Presenting Action-Centered Recipe to Reduce Cooking Failure for Beginners

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The aim of this research is to reduce cooking failures of a user who has lack of cooking experience. Currently, it is possible to cook easily referring to a user-contributed recipe site. However the details of recipes posted on the recipe sites are often inconsistent and this inconsistency makes them confuse and resulted in cooking failure. To solve this problem, we propose a system that presents recipes as a form of a flow graph. With this system, a user who only has little experience of cooking will understand recipes easily. To confirm the usefulness of the proposed system, this paper conducts a comparison between cooking with a user-contributed recipe site and that with the proposed system.

1. Introduction

In recent years, a user-contributed cooking-recipe site (hereinafter referred to as cooking-recipe site") has become popular. It allows anyone to post their cooking recipes, instead of allowing only a specific person to post the recipes. The number of cooking recipes on cookpad[*1], one of the cooking-recipe sites, is increasing every year. As of December 2018, there were approximately 3 million cooking recipes[*2]. A user creates a cooking recipe based on his/her cooking knowledge and skill level, and submits a cooking recipe to a cooking-recipe site. Therefore, the format of the description differs for users who submit the same recipe. Consequently, the degree of difficulty of cooking varies depending on the recipe, even for the same dish, and the cook needs to select a recipe from the recipe site according to his/her skill level. However, because there are several posted recipes, there are multiple recipes with different degrees of difficulty; therefore, the cook does not always select a suitable cooking recipe. Furthermore, it is challenging for cooks with a short cooking history to understand the cooking process because they are not familiar with cooking. For example, the lack of prerequisite knowledge in cooking can be a cause of failure, which would be due to the cook. Cooking recipe sites may omit important details related to recipes, assuming that the cook has a certain level of knowledge, to prevent the recipe from becoming redundant owing to excessive detail. Although cooking recipes do not include descriptions, such descriptions are inherent in the process, and the cook needs to supplement the process and cook accordingly. Cooks with short cooking histories often do not have the prerequisite knowledge and fail because they cannot understand cooking terms or recognize an omitted cooking process. With this background, this study aims to solve problems caused by cooks, focusing primarily on inexperienced cooks. To solve this problem, we present a recipe that can reduce failures due to inexperienced cooks. In this study, we propose an interface that displays cooking recipes in a flow-graph format to reduce cooks ' failures.

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∗1 Cookpad Inc.: cookpad `http://cookpad.com/`

∗2 `http://pdf.irpocket.com/C2193/BXIb/JHMN/zzTh.pdf`(confirmed on December 13, 2018)

2. Relatedwork

Several studies have been conducted on the cooking skills[2]. Hirashima et al. found that "cutting," which is frequently used in cooking operations, was critical in cooking, and it was challenging to cook if "cutting" could not be learned[2]. Therefore, to analyze the difficulty of the "cutting method" and its factors, we investigated the knowledge of the "cutting method" and the degree of self-confidence during cutting, in university and vocational school students. The analysis suggested that it was necessary to learn the skill for using basic kitchen knives even during cooking training at universities and vocational schools.

Ohsugi et al. focused on the ambiguity of the expressions in the cooking procedure texts and investigated the causes of these occurrences to study the structure of cooking recipes[4]. In this study, terms related to cooking were manually extracted from texts of cooking procedures and were tagged. We analyzed the action and its associated elements such as foodstuffs and tools. As a result, the ambiguity of the expression was attributed to the fact that the accompanying elements were different, even for the same action.

3. Desigin Guidelines

In many cases, cooks with short cooking histories do not have the prerequisite knowledge; therefore, on the Web, they search for terms that they cannot understand. For example, cookpad provides the basic cooking-related information, such as preparation and cooking terms [*3]. However, cooks need an environment that concentrates on cooking because time-related processes may occur during cooking. A person with a short cooking history needs to look

∗3 `https://cookpad.com/cooking_basics` (confirmed on January 21, 2019)

at multiple webpages and different types of content while cooking, and thus cannot concentrate. An inexperienced cook is unfamiliar with cooking; therefore, he/she cannot perform time-related processes well while performing other tasks, and thus fails to cook properly.

Existing cooking-recipe sites often use traditional cooking-recipe formats (text and images). However, displaying the cooking procedure in flow format can be regarded to support to an easier understanding of the recipe, and several studies have presented cooking recipes in of a flow, which this study follows[1, 5, 6]. Additionally, it is not clear how one operation leads to the next in a cooking recipe that consists of existing text and images. Therefore, the cook cannot intuitively grasp the cooking process but can understand how much he has cooked.

Based on these facts, the design guidelines for the proposed system were: (1)to compensate for the lack of knowledge and experience; (2) to check supplementary information, such as advice and tips on the same page as the cooking procedure; (3) treating one operation as one procedure; (4) cooking can be grasped intuitively; therefore, a method of expressing the procedure in a flow-graph format was adopted.

4. Implementation

4.1 System Structure

A recipe-presentation system was constructed, based on the design guidelines described in Chapter 3.. Figure 1 shows the configuration of the proposed system. The system consists of a cooking-recipe database (DB), terms related to cooking for each cooking recipe, a data-shaping module, a presentation screen, an input determination unit, usage data, and a screen generation unit. The processing flow executed by the system is described below. First, the cooking recipe selected by the user in the select box is processed by the input determination unit of the system. Next, if a dish that matches the input dish name is stored in the usage data, the system shifts the processing to the screen generation unit. Finally, the screen generation unit generates the screen based on the usage data and presents the presentation screen to the user.

Furthermore, the recipe DB used by Cookpad Co., Ltd. through the National Institute of Informatics (cookpad dataset) was used for the recipe data [*4]. This database is in the MySQL format that can use data of approximately 1.72 million items of cooking recipes posted on cookpad by September 30, 2014. Mori et al. automatically extracted the terms related to cooking from these data (see the broken line in Fig. 1)[3][*5]. In our study, data are created by adding tags that can identify ingredients and tools as named entities (see the terms related to cooking in Fig. 1). These data are further shaped (see the data-shaping module in Fig. 1) and used in the proposed system.

*4 Cookpad Inc. (2015): Cookpad Data. Informatics Research Data Repository. (Dataset). https://doi.org/10.32130/idr.5.1(Confirmed on January 4, 2019)

*5 http://www.ar.media.kyoto-u.ac.jp/data/recipe/(confirmed on February 22, 2019)

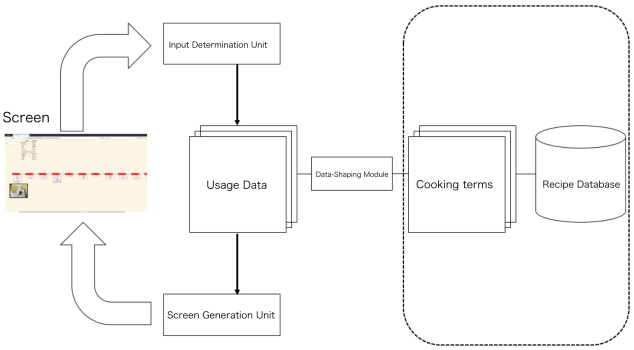

Figure 1: System Flow

4.2 Used Data

The proposed system should identify the actions and ingredients in the cooking procedure to satisfy design guideline (4), as described in Chapter 3.. Therefore, we use the tagged data extracted from the cooking-recipe DB. The tagged data is stored in JSON format for each cooking recipe stored in the DB. Additionally, the tagged data contains the procedures, the names of the ingredients listed on the cookpad, and advice on cooking. The name of the dish, quantity, and procedure from the tagged data were used for the proposed system.

4.3 prototype

The data-shaping module program described in section 4.2 was developed using Anaconda 3-2.4.1 as a platform and Python version 3.5.1. Furthermore, JSON and collections were used as Python libraries. The input judgment unit, screen generation unit, and presentation screen were developed as web applications. HTML, CSS, and JavaScript were used for development. We used D3.js[*6] version 3.5.17, jQuery version 3.2.1, Tippy.js[*7] version 2.5.4, and anime.js[*8] version 2.2.0., as JavaScript libraries,

Figure 2 shows the prototype of the proposed system. The proposed system consists of a select box for selecting the name of the dish (see ① in Fig. 2, a material part indicating the ingredients required for cooking (see ② in Fig. 2), and a flow-graph part that shows the recipe of the selected dish name in a flow graph (see ③ in Fig. 2). In the select box, the recipe name stored in the user data in Fig. 1 is displayed. First, the user selects a recipe for cooking, after which the corresponding ingredients and procedure are displayed. The flow is a block of terms related to cooking. With this arrangement, it is possible to adhere to design guideline (3) described in Chapter 3..

Moreover, by arranging the actions in a flow, the user can grasp the flow and recipe before cooking. The part where the flow is branched indicates that other operations can be performed while operating. Therefore, for each group of actions, an image is placed at the end of the action, and

*6 https://d3js.org/(confirmed on January 4, 2019)

*7 https://atomiks.github.io/tippyjs/(confirmed on January 4, 2019)

*8 http://animejs.com/(confirmed on January 4, 2019)

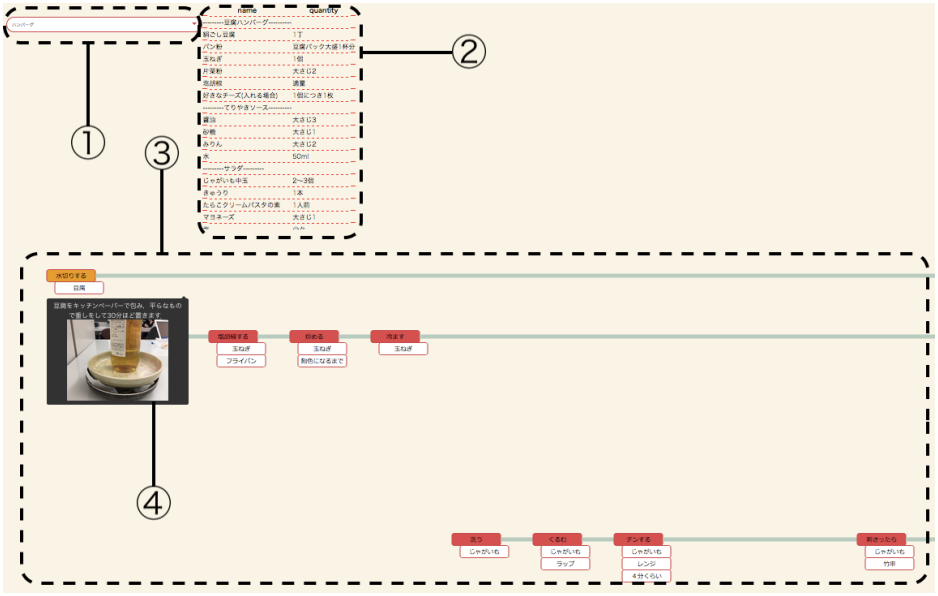

Figure 2: Proposal System

alerts and tips are written in the text (hereinafter referred to as the image display function). The user can confirm the term by hovering over the action block and understand the terms and expressions (see ④ in Fig. 2). The image display function satisfies design guidelines (1) and (2) as described in Chapter 3.. These functions can satisfy design guideline (4).

5. The User's Behavior

We compared user's behavior who used the proposed system or the existing text-based cooking-recipe site, cookpad, to clarify whether the proposed system can reduce the user's cooking failures. In this experiment, the participants cook using either cookpad or the proposed system. The experiment was divided into two groups: a cookpad group that cooks using cookpad for college students, and a proposed system group that cooks using the proposed system. The experiment was conducted for a total of eight cooks, four using cookpad, and four using the proposed system.

The evaluation criteria were determined based on (1) whether the cooking was done skillfully, and (2) how the cook performed and felt. We performed quantitative and qualitative evaluations. In comparison with (1), the average cooking time until the completion of the dish was evaluated quantitatively (see Fig. 3). There was no significant difference between the groups ($t(6) = 1.097, p = 0.3148, n.s.$). There was no difference between the two groups in the quantitative evaluation. As a qualitative evaluation, the subjective evaluation of the cooks was confirmed through interviews. In response to the question, "whether the cooking was skillful" in the interview after cooking, all four members of the cookpad group answered that, "the cooking skills were poor." On the other hand, 2 out of 4 respondents in the proposed-system group answered that "the skill was not good." Opinions, such as, "the tempo was not better than expected," and "I did not know how to burn." The other two did not indicate that the skill was good, but Participant H responded that, "It was difficult to work, but it was easy to cook because it was a simple process." The above evaluations of skill suggest that the proposed system tends to cook skillfully compared to cookpads.

For (2), as a qualitative evaluation, the subjective evaluation of the cook was confirmed by observing the participants' cooking appearance and interviewing them. In parallel work, to make two dishes simultaneously in the cookpad group, three out of four people were working in parallel. Participant A did not work in parallel. For the proposed-system group, all four participants cooked in the order presented by the proposed system. Moreover, two of them looked at the cooking recipe and observed that the part which could be cooked in the previous process was done during the waiting time while cooking.

Furthermore, in response to the question, "Is it easy to cook?," two out of four respondents in the cookpad group who answered, "Easy to cook," stated that, "It was not as difficult as expected." Regarding the proposed system group, three out of four respondents answered that it was easy to cook. Opinions such as "it was easy to cook without the cooking skills," "it was difficult to cook partially, but it was easy to cook," and "it was easy to understand cooking in parallel," were obtained. From the above evaluation, it was suggested that the proposed system was effective for cooking as intended by the cook.

6. Discussion

It is suggested that flow branching is effective when cooking multiple items simultaneously, using the proposed system. From the observation of the cooking appearance, all the cooks of the proposed-system group cooked according to the procedure. Participant G says, "By branching in a

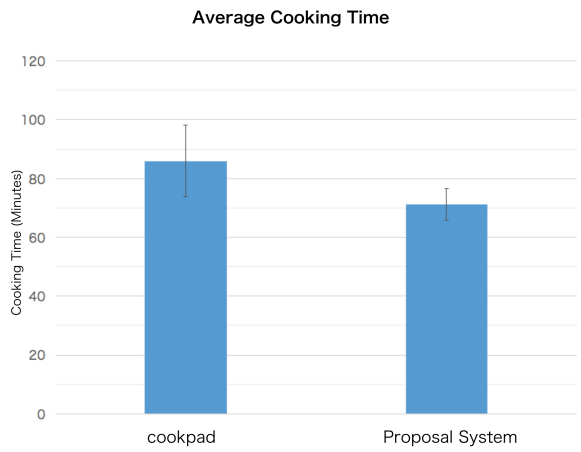

Figure 3: Time Comparison

row, it is possible to determine the dish to work on based on the ingredient." From participant H, the opinion was "It was easy to understand that cooking in parallel was easy." However, because the author created this branch, it was not optimized for cooking efficiency. Therefore, it is necessary to formulate a method that can be optimized when cooking multiple items in the future.

Furthermore, for the question item "How did you follow the recipe?," Participant E replied, "I cooked after confirming the visible range on the interface." Participant F replied, "We cooked after first looking at the entire item and confirming which dish to cook and for what time." F was checking the next step on the recipe during in the process of doing nothing (e.g., baking a hamburger). Participant G replied, "I have focused on my actions and the next one." Participant H replied, "I only have focused my actions what I have to do at that time." From these facts, it is suggested that all members can grasp the procedure to be performed from the perspective of the recipe and that they could be conscious of the next operation.

7. Conclusion

The purpose of this study was to reduce cooking mistakes for people with short cooking histories. In this study, we focused on cooking actions as a method of presenting cooking recipes and developed a system that expresses the cooking actions as a flow graph by grouping cooking actions according to the cooking procedure. We conducted a comparative experiment between the proposed system and the existing cooking recipe site cookpad to verify the effectiveness of the proposed system. As a result of the comparative experiment, it was suggested that the proposed system was able to cook better than cookpad. It is also suggested that the cook is effective when cooking in parallel.

The proposed system could not support the action performed by the cook. For example, the participants of the proposed system group commented, "I did not understand how to control the fire," and "I did not work well when crushing potatoes." Therefore, it may be possible to provide support by presenting one image of cooking completion and a series of photos, gif animation, or a recovery method for failure.

Furthermore, from the interview after cooking, the opinion that "the cooking was easy because the seasonings, ingredients, and utensils were all available" was obtained. Primarily, cooks cook in their own cooking environment. At that time, utensils and ingredients necessary for cooking are selected. Therefore, it is necessary to prepare dummy seasonings, ingredients, and cooking utensils to conduct experiments close to the actual cooking environment.

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