Recipe Helper System Mobile Application with Voice Recognition

by

Kavita Kaur Deol

Dissertation submitted in partial fulfilment of

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Bachelor of Technology (Hons)

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Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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Approved by,

_____

(Ms. Vivian Yong Suet Peng)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

May 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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KAVITA KAUR DEOL

ABSTRACT

This project features research done on the current technology of mobile application on an android platform as well as performing integration of the mobile app to existing Voice recognition systems and software's. With the current growth of the mobile application technologies in handheld devices, the workload of human is eased in many ways. Integrating voice recognition abilities that has grown vastly since 1963 will enhance these technologies taking it into another level and spectrum. Voice Recognition not only allows human interaction with computers but also brings in the edge of using such technologies in our daily lives.

This project forms a purpose to develop a mobile application that is able to ease the workload in households. The mobile application developed on an Android platform that is integrated with Voice Recognition abilities to allow the user to communicate with the device without the need of using their hands while cooking. The mobile application is designed to contain cooking recipes from various countries and having the ability to view and interact with users during the cooking process. The project research is done in phases and the research and planning stages are completed in FYP 1 followed by the designing and testing of the application in FYP 2. The project follows a thorough method of throwaway prototyping and the system is developed accordingly. Various tests has been performed to measure the accuracy and performance upon a different groups of people and the results have indicated the benefits and necessity of this mobile application and the function of it has proven to accomplish the initial project objectives.

ACKNOWLEDGEMENTS

The accomplishment of this final year project involves several parties that have contributed in order to execute the entire project itself. It is a pleasure to acknowledge some several hand helpers that has encouraged and motivated as a drive to complete the entire project successfully.

I would like to express my utmost gratitude to my supervisor, Ms. Vivian Yong Suet Peng who not only served as my supervisor but also encouraged and challenged me throughout my academic program. She patiently guided me through the completion of this project, provided me support, knowledge and feedback from the beginning itself and had faith in me to accomplish my goals and objectives.

I would like to acknowledge all of the people who encouraged me in this project; Mr. Syazwan for his guidance and feedback on developing the mobile application, my close friends dear to me, Ms. Hidayah Ishak and Ms. Norhiqmah for their encouragement and mental motivation towards my project as well and for being by my side through the odd hours of the night.

Lastly and not the least, I would like to thank all the participants involved in the testing and survey of the project, without their presence it would not have been successful. My deepest gratitude goes out once again to all those whom have contributed in the making of the project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND NOMENCLATURES

Apps	Application
VR	Voice Recognition
SR	Speech Recognition
TTS	Text to Speech
FYP	Final Year Project
HTTP	Hypertext Protocol

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 Background of Study

Growth of the current technology has urbanized and spread rapidly worldwide. One of the most current development is the mobile application whereby it is an application software that is developed for low-power handheld devices such as personal digital assistants, enterprise digital assistants or mobile phones. In these smart phones, there are operating systems embedded in it ranging from various developers, present in the market are iOs (iPhone), Android, Windows, Symbian and a few more. These operating systems manage the hardware and software's of smart phones. Some OS platforms cover the entire range of the software pile while others may only include the lower levels (typically the kernel and middleware layers) and rely on additional software platforms to provide a user interface framework. Within these phones, there are applications (apps) present, which are known as software programs which allow one to perform various functions with it. These applications or apps are either pre-installed on phones during manufacture, downloaded by customers from various mobile software distribution platforms, or web applications delivered over HTTP [1]. The hype of using smart phones has spread like wildfire, giving mankind an ease of access to various needs from their mobile phones. With this, various mobile applications has been developed to cater human needs and wants.

Along with the swift leap in this technology of mobile application (apps), one of the ways that could be implemented in its development in order to ease human work would be Voice Recognition abilities in a mobile application. This technology involves translating spoken words into texts and actions. In other words, instead of using a keyboard, users are able to communicate and voice out to the device itself and a response is obtained. Speech-recognition or Voice-recognition software applications comprise several basic components, such as the microphone, sound card, vocabulary, speaker profile, language model, and recognition engine. The microphone and sound card convert analog human speech into a digital waveform whereas the recognition engine uses speech-recognition codes to

statistically match digitized sounds to words. To develop a match between speech and the system's vocabulary, two to three words are analyzed in sequence to determine the most likely word grouping. A large basic vocabulary of 300,000 words and the speaker profile help match the speech of the user and create text by the recognition engine. The speaker profile is a recording of the user's speech matched to a specific text [2].

The vision for adapting speech-recognition technology existed long before any real-life practical adaptations were possible. Finally, in the late 1980s and early 1990s speech-recognition technology found its first niche in the marketplace which comprised activities in which users needed to operate computers but did not have a free hand to punch keys or manipulate a mouse. [2] Along with the growth and vast use of mobile application in handheld devices, integration with voice recognition will bring a whole new advancement and open up more opportunities for speech to aid user experience. This integration not only will simplify and lighten tasks and responsibilities of humans in their daily life activities; in fact it also allows handset manufacturers to stand out with their product.

1.2 Problem Statement

The focus in this project is not to develop a major new technology; however it involves applying the current technology into mobile applications to solve slightly smaller but relevant problems in households. According to research individuals find difficulty in managing cooking recipes and cookbooks in households. Therefore, several mobile apps were developed to curb the issue. However, that does not form a user friendly environment especially when the need arises to use these gadgets in household kitchens for an instance.

1.2.1 Project Identification

Several users that are part of this situation have the tendency to find issues while using their gadgets and performing household tasks at the same time. For an instance, housewives, professionals such as chefs and amateurs, students of culinary art schools all have the similar problem as common grounds. The individual may be busy in cooking preparation, and they all face the same problems whereby simple tasks such as finding and recalling the lines of the recipe in the cookbook becomes a major bottleneck and also time consuming. It is uneasy as at the same time, they need to keep track of their cooking to avoid any disasters taking place.

Following that, gadgets such as smart phones and tablets were developed that enables users to view cooking recipes from their personal hand held devices. However, users are still at unease whereby it is difficult to hold the device and cook at the same time. These issues tend to lead to bigger concerns; using mobile gadgets inappropriately will just cause the life of the device to decrease. In other words, users have to juggle and struggle with the need to read out recipes from their devices (phones and tablets) when at the same time their hands are fully occupied or is messed with cookery. This is the reason why this project is necessary to solve minor hiccups in households to avoid large ones by setting up a mobile application which will be able to present recipes and ease the learning of the art of cooking with voice recognition abilities.

If we were to take this into a different angle, away from culinary and cooking, the similar problem takes places amongst students especially in laboratories. For an instance, similarly in laboratories, students and lecturers are pre occupied with handling devices, tools and equipment which leads to troublesome methods in order to read experiment steps and procedures. Therefore, students have resorted to the use of their mobile devices to capture the steps and procedures, however the problems remains the same as the users are engaged in their tasks that they find difficulty to stop their current step just to move to the next page or just to click to view the next step. Thus, this research is brought upon to test the use of voice recognition to curb these similar issues. In this project, the focus is driven towards testing the voice recognition abilities in a mobile application that involves cooking and recipes.

1.2.2 Project Significance

This particular project brings significance into the lives of many users especially in managing household's major task such as cooking. The whole idea and worth of this project is to develop a mobile application that will ease the workload of human beings. Here, the focus is into the culinary world as a stepping move into the household world. The system is meant for users to find less difficulty while in their respective kitchens and is targeted to all household managing beings, restaurant chefs and culinary schools.

Also, this project signifies the need of inducing and increasing digital lifestyles in households especially in Malaysia. Globally, many countries have started being kitchen savvy whereby

technology has moved into the domestic cooking world. With this enhancement mobile application, Malaysians can now start increasing the use of the latest technologies in performing daily tasks such as cooking in their very own home. Furthermore, this project is designed to explore the abilities of integrating voice recognition with daily life activities. Voice recognition that has grown throughout the years is finally able to assist us humans; hence this project will imply the use of voice recognition in daily activities as a helping hand to humans.

1.3 Objectives and Scope of Study

The objectives and scope of work to be achieved are as follows:

1. To understand the past and current technology of voice recognition systems.
2. To perform thorough researches and fully understand the development methods of a mobile application on an Android platform.
3. To understand and examine current voice recognition software's and find methods to integrate it with the mobile application and further enhance its functionalities.
4. To develop a mobile application on recipes and cookery on an ANDROID platform which integrates with a voice recognition tool as an enhancement to ease user during cooking in households, restaurants and culinary schools.
5. To perform thorough tests to ensure the voice recognition software chosen performs at its optimum level.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2. LITERATURE REVIEW AND THEORY

2.1 History of Voice and Speech Recognition

Ever since the technology of Automatic Speech Recognition (ASR) and Transcription began in 1936 and progressed from then onwards, the largest barriers to the speed and accuracy of speech & voice recognition were computer speed and power .Garfinkel (1998) points out how with the average CPU now above a Pentium III and RAM levels at 500 MB and up, accuracy levels have reached 95% and better with transcription speeds at over 160 words per minute. The study of automatic speech recognition and transcription began in the 1936 with AT&T's Bell Labs where most research was funded and performed by Universities and the U.S. Government (primarily by the Military and DARPA - Defence Advanced Research Project Agency) The first company to launch a commercial product was Covox in 1982 along with this introduction of sound to computers came an early form of speech recognition and followed by Dragon Systems. Nuance, Inc. a company that was founded in 1982 and whose eventual product has become the overwhelming leader in the speech recognition market [3].

Moving from there is the success story of “Radio Rex” in the field of speech recognition whereby a toy dog that came in a house. As mentioned by Barber.J (2005) in his article, Rex was the pioneer into the field of speech recognition. This particular dog was held within its house by an electromagnet, as current flowed through a circuit bridge, the magnet was energized. The bridge was sensitive to 500 cps of acoustic energy. The energy of the vowel sound of the word "Rex" caused the bridge to vibrate, breaking the electrical circuit, and allowing a spring to push Rex out of his house [4].

Despite some failures, appreciation and interest for the field began to grow. The agency that funded the research became known as the Defence Advanced Research Project Agency (DARPA). Following are the early key advances of the technology [4]:

- In 1952, as government-funding research began to gain momentum, Bell Laboratories developed an automatic speech recognition system that successfully identified the digits 0-9 spoken to it over the telephone.

- In 1959, MIT developed a system that successfully identifies vowel sounds with 93% accuracy.
- In 1966, a system with 50 vocabulary words was successfully tested.
- In the early 1970's the SUR program began to produce results in the form of the HARPY system. This system could recognize complete sentences that consisted of a limited rage of grammar structures. This program required massive amounts of computing power to work, 50 state of the art computers.
- In the 1980's Hidden Markov Models (HMM) become the standard statistical approach for computation.
- In 1996, the consumer company, Charles Schwab became the first company to implement a speech recognition system for its customer interface.
- In 1997 Dragon Systems release "Naturally Speaking," the first continuous speech dictation software.
- In 2002, TellMe supplies the first global voice portal, and later that year, NetByTel launched the first voice enabler. This enabled users to fill out a web-based data form over the phone.

2.2 Development of Voice Recognition Technology

Speech recognition technology has advanced tremendously over the last four decades, from ad-hoc algorithms to sophisticated solutions using hill-climbing parameter estimation and effective search strategies. While these algorithms advanced, mobile devices became ever more competent computing platforms for the use of voice recognition. The combination of sophisticated algorithms and generous computing capabilities has not, however, put a speech recognition system in everyone’s daily technical diet [5]. "In the early days, the capabilities of the technology combined with the computing power of the various devices required that you have training so that [the software] would have data about the specific user and not use up too much computer power," explained Mike Thompson, senior vice president and general manager of Nuance Mobile but the computing power of today's Smartphone is such that voice training is no longer required. The digital voice models that form the basis of today's

speech recognition software are sophisticated enough that they can learn — on their own — their users' verbal quirks.

The use of voice and speech recognition in mobile devices has bloomed. Mobile voice-recognition apps also have other advantages over their older desktop counterparts. One is the ability to communicate with powerful central computers, or servers, that can combine information from millions of users and then make broad generalizations that help improve the apps' overall ability to recognize words [6]. According to Dave Grannen, president and CEO of speech recognition software, lingo, "The first time you speak to the phone, we put a cookie" — a kind of digital tag — "on your device and when you say something we call up your personal language model from our servers and use it to get better accuracy,". An individual's voice model contains information about his accent and unique way of pronouncing certain words, among other things. The servers can combine the voice models of several speakers who have similar accents to improve the accuracy for that population."If you're from India and speaking English as a second language on Vlingo, we work pretty darned well. If you're from Germany speaking English, it doesn't work so well," Grannen told TechNewsDaily [6].

This development of technology has even impacted healthcare sector. Ronaldo Parente (2004) points out on how the healthcare industry started implementing speech recognition systems for medical reporting in 1994. The author explains the challenges first faced involving scepticism by doctors, who were reluctant to abandon traditional ways of performing their work. The technology needed to be user friendly and accurate in order to carve a niche in the market, but the early systems were perceived as anything but user friendly. These systems still had frustratingly small vocabularies and were not programmed to understand medical terminology. Furthermore, a major barrier to acceptance existed in the industry itself [2].

From the challenges faced by the sector, several improvements were seen in time. Ronaldo Parente (2004) once again describes Continuous improvement in the technology of speech-recognition systems became imperative for hospitals so that their doctors would come to believe in the value of these systems. Therefore, the vocabularies built into these systems grew tremendously in both size and the degree to which they were tailored to the jargon and terminology of the medical profession. The systems gradually became better at adapting to a

particular user's speech, regardless of timbre, speech character, accents, or head colds. Accuracy rates rose dramatically, and doctors were no longer struggling for the “right” words for the system to understand and record. [2] Also according to the author’s research, once the speech-recognition system was implemented, the physicians felt it offered many advantages. First, they were pleased that there was little or no disruption to the way they had grown accustomed to practicing. The use of the cassette recorder and background recognition allowed this. They also saw a marked improvement in report turnaround time, from four days to 24 to 48 hours. An important by-product was that the referring physicians received reports more quickly and also noticeable reduction in the number of people and steps involved in procedures.

2.3 Theory and Applications

Once we can consider this technology advancement, we can relate it and bring it back to our household kitchens. There were several suggestions of having the usage of computers in the kitchen mainly a wireless solution. This is ideal from small kitchens. According to Wes Kehler, an owner of Classic Kitchen Designs, users can now have built in computers into kitchen cabinets to allow users an ease for recipe viewing and space to perform their cookery [7]. This method would definitely involve large cost and may not be feasible in other platforms. Therefore, a mobile application with feature of voice recognition will definitely be cost savvy and will indirectly result to better time management in household kitchens.

Following to the above, a fit example would be of the built in iPad. It has brought us to new levels of media entertainment and utility uses, and we’re seeing new and exciting integrations almost daily. There are dashboard integrations, shelf integrations, and many more [8]. Not long ago, everyone with a TV in their kitchen was a front runner in media entertainment in the house. Today, that’s old news and many of us have flat screens hanging in our living room, kitchen, and bedroom and even in the bathroom. It’s safe to say that our need for entertainment in all situations is more than freakish, however really time saving according to Dybwad.B (2010). Alan Daly, a local decided that his kitchen needed a different edgy look to it, and he decided to integrate his new iPad into a cabinet door where he could easily get news, movies, music and even recipes quickly and comfortably while enjoying his cooking, or whatever he was doing in the kitchen for long periods of time [8].

On this similar platform, a previous final year project by Chan. A (2005) was about developing a voice recognition system computer program based on research done on existing

VRS (Voice Recognition Systems), theories and applications [9]. The system which is a computer software program is designed to store cooking recipes of various kinds and also a voice recognition ability to ease users. The author and developer completed the project and managed to form a system that was able to assist users in the kitchen to retrieve recipes, edit recipes and view measurements. The system is however is not mobile and is only usable as computer program software and nothing else. Thus, the mobile application will be taking this project to the next level.

2.4 Current Relevant Products

There are several current relevant products in the market that is similar to the Recipe Helper system mobile application project itself. The relevant products exist on both iOs and Android platforms. In this section of the report, it is listed the relevant products and how it is differentiated from the project that I am progressing on.

2.4.1 iCookbook

This particular mobile application now exist on several platforms; iOs, Android and as well as BlackBerry. This cooking app is able to perform ideal functions such as to search for recipes, editing recipes, adding photos, saving as favourites, preparation mode, printing and so on. However, this mobile app only has voice command (recognition) abilities only on the iPhone/iPad operating system and not on the Android system.

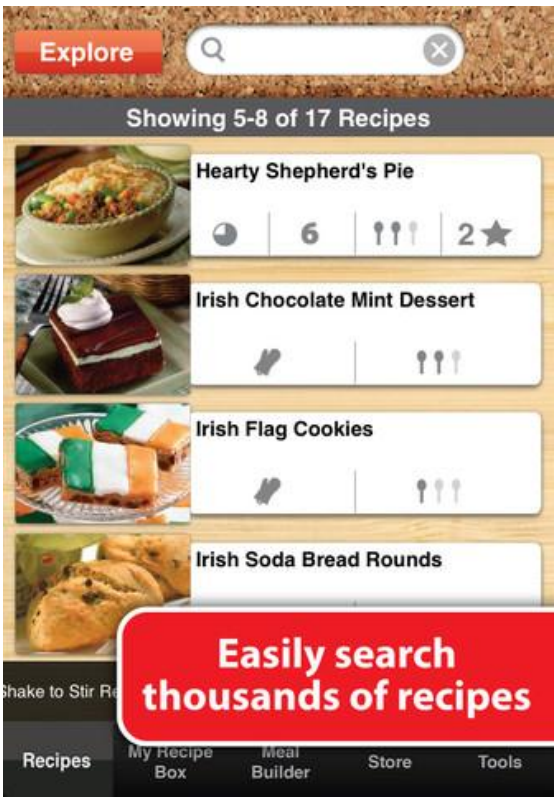


Figure 1

2.4.2 Kitchen Helper

This mobile application has a similar name to the one proposed, however this system is completely different. This mobile app comes with a built-in a quantity adjuster that makes it easy to scale recipes up to feed any crowd. It is an app that is able to find alternatives to cooking products if absent of a certain ingredient besides being an app that is able to convert measuring scales for cooking purposes.

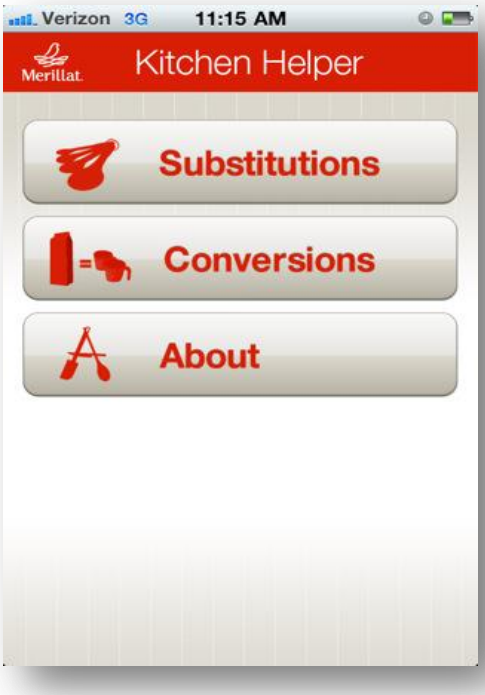


Figure 2

2.4.3 iFood Assistant

This particular mobile app was developed by and for Kraft Foods Sdn Bhd. The recipes present in this app are all comprising of recipes based on Kraft's ingredients. This app is free and is only able to search for recipes, save recipes and enables the user to use voice recognition to move steps of the ingredients and procedures. However, this app is very Kraft-centric, no editing is allowed in this app. Users have reported on how the search accuracy of

this app is rather poor. “Many of the items don’t seem to be correctly categorized for searching. There were several items that show up in the list, but aren’t included in search results under their specific category”, according to Chester Baker a blogger.

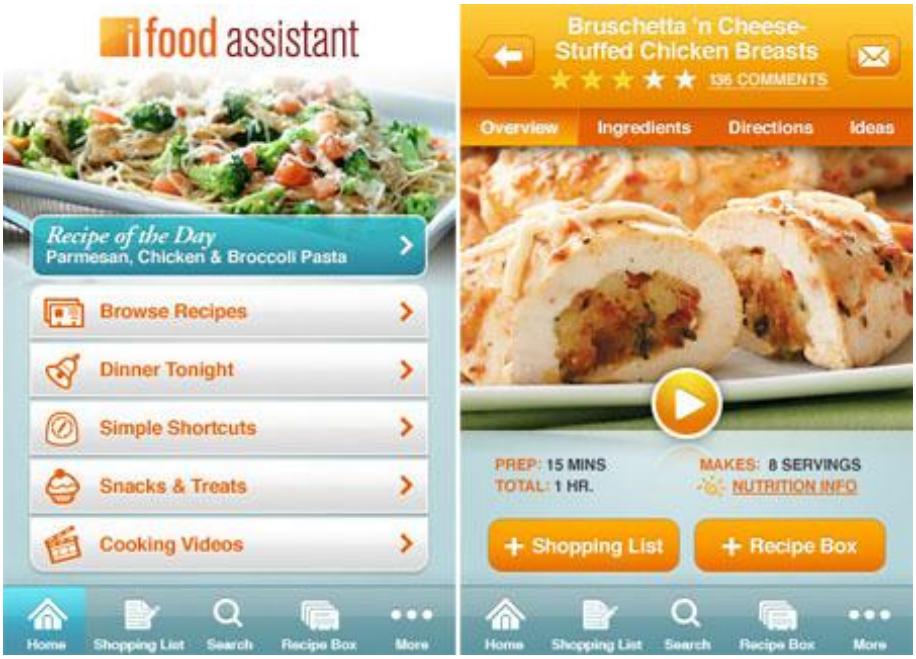


Figure 3

2.4.4 Digital Recipe Sidekick

The Digital Recipe Sidekick is an application that is only present on the Android platform; hence this current product is one of the closest competitors to the current project that is being proposed. This app is rather comprehensive in terms of its functionalities as it is able to perform functions such as editing of recipes, saving recipes, voice recognition abilities to move from one step to another and sharing of recipes. This app however, does not have recipes stored in; it is different that it extracts the recipes from a website, Allrecipes.com, hence in order to obtain new recipes the user needs to keep on fetching the recipe from an external website. Besides that, this app is rather not user friendly, the design and Human Computer Interface appears to be complicated and messy as well as the organization and arrangements of the recipes.

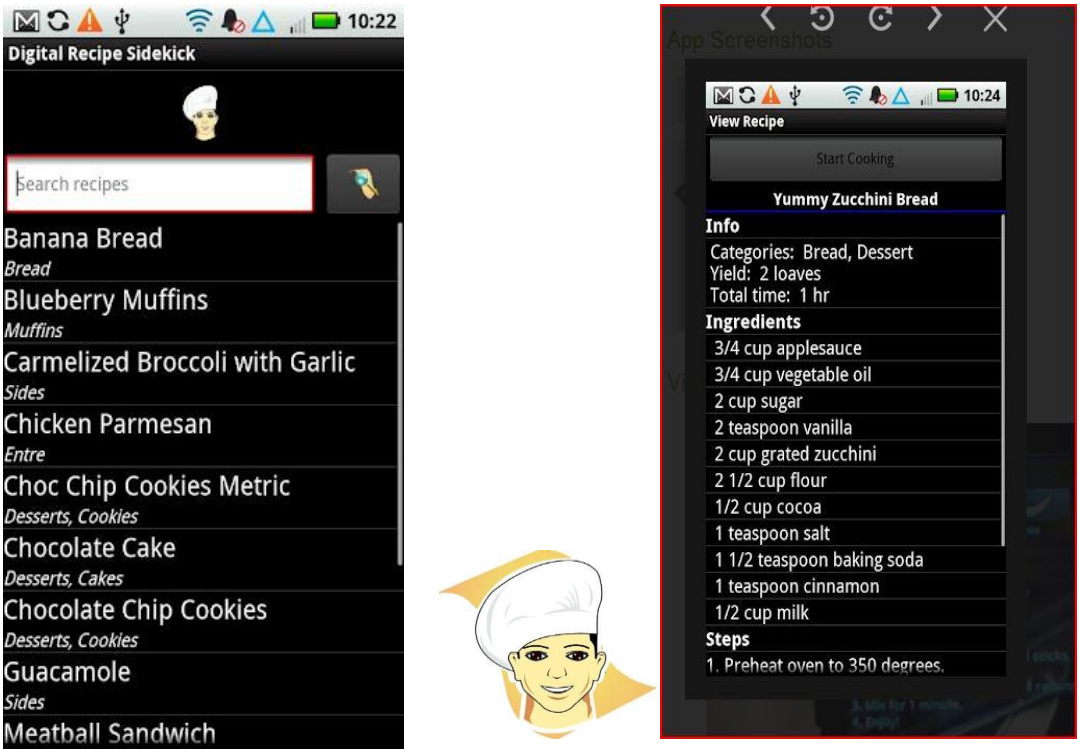


Figure 4

2.4.5 Comparison between the Proposed and Current Products

Characteristrics	My Proposed Project	Current products
User Interface	Simple, User-friendly	Complex
Functionalities	Search, Edit, Save, Voice Recognition	Search, Edit, Save, Not all have Voice Recognition
Human Computer Interaction	Easy to navigate ,visible	Hard to navigate
Scope of Content	Open/General	Niche (i.e. iFood assistant)
Visibility	Free	Mostly Chargeable

CHAPTER 3

METHODOLOGY

3. METHODOLOGY

This chapter highlights on how this project will be developed. A proper methodology and project activities that go along with it are most vital to ensure the project is working. Furthermore, this chapter will also discuss the research methodology used, the entire planning and analysing stage of the project formation, the system analysis and requirements definition, the rough design of the mobile application, the implementation, testing and integration of the Voice Recognition software with the mobile application itself.

3.1 Research Methodology

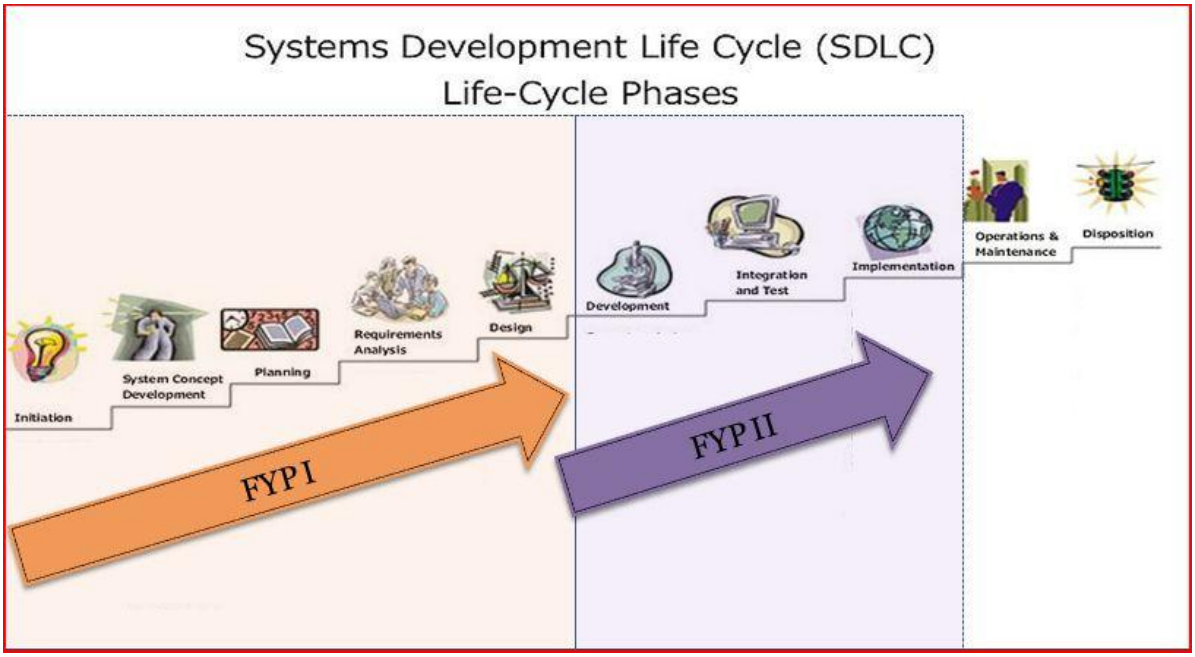


Figure 5

The figure above describes the research flow in the System Development Life Cycle phase of the project that I am developing. As seen above, several stages are completed within the first leap of the project such as the planning, requirements definition, and design of the mobile app. In the second leap of the project phase will be the development, testing packs and finally the implementation and maintenance of the developed project.

Moving further into the research methodology, this project implements throwaway prototyping-based methodology in detail. This methodology is used for a rather different purpose which has a relatively through analysis phase that is used to gather information and to develop ideas for the main concept of the project system itself. Each prototype that is developed is used to minimize the risk associated with building the system by identifying the issues at every particular stage before the final system is readily built. Once the issues are resolved at the analysis stage, then the project moves into design and implementation. This particular methodology benefits the analysis and design stages as it removes and reduces any issues that arise before the final system is built.

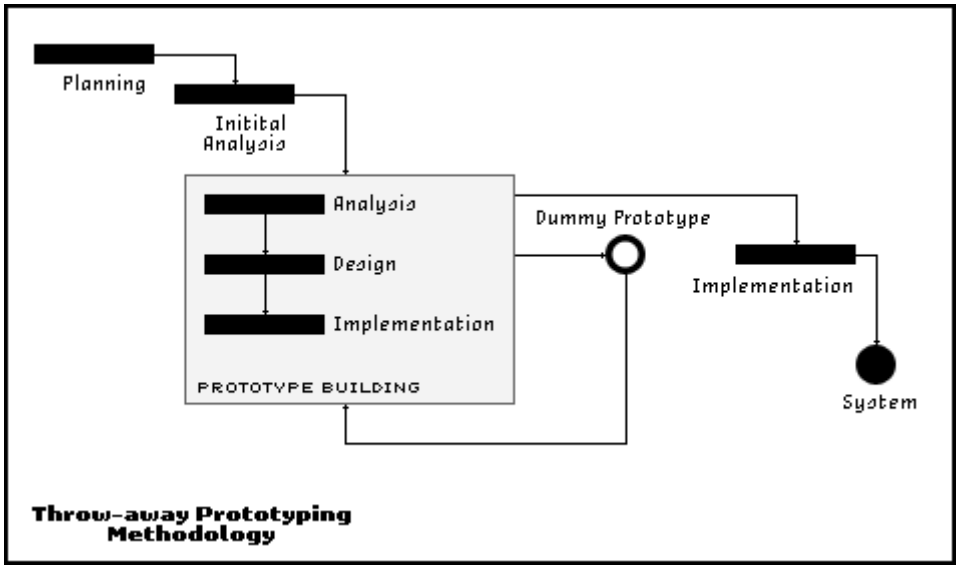
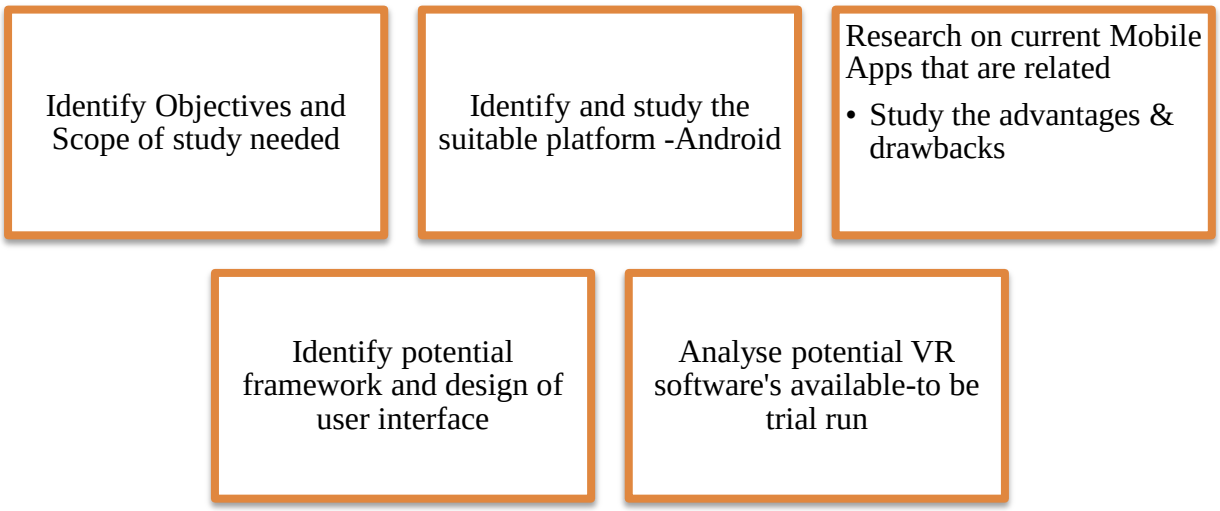


Figure 6

3.2 System Methodology

3.2.1 Planning and Gathering Information

In the beginning stage of planning the development, the necessary is to identify the possible needs to be present in the mobile app itself based on the identified scope of study and objectives of the project. Following that the plan is to study the platform to be used, perform research on current apps on Recipes on the Android platform that is existent and evaluate each of the application to gather information on how the design and framework should turn out for the Recipe helper system. Several other current products are evaluated here and the flaws of each are identified as mentioned in Chapter 2 of this report.



From then on, the potential framework and set up design is sketched in this phase as well as generation of ideas to form the user interface. Following that, in this stage, research on several voice recognition software's; is also vital to identify its suitability to be integrated into the potential system of the mobile application.

The planning stage is continued and further evaluated through a use case diagram, whereby the interaction between the user and admin is visible. The user is the potential external user of the system and the admin is the developer of the particular system itself. From the use case diagram below, it shows the user interacting with the system by retrieving the recipes from the updated database by the admin/developer. From then on, the user will also interact with the system and navigate the system according to the desired using the voice recognition ability embedded in the system and at the same time the system responds with the user with voice/ audio output through text to speech recognition. This diagram shows how the two parties will interact with one another.

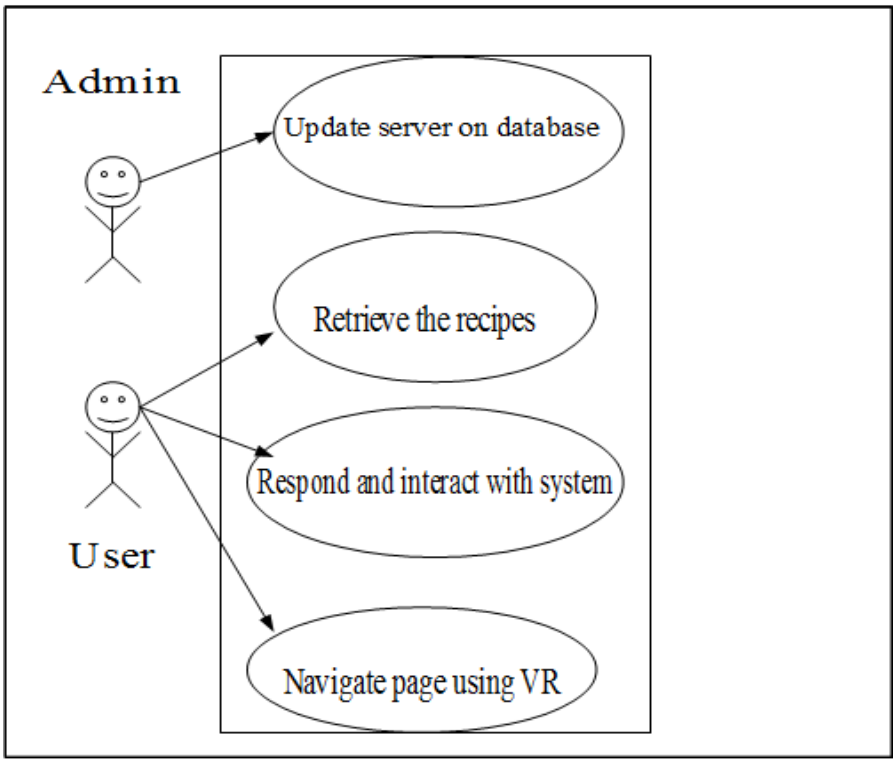


Figure 7

3.2.2 System Analysis and Requirements Definition

Upon collecting viable information and understanding the research made on the application previously, this stage is now to list and identify functionalities in the required system. Besides the main function of having voice recognition abilities that will read to the user the selected recipe's steps in cooking and allow the user to navigate through speech and words, the recipe helper system will also perform as a recipe cookbook (mobile version), whereby it will display several mouth-watering recipes based on the different countries in the globe ranging from Asian till the American delicacies. Besides that, it will also be able to store and save recipes selected by the users as their favourites and potentially looking into performing editing of these recipes selected to suite the user's needs and include their personal recipes into the app itself.

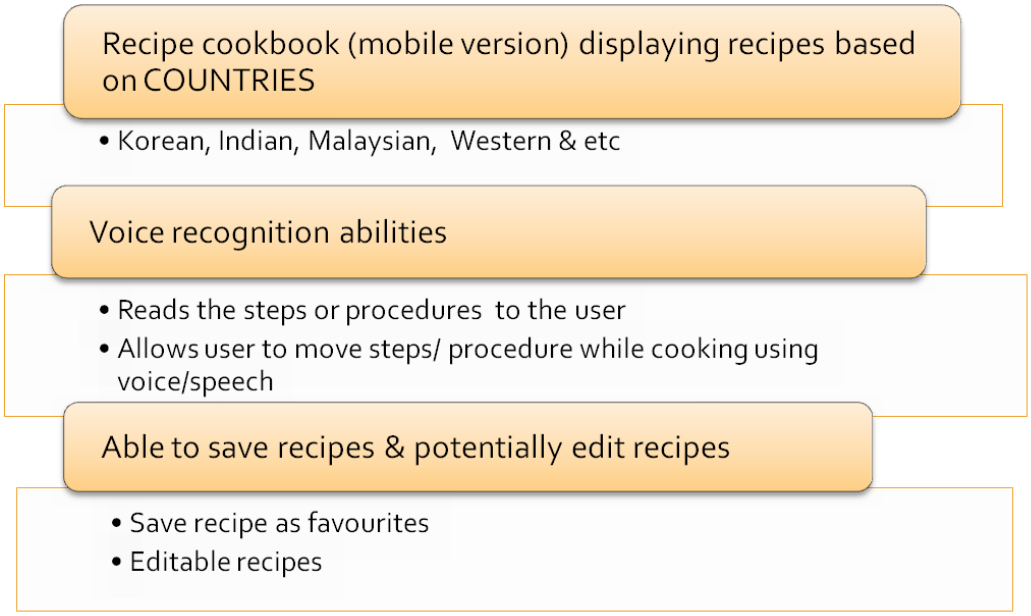


Figure 8

3.2.3 Development Phase

In this phase of the development of the project (the most important part of the system), it visualises the flow and modular structure and architecture of the recipe helper system. From the functionalities listed above, a modular flow of how the system will be can be derived. How the system will flow in overall a general matter, the voice recognition integration and other user functionalities flow within the system.

3.2.3.1 Modular Flow Structures and Architecture

The flow of the system can be divided based on the number of tabs (or interfaces) present in the mobile application itself. The flow charts below show the flow of the user once accessing the system at the beginning till the very end of exiting the system. The first chart below figure 9, visualizes the flow of the user while using the recipe section from the initiation of the app to the selection of the recipes, the voice recognition detection and response, and until the user has complete using the application and exits. The following charts in figure 10, 11 and 12 demonstrates the modular flow of each tab in the app i.e. search, voice recognition and saving the recipe as favourite.

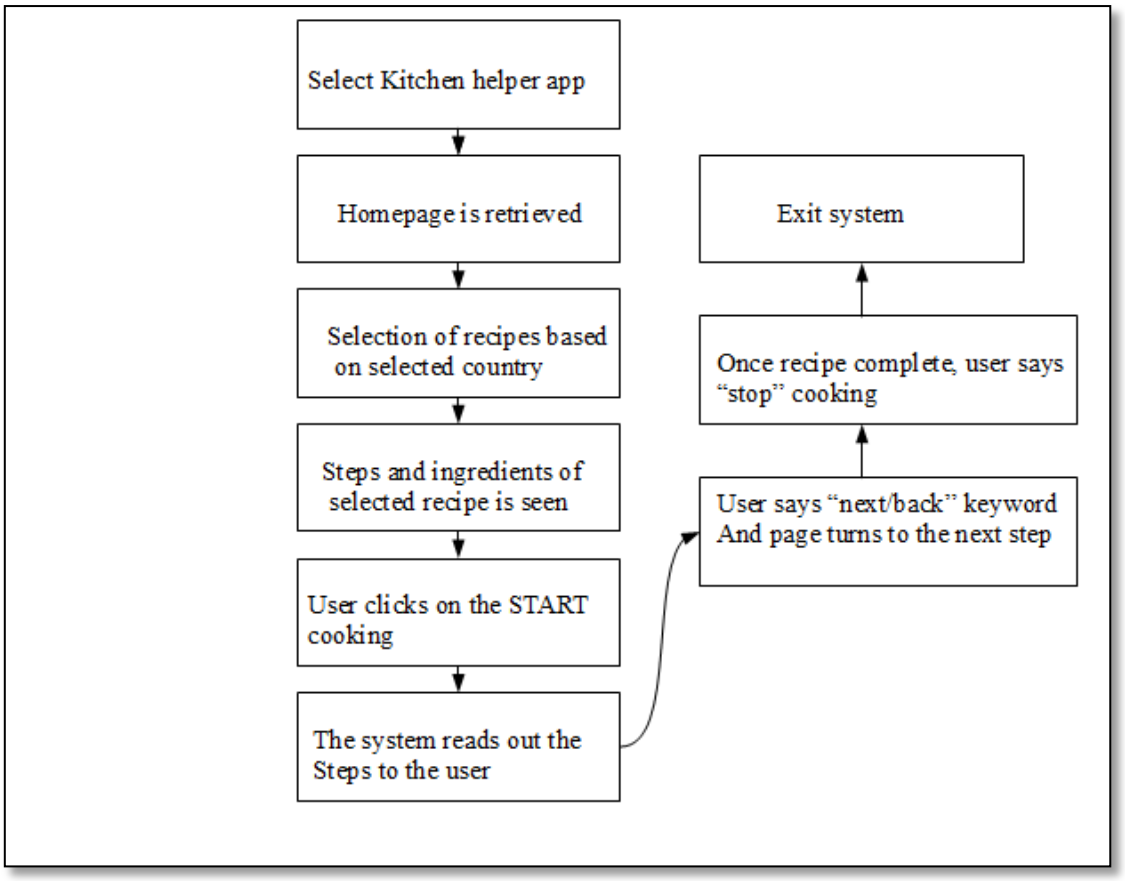


Figure 9: Overall flow

The figure above shows the structural flow of the mobile app from the beginning where the users starts the application and until exit of the system. As mentioned prior to this section, in this paper, the user will begin by initiating the application and a homepage appears and from then, a list of recipes follows according to countries i.e. Malaysia, India and etc. Once user has selected the respective recipe, the ingredients are then showed on the screen; user clicks on the button (start) 'Cook It' and the steps appear. From here on, the user is able to navigate to the next page with words 'next' and 'back' and the steps are read out to the user. Upon completing the event, user clicks on the button 'end' and recipe is complete and application exits.

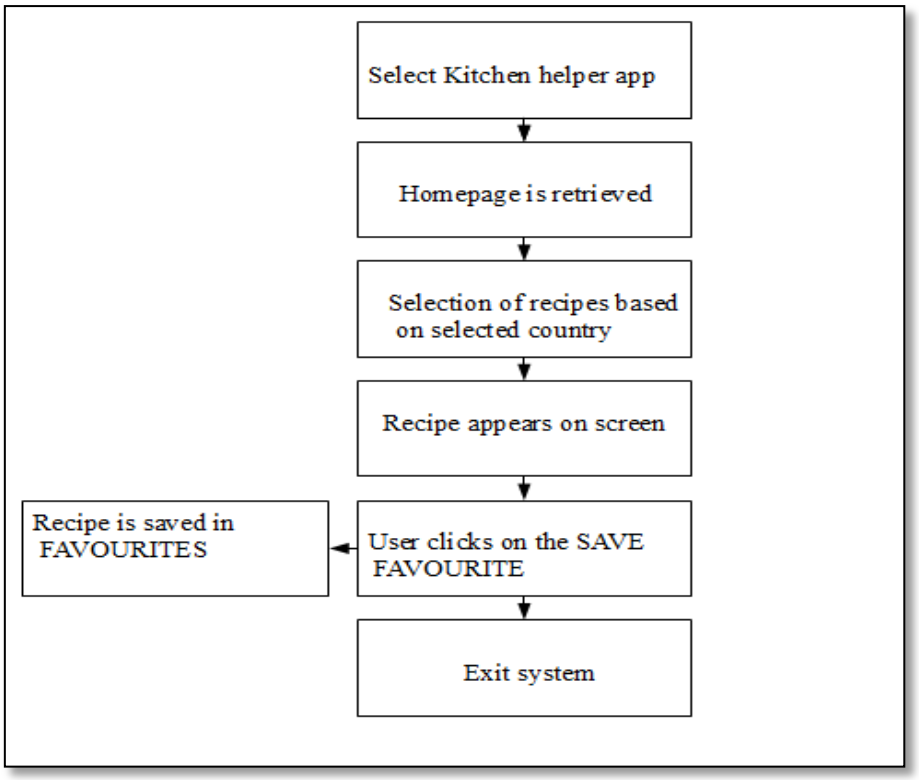


Figure 10: Save as Favourite

The favourite selection tab on the application (app) works simply for the user to save the respective recipe as their favourites. Upon clicking the heart shaped save button on the top of the recipe, the recipe is then saved into the favourite's tab. User is able to view the saved recipes by selecting the favourite button present on the main page of the application itself.

The following figures below (11 and 12) respectively show the search tab whereby the user is able to perform a search on the preferred recipe. Once the search tab on the app is selected, the user places in the recipe and the recipe appears. User is allowed to perform editing at this point of the application. The user is able to edit the recipe according to their respective needs and it will appear according to the county of the recipe edited.

The next figure shows the flow of the Voice Recognition ability of the app. Once the user selects the recipe and clicks on 'Cook It', the VR is activated and the app starts to interact with the user itself. The user is able to navigate steps from next to back and able to navigate through steps of the recipes and at the same time, the text to speech abilities as well are initiated and the ingredients are read out to the user.

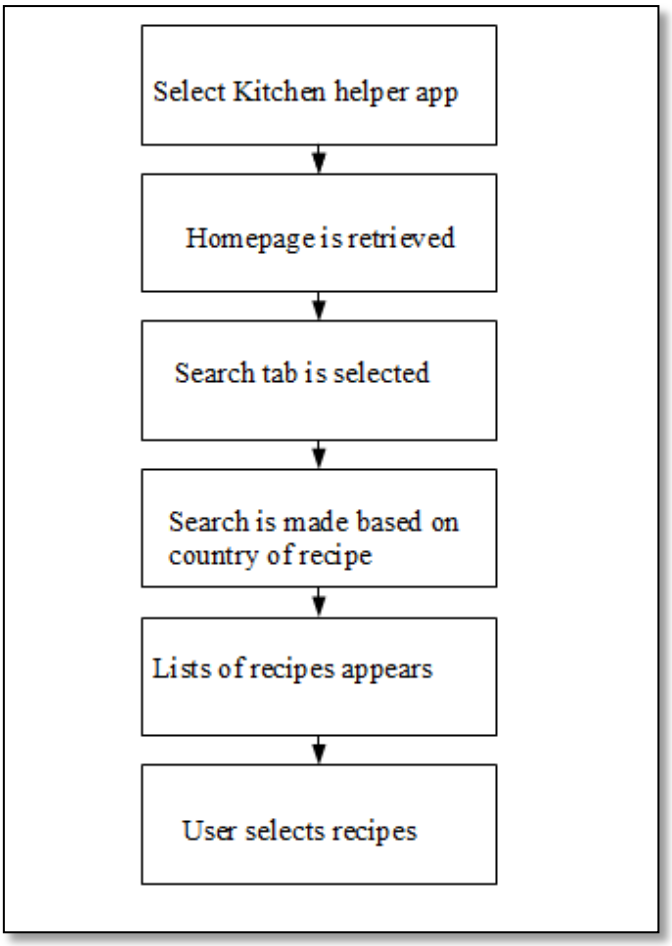


Figure 11: Search Tab

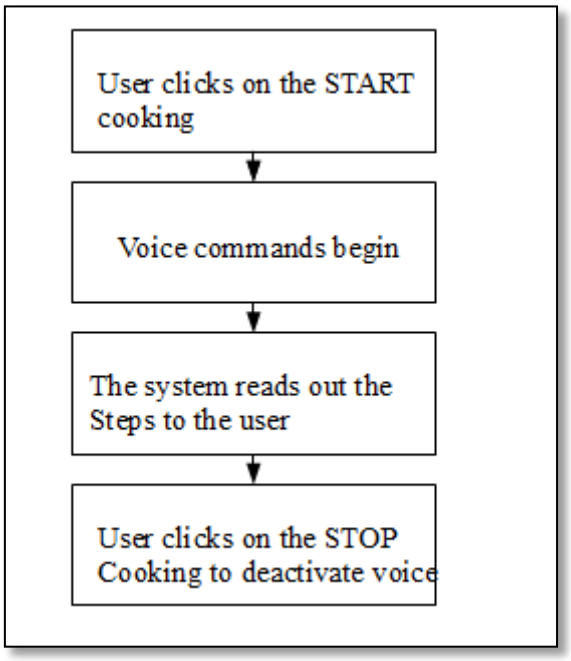


Figure 12: Voice Recognition

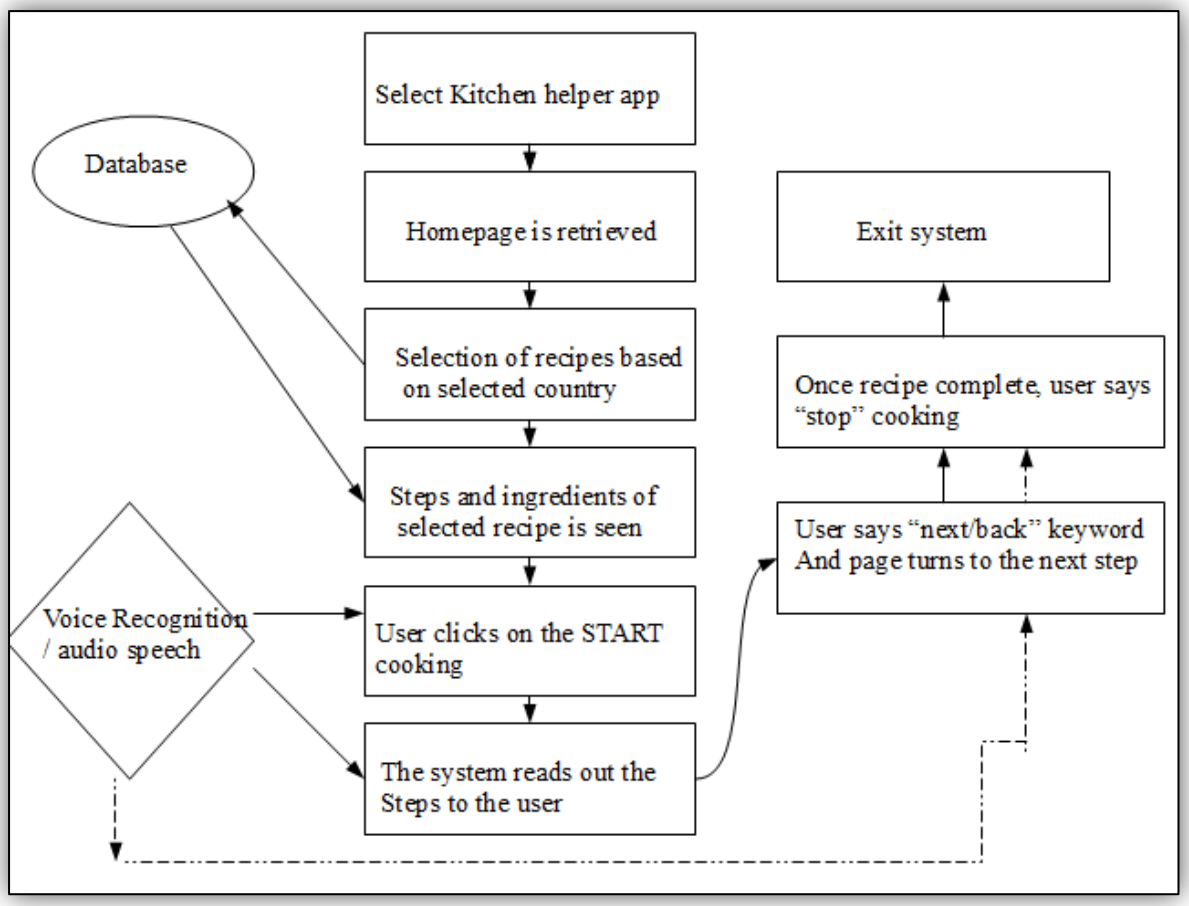


Figure 13: Voice Recognition interaction with the application

The figure above shows the entire application interacting with the Voice Recognition, audio/ text to speech recognition abilities, calling in the database (MySQLLite) and also the basic app itself. The user will begin by initiating the application and a homepage appears and from then, a list of recipes follows, once user has selected the respective recipe, the ingredients are then showed on the screen; user clicks on the button (start) 'Cook It' and the steps appear. When this happens, the VR from GOOGLE API is called from the Google server and the voice recognition abilities starts in the app. The VR will allow the user to navigate from pages and ingredients back- next and at the same time, the text to speech function is also called and imported from the android platform itself. This function will read out the steps to the user. The recipes on the other hand appear once the database is called and that happens once the respective recipe is selected. The database is called and the ingredients appear. the steps are read out to the user. Upon completing the event, user clicks on the button 'end' and recipe is complete and application exits. Finally all user interaction with the VR ends once the user selects stop/end.

3.3 Design of the Mobile Application (App)

The design of the system will be rather user friendly to ease the understanding and usage for users. The app is proposed to have these features:

- ✓ Simple, user friendly layout
- ✓ Homepage(Main screen); with the Country Based recipe categories placed in alphabetical order
- ✓ Tab1 ; search (to be able to search for recipes)
- ✓ Tab 2; favorites (save favorite recipes)
- ✓ Each recipe step page:
  - ✓ Ingredients and Steps on the next page
  - ✓ Example :Next Slide

For each recipe selected by the user, users are able to view the ingredients and steps/procedures involved to prepare the respective dish. To begin the recipe helper with voice abilities, users are to press Cook It (start) (button to enable voice and speech recognition abilities).

3.3.1 Prototype of Interface

The user interface is created to be simple and easy to understand for the user. This is to accommodate users who have not had any past experiences in operating or using mobile application and also to ease them since several others are rather complex with their user interface. The user interface covers most of the functionalities available. The user interfaces are showed below in this section.

Figure 14: Main page showing the lists of countries

Figure 15: Selected recipe (China) and list of recipes

Figure 16: The interface of the ingredients which was selected

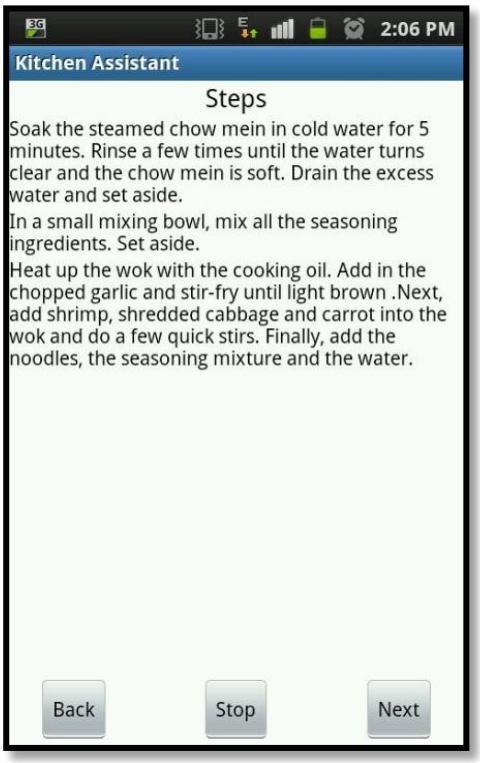


Figure 17: Once the button Cook It is selected, the steps appear according to the VR by user.

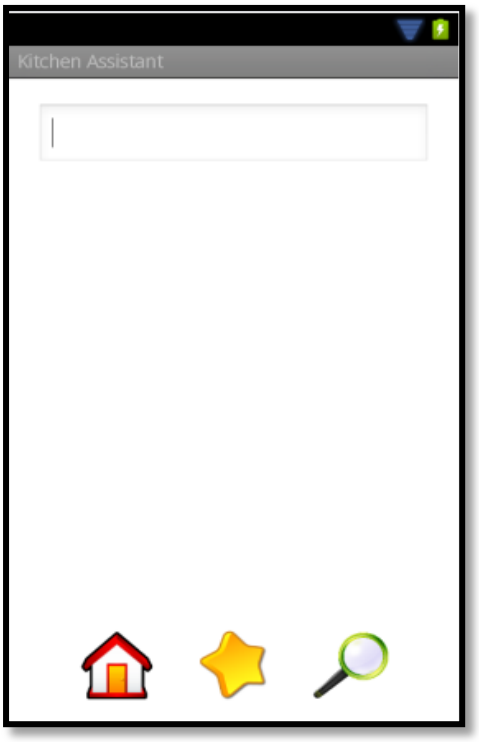


Figure 18: Interface of the search tab to search recipes

Figure 19: Interface of the favorite tab that shows recipes saved as favorite

The interface on figure 14 is the main page with the country flags to identify and categorize the recipes according to the countries. The interface on figure 15 is the lists of recipes for the selected country and once selected, interface figure 16 is seen and once user interacts by clicking the Cook It button, it moves to interface on figure 17. From then on, user is to navigate pages accordingly with words “Next” or “Back” and simultaneously the recipe is read out to the users based on each of the step appearing on the screen.

3.4 Verification and Validation

During this stage, the system is to be implemented, whereby once the framework and design of the mobile application have been identified, research on the functionalities are complete, the design has been set up, integration with voice recognition software's will begin. Testing without doubt is needed for the system. Besides error checking, testing will ensure that the system specification have covered and solved most if not all users' problems. Testing will also ensure that the system interface is user friendly enough for users to understand and navigate through the mobile application itself. This is the phase where the users may see the functionalities of the system and the developer may know if the system is able to operate according to planned objectives and at optimum performance.

There would be a few testing phases involved; the **pre-test** and **post-test** of the mobile application itself and **testing for the voice recognition software's** integration on the performance and accuracy of the selected software.

In pre-test it is to show if the system has significance and feasibility related to the users and how does it relate to making their lives easy with the application. This test is done immediately before performing the final completion of the design; this is to allow developer to see the need of the app based on the selected target market:

- System has significance & feasibility to users?
- Making their lives easy with the application?
- Method: Survey on 10 people

Post-Test will be necessary to test out the system from the similar users. The post-test will be done by performing a comparison of the mobile app proposed versus the closest competitor in the current market: Digital *Recipe Sidekick VS My Project*

In testing for the voice recognition software there would be involved testing on the major contribution of this project, Voice Recognition. In order to test the VR software launched and implemented, tests are to be carried out to fully evaluate the performance and functionality also the accuracy of the software to detect the user's voice itself. The test would be a simple survey conducted based on a questionnaire given upon trying out the VR software- Google API and entire performance of the voice recognition software being able to detect.

With this users will be given both the mobile applications to meddle with and several questions based on both the apps will be given to users to enable them to evaluate the mobile application and thus further fixing and maintenance can be formed from then on. Furthermore, this testing will also allow the developer to obtain feedbacks and response on the system functionalities according to the user's needs and will allow some allocation to do further correction on the system and how it can be better than the competitor:

- The target users for the testing involve these categories:
  - Students (Aged between 18 to 25)-Minimal cooking
  - Housewives- Large amount of cooking
  - Professionals (chefs, restaurants)- Extensive daily cooking

3.5 Project Activities

The project activities from here on involve the key milestone for the mobile app, the flow of Gantt chart for the planning of the project and how the project is completed within the feasible time frame given whereby Chapter 1 and 2 is focused for completion within FYP1 that has been completed, hence now the focus is towards the designing and implementation of FYP2.

3.5.1 Key Milestone

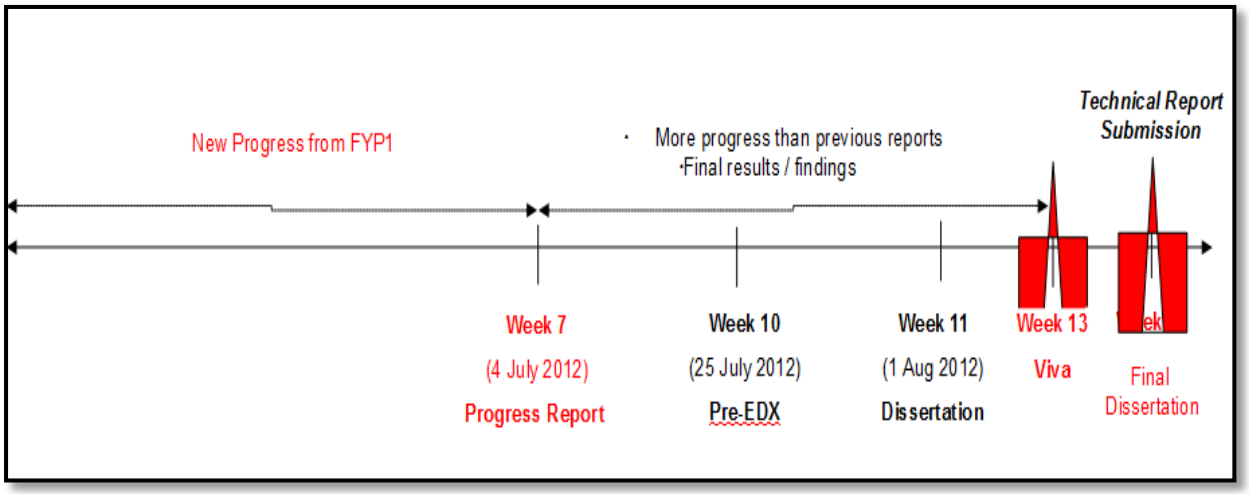


Figure 20

3.5.2 Gantt Chart

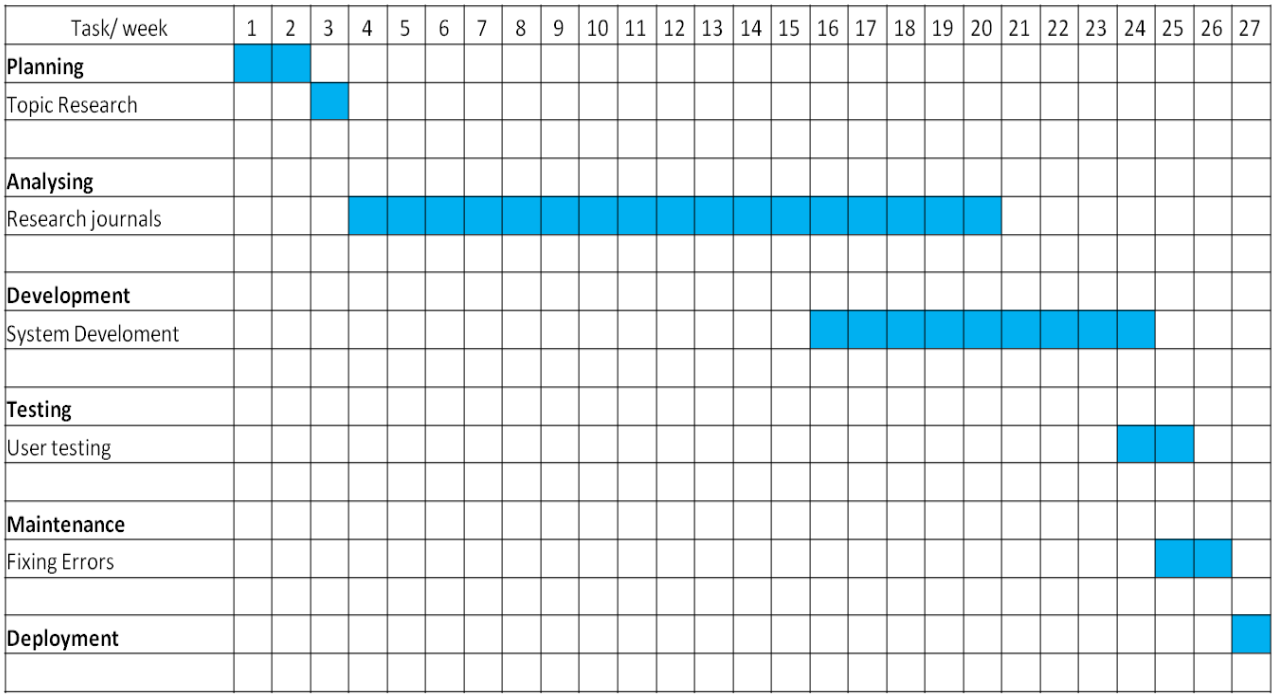


Figure 21

The Gantt chart above shows the project flow based on the given number of weeks. The project is able to fit in the short timeline given hence; this shows the feasibility of this project. The longest faces are the research phase as well as the development of the mobile application. This timeline is subject to changes, whereby at some phases the testing might consume a week longer or might take place ahead of time planned. The deployment of the project is the final phase in the development life cycle of my project.

3.6 Tools Required

Hardware: Android platform- Samsung Tablet, Personal computer with processing speed of 1.5 GHz and sufficient RAM and hard disk space.

Storage capacity	Flash memory 2 GB (CDMA), 16 GB or 32 GB models and microSD slot
Memory	512 MB
Display	1024 × 600 px (aspect ratio16:10), 7.0 in (18 cm) diagonal, appr. 21 in2(140 cm2) at 170 PPI
Graphics	PowerVR SGX 540
Input	Multi-touch screen
Weight	380 g (13 oz)

Software: Android SDK tools need to be installed to develop Android applications. The most important SDK tools are Android SDK Manager, the AVD Manager the emulator, and the Dalvik Debug Monitor Server. All of these tools are easily found in *Android Developers* website and there are also provided with tutorial in developing application for starters. The following is the lists of required software's:

- Android SDK platform tools & ADT Plug-in for Android
- Eclipse Classic
- Android Emulator
- Language: Java
- Voice recognition software

CHAPTER 4

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

4.1. Results of User Testing

As mentioned above the testing for voice recognition is divided into 2 parts. The testing for voice recognition is initiated at the beginning of the development phase so that, the main contribution to this project which is the voice recognition flows smoothly when it is closer towards the final execution of the project. Prior to performing the VR testing, the Pre-Test was conducted and finally the post-test. The testing was performed on several groups, Group 1: Students which includes those graduates and young adults. Group 2: are Housewives and Group 3: which are professionals such as chefs and cooks. The pre-test involved 10 testers for each group, the VR testing involved 15 participants and the final post-test involved 10 participants in total. The objective of the testing is to find out the usage and need of the mobile application and then the performance on the integration of technologies and also the expectancy of the recipe helper to assists the user.

4.1.1 Pre-Test

The pre-test was performed via a questionnaire, prior to the usage of the Recipe helper system and all groups are given the similar amount and type of questions, 1 set was used for all. The questions flows are as shown below:

- The frequency of Cooking performed : Daily, Weekly, Monthly
- Choice of recipe sources : Books, Newspapers, Internet, TV Shows
- Problems faced during cooking and reading recipe:
    1. The search of recipe takes long
    2. Recipes not stored in a properly order or manner
    3. Difficulty in tracking lines in recipe
    4. Messed up hands while viewing recipe
    5. Unable to customize a recipe to own needs

4.1.1.1 Group 1- Students

The test was conducted on a group of 10 students. From the figure 22, most of the people in this particular group of users cook not on a daily basis. Most of the users are cooking basically on a weekly basis. About 70% of the students have confirmed to be cooking only mainly on weekly and very limited on daily and monthly basis.

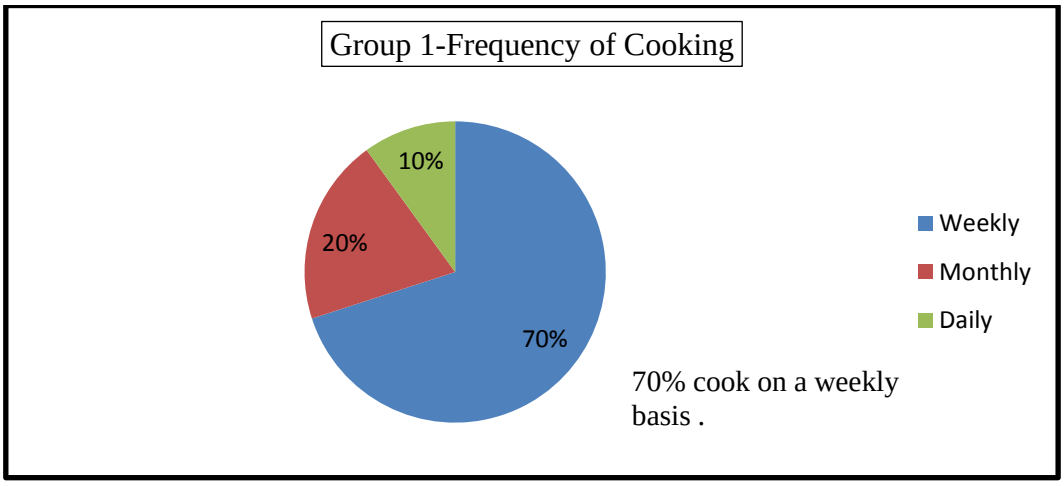


Figure 22- Frequency of Cooking for Group 1

The following figure shows that almost 60% still prefer to use recipe books as main source of recipes and followed by the internet that is about mainly 30 % of the users from this group that are searching for recipes on the web and the rest follow TV shows and newspapers.

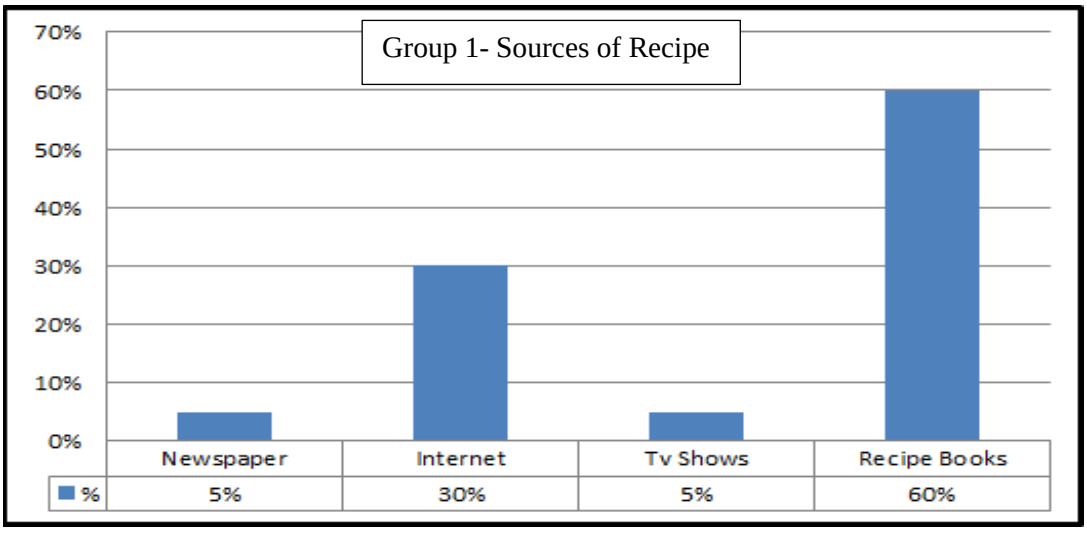


Figure 23-The Sources of Recipes for Group 1

The figure 24 below shows the following users of Group 1 based on the ranking of the problems faced by the users when it comes to cooking (the following problems has been described initially in page 29). The two main problems faced by the users of this group is that users have difficulty to find recipes, followed by how messed up their hands are during cooking activity and also the fact that their recipes are not stored in an orderly manners. The graph shows the statistics accordingly.

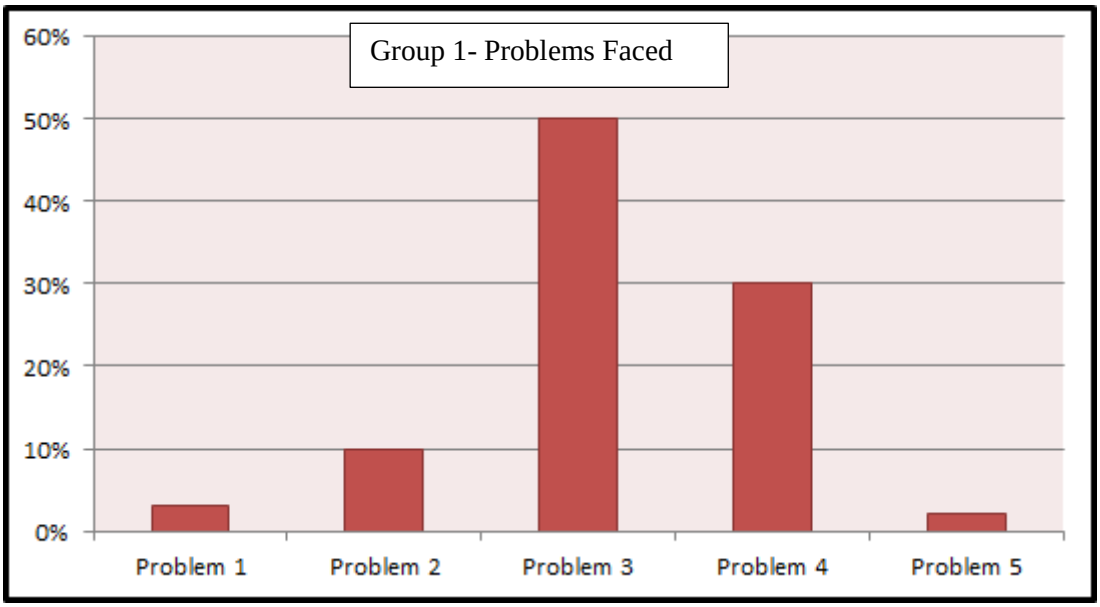


Figure 24- The Problems Faced by members of Group 1

4.1.1.2 Group 2- Housewives

The test was conducted on a group of 10 housewives ranging from ages 35 to 60. From the figure 25, most of the people in this particular group of users cook on a daily basis. About 90% of the housewives have confirmed to be cooking only mainly on daily basis and rarely on monthly or weekly basis.

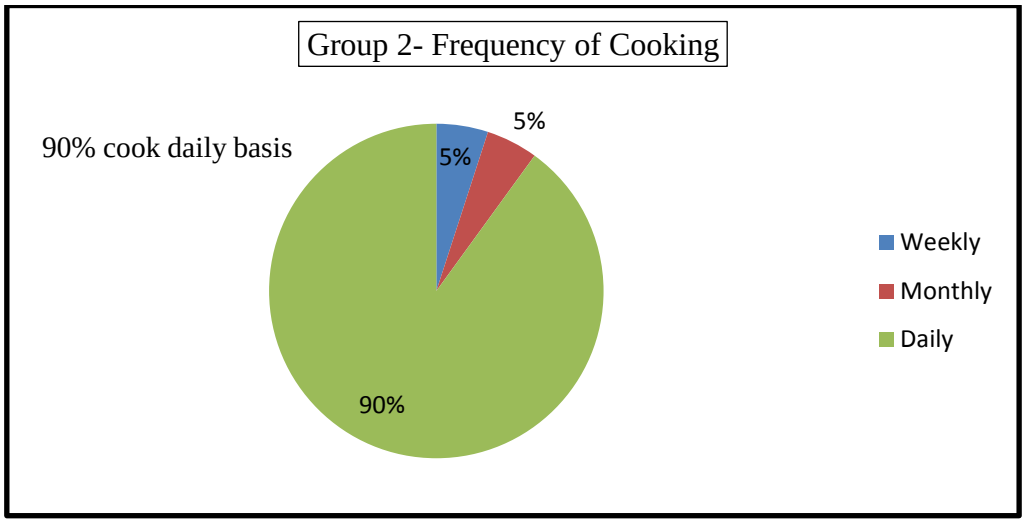


Figure 25- Frequency of Cooking for Group 2

The following figure shows that almost 60% still prefer to use recipe books as main source of recipes and followed by the TV Shows which are usually all time housewives favorite that is about mainly 20 % and the rest can be viewed below:

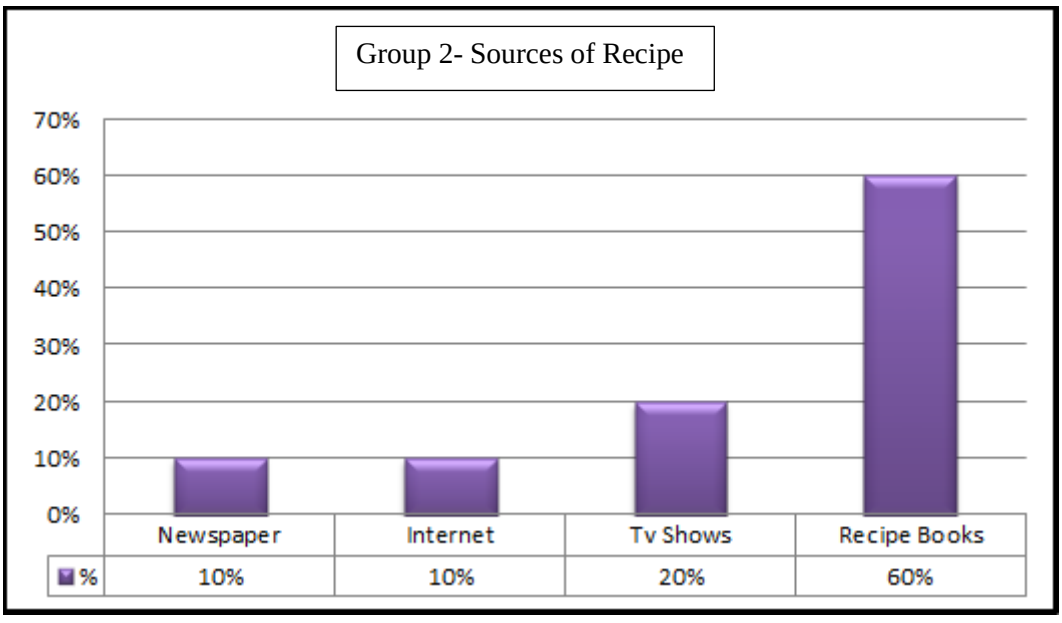


Figure 26- The Sources of Recipes for Group 2

The figure 27 below shows the following users of Group 2 based on the ranking of the problems faced by the users when it comes to cooking. The graph shows the statistics accordingly. The readings are similar to the readings of Group 1-Students.

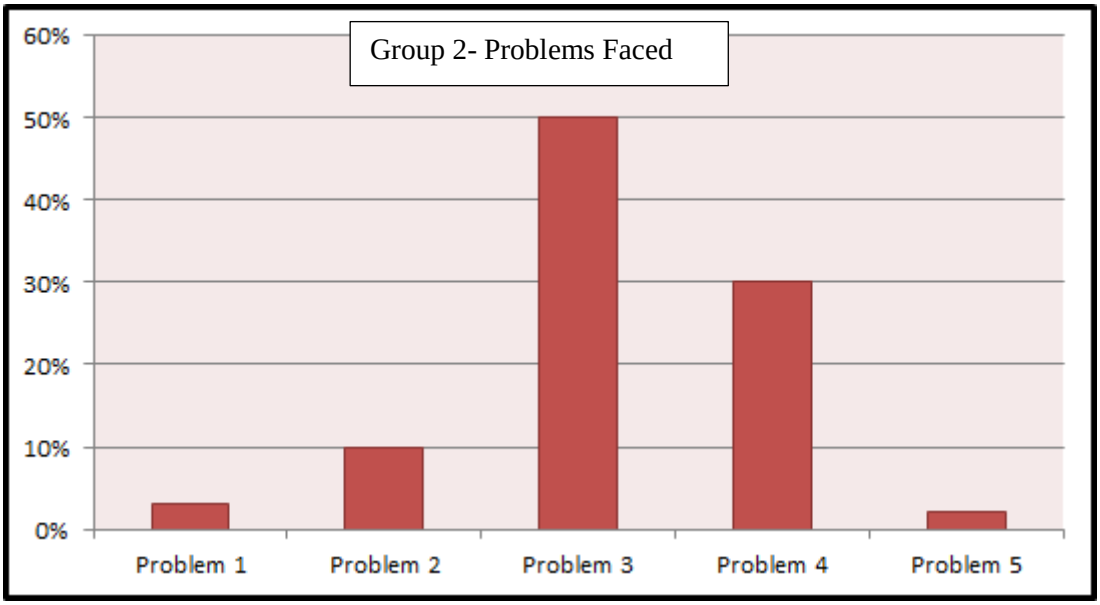


Figure 27- The Problems Faced by members of Group 2

4.1.1.3 Group 3- Professionals (chefs)

The test was conducted on a group of 10 professionals as in major chefs or cooks, restaurant owners ranging from ages 25 to 60. Most of the people in this particular group of users cook on a daily basis. About 90% of the professionals cook as a way of gaining their daily income has confirmed to be cooking only mainly on daily basis and rarely about 5% on monthly or weekly basis.

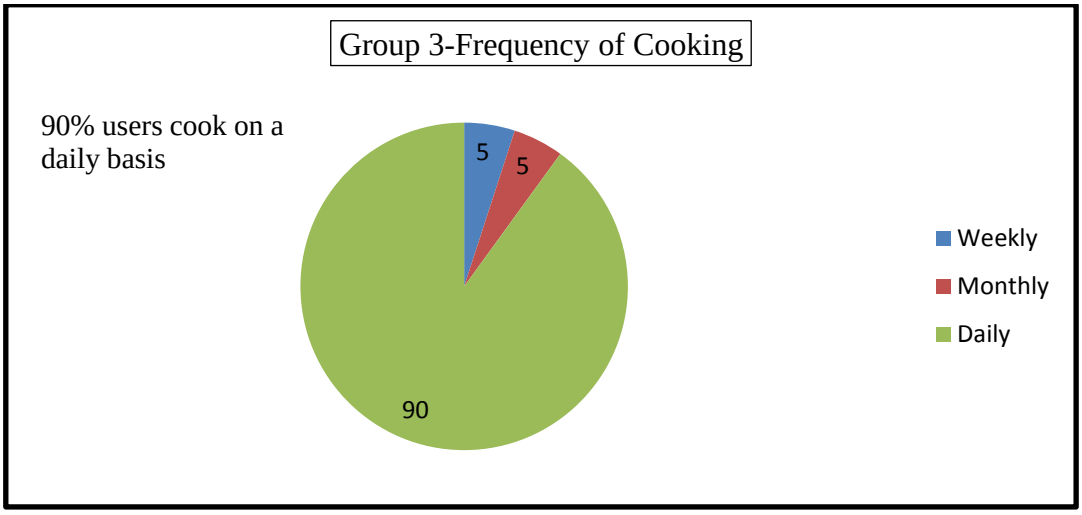


Figure 28- Frequency of Cooking for Group 3

The following figure shows that almost 60% still prefer to use recipe books as main source of recipes and followed by the TV Shows that is about mainly 20 % and the rest can be viewed below as per stated in the graph.

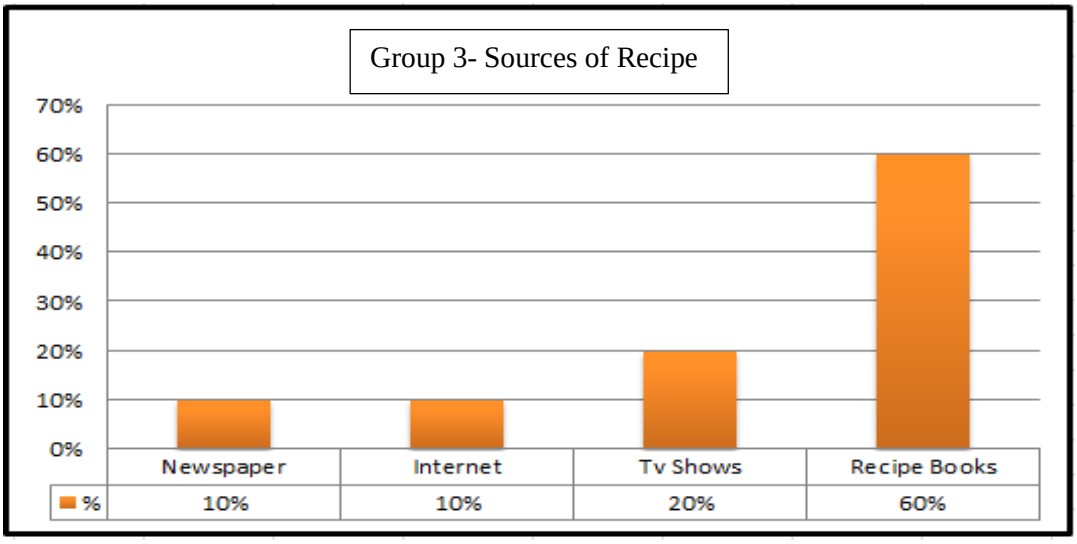


Figure 29- The Sources of Recipes for Group 3

The figure below shows the following users of Group 3 based on the ranking of the problems faced by the users when it comes to cooking. The graph shows the statistics accordingly that the readings are different from the previous groups. This group shows at least 80% of the users face difficulty in problem 4 whereby their hands are messed up while cooking to view the recipe followed by the other issues as seen below.

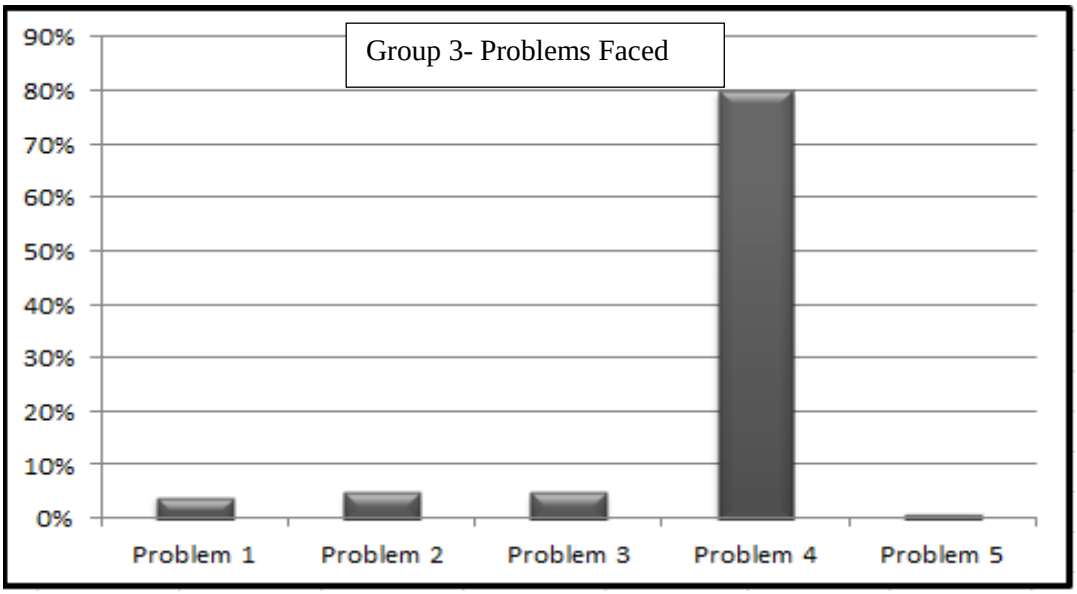


Figure 30- The Problems Faced by members of Group 3

4.1.2 Conclusion for Pre-Test

As a conclusion, we are able to summarize from the various graphs and charts on the behavior pattern of the 3 different groups that has been tested upon. Most of the users find it rather difficult to view the recipes and find the page or line while cooking and in Group 3 the significant problem would be the fact their hands are rather messy during cooking with all the cookery. Hence, all 3 groups would want to have functionalities that will make their lives easier and at the same time user-friendly to ease them from any difficulty.

4.1.3 Voice Recognition Testing – (Performance and Accuracy Testing)

In this first part of the testing, a group of users which include, housewives, students and chefs were used as the target audience to test Part 1 of the Voice Recognition feasibility and performance test. In this phase of the testing, a questionnaire/ survey was conducted on the groups mentioned above upon testing the voice recognition software used – GOOGLE API voice recognition test app.

This particular software captures user's voices and interprets them into words using the Google API speech recognition platform. The words used in this test were the three simple and basic words that will be majorly used by users in this mobile application i.e. "START, STOP, NEXT, BACK". The following shows the survey questions given as well as the discussion of the results to the testing done. Questions are shown in the appendix of the report.

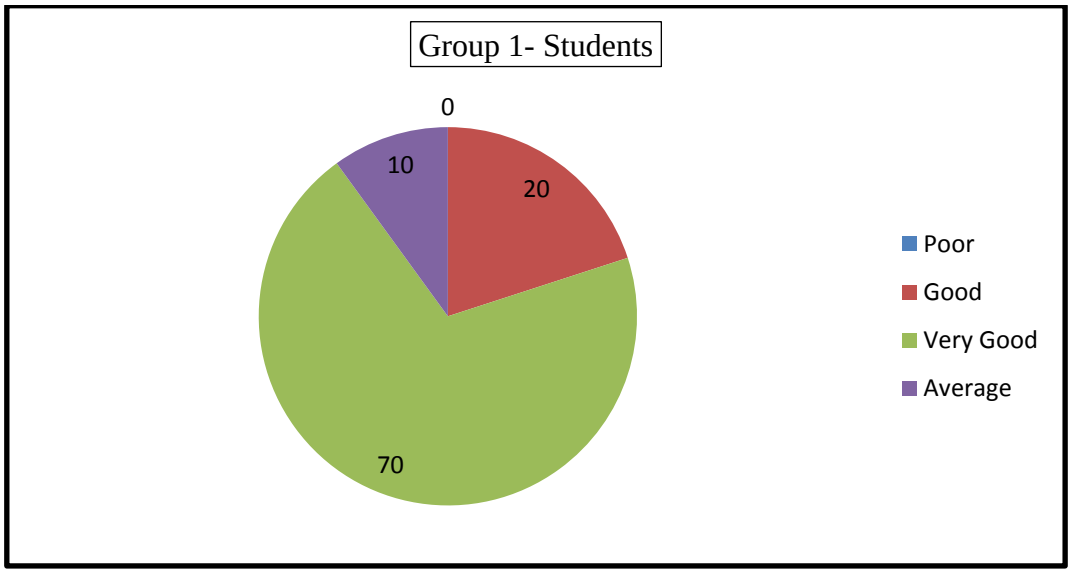


Figure 31- VR Testing of Group 1: Students

The pie chart above shows the results obtained on the performance and accuracy of the selected words using the voice recognition approach selected. Based on the results obtained the ranges are as mentioned below the chart. The study was completed on 15 students and similarly was done with over 15 housewives and 15 restaurant owners or chefs. Based on the survey results of Group 1, it clearly shows no students have rated as poor, and 70 % of the statistics show the students have rated the VR software as very good.

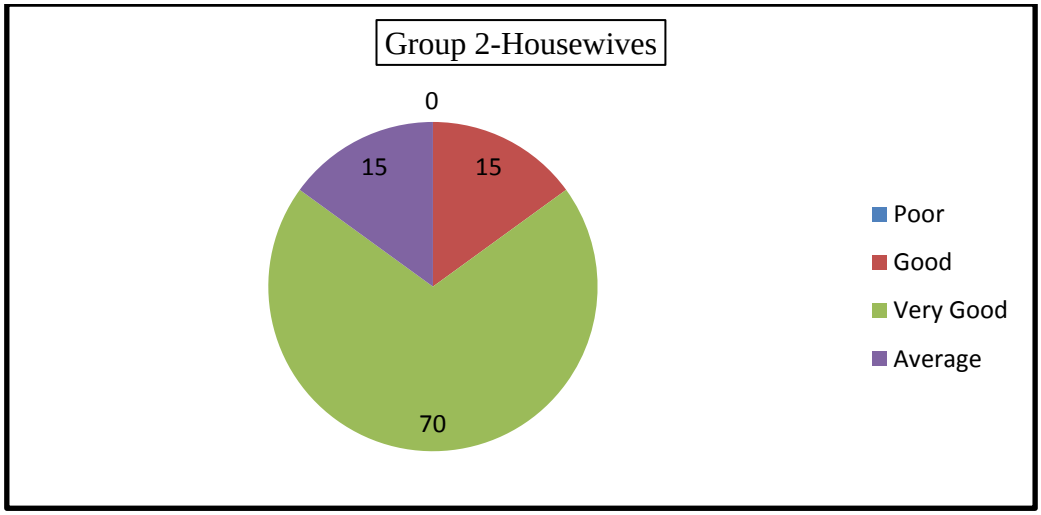


Figure 32- VR Testing of Group 2: Housewives

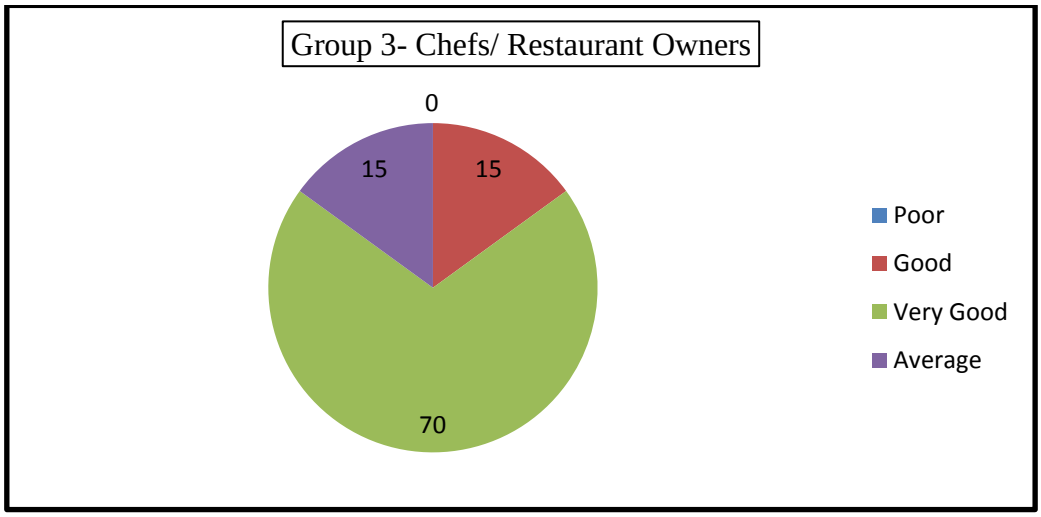


Figure 33- VR Testing of Group 3: Chefs/Restaurant Owners

Similarly, the statistics obtained for both the other group of target testers, Group 2 and Group 3 equally show the users are rather happy with the performance of the VR software used. Therefore, once again the stats for housewives show a high percentage claiming it to be very good and likewise with the restaurant owners and chefs. NO percentage or no target has rate the system as poor, however some have given a 15% to the software being average at performance and accuracy to detect the voice input of the users.

4.1.4 Conclusion for Voice Recognition Testing

As a whole, the Voice Recognition testing for part 1 has been rated as successful. Hence, the outcome from this testing is that the project will proceed to use Google API speech recognition as the platform to detect the user speech in the mobile recipe helper itself. From this first part of the VR testing phase, the improvement can still be made on the time taken for the speech/vice is detected by the software itself. Once done, the software once again will be tested with the similar users and target testers above in order to derive a better conclusion (post-test).

4.1.5 Post-Test

The post-test was performed after the system has been developed and was given to the similar group of respondents as before. The users here are given the chance to test out the system upon downloading it into their tablets or hand phone sets. The users are allowed to test the functions of the system, performance, and if the system has reached its objective to ease their lives and perform a comparison with another system which is currently in the market; *Digital Recipe Sidekick* also identified as "App X" in the findings that has functions and applications similar to the Recipe Helper system itself. The 10 users are given questions and they have to rank accordingly if they were to "Disagree", "Agree", "Strongly Agree" or "Neither". The questions flows are as shown below:

1) The system is easy to navigate and use
2) The interface is user-friendly and colorful
3) The interface is neatly arranged and eases the human eye
4) The downloading is free
5) The voice recognition is rather accurate
6) The system reads out the recipes clearly
7) The voice recognition is easy to use
8) Most of my problems are settled using this system

4.1.5.1 Comparison of Total Groups of Users

The respective figures below the comparison between the Recipe Helper system and App x also called as the *Digital Recipe Sidekick*. The following below shows the statistical comparison between both the applications based on the questions mentioned above. All users are given the questions above to be answered based on the respective apps itself.

According to all the user (10 in total) groups, majority strongly agrees and agrees that the interface for the Recipe helper is rather user friendly, colorful and easy to navigate the interface. About 60% has agreed that the VR is rather accurate, however a certain percentage has disagreed with regards that it could be further improved. Besides that, another about 70% feels that the text to speech ability is rather useful and helps user to perform cooking easily when using this application. Furthermore, a strong record of the groups have agreed that the VR all in all is easy to use if to be compared to figure 35 on the other app, users feel that the interface is not as user friendly, bright or easy to the eye as compared to the recipe helper system. In terms of the VR accuracy, some percentage has chosen the neutral side meaning they feel an average performance for the recipe helper system. For the other app, if we were to compare Question 7, users feel that Recipe Helper has a VR ability that is much more easier to use than the other app (app x). *The concise readings and data of the graphs below can be found in the appendix.

1) Question 1: The system is easy to navigate and use

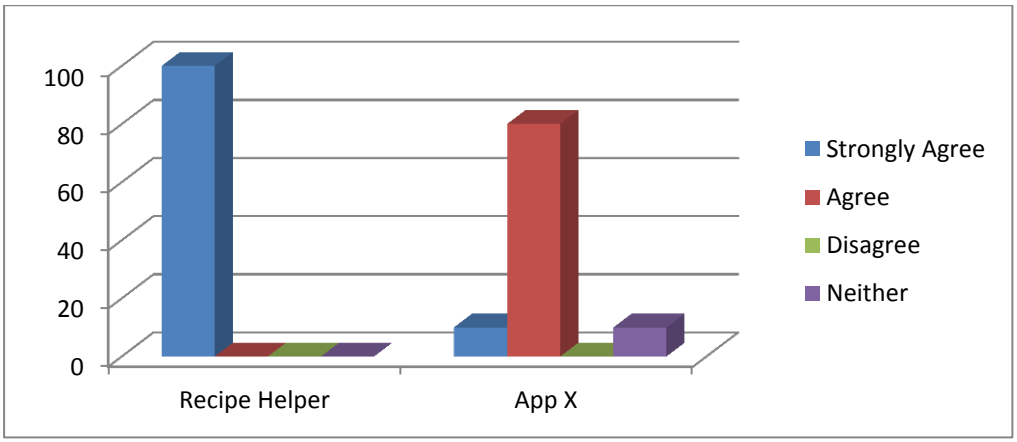


Figure 34- Comparison for Question 1

2) Question 2: The interface is user-friendly and colorful

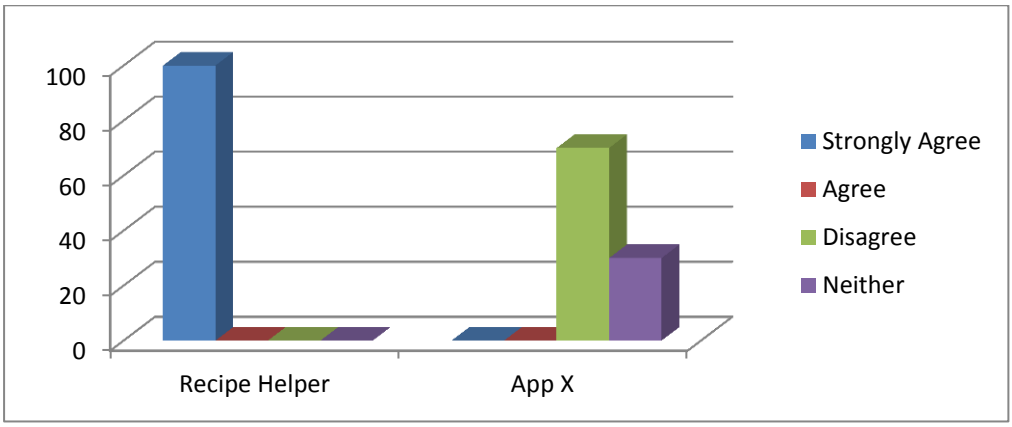


Figure 35- Comparison for Question 2

3) Question 3: The interface is neatly arranged and eases the human eye

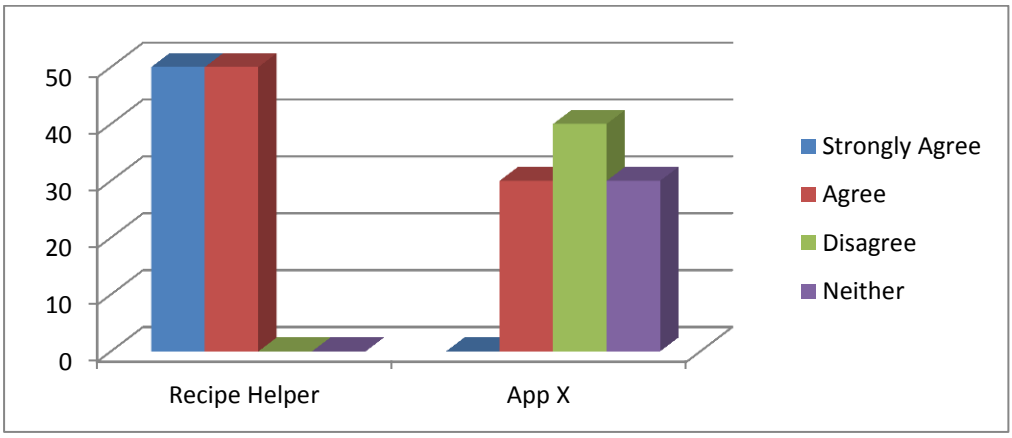


Figure 36- Comparison for Question 3

4) Question 4: The downloading is free

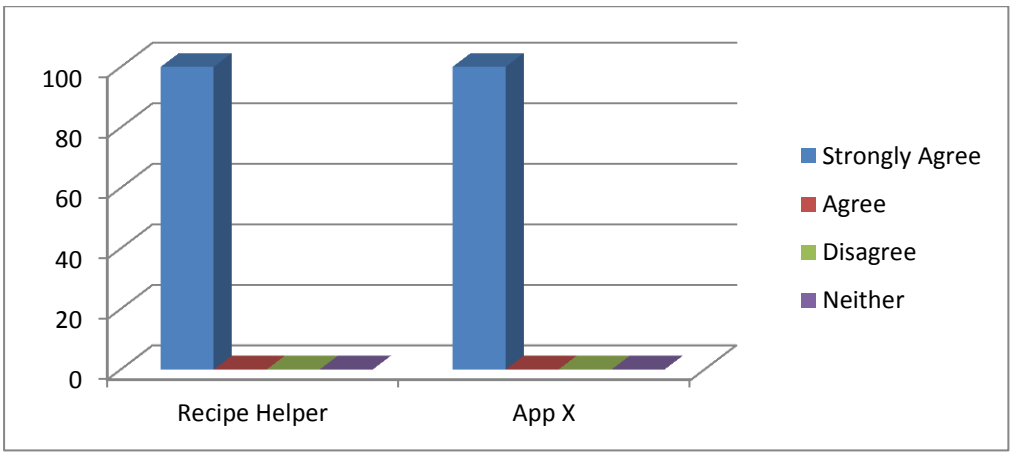


Figure 37- Comparison for Question 4

5) Question 5: The voice recognition is rather accurate

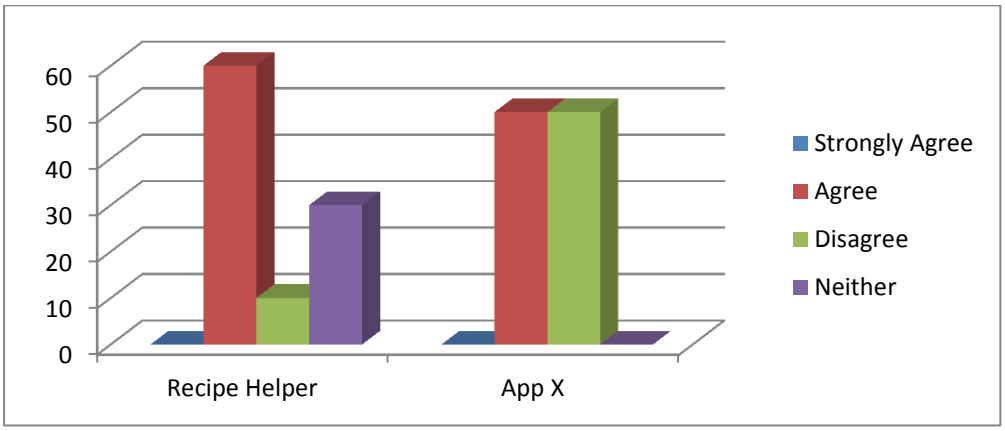


Figure 38- Comparison for Question 5

6) Question 6: The system reads out the recipes clearly

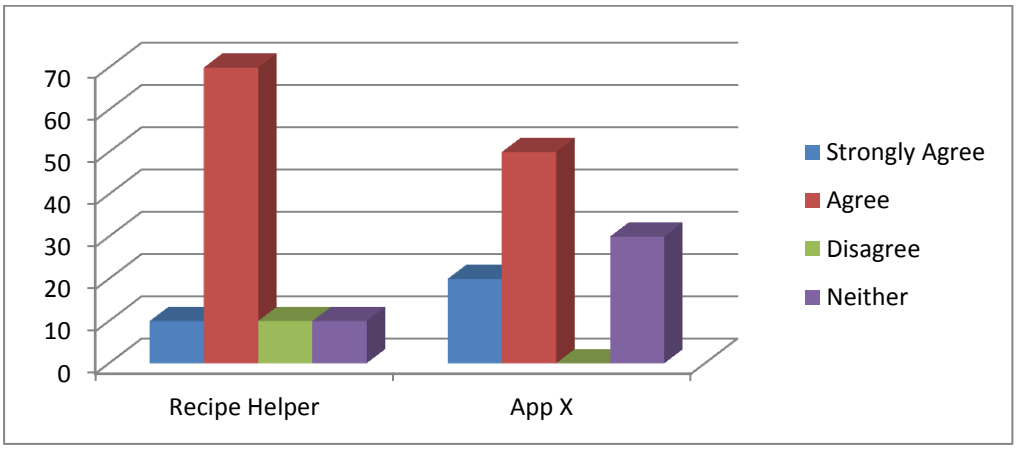


Figure 39- Comparison for Question 6

7) Question 7: The voice recognition is easy to use

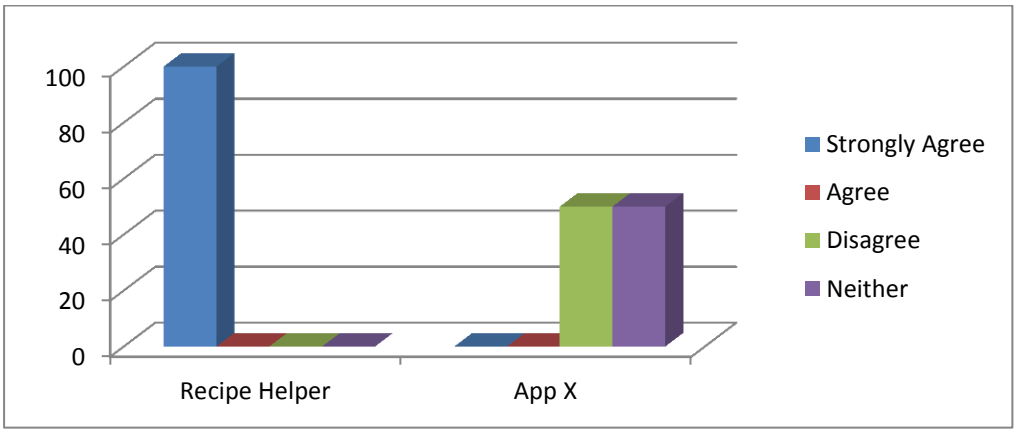


Figure 40- Comparison for Question 7

8) Question 8: Most of my problems are settled using this system

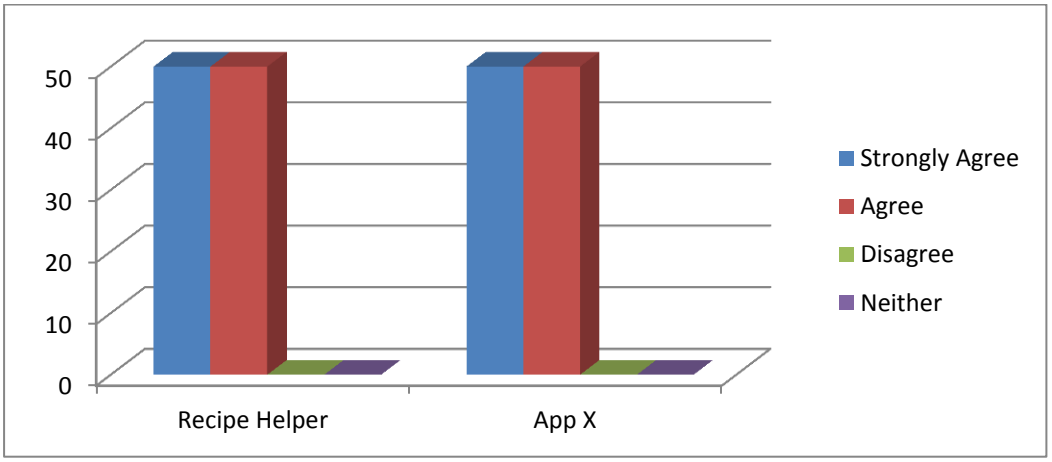


Figure 41- Comparison for Question 8

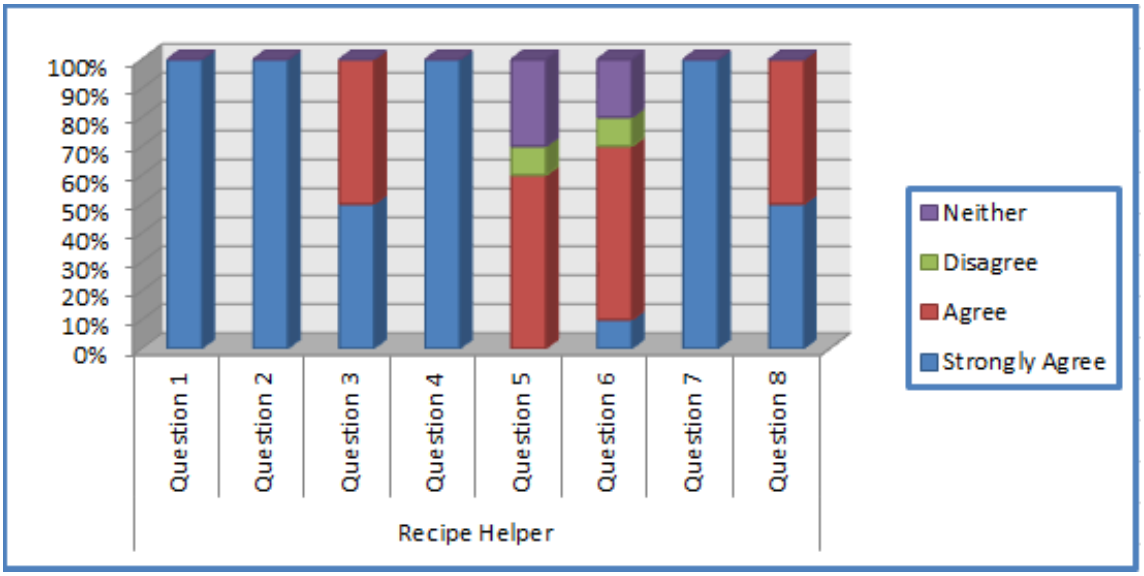


Figure 42- Overall Questions Distribution for Recipe Helper

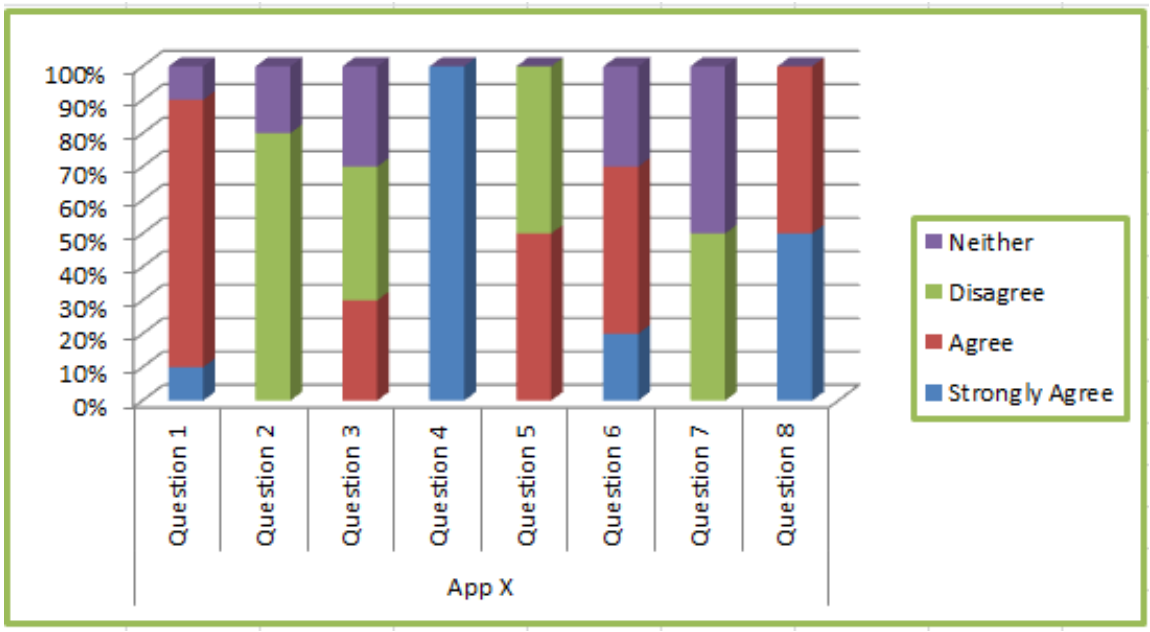


Figure 43- Overall Questions Distribution for App X (Digital Sidekick)

4.1.6 Conclusion for Post-Test

As a conclusion it can be made that both mobile apps are rather good in terms of the performance. However, the Recipe Helper system scores a better grade in terms of the user friendliness, the interface and appearance and the users find it easy to navigate the VR whereas in the app x, it is rather complicated since they have many ways to navigate the page. In other words, the users are looking for something simple and easy that is less complex. If we were to compare, the app x is rather complex and suits users that are very IT savvy instead.

4.2 Discussion

The Recipe Helper System is a tool that provides a helping hand for an individual that spends rather a lot of time in the kitchen preparing meals or even for those with the fetish of cooking. The additional features present in the mobile app, makes it more than just a regular recipe app itself, compared to the others, it enables users to do their tasks more efficiently and reduce the hassle present in the kitchen. Hence, based on the findings above and the results derived from the various tests performed, it can be justified why and how the presence of this mobile application is differentiated and needed in the present market.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

As a whole, this project is formed is purpose to tap into the latest technology mobile applications on the upcoming growing platforms of tablets and smart phones. Mobile applications have vastly grown, and develop in many ways to assists human workload; hence this project is another way to help reduce difficulties faced in households, focusing on targets such as housewives, students and professionals such as chefs. This project is developed to ease learning of cooking and provides a platform for users to cook and learn at the same time without any hiccups.

Integrating voice recognition into the mobile application is one of the latest upcoming in the mobile world. With this integration, benefits are seen in every angle possible. This project provides a platform for the users to communicate with the device with simple verbal language and without the user being interrupted while cooking. Looking back into the objectives and scope of this project which has been accomplished are:

1. To understand the past and current technology of voice recognition systems.
2. To perform thorough researches and fully understand the development methods of a mobile application on an Android platform.
3. To understand and examine current voice recognition software's and finds methods to integrate it with the mobile application and further enhance its functionalities.
4. To develop a mobile application on recipes and cookery on an ANDROID platform which integrates with a voice recognition tool as an enhancement to ease user during cooking in households, restaurants and culinary schools.
5. To perform thorough tests to ensure the voice recognition software chosen performs at its optimum level.

The goals made initially have been accomplished in order to establish this project into the market for ready-to is used. To sum it up, this project is designed and tested according to its phases is to benefit the whole community and target market. Although not being the pioneer in the market, this project will curb and try to accommodate the market whereby other competitions have slacked. In other words, the aim is to be better than the current products similar to this.

Upon completing all the tests involved, the final concludes from this particular report is that the Voice Recognition Software has been given a green light to have further usage upon since the test results were rather positive on the performance and accuracy of the software. The mobile app formed will further be improved and enhanced with more functionalities and the current objectives of developing an app to ease users with VR functions has been a success.

5.2 Recommendation

In the near future, the following are additional enhancements that can or may be applied to the current system in order to make it better:

- Include more efficient Voice Recognition software whereby it would not require the need to access the Google server, in other words software that is embedded into the system itself.
- To include voice command 'Repeat' to enable user to re-view the recipe read out.
- To include various nations' recipes especially from isolated countries itself.
- Include more error checking devices that will advise users on how to navigate the pages through.
- To further develop the mobile application and ready to be published into the android market itself ready to be used worldwide
- To have more functions such as an alarm system or timer to time the users
- Enhance functions similar to Siri in iOs to perform other activities while cooking i.e. send text messages and answer phone calls through Voice Recognition.
- Extend the abilities of the application and make it ready to even be published in the iOs platform.
- Allow the user to send recipes of the edited ones via email to friends and family.

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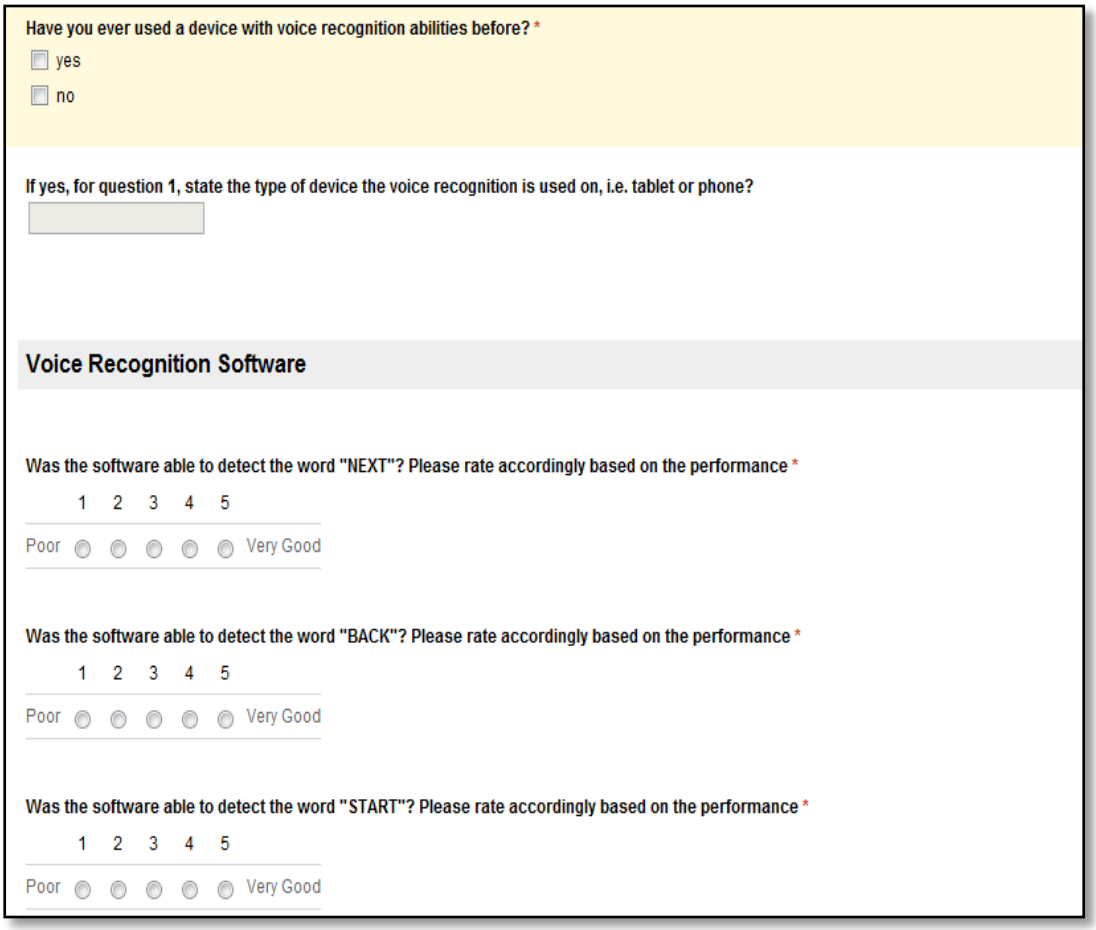
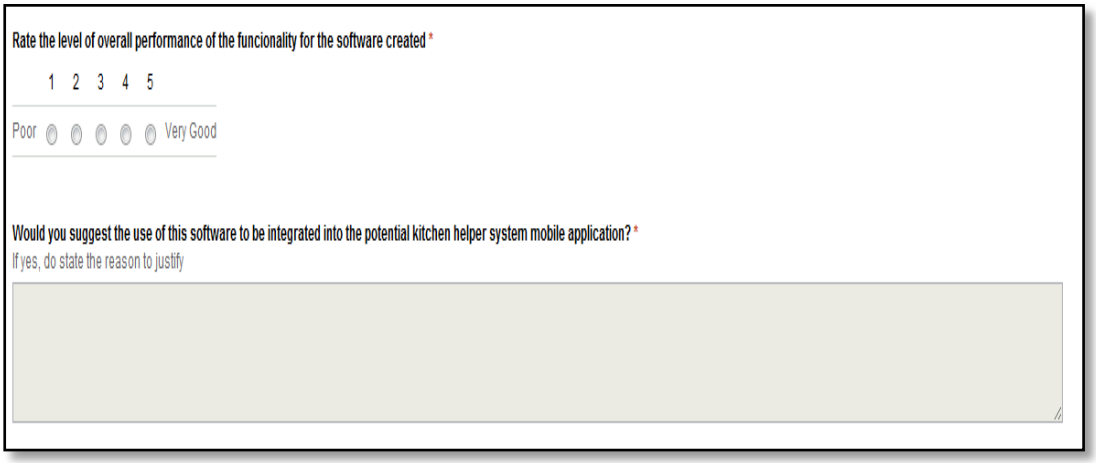
APPENDICES

1. The questionnaire survey given out for VR Testing:





2. The tabulated data for the comparison between Recipe Helper app and App x:

	Recipe Helper							App X						
Questions	SA (4)	A(3)	D(2)	N(1)	Total Score	Sd	Mean	SA (4)	A(3)	D(2)	N(1)	Total Score	Sd	Mean
1	40	0	0	0	40	20	10	4	24	0	1	29	11.29528	7.25
2	40	0	0	0	40	20	10	0	0	14	3	17	6.652067	4.25
3	20	15	0	0	35	10.30776	8.75	0	9	8	3	20	4.242641	5
4	40	0	0	0	40	20	10	40	0	0	0	40	20	10
5	0	18	2	3	23	8.261356	5.75	0	15	10	0	25	7.5	6.25
6	4	21	2	1	28	9.416298	7	8	15	0	3	26	6.557439	6.5
7	40	0	0	0	40	20	10	0	0	10	5	15	4.787136	3.75
8	20	15	0	0	35	10.30776	8.75	20	15	0	0	35	10.30776	8.75
				TOTAL	281	118.2932	70.25				TOTAL	207	71.34233	51.75

q1

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	100	0	0	0
App X	10	80	0	10

q2

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	100	0	0	0
App X	0	0	70	30

q3

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	50	50	0	0
App X	0	30	40	30

q4

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	100	0	0	0
App X	100	0	0	0

q5

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	0	60	10	30
App X	0	50	50	0

q6

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	10	70	10	10
App X	20	50	0	30

q7

	Strongly Agree	Agree	Disagree	Neither

Recipe Helper	100	0	0	0
App X	0	0	50	50

q8

	Strongly Agree	Agree	Disagree	Neither
Recipe Helper	50	50	0	0
App X	50	50	0	0

3. Coding clip of the **Voice Recognition** application in Eclipse

```
for (int i = 0; i < data.size(); i++)
{
   txt = data.get(i).toString();
  if (txt.contains("next"))
  {
      TextView txtRes = (TextView)findViewById(count);
      txtRes.setVisibility(View.VISIBLE);
      speakOut(txtRes.getText().toString());

        Intent intent = new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
        intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL,RecognizerIntent.LANGUAGE_MODEL_FREE_FORM);
        intent.putExtra(RecognizerIntent.EXTRA_CALLING_PACKAGE,"voice.recognition.test");

        intent.putExtra(RecognizerIntent.EXTRA_MAX_RESULTS,5);
        sr.startListening(intent);
        Log.i("111111","11111111");
        count++;
  }
  else if (txt.contains("start"))
  {
      TextView txtRes = (TextView)findViewById(count);
      txtRes.setVisibility(View.VISIBLE);
      speakOut(txtRes.getText().toString());

        Intent intent = new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
        intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL,RecognizerIntent.LANGUAGE_MODEL_FREE_FORM);
        intent.putExtra(RecognizerIntent.EXTRA_CALLING_PACKAGE,"voice.recognition.test");

        intent.putExtra(RecognizerIntent.EXTRA_MAX_RESULTS,5);
        sr.startListening(intent);
        Log.i("111111","11111111");
        count++;
  }
```

```
    else if (txt.contains("back"))
    {
        if (count!=1)
        {
        count--;
        TextView txtRes = (TextView)findViewById(count);
        txtRes.setVisibility(View.GONE);
        txtRes = (TextView)findViewById(count-1);
        speakOut(txtRes.getText().toString());
        }
          Intent intent = new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
          intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL,RecognizerIntent.LANGUAGE_MODEL_FREE_FORM);
          intent.putExtra(RecognizerIntent.EXTRA_CALLING_PACKAGE,"voice.recognition.test");

          intent.putExtra(RecognizerIntent.EXTRA_MAX_RESULTS,5);
          sr.startListening(intent);
          Log.i("111111","11111111");


    }
    else{
        Intent intent = new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
          intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL,RecognizerIntent.LANGUAGE_MODEL_FREE_FORM);
          intent.putExtra(RecognizerIntent.EXTRA_CALLING_PACKAGE,"voice.recognition.test");

          intent.putExtra(RecognizerIntent.EXTRA_MAX_RESULTS,5);
          sr.startListening(intent);
          Log.i("111111","11111111");
    }
            Log.d(TAG, "result " + data.get(i));
            data.get(i);

  }
 // mText.setText("results: "+String.valueOf(data.size()));
```

4. Coding clip of the **Text To Speech** ability of the system

```
private void speakOut(String text) {

        tts.speak(text, TextToSpeech.QUEUE_FLUSH, null);
    }
public void onClickListerner()
    {
        Button btnNext = (Button) findViewById(R.id.btnNext);
        Button btnBack = (Button) findViewById(R.id.btnBack);
        Button btnStop = (Button) findViewById(R.id.btnStop);


        btnNext.setOnClickListener(new OnClickListener() {
                public void onClick(View arg0) {
                    TextView txtRes = (TextView)findViewById(count);
                    txtRes.setVisibility(View.VISIBLE);
                    speakOut(txtRes.getText().toString());
                    count++;
                }
            });



        btnBack.setOnClickListener(new OnClickListener() {
            public void onClick(View arg0) {
                if (count!=1)
                {
                count--;
                TextView txtRes = (TextView)findViewById(count);
                txtRes.setVisibility(View.GONE);
                txtRes = (TextView)findViewById(count-1);
                speakOut(txtRes.getText().toString());
                }
            }
        });
```

```
  public boolean onKeyDown(int keyCode, KeyEvent event)  {
      if (keyCode == KeyEvent.KEYCODE_BACK && event.getRepeatCount() == 0) {
          sr.destroy();
      }

      return super.onKeyDown(keyCode, event);
  }
  public void onInit(int status) {

        if (status == TextToSpeech.SUCCESS) {

            int result = tts.setLanguage(Locale.US);

            if (result == TextToSpeech.LANG_MISSING_DATA
                    || result == TextToSpeech.LANG_NOT_SUPPORTED) {
                Log.e("TTS", "This Language is not supported");
            } else {
               // btnSpeak.setEnabled(true);
                //speakOut();
            }

        } else {
            Log.e("TTS", "Initilization Failed!");
        }

    }
  @Override
    public void onDestroy() {
        // Don't forget to shutdown tts!
     sr.stopListening();
        if (tts != null) {
            tts.stop();
            tts.shutdown();
        }
        super.onDestroy();
```

Recipe Helper System Mobile Application

With Voice Recognition

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***Abstract* — this project features research done on the current technology of mobile application on an android platform as well as performing integration of the mobile app to existing Voice recognition systems and software's. With the current growth of the mobile application technologies in handheld devices, the workload of human is eased in many ways. Integrating voice recognition abilities that has grown vastly since 1963 will enhance these technologies taking it into another level and spectrum. This project forms a purpose to develop a mobile application that is able to ease the workload in households. The mobile application developed on an Android platform that is integrated with Voice Recognition abilities to allow the user to communicate with the device without the need of using their hands while cooking. The mobile application is designed to contain cooking recipes from various countries and having the ability to view and interact with users during the cooking process. The project follows a thorough method of throwaway prototyping and the system is developed accordingly. Various tests has been performed to measure the accuracy and performance upon a different groups of people and the results have indicated the benefits and necessity of this mobile application and the function of it has proven to accomplish the initial project objectives.**

Keywords – Voice recognition, VR, text to speech, mobile application, recipe helper, kitchen assistant, cooking.

I. INTRODUCTION

Growth of the current technology has urbanized and spread rapidly worldwide. One of the most current developments is the mobile application whereby it is application software that is developed for low-power handheld devices.

Along with the swift leap in this technology of mobile application (apps), one of the ways that could be implemented in its development in order to ease human work would be Voice Recognition abilities in a mobile application. This technology involves translating spoken words into texts and actions. The focus in this project is not to develop a major new technology; however it involves applying the current technology into mobile applications to solve slightly smaller but relevant problems in households. According to research individuals find difficulty in managing cooking recipes and cookbooks in households.

Several users that are part of this situation have the tendency to find issues while using their gadgets and performing household tasks at the same time. For an instance, housewives, professionals such as chefs and amateurs, students of culinary art schools all have the similar problem as common grounds. The individual may be busy in cooking preparation, and they all face the same problems whereby simple tasks such as finding and recalling the lines of the recipe in the cookbook becomes a major bottleneck and also time consuming. It is uneasy as at the same time, they need to keep track of their cooking to avoid any disasters taking place.

This particular project brings significance into the lives of many users especially in managing household's major task such as cooking. The whole idea and worth of this project is to develop a mobile application that will ease the workload of human beings. The objectives include:

1. To understand the past and current technology of voice recognition systems.
2. To perform thorough researches and fully understand the development methods of a mobile application on an Android platform.
3. To develop a mobile application on recipes and cookery on an ANDROID platform which integrates with a voice recognition tool as an enhancement to ease user during cooking in households, restaurants and culinary schools.

II. LITERATURE REVIEW & THEORY

A. History of Voice Recognition

Ever since the technology of Automatic Speech Recognition (ASR) and Transcription began in 1936 and progressed from then onwards, the largest barriers to the speed and accuracy of speech & voice recognition were computer speed and power .Garfinkel (1998) points out how with the average CPU now above a Pentium III and RAM levels at 500 MB and up, accuracy levels have reached 95% and better with transcription speeds at over 160 words per minute. The study of automatic speech

recognition and transcription began in the 1936 with AT&T's Bell Labs where most research was funded and performed by Universities and the U.S. Government (primarily by the Military and DARPA - Defense Advanced Research Project Agency) The first company to launch a commercial product was Covox in 1982 along with this introduction of sound to computers came an early form of speech recognition and followed by Dragon Systems. Nuance, Inc. a company that was founded in 1982 and whose eventual product has become the overwhelming leader in the speech recognition market [3].

Moving from there is the success story of "Radio Rex" in the field of speech recognition whereby a toy dog that came in a house. As mentioned by Barber.J (2005) in his article, Rex was the pioneer into the field of speech recognition. This particular dog was held within its house by an electromagnet, as current flowed through a circuit bridge, the magnet was energized. The bridge was sensitive to 500 cps of acoustic energy. The energy of the vowel sound of the word "Rex" caused the bridge to vibrate, breaking the electrical circuit, and allowing a spring to push Rex out of his house [4].

B. Development of Voice Recognition Technology

Speech recognition technology has advanced tremendously over the last four decades, from ad-hoc algorithms to sophisticated solutions using hill-climbing parameter estimation and effective search strategies. While these algorithms advanced, mobile devices became ever more competent computing platforms for the use of voice recognition. The combination of sophisticated algorithms and generous computing capabilities has not, however, put a speech recognition system in everyone's daily technical diet [5]. "In the early days, the capabilities of the technology combined with the computing power of the various devices required that you have training so that [the software] would have data about the specific user and not use up too much computer power," explained Mike Thompson, senior vice president and general manager of Nuance Mobile but the computing power of today's Smartphone is such that voice training is no longer required. The digital voice models that form the basis of today's speech recognition software are sophisticated enough that they can learn — on their own — their users' verbal quirks.

Mobile voice-recognition apps also have other advantages over their older desktop counterparts. One is the ability to communicate with powerful central computers, or servers, that can combine information from millions of users and then make broad generalizations that help improve the apps' overall ability to recognize words [6]. According to Dave Grannen, president and CEO of speech recognition software, lingo, "The first time you speak to the phone, we put a cookie" — a kind of digital tag — "on your device and when you say something we call up your personal language model from our servers and use it to get better accuracy,". An individual's voice model contains information about his accent and unique way of pronouncing certain words, among other things. The servers can combine the voice models of several speakers who have similar accents to improve the accuracy for that population. "If you're from India and speaking English as a second language on Vlingo, we work pretty darned well. If you're from Germany speaking English, it doesn't work so well," Grannen told TechNewsDaily [6].

From the challenges faced by the sector, several improvements were seen in time. Ronaldo Parente (2004) once again describes Continuous improvement in the technology of speech-recognition systems became imperative for hospitals so that their doctors would come to believe in the value of these systems. Therefore, the vocabularies built into these systems grew tremendously in both size and the degree to which they were tailored to the jargon and terminology of the medical profession. The systems gradually became better at adapting to a particular user's speech, regardless of timbre, speech character, accents, or head colds. Accuracy rates rose dramatically, and doctors were no longer struggling for the "right" words for the system to understand and record. [2] Also according to the author's research, once the speech-recognition system was implemented, the physicians felt it offered many advantages.

C. Theory and Applications

According to Wes Kehler, an owner of Classic Kitchen Designs, users can now have built in computers into kitchen cabinets to allow users an ease for recipe viewing and space to perform their cookery [7]. This method would definitely involve large cost and may not be feasible in other platforms. Therefore, a mobile application with feature of voice recognition will definitely be cost savvy and will indirectly result to better time management in household kitchens.

On this similar platform, a previous final year project by Chan. A (2005) was about developing a voice recognition system computer program based on research done on existing VRS (Voice Recognition Systems), theories and applications [9]. The system which is a computer software program is designed to store cooking recipes of various kinds and also a voice recognition ability to ease users. The author and developer completed the

project and managed to form a system that was able to assist users in the kitchen to retrieve recipes, edit recipes and view measurements. The system is however is not mobile and is only usable as computer program software and nothing else. Thus, the mobile application will be taking this project to the next level.

D. Current Relevant Products

The Digital Recipe Sidekick is an application that is only present on the Android platform; hence this current product is one of the closest competitors to the current project that is being proposed. This app is rather comprehensive in terms of its functionalities as it is able to perform functions such as editing of recipes, saving recipes, voice recognition abilities to move from one step to another and sharing of recipes. This app however, does not have recipes stored in; it is different that it extracts the recipes from a website, Allrecipes.com, hence in order to obtain new recipes the user needs to keep on fetching the recipe from an external website. Besides that, this app is rather not user friendly, the design and Human Computer Interface appears to be complicated and messy as well as the organization and arrangements of the recipes.

The following table shows a comparison between the app developed and other relevant products in the market as a whole.

Characteristrics	My Proposed Project	Current products
User Interface	Simple, User-friendly	Complex
Functionalities	Search, Edit, Save, Voice Recognition	Search, Edit, Save, Not all have Voice Recognition
Human Computer Interaction	Easy to navigate ,visible	Hard to navigate
Scope of Content	Open/General	Niche (i.e. iFood assistant)
Visibility	Free	Mostly Chargeable

III. METHODOLOGY

A. Research Methodology

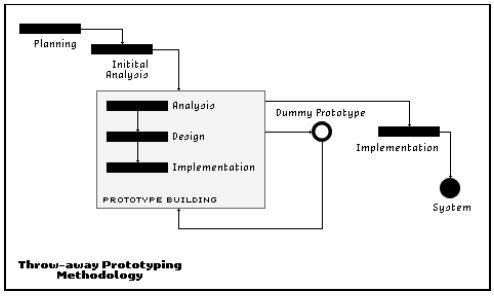


Figure A-1: Throwaway Prototype

This methodology of throwaway prototyping is used for a rather different purpose which has a relatively through analysis phase that is used to gather information and to develop ideas for the main concept of the project system itself. Each prototype that is developed is used to minimize the risk associated with building the system by identifying the issues at every particular stage before the final system is readily built. Once the issues are resolved at the analysis stage, then the project moves into design and implementation. This particular methodology benefits the analysis and design stages as it removes and reduces any issues that arise before the final system is built.

B. Tools and Equipments

Hardware: Android platform- Samsung Tablet, Personal computer with processing speed of 1.5 GHz and sufficient RAM and hard disk space.

Software: Android SDK tools need to be installed to develop Android applications. The most important SDK tools are Android SDK Manager, the AVD Manager the emulator, and the Dalvik Debug Monitor Server. All of these tools are easily found in *Android Developers* website and there are also provided with tutorial in developing application for starters. The following is the lists of required software's:

- Android SDK platform tools & ADT Plug-in for Android
- Eclipse Classic
- Android Emulator
- Language: Java
- Voice recognition software

C. System Methodology

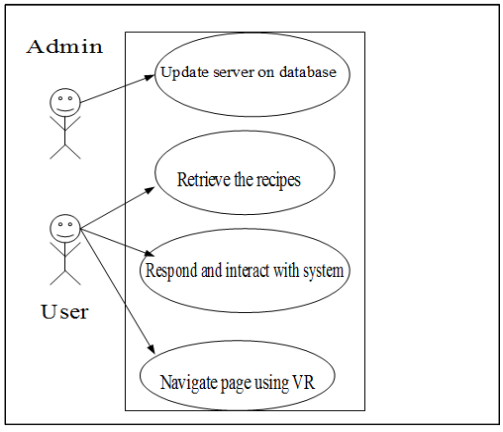


Figure C-1: Use Case Diagram

The planning stage is continued and further evaluated through a use case diagram, whereby the interaction between the user and admin is visible. The user is the potential external user of the system and the admin is the developer of the particular

system itself. From the use case diagram below, it shows the user interacting with the system by retrieving the recipes from the updated database by the admin/developer. From then on, the user will also interact with the system and navigate the system according to the desired using the voice recognition ability embedded in the system and at the same time the system responds with the user with voice/ audio output through text to speech recognition. This diagram shows how the two parties will interact with one another.

Upon collecting viable information and understanding the research made on the application previously, this stage is now to list and identify functionalities in the required system. Besides the main function of having voice recognition abilities that will read to the user the selected recipe's steps in cooking and allow the user to navigate through speech and words, the recipe helper system will also perform as a recipe cookbook (mobile version), whereby it will display several mouth-watering recipes based on the different countries in the globe ranging from Asian till the American delicacies. Besides that, it will also be able to store and save recipes selected by the users as their favourites and potentially looking into performing editing of these recipes selected to suite the user's needs and include their personal recipes into the app itself.

D. System Architecture

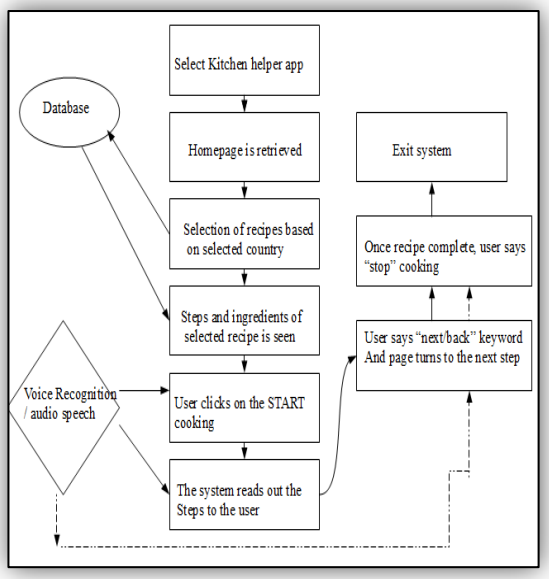


Figure D-1: Overall modular flow of the app

The figure above shows the entire application interacting with the Voice Recognition, audio/ text to speech recognition abilities, calling in the database (MySQLLite) and also the basic app itself. The user will begin by initiating the application and a homepage appears and from then, a list of recipes follows, once user has selected the respective recipe, the ingredients are then showed on the screen; user clicks on the button (start) 'Cook It' and the steps appear. When this happens, the VR from GOOGLE API is called from the Google server and the voice recognition abilities starts in the app. The VR will allow the user to navigate from pages and ingredients back- next and at the same time, the text to speech function is also called and imported from the android platform itself. This function will read out the steps to the user. The recipes on the other hand appear once the database is called and that happens once the respective recipe is selected. The database is called and the ingredients appear. The steps are read out to the user. Upon completing the event, user clicks on the button 'end' and recipe is complete and application exits. Finally all user interaction with the VR ends once the user selects stop/end.

E. Prototype Interface

Figure 14: Main page showing the lists of countries

Figure 15: Selected recipe (China) and list of recipes

Figure 16: The interface of the ingredients which was selected

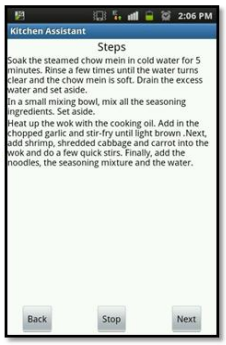


Figure 17: Once the button Cook It is selected, the steps appear according to the VR by user.

IV. RESULT AND DISCUSSION

The testing for voice recognition is initiated at the beginning of the development phase so that, the main contribution to this project which is the voice recognition flows smoothly when it is closer towards the final execution of the project. Prior to performing the VR testing, the Pre-Test was conducted and finally the post-test. The testing was performed on several groups, Group 1: Students which includes those graduates and young adults. Group 2: are Housewives and Group 3: which are professionals such as chefs and cooks. The pre-test involved 10 testers for each group, the VR testing involved 15 participants and the final post-test involved 10 participants in total. The objective of the testing is to find out the usage and need of the mobile application and then the performance on the integration of technologies and also the expectancy of the recipe helper to assists the user.

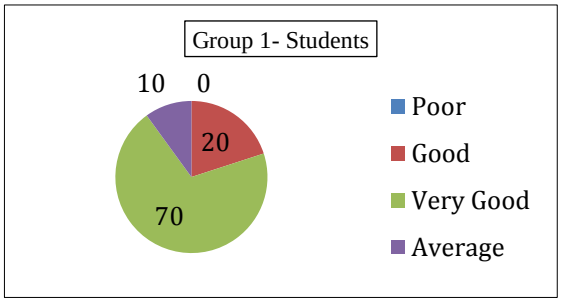
A. Pre-Test

The pre-test was performed via a questionnaire, prior to the usage of the Recipe helper system and all groups are given the similar amount and type of questions, 1 set was used for all. The questions flows are as shown below:

- The frequency of Cooking performed : Daily, Weekly, Monthly
- Choice of recipe sources : Books, Newspapers, Internet, TV Shows
- Problems faced during cooking and reading recipe

As a conclusion, we are able to summarize from the various graphs and charts on the behavior pattern of the 3 different groups that has been tested upon. Most of the users find it rather difficult to view the recipes and find the page or line while cooking and in Group 3(chefs) the significant problem would be the fact their hands are rather messy during cooking with all the cookery. Hence, all 3 groups would want to have functionalities that will make their lives easier and at the same time user-friendly to ease them from any difficulty.

B. VR Performance Testing



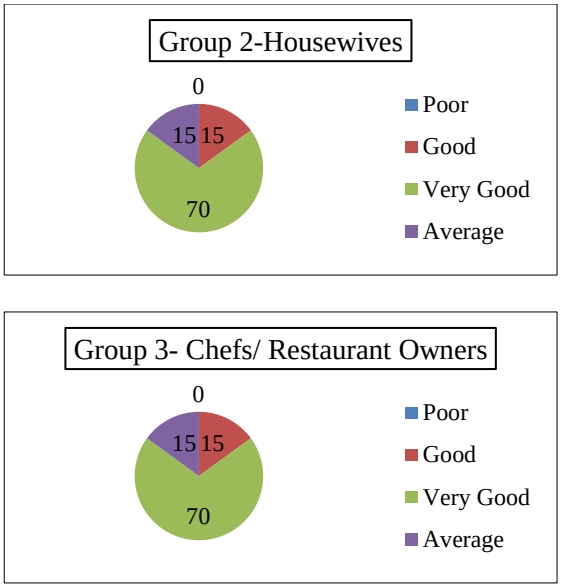


Figure B-1: Graphs for all 3 groups in VR testing

In this first part of the testing, a group of users which include, housewives, students and chefs were used as the target audience to test Part 1 of the Voice Recognition feasibility and performance test. In this phase of the testing, a questionnaire/ survey was conducted on the groups mentioned above upon testing the voice recognition software used – GOOGLE API voice recognition test app.
The words used in this test were the three simple and basic words that will be majorly used by users in this mobile application i.e. "START, STOP, NEXT, BACK". Based on the survey results of Group 1, it clearly shows no students have rated as poor, and 70 % of the statistics show the students have rated the VR software as very good. Similarly, the statistics obtained for both the other group of target testers, Group 2 and Group 3 equally show the users are rather happy with the performance of the VR software used. Therefore, once again the stats for housewives show a high percentage claiming it to be very good and likewise with the restaurant owners and chefs. NO percentage or no target has rate the system as poor, however some have given a 15% to the software being average at performance and accuracy to detect the voice input of the users.

C. Post-Test

The users here are given the chance to test out the system upon downloading it into their tablets or hand phone sets. The users are allowed to test the functions of the system, performance, and if the system has reached its objective to ease their lives and perform a comparison with another system which is currently in the market; *Digital Recipe Sidekick* also identified as "App X" in the findings that has functions and applications similar to the Recipe Helper system itself. The 10 users are given

questions and they have to rank accordingly if they were to “Disagree”, “Agree”, “Strongly Agree” or “Neither”. The questions flows are as shown below:

1) The system is easy to navigate and use
2) The interface is user-friendly and colorful
3) The interface is neatly arranged and eases the human eye
4) The downloading is free
5) The voice recognition is rather accurate
6) The system reads out the recipes clearly
7) The voice recognition is easy to use
8) Most of my problems are settled using this system.

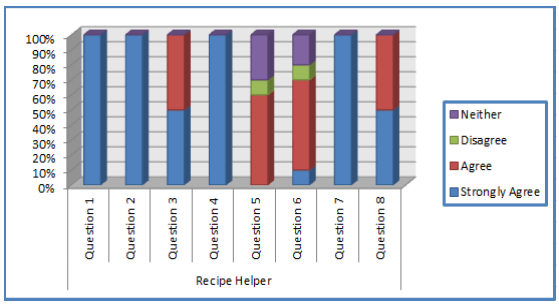


Figure C-1: Overall Questions Distribution for Recipe Helper

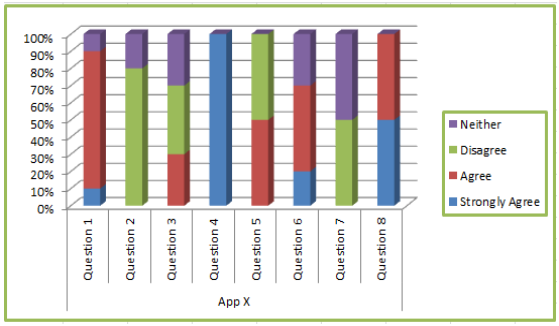


Figure C-2: Overall Questions Distribution for App X

	Recipe Helper							App X						
Questions	SA (4)	A(3)	D(2)	N(1)	Total Score	Sd	Mean	SA (4)	A(3)	D(2)	N(1)	Total Score	Sd	Mean
1	40	0	0	0	40	20	10	4	24	0	1	29	11.29528	7.25
2	40	0	0	0	40	20	10	0	0	14	3	17	6.652067	4.25
3	20	15	0	0	35	10.30776	8.75	0	9	8	3	20	4.242641	5
4	40	0	0	0	40	20	10	40	0	0	0	40	20	10
5	0	18	2	3	23	8.261356	5.75	0	15	10	0	25	7.5	6.25
6	4	21	2	1	28	9.416298	7	8	15	0	3	26	6.557439	6.5
7	40	0	0	0	40	20	10	0	0	10	5	15	4.787136	3.75
8	20	15	0	0	35	10.30776	8.75	20	15	0	0	35	10.30776	8.75
				TOTAL	281	118.2932	70.25				TOTAL	207	71.34233	51.75

Figure C-3: Data comparison between both apps to show total score obtained.

As a conclusion it can be made that both mobile apps are rather good in terms of the performance. However, the Recipe Helper system scores a better grade in terms of the user friendliness, the interface and appearance and the users find it easy to navigate the VR whereas in the app x, it is rather complicated since they have many ways to navigate the page. In other words, the users are looking for something simple and easy that is less complex. If we were to compare, the app x is rather complex and suits users that are very IT savvy instead.

V. CONCLUSION AND FUTURE WORK

The goals made initially have been accomplished in order to establish this project into the market for ready-to is used. Upon completing all the tests involved, the final concludes from this particular report is that the Voice Recognition Software has been given a green light to have further usage upon since the test results were rather positive on the performance and accuracy of the software. The mobile app formed will further be improved and enhanced with more functionalities and the current objectives of developing an app to ease users with VR functions has been a success.

In the near future, the following are additional enhancements that can be applied:

- Include more efficient Voice Recognition software whereby it would not require the need to access the Google server, in other words software that is embedded into the system itself.
- To include voice command ‘Repeat’ to enable user to re-view the recipe read out.
- To include various nations’ recipes especially from isolated countries itself.
- To further develop the mobile application and ready to be published into the android market itself ready to be used worldwide

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