the onion and the board to teach the cook the target. The system presents the hand's position and the onion's position by projecting computer graphics (CG) of the onion and the hand as illustrated in Figure 1(a). After correctly placed the onion, the system overlays the CG of a cutting line and a knife (Figure 1(b)) in addition to the onion and the hand. At the same time, the system provides the cook with an instruction by a projected text and a robot's speech to follow the CG.

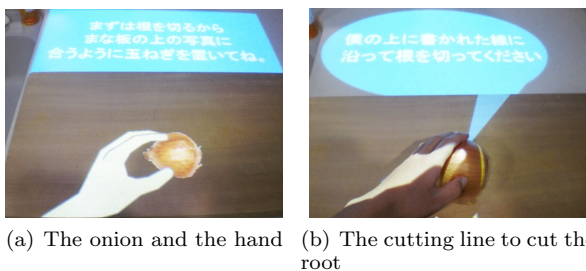


Figure 1: CG projections in step 2

Step 6: Making perpendicular cuts

This is a step that the cook makes perpendicular cuts to the cutting board. The cook has to keep the root connected to prevent the onion from tearing to pieces.

The system gives instructions to put the half onion on the cutting board by the projected text and the robot's speech. The robot does an action like pointing the onion and the board. The position to put the onion is presented by an onion CG. After correctly put the onion, the system shows a cutting line and a hand position to hold the onion by CG as illustrated in Figure 2. For the safety cooking, the cook should change the hand position. First the hand position is presented as illustrated in Figure 2(a). Because this hand position includes the danger of injuries, the system switches the hand position like in Figure 2(b).

The cooking novices tend to put an onion parallel to the cooking table, which is not comfortable for them. The cooking novices can learn know-how that they should put an onion at an angle as illustrated in Figure 2(a). By learning this, they become to cut something with a comfortable posture.

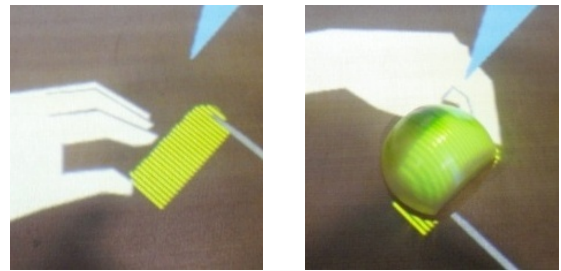


Figure 2: The change of the hand position

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3.2 Implementation

We used a “Phyno” as a robotic agent. The actions and lines of Phyno are set on the basis of a pilot study. The ingredient recognition is implemented with a camera placed over the cooking table and image processing. The information overlay is implemented with a projector placed over the table. We described the detail of the implementation in the other paper [2, 4].

4 Related Work

Some researches aim to provide easy-to-understand cooking instructions. For instance, Siio et al. [3] developed a system that present shortly-divided cooking videos step by step according to the actual cooking process. Hamada et al. [1] developed a cooking support system with cooking videos and texts.

5 Conclusions

In this research we aim to provide the cooking novices with easy-to-understand and safe cooking instructions. To this end, we developed a cooking support system with a robotic agent, information overlay and ingredient recognition. As a result of an experiment, our system received a high evaluation for the presentation of the hand position and so on.

References

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