Conceptual Design, Project Plan, and Feasibility Study

Submitted by

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1.0 INTRODUCTION

The purpose of this deliverable is to generate a conceptual design for this team's product. Three members of the team have created sketches for their product concepts, and it is a brainstorm of criteria and characteristics of what they envisioned. Following a justified classification that will refine and condense the 3 sketches, this team will list four main concepts that will be present in the product. There will be a table to discover the advantages and disadvantages of each concept and then choose the best objectively. After choosing the best design, there will be a final concept that is ready to start prototyping.

2.0 FUNCTIONAL DECOMPOSITION

There are a number of things our client requested, they can be described as 4 main subsystems. Information given to the user, user input, interpretation system and communication with the appliance.

Information given to the user

The product must be able to inform the user of the state of the appliance and what the buttons they are pressing mean. This information must be interpretable by a visually impaired user.

User input

The user must be able to input commands meant to control the appliances. The controls must be usable by a visually impaired user and be described by the information given to the user subsystem.

Interpretation system

The input given by the user must be in some way translated into commands which the interpretation system can understand and communicate with the appliance. The interpretation system must also be able to translate the information given about the appliance's current state into a way the user can understand.

Communication with the appliance

The interpretation system must be able to communicate with the appliance in some way that allows the appliance to be manipulated the way which the user intends, as well as understand the current state of the appliance.

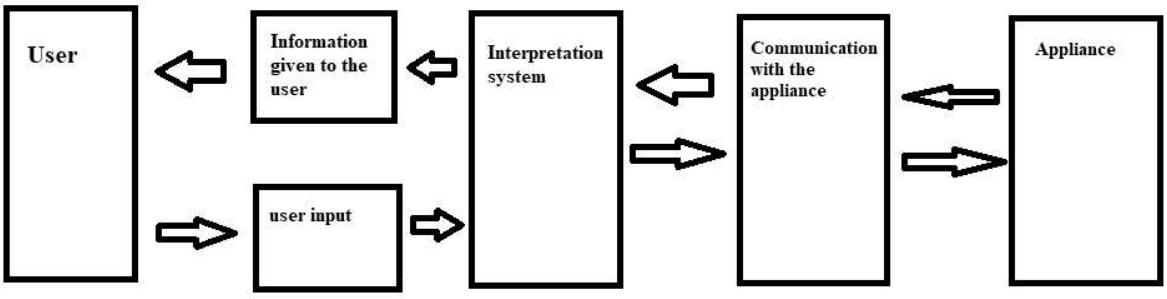


Figure 1: This figure shows the network of subsystems and which other subsystems they interact with.

3.0 CONCEPTS

Creator: Ryan

Concept 1: User input: voice control.

The system would be controlled by a user's voice saying specific commands. The user would be able to give any command or request for information via voice commands which would then be processed by the product

Concept 2: Information given to the user: text to speech.

Any information needed to be given to the user would be given by text to speech. The product would determine what information the user has requested or is otherwise relevant and would read it out loud.

Concept 3: Overall Design: Wrist Strap Mounted Visual Application

_____A mobile phone would be mounted to an attachment on a wristband. The phone would have an application installed which would use the phone's camera which would read the state of the appliance as well as tell the user where their hand is relative to the controls of the appliance. The application could be controlled by either buttons or voice commands and would relay information to the user via text to speech. It would be coded to understand these user inputs and translate them into instructions that would be given to the user as to how to control the appliance by telling their user where their hand is relative to the appliance controls.

Creator: Mustafa Warsame

The customer needs an interactive and efficient application that can allow them to use their household appliances. An application is being used as most people who are visually impaired are taught to use phones.

Table 1: Mustafa's three design concepts

Concept 1 Description: In the home page(Figure 1) there is expected to be different languages to communicate to the customer. To communicate with a language other than English then it is necessary to press the "MORE" button and tell the Vissiolle what language the user wants to speak. The setting icon on the top left of the screen will help the user change the button sound, button volume, etc. In the Interface of Vissiolle(Figure 2), the main camera will be necessary to accurately depict what the household appliances the user wants to use. The button on the left that says "Object Recognition" can identify objects and give the user an accurate description of the object selected. The button in the middle that says "Artificial Intelligence Vision" will be a set of eyes telling the user what is in front of them as they walk. This button should tell the user as they walk toward an object what it is and it can be moved around and tell the user about the surroundings quickly. This button will make it easier to use household appliances that require things like detergents, pans and pots, etc. The last function will be "Point Recognition" and this button will be read whatever the user points at. This button requires the user to hold it while pointing it and it is meant for the user to effectively use their household appliances.	 **Figure 2: Concept 1 Prototype home page for Vissiolle application.**  **Figure 3: Concept 1 Interface for Vissiolle application. This contains Object Recognition, Artificial Intelligence Vision, and Point Recognition**

Concept 2 Description:

This concept(Figure 4) has no home page as it will assume the user knows how to use a phone. Thus decreasing volume and changing language can be done with the virtual assistant. The button on the left is a “Virtual Assistant” that will answer any direct question the user has for it. The button on the right, the “Artificial Intelligence Vision” will be a set of eyes telling the user what is in front of them as they walk. The functions of this button is similar to concept 1 as it is very useful to the user and will give a more specific answer then the “Virtual Assistant” button.

Figure 4: Concept 2 Interface with Virtual Assistant and Artificial Intelligence Vision.

Concept 3 Description:

This concept(Figure 5) uses the landscape camera feature to allow the user a bigger lens. The object recognition and the “Artificial Intelligence Vision” is similar to concept 1. However, the homepage is discarded as the settings button is on the right side. It contains the settings that can only be changed on Vissiolle. Now the “Vissiolle Personal Artificial Intelligence” button will be a system like “Siri” that will be a modified virtual assistant for only those who are visually impaired.

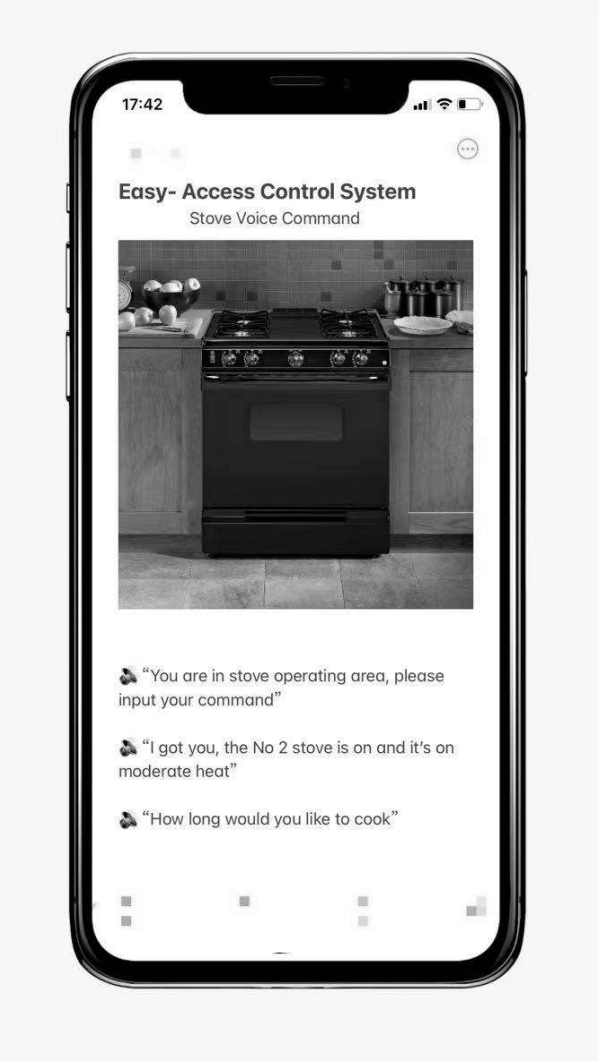
Figure 5: Concept 3 Interface contains Object Recognition, Artificial Intelligence Vision, Vissiolle Personal AI, Settings.

Creator: Jiyao Lian

Concept Description

The client demands a smart control system to have easy access to the majority of household appliances under visually impaired conditions. To create an application that is designed for iOS and Android platforms will be a great solution that has no extra cost other than the smartphone itself, especially the client emphasizing the accessibility and convenience of use.

Table 2: Jiyao's three design concepts

Concept 1 Description: This concept is focused on customers's accessibility and safety when operating household appliances like stoves. The system consists of an interactive application and smart-controlled stove. The stove itself is modified from a conventional stove. In another word, the stove is linked with the control application and can receive the customer's voice command from a smartphone terminal then the stove will receive a signal from the smartphone and operate according to the customer' s demand. The system in real life use scenario: When the user with the application opens and walks close to the appliance (in this case, the appliance is the stove), the app will automatically detect the user is now in the stove operating area, which means the stove is on and stand by for any incoming voice command signal from the smartphone. The app will say: "You are in the stove operating area, please input your command." The user: "Turn on the No.2 stove and put it on moderate heat". The app will reply: "I got you, the No 2 stove is on and it's on moderate heat. By the way,	 **Figure 6: The application display page with voice command interacting with the users**

how long would you like to cook?” The user: “.....”	
Concept 2 Description: The second concept is based on creating an application that is still able to run on both iOS and android platforms. However, there is a major difference. Since the client expressed her preference about having physical buttons to control, the concept is going to be the solution for that. Since the application runs on mainstream smartphones, therefore there are not many options to implement physical buttons. So this concept aims to use only two physical buttons on smartphones which are two volume adjustment buttons to let clients input their commands. For example, when the client finishes loading the washing machine, the client could listen to the voice guidance from the app, and input according to their need. The app: “The washing machine is loaded, please set the mode.” The client will use two volume adjust buttons by pressing it to go through the mode selections. The app: “Standard mode is set, press the upper volume adjust button to start or press the lower volume adjust button to cancel.”	 **Figure 7: The application display page with visual display and voice interacting with users**

Concept 3 Description: The third concept is an individual controller that has Wi-Fi connections with the majority of household appliances which the controller can send commands to the particular appliance that the client is going to access. The controller features physical buttons with braille printed on each button to better navigate users reducing the chance of pressing mistakenly. The voice interacting system for the controller is an optional feature.	 **Figure 8: An appliance controller for visually impaired clients with braille on physical buttons**

4.0 CONCEPT ANALYSIS AND EVALUATION

The criteria were selected based on customer needs as well as creator needs. These were weighted appropriately, so the more important aspects or features of the project have more importance to the final decision made. Each criteria is scored on a scale of 1 to 5, 1 being the worst and 5 being the best.

The table will be using the team members' names with the concept to the right of it, e.g (M.C1) that will represent Mustafa Concept 1 for Table 1.

Table 3: Table comparing all of the conceptual design options

Criteria	Importance	Mobile Application	Smart Speaker Appliance	Home Machine Appliance
Team Member Concepts		M.C1,M.C2, M.C3, J.C1, J.C2, R.C1, R.C2	R.C3	J.C3
Cost	2	5	3	2

User Friendly	4	2	3	3
Ability to Answer User Questions	4	5	5	5
Depth of Training	2	2	4	4
Accessibility	3	5	1	1
Total		57	49	47

5.0 CHOSEN SOLUTION

Figure 9: An example of a potential interface the app would use

After analysing and evaluating our concepts, creator Mustafa's concept one was the most promising. This concept provides most of the criteria for this product. Although not all criteria

are met, further development will be made to provide the most optimal functions for the client to obtain the best possible application.

6.0 GROUP DESIGN CONCEPT

Hence, after a group discussion, analysing and evaluating the concept and the required criteria, this concept is going to be used as this team's group design concept. This concept has shown all aspects of the required criteria. Some of the functions that this application contains is Artificial Intelligence to directly communicate with the user, “Object Recognition” that can identify objects and give the user an accurate description of the object selected, “Artificial Intelligence Vision” will be a set of eyes telling the user what is in front of them as they walk, and “Point Recognition” which will be read whatever the user points at. The settings for this application will be fully integrated with the general phone function. These functions will allow the user to efficiently use their household appliances.

Figure 10: This concept is a culmination of the groups ideas for Vissiolle

7.0 CONCEPT'S RELATIONSHIP TO THE TARGET SPECIFICATIONS, ITS BENEFITS AND DRAWBACKS

Table 4: This outlines target specification of metrics that includes the values based on the customers needs.

Target Specifications					
#	**Target Specification**	**Value**	**Marginal value**	**Ideal value**	**Importance**
1	**Cost**	?	50	Less than 50	1
2	**Device Usage**	Handheld	Handheld	Handheld	2
3	**Human Assistance**	No	No	No	3
4	**User Friendly**	Yes	No	Yes	4
5	**Compatibility with different platforms**	iOS, Potentially android	iOS	iOS,Android	3

Table 5: Benefits and possible Drawbacks for creating an application

Benefits and possible Drawbacks of concept	
Benefits	**Drawbacks**
Easy-access with shallow depth of training	Might face compatibility between the application with certain household appliances
Buttons with sound effect will minimize the chance of mistouch	Lack of physical buttons

8.0 CONCLUSION

After brainstorming a variety of concepts we began to compare them to determine what the most viable option was. We assembled a list of different criteria each assigned a different weight based on its importance and then scored each concept based on each criteria. The concepts were then ranked based on their scores and those scores' weights. This led us to the conclusion that a mobile application would be the best concept to follow through with.