

Usability Study of Kitchen app with Multimodal Interaction Among Beginner & Intermediate Cookers

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Abstract— This paper presents the usability study of a cooking application, KitchenGeek with a wearable device, Smart M between two user groups, beginner and intermediate cookers to test if the application and device lowers the gap of time taken for both of the user groups to complete the cooking tasks. The results of this paper indicates that KitchenGeek and Smart M did lower the gap of time taken for task completion and it helps beginners to cook better than not being able to cook at all. An independent-samples t-test was conducted to compare the score of beginner and intermediate groups of cooker. The result shows that there was no significant difference in time taken to complete all cooking tasks for beginner and intermediate group of cookers ($p= 0.85$). This research suggests that beginners should use KitchenGeek and Smart M to improve their cooking skills and they will be able to cook at the same rate as intermediate cookers.

Keywords — *Cooking, application, device, beginner, intermediate*

I. INTRODUCTION

Nowadays, people rarely have time to cook or to learn cooking. This is due to the time confliction with their career life. A way that was introduced to solve this problem was to create a cooking application that will aid user to cook easily, anytime and anywhere. A cooking application is an app that database of food recipes together with the list of ingredients and detailed instruction of how to cook a certain recipe. Our team has developed a cooking application, named KitchenGeek that will help users of the app to cook much more easily. This is because we have integrated the use of Smart M, a wearable device, inspired from Kinect Technology that can be used to control KitchenGeek without touching the mobile screen, by using hand gestures and microphone. While cooking has been less necessary to the living generation, more and more people are cooking less due to them opting for fast food and restaurant food because they can obtain it easily. Other than that, some users find Long ingredient lists and complicated methods of cooking a stressful thing to do. [1] However, it is extremely unhealthy to consume fast food on a long run. This is why we have developed an application that will utilize and encourage user to cook on their own. With the help of KitchenGeek, we believe that users will be more convinced and it will promote behavioral change among users. From Fogg's [2] list of common uses of persuasive technologies as tools, it is possible to exemplify how they could be embedded within a persuasive intervention intended to influence people's behaviors whilst cooking [3]. A number

of studies report the use of ICTs as assistants for cooking, trying to improve confidence [4], skills [5] or usability [6]. It is understood that the cooking activity places challenges upon the use of electronic interventions.

There are many cooking applications available [7,8]. None of cooking applications has used a wearable technology to be integrated with their app. KitchenGeek however have few distinct and unique features such as, users who use KitchenGeek will be able to send notifications to their family members or loved ones saying that the meal will be ready in a while. Other than that, with the usage of Smart M, users will be able to control KitchenGeek by only using hand gestures and voice technology. The reason why we introduced such technology to our application is we want to ease users while they are cooking. The usage of smart phone application while cooking is highly not recommended as it will make our screen dirty and might cause unfavorable accidents. Thus, with the usage of smart M, a device wearable on our neck, both head and water resistant, helps user to go for next or previous, or to select yes or no options just hand gestures detected by IR Emitter and IR Sensor. To search for ingredients, user can simply say out the ingredients' name or the dish name itself to search for it. There is no need for the user to grab their hand phones to search for the items. Users' smart phones can be placed on a hand phone stand to have a better view of the recipes.

II. LITERATURE REVIEW

Many previous research has been done on the integration of applications with wearable technology. One such example is Mi Band[9], a wearable smart watch that tracks users' fitness information such as pulse rate, blood pressure and number of steps taken by a person each day and records it into a mobile phone application. Another app is A head mounted display called the "Private Eye" was invented, which used a vibrating mirror to create a display directly in the wearer's field of vision [10]. Wearable technology has made our lives easier as we don't have to constantly open the application and manually record information.

Inspired from this technology. KitchenGeek also comes with a wearable device, Smart M that will utilize the users to cook faster with higher satisfaction rate. Previous research shows that the use of wearable technology along with application has increased the usage of apps more drastically and it promotes to behavior change. As in for KitchenGeek, by

using Smart M, it will promote the behavior and interest of cooking among the users itself. Previously, users have cooked based on their knowledge on cooking and also obtained aid from others. Sooner after that, recipe books such as The French Laundry Cookbook [11] has been published and sold in order to utilize users to cook. This is because, as people are becoming more career oriented and more focused on education, they have lesser time to focus on cooking.

III. EXPERIMENTAL DESIGN

This experimental evaluation was carried out on two different user groups (beginner : people who do not have any knowledge on cooking and with intermediate cookers : users who have a medium knowledge and experience on cooking) to allow participants' perform the tasks of cooking using KitchenGeek and Smart M.

A. Equipments

Our equipment are KitchenGeek Application on a smartphone using Android platform and Smart M, a wearable technology. KitchenGeek application is a mobile application that has a database of dish recipes along with the instruction on how to cook the dishes. Other than that, user can also create their profile to save and rate recipes as well as post their own recipes on social media. Smart M is a wearable device, inspired from a Kinect Technology that allows user to control the app through hand gestures and voice technology. It is equipped with IR Emitter and IR Sensor that senses hand gestures, Touchpad that allows user to scroll or click, Speakers for user to listen to recipes, Camera that detect hand gestures and Microphone that allows user to say out the dish name or the ingredients name.



Figure 1: KitchenGeek prototype

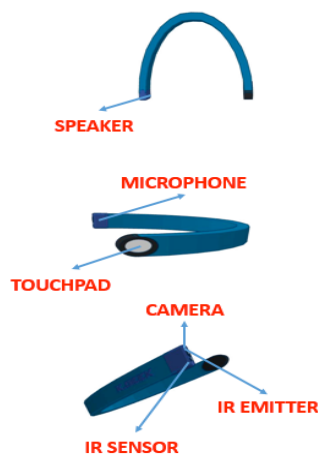


Figure 2: Smart M device

B. Procedure

Participants were given instructions about how to use KitchenGeek and Smart M. We made sure that all participants of the experiments had knowledge on using smartphones. Participants were also given an overview of the planned

evaluation and agreed for voluntary participation. All the participants read and signed the informed consent form. Pre-test questionnaire was used to collect demographic information about participants. Five very common goal-oriented tasks were set out for participants to perform. It was expected that all those tasks would be very easy to perform on using KitchenGeek and Smart M rather than traditional cooking method. The user goal was to cook Omelette. The tasks were:

- Task 1: Use speech to search for Omelette
- Task 2: Choose Omelette recipe using touch pad
- Task 3: Gather Butter, Oil, Egg, Onions, Pepper, Salt instructed by KitchenGeek application
- Task 4: Listen and Navigate through Omelette recipe instructions by using Smart M device.
- Task 5: Send notification to family members that dish will be done soon (Yes/No)

The participants performed tasks under direct observation. While participant performed the task, for the each task - following measures were recorded in observation.

- Time taken for each task to complete.
- Task Completed or not.
- Participants' satisfaction for every task done.

C. Participants

Thirty participants were selected for our usability study of KitchenGeek and Smart M. Fifteen of them were beginners on cooking, mainly students and unmarried people where they have no prior experience to cooking. Some of them have only cooked minor dishes and has no experience of cooking large dishes. Another fifteen participants were intermediate cookers where they had prior experience in cooking large dishes. Most of them were adults above the age of 30 and married people. They have experience cooking for their family and they cook at least three to four times in a week.

When asked about if they would use a mobile app to help them to cook, all of them agreed that they would like to try KitchenGeek and Smart M, however they were concerned about if they will feel comfortable and convenient as well. Participants showed positive attitude towards its use and were interested in testing. Participants did not have to pay for the use of KitchenGeek and Smart M.

IV. USER PERFORMANCE

A. Task 1

Performing Task 1 on Say out Omelette into search box using microphone was very simple task. This is because it does not require any usage of the app itself. The users are exposed to using the application beforehand they could use Smart M. However, attempting the first task, initially participants were confused on where to say the word as they do not know the location of the microphone. Our team members explained on the components of Smart M to the users so that they clearly know the locations of components. They quickly picked up this knowledge.

B. Task 2

Task 2 was to click Omelette search result using the touchpad at the side of the Smart M. Users did this task really quickly because of their familiarity of using touch pad on their laptops. Users slide the Omelette options much more naturally and they selected the ones that we have chosen for them to cook on as many options are available on the application.

C. Task 3

Task 3 was on Gathering Butter, Oil, Egg, Onions, Pepper, Salt as instructed by KitchenGeek application. They was to be instructed through speaker. Users find it really easy to listen the instructions. Some users still viewed the screen as they felt that looking at the pictures of ingredients is much more easier. This was done by users who did not recognize the list of ingredients. Sooner after that, participants began getting comfortable with KitchenGeek Application and the usage of Smart M. They began to act more naturally towards the device and feel less awkward compared to their usage for the first task.

D. Task 4

For the fourth task, listening and navigating through Omelette recipe instructions through speaker. Before listening to the instruction, we made sure that users has successfully gathered all the data. Users were instructed to use natural hand gestures to control the application as they went through the recipes. Some of the hand gestures are as follows:



This hand gesture indicates to play the recipe or pause the instructions.



This gesture means sliding to next recipe once they are done with one instruction.



This gesture means sliding to previous recipe if they do not get the previous instruction.

E. Task 5

The last task was to ask user if they want to send notifications to their family members through messaging that the dish will be done soon. The application integrates with the phone messaging and if this option is selected, the preset phone numbers will receive a message saying that Omelette will be done with a few minutes time. If user selects to send the message, they have to do the following hand gesture:



1. This hand gesture indicates "Yes"

Or else if they do not wish to notify their family members or loved ones about the dish, they can simply reject the offer and display the following gesture :



2. This hand gesture indicates "No"

Participants showed satisfaction as the hand gestures were relatively easily to do and they felt natural while doing them. After the fifth task, the dish is done and was served accordingly.

V. DATA ANALYSIS

Evaluation results were analysed to identify the usability of KitchenGeek mobile application with wearable Smart M device between two user groups. All participants from both user groups managed to complete all tasks given. From the table above, for task 1, 2, and 5, the mean difference is not too big compared to task 3 and 4. This mean on some part of the procedure, KitchenGeek, together with Smart M device, do closes the gap between these two user groups. But the real main function of KitchenGeek application and Smart M device lies to the task 4, where the users need to listen and navigate through Omelets recipe instructions through Smart M device.

User Group		Completion Time				
Beginner	N	15	15	15	15	15
	Mean	.78	.22	145.50	296.86	.254
	Std.Dev	.27	.020	29.18	13.593	.026
	Min	.62	.18	102.49	278.04	.21
	Max	1.35	.26	185.20	318.55	.29
Intermediate	N	15	15	15	15	15
	Mean	.75	.22	140.14	299.81	.25
	Std.Dev	.24	.021	21.34	15.95	.026
	Min	.63	.18	107.61	272.94	.21
	Max	1.36	.25	170.87	319.70	.29
Total	N	30	30	30	30	30
	Mean	.77	.22	142.82	298.34	.25
	Std.Dev	.25	.02	25.27	14.64	.026
	Min	.62	.18	102.49	272.94	.21
	Max	1.36	.26	185.20	319.70	.29

Table 1: Mean and Standard Deviation comparison

The mean difference between beginners and intermediates is approximately 2 seconds apart. To compare with task 1, 2, and 5, the value may be seemed big but in real life situation the 2 seconds' differences is not that big and noticeable therefore, again, KitchenGeek is proven to achieve its goal; to make the gap between beginners and intermediate in cooking closer to each other.

The average total time spent by beginners' user group was 443.617 s while for the intermediates' user group the value was 441.165 s. The boxplot chart (Fig. 3) shows the spread of the data. Parametric and non-parametric summary statistics are presented for each variable, to indicate the central tendency and the dispersion of the observations.

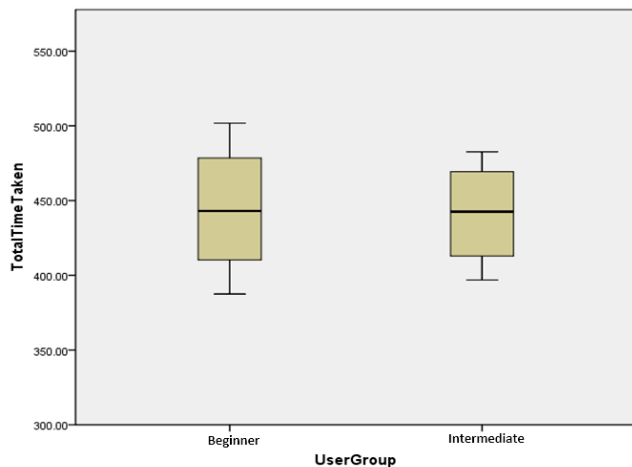


Fig. 3: Boxplot of Total Time Taken VS User Group

From the boxplot chart above, it is shown that dispersion on overall time taken to complete all tasks is bigger for beginners' case (standard deviation: 37.964 s), compared to intermediates' (standard deviation: 29.789 s). This proves that, with the help of KitchenGeek and Smart M device, the ability to cook for beginners is still diverse, with the highest time taken still falls into beginners' user group. In the other hand, the average, and interquartile range of beginners' user group is not that far away from intermediates', as shown on boxplot above.

A. Tests for significant

Based on our aim to reduce the gap between beginner cooks and intermediate cooks, our null and alternative hypotheses are as follows:

H0: There is no difference between beginners and intermediate cooks in cooking performance (time taken to complete all cooking tasks)

H1: There is a difference between beginners and intermediate cooks in cooking performance (time taken to complete all cooking tasks)

An independent-samples t-test was conducted to compare the score of beginner and intermediate groups of cooker. The results shows that there was no significant difference in time taken to complete all cooking tasks for beginner (M=443.62, SD = 37.96) and intermediate [M= 441.17, SD =29.79]; $t(28) = 0.2, p= 0.85$. Thus the null hypothesis (H0) is accepted.

B. Subjective Satisfaction

The System Usability Scale (SUS) provide a quick and reliable tool to measure the usability and evaluate a system. It consists of 10 items questionnaire with 5 response option scale from "Strongly Disagree" to "Strongly Agree". SUS is used to evaluate satisfaction rate of KitchenGeek; user experience when using the app : whether it is satisfying and help them to successfully complete the task. Overall average score of SUS is 4.36. this results shows that participants were reacted

positively and satisfied with their experience with KitchenGeek.

VI. CONCLUSION

The analysis of the comparison between beginner and intermediate user group shows KitchenGeek has a good potential and bridge the gap between beginner cooks and intermediate cooks.

KitchenGeek has included the ability to detect an instruction through hand gestures that ease and limits users movement when cooking. Users do not have to consecutively pick up and touch their smartphone when cooking. At the same time, another features, which is the ability to notify other people to eat together such as family members through social networks could immensely enhance the functionality of a cooking app.

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