

Cooky: A Cooperative Cooking Robot System

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Figure 1: Left: Overview of the system. Center: Graphical user interface. Right: Robot stirs the pot.

1. Introduction

We propose a cooperative cooking robot system that operates with humans in an open environment. The system can cook a meal by pouring various ingredients into a boiling pot on an induction heating cooker and adjusting the heating strength according to a recipe that is developed by the user. Our contribution is in the design of the system incorporating robotic- and human-specific elements in a shared workspace so as to achieve a cooperative rudimentary cooking capability. First, we provide a graphical user interface to display detailed cooking instructions to the user. Second, we use small mobile robots instead of built-in arms to save space, improve flexibility, and increase safety. Third, we use special cooking tools that are shared with the robot. We hope insights obtained in this study will be useful for the design of other household systems in the future. A previous version of our system has been presented [1]. This demonstration will show an extended version with a new robot and improved interaction design.

2. Overview

Figure 1 (left) shows an overview of our system, named Cooky. A small mobile robot on a customized table pours ingredients and seasonings into a pot on an IH cooker according to a recipe. The ingredients are placed on customized plates and the seasonings are placed in customized bottles so that the robot can handle them. The locations of the robot, plates, and bottles are tracked using attached visual markers and a ceiling camera. The robot, the IH cooker, and the camera are all connected to a controlling PC. The system comes with a graphical user interface (GUI) for observing the progress and scheduling the user and robot's tasks.

3. User Interaction

Making a recipe on the GUI. Cooking starts by making recipe in the GUI. The user designs the cooking procedure, which includes what ingredients to use and how to adjust the heater strength. The timing for adding ingredients is defined by dragging and dropping corresponding icons on the screen to the first timeline (Figure 2). The user can drop multiple copies of an icon to ask the robot to execute the task multiple times. The human's tasks, such as tasting or pouring water, are scheduled by putting icons on the second timeline. Temperature control is defined by editing the graph on the third timeline. The user can save the new recipe and reload it at a later time.

Pre-processing the ingredients. The user then pre-processes (i.e., slices) the ingredients according to the recipe, puts them on plates with visual markers, and creates a connection between each visual marker and the corresponding ingredient icon on the GUI.

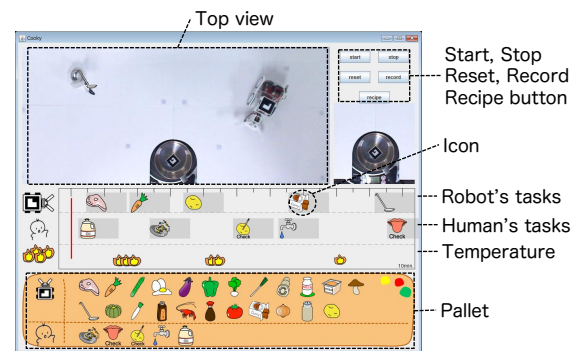


Figure 2: Cooking instruction interface.

Cooking. The user presses the start button to initiate the cooking. The system then oversees putting the ingredients in the pot one by one, adjusting the heater strength, stirring the pot, and giving instructions to the user according to the cooking procedure.

4. Small Cooking Robot

We developed a small mobile robot for transporting the ingredients and seasonings and for stirring the pot. The robot grasps an item using a mechanical hand with two fingers, moves to the pot, and shakes it in or stirs the pot. The robot does not have any sensors and is wirelessly controlled by the host computer. A small mobile robot carrying plates and bottles is more appropriate than a large arm fixed to the environment in a shared and open working space because it improves flexibility and mobility.

5. Sharing Tools and Environment

We created a special table and placed it higher than the pot so that the robot can easily pour ingredients and seasonings. We also created special plates so that the robots can handle them and a visual marker can be easily attached. The IH cooker is a modified version of a commercial model in order to enable remote control of the temperature. All these tools and the environment can be used by humans with or without the Cooky system.

6. Future Work

In future, we plan to incorporate more home appliances, develop multi-purpose robots, and adapt the concept to other domestic tasks.

References

1. Sugiura, Y., Sakamoto, D., Withana, A., Inami, M. and Igarashi, T. 2010. Cooking with robots: designing a household system working in open environments. In *Proc. CHI '10*. ACM, 2427–2430.