Samsung Galaxy Microwave Oven Interface

By:

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1. Description

Many of us use microwave oven in our daily life. As a busy engineering student with a slight gaming addiction, it is my preferred way of heating up food and beverages. Yet, very few of us use more than the basic function of heating our food by setting the timer. Not only are there no standardization of the interface of these devices, standardization within the same manufacturer is also non-existence. Compound with varying form factor and functionalities, using an unfamiliar microwave oven can lead to a frustrating and time consuming experience. In this report, I am specifically targeting Samsung's microwave oven model ME17H703SH. The interface of ME17H703SH can be seen in Figure 1 to the right.

The interface has a simple single line monochrome LCD display for user feedback. The inputs are divided into five sections: Sensor Cooking, Cooking Presets, Light, turntable and Vent. Buttons within the Sensor Cooking and Cooking Presets section may take user into an option menu where user cycle through options one at a time. All button names are **bolded** to improve the readability of this report.

Figure 1 - ME17H703SH's interface

2. Analyze

2.1. Functionality

The primary function of a microwave oven is to heat up food and beverages. The basic function is one-stage cooking. In this mode, the microwave oven will automatically set the power level to highest. The user simply input the time (for 20 minutes, enter **2**, **0**, **0**, **0**). Other function such as **Fit Choice**, press the button repeatedly to cycle through the available items, enter the number with the number pad and press the **Enter/Start** button. Different function has its own option menu.

2.2. Stakeholders

Microwave oven is a common kitchen appliance that is found in most home and offices/school cafeteria. They are usually placed on countertops or higher. Due to the location, microwave ovens are used by anyone that is at least six years of age. Although there could be a function that matches the exact need of the users, many solve their needs with the basic function.

2.3. Requirements and Goals

Most importantly, microwave oven is a common kitchen appliance and should not require training. The interface should be obvious to anyone who has prior experience with microwave oven. The user should not be required to read through the user manual to navigate the option menu. The average user should be able to learn how to use each function in two minutes.

Each button should have one or more clear and distinct functions. The label on the buttons should clearly indicate the purpose of the buttons. The average user should not need to exit a sub-menu more than three times to reach their desired function.

Finally, the control panel should be compact and not increase the height and width of the microwave oven. The control panel should be no more than twenty percent of the total width. This may causes a reduction of buttons and increase the number of items in a given option menu. The user should be able access any function in less than twenty seconds.

2.4. Problems

2.4.1. Lack of Feedback

Having positive feedback to inform the users that what they are searching through the places is desirable. With the single-line monochrome LCD screen, the amount of display information at a given time is limited. Without multi-line display, an option menu is slow to iterate over.

2.4.2. Ambiguous Labels

Some of the labels in this model have ambiguous names. For example, the first category of buttons is labeled "Sensor Cooking". The name is ambiguous and the buttons within this category offer little to no information about the purpose of this category. The same applies to **Eco Mode**. Under "Cooking Presets", there are button for **Kids Meals** and **Snacks**. The distinction between the two is not obvious. According to the manual, chicken nuggets and hot dogs are under kids meals while cheese sticks and chicken wings are considered snacks.

2.4.3. Complex Key Press Series

After reading the user manual, some features are non-trivial. Nowhere on the interface suggested that there is a multi-stage cooking function. To use such function, a series of number pad and **Power Level** input is required. Navigation within the "Cooking Presets" options is equally complex.

3. Design Goals and Evaluation

Since the majority users only use the basic function, the simple and straight forward solution is to reevaluate which features are common and should be maintain. The features that are uncommonly used are considered irrelevant and should be removed. This may remove some of the current buttons and free up space on the control panel for more specific buttons. For example, in this specific model, we may consider that only the chicken nuggets within the **Kids Meals** is deemed a common use case and replace the **Kids Meals** button with a chicken nuggets button. Without the unnecessary features, the required feedback to guide users is simplified. The need to navigate through complex option menu is less severed. This is due to the fact that fewer options are available and a specific button will bring the user closer to the desired function. The less complex key strokes are required with a shallower option menu. Each button has a more distinct and specific role, reducing ambiguously and confusing labels.

A more complex solution is to implement a higher resolution display. In order to maintain all the current features while reducing ambiguity, we can display more information on the display than the surface area of the buttons. The screen can serves as the user manual and informs the users about the particular function of the button they pressed. With a higher resolution display, more information can be shown at

0 - Chicken nuggets   1 - Cheese sticks
2 - French fries   3 - Chicken wings
4 - Frozen sandwiches   5 - Nachos
6 - Hot dogs   7 - Potato skins

Figure 2 - menu with higher resolution display

once. This can give user more feedback in shorter time. This method may also levitate some of the complex key press series required. In this model, the user cycles through the option menu one item at a time. Only one item is displayed at a given time. In figure 2 seen on the right, the display is showing the options of both the **Kids Meals** and **Snacks** button. This enables us to merge buttons of similar functions together. The user can see the full purpose of this button without the need to cycle through the menu. The average key presses required to reach the desired function is reduced. In this model, the user needs to press and the **Kids Meals** button to enter the **Kids Meals** menu and four more times to reach the hot dogs option. In this design, it is possible to two key presses; first press to enter the menu and press **6** to select hot dogs.

The most complex solution is to add soft buttons much like the buttons found on Samsung's smartphone, highly increases the flexibility. The best solution is also the most expensive solution and this will noticeably increase the production cost of this unit. Not all buttons needs to be soft buttons. Buttons such as the numbers, **Enter/Start** and **Stop/Clear** is commonly used and not needed. Buttons such as **Popcorn** has no functions when inside the **Reheat** option. By having soft buttons, the interface can display only relevant buttons to the user. This solution can inform what a user can do within a certain option and also informs the user what to ignore by not displaying a given option. With displaying only relevant soft buttons, each button can take up more space and contain more information on its surface, further reducing the ambiguity of the buttons. After selling the microwave oven, a software upgrade to improve the user experience and customize the user interface to suit the user needs is possible. The menu display can highly flexible in term of shape, size and the number of buttons. In figure 2, each option needs to be map to a physical button, this restriction no longer applies. This can greatly reduce the number and the complexity of the key press series required to access a given option on average.

Determining which features are common is critical. The interface design should be base around common use cases. Rare use cases may be the last option in the menu or not supported at all. Focus groups will be required to understand the needs of different market segments. The feedback need to be analyzed and the prototype should be built to test the hypothesis. To implement the first solution alone should be relatively inexpensive. Microwave oven is design to have modular construction. Minor redesign of the front panel and software is needed. The second solution of adding a higher resolution display is more challenging. The hardware changes needed to support this is more significant. To maintain readability at the same distance while displaying more information, the text is needed to be bigger. Minor changes to the frame maybe required. The third solution requires the most engineering work to accomplish. To drive such display and input method, the core micro-controller may need a substantial upgrade. Assumption was made that the company contains the technologies required to implement the third solution.

Deliverable	Solution 1		Solution 2		Solution 3	
	Man-hour	Cost	Man-hour	Cost	Man-hour	Cost
Focus group and data analysis	20	$1000	20	$1000	20	$1000
Mockup prototyping and user feedback	10	$500	20	$1000	20	$1000
Redesign and medium fidelity prototyping	20	$1000	40	$2000	50	$2500
Heuristic evaluation and user evaluation	20	$2000	40	$4000	40	$4000
Redesign and implementation	40	$2000	80	$4000	200	$10000
Total	110	$6500	200	$12000	330	$18500

EECE418

Assignment 1: Self Assessment Report

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Date: Jan 19, 2015

Note: each element must have a justification; otherwise it will be assumed Strongly disagree. If additional space is needed for a justification, use a separate page and label justification with the Assessment.

	Assessment	1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree n/a = Not applicable.
1.	Title page includes all elements.	1 2 3 4 5 n/a ✓
Justification:	clearly and included all elements to the best of my	
2.	The primary functionality of the interface is described well.	1 2 3 4 5 n/a ✓
Justification:	The basic use case is straight forward	
3.	How each function is accessed is described clearly.	1 2 3 4 5 n/a ✓
Justification:	not explain all function in depth. The user manual	

4.	All the relevant stakeholders are identified.	1 2 3 4 5 ✓ n/a
Justification:	The stakeholder is obvious for common item.	
5.	The impact of the interface on each stakeholder is described well.	1 2 3 4 5 ✓ n/a
Justification:	I interviewed my mother for this	
6.	The functional requirements from the users' point of view are identified well.	1 2 3 4 5 ✓ n/a
Justification:	Majority of the e requirements are functional.	
7.	The non functional requirements from the users' point of view are identified well.	1 2 3 4 5 ✓ n/a
Justification:	Some non-functional requirements are identified.	
8.	Constraints on the system related to the user experience are clearly described.	1 2 3 4 5 ✓ n/a
Justification:	Constraints are clearly listed	
9.	The list of usability and user experience goals is clearly articulated.	1 2 3 4 5 ✓ n/a
Justification:	They are listed clearly in the end of each paragraph.	

10.	The priorities assigned to the items in the list of usability/user experience goals are well justified.	1 2 3 4 5 n/a ✔
Justification:	Some explanation is given for each	
11.	From the prioritized list of goals, three main usability and user experience questions are identified.	1 2 3 4 5 n/a ✔
Justification:	Each problem clearly explain in each each section.	
12.	For each usability and user experience question identified, the performance of the current system is well analysed and documented.	1 2 3 4 5 n/a ✔
Justification:	between current system and	
13.	The list of goals have objectifable measures for evaluating the user interface.	1 2 3 4 5 n/a ✔
Justification:	They are listed clearly in the end of each paragraph.	
14.	Three significant problems with the interface have been identified.	1 2 3 4 5 n/a ✔
Justification:	Each problem clearly explain in each each section.	
15.	All the problems identified are related to the user experience.	1 2 3 4 5 n/a ✔
Justification:	no extra functions has been added	

16.	None of the problems identified are technical issues.	1 2 3 4 5 n/a ✓
Justification:	The technical items are only mention in the cost estimate	
17.	None of the problems identified are "nice to have" features.	1 2 3 4 5 n/a ✓
Justification:	accessible, it is not easy distinguish what is	
18.	Three possible solutions are clearly identified.	1 2 3 4 5 n/a ✓
Justification:	Each solution has its own sub section	
19.	For each problem, the solution presented is well thought out and described how it solves the problem.	1 2 3 4 5 n/a ✓
Justification:	It is been throughly explained	
20.	The budget captures the main costs associated with each solution.	1 2 3 4 5 n/a ✓
Justification:	The cost and the assumption is stated	
21.	The budget doesn't miss any obvious costs.	1 2 3 4 5 n/a ✓
Justification:	Venture Design, no obvious costs is	

22.	The budget doesn't have any irrelevant costs.	1 2 3 4 5 n/a ✔
Justification:	Only the R&D costs are included	

23.	The figures in the budget are well justified from reliable sources.	1 2 3 4 5 n/a ✔
Justification:	The cost per hour data is based on 2004 figures.	

24.	The presentation of the report is easy to read.	1 2 3 4 5 n/a ✔
Justification:	button names should make this more	

25.	There are no grammar or spelling errors in the report.	1 2 3 4 5 n/a ✔
Justification:	check but English is not my first	

26.	Material over the recommended 3 pages (i.e. appendices, tables, figures, text) is well justified.	1 2 3 4 5 n/a ✔
Justification:	The text is exactly 3 pages	

Comments: