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Chatterbox

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BSc in Information Technology

Design And Development Of An Augmentative and Alternative Communication (AAC) Application Focused On People Who, Due To A Stroke, Lost Their Ability Of Speaking And Also Compromised Their Motor Coordination.

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ORANGE|inc.

BSc in Information Technology

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Abstract

In the market, there are not many options or tools for people that once could speak. However, due to an accident or stroke, not only lost their voices and even some of their movements, but also sign language is not an option either. The issue is that whichever communication alternative that is available is either too expensive to use or too complicated for their actual situation such as google voice, notepads, general writing tools, etc. as each of them requires a little bit of work to manage.

Therefore we intended to ease speech-impaired people's lives by designing and developing an application that speaks for them by only one touch. It is a user friendly application, with different interfaces divided according to its category such as Emergency, Fun, Greetings, Feelings and Daily Chat. Each interface displays its own set of buttons with different sentences, and each button plays out its corresponding sentence as soon as it is tapped. The sentences were recorded by us, applying different intonations so, it would give the application a better humanized form.

We hope to make their lives easier, and give them back the possibility of expressing themselves in an easier way and keep up a steady conversation.

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Acknowledgments

We would like to convey our appreciation to all of those who contributed to the achievement of this report. We would like to extend a special gratitude to our supervisor Greg South, whose patience and contribution in encouraging and estimulating us to give and present our best during the conclusion process of this project.

We are also thankful to the Faculty for leading us and delivering their best to walk us through this journey.

Lastly but not least, our deepest gratitude to each member of this great team, who worked hard, with commitment and harmony to achieve the excellence of this work. It is brilliant how much we have learnt and improved throughout this whole process.

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Chapter 1

1.1 - Introduction

1.1.1 - Overview

Orange Inc. is the name of a group of students at CCT - College of Computing Technology which was formed in 2017 and still most of us remain the same.

Back in 2017, we had a different proposal for our final project. But then, we thought for our final project we should choose a better and social-related idea; something to contribute to people's lives, and last but not least, something to make us excited to work on.

So, during the following week, the five of us dived deep into searches, videos, real life developers, special needs applications programs etc. as an attempt to find out ideas that would comply with our prerequisites.

A week after, we got together in the library for our first project meeting to discuss potential ideas. We had eleven different ideas. Democratically, we went through all the positive and negative points of each one of them until we narrowed them down to three final ideas as presented below:

- Online Blood Bank System;
- College Application for Students;
- Speech-Impaired Application.

Soon after, we decided to listen to an external opinion and, as a result, we talked to CCT Assistant Head of ICT Faculty Greg South on the coming day to help us make a final decision. After this meeting, we had no doubts about what we should to go for.

1.1.2 - Inspiration

In many of our casual conversations, Clayton Crispim once mentioned he had a friend whose mother had a Cerebrovascular Accident (CVA), also known as a stroke. Her stroke consequence resulted in speaking difficulties - family can understand her most of times however, strangers find it quite challenging - and paralysis on her right side of the body, including her face.

Stroke Association based in London (April-2012) says "about one third of stroke survivors have some difficulty in speaking or understanding what others say". Having that in mind, Kleyton Soares came up with an idea to build a mobile application for people who were able to speak once but, due to a stroke for example, are both unable to communicate verbally, either temporary or permanently, and had their movements compromised owing to the incident making sign language not viable.

Thereupon, asha.gov says Augmentative and Alternative Communication (AAC) method will be put in practice. AAC is when you use other forms of communication without talking such as: using a notebook, facial expressions, body language, sign language or pushing buttons of a computer program.

There are two types of AAC:

- Unaided Systems: when using nothing but your body solely;
- Aided Systems: when using some kind of tools and/ or device to communicate.

Further searches have shown us a number of people in the same situation and little to no AAC. In some cases, these people have been using flashcards or tablets to communicate but it is not being good enough. They usually lack speed to keep up a basic conversation and frustration comes into play - making them unable to express themselves.

We kept on digging into speech-impaired searches when we came across to BBC reality show called *The Big Life Fix* which each episode describes three

different life stories of people with special needs and developers focused on building an application or device to help them out. The episode that got our attention is the number 2, which was on air on 7th December 2016, and reveals Graham's story.

Graham had a stroke and thought he had lost his voice forever. His brain was still working fine, but he could not speak and his movements were compromised as well. The AAC his wife found to get him to communicate was using a mobile computer, also known as a tablet, to type. Nonetheless, due to his loss of movements, it was hard for him to use this device leading him to fatigue, frustration and feeling of powerlessness.

Thinking about Graham's situation, we have developed **ChatterBox** which is explained in details in the following chapters.

1.1.3 - Empirical Research

Speech impairment can be defined as condition where an individual's ability to produce speech sound is somehow compromised, varying in a range from mild (as, for instance, mispronunciation of certain words) to severe (such as inability to pronounce any word at all).

In an attempt to get an insight of what speech-impaired people go through on a daily basis and better understand their needs, we have reached out a number of institutions in Ireland related to the problem, for instance, Speech and Language Therapy Department in hospitals such as Beacon and Saint James, Advanced Hearing Aid, The Irish Association of Speech & Language Therapists (IASLT), among others.

The percentage of people with speech problems concentrated in Ireland could not be located on the World Wide Web. The reason being, according to Deaf Hear Centre located at Parnell Square is that, in Ireland, there is not any kind of census to analyse specifically the number of affected people.

The last census carried out in 2016[1] by the Irish Central Statistics Office (CSO), the question number 16 asks whether the person has any long-lasting condition or difficulties. Unfortunately, none of the seven alternatives point out to speech-impairment which proves that there is no evidence about the number of Irish people living under this condition.

With this lack of concrete statistics or concise information about the problem we are trying to solve in our project, we decided (with approval of CCT Faculty) to reach out participants that deals on a daily basis with this type of public aiming to understand better the particularities of the problem.

As we strongly believe that understanding the difficulties and needs of people affected by this type of disability would have a huge impact on the successful development of our application, we came up with a questionnaire which covers five key questions sent by email along with brief explanation about what we expect from responders:

1. What are the issues participants would have to understand these patients? - We know that the main focus of this application is the person with disability itself, but people directly involved with them can give us information for a case scenario that we cannot see so clearly or we have not thought about.

2. What are the main difficulties they have? - What the struggles they actually have, what we need to have in mind when developing the program to become a useful and user friendly application.

3. What do you think can be done to improve their qualities of life? - Would our project/application be one of the things listed by them as a way to improve their quality of life?

4. What are the most common sentences the patient needs to express oneself (concerning daily needs)? - We know every individual has their peculiar needs and

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[1] Source:
https://www.cso.ie/en/media/csoie/census/census2016/2016censusforms/65995_English_Household_2016_New_Version_Do_Not_Complete.pdf

also, we tried to gather general sentences used on a daily basis chat however, it would be great if we would make our application more humanized and sensitive.

5. Which sentences would a close relative miss listening to the most or would love to hear again? - Sentences which people emotionally involved (families and friends) with a disabled person most miss hearing for example, sentences such as "I love you", or some kind of joke or saying used before.

We got few important replies, result of our questionnaire above, which for sure were crucial to guide us to the right direction about continuing our work and succeeding on the process of development of our application, we selected few samples from the return we had on our questionnaire below:

I - *"Hi Clayton,*

That sounds like a worthwhile project. Some suggestions for you:

...I think it would be very meaningful and informative for your project to try to interview/ send questionnaires to who use technology like this and their carers, as they would be the best at answering what sort of audio messages they would need on a device. "

II - *"...If you are talking about stroke patients - it depends on the location of the 'event' in the brain. If movement of the oral structures is affected it can have an impact on speech. Equally language can be affected where speech is okay but people cannot form coherent sentences or have word-finding difficulties. If movement of the hand(s) is affected it may impact on dexterity re using any technology to communicate. In the early stages pointing to pictures or objects can help.*
...If by 'they' you mean the stroke victim- the initial difficulties can be telling others about pain or discomfort or basic needs, isolation, lack of independence, fear of the future, and especially frustration at not being able to get their message across.
... You would also benefit from looking up the most commonly used words and phrases in the English language for this.
...it may be a phrase that the person used regularly eg Irish people like talking about the weather!! Dexterity is important when using an app ...you will need to consider this in your project. Creating any form of communication device is called Alternative and Augmentative Communication (AAC) - consider further reading on this. Also look up Proloquo2go - which is a widely used AAC system."

According to Idea.ed.gov. (2018), speech and language impairments can cause social and educational challenges (such as effective communication between colleagues, difficulties to speak in public, express verbal emotions, understand or give oral presentations, participate in group activities and so on), as the communication is the core layer of these processes and, consequently, this can lead the individual to isolation and frustration as a result for not being able to express themselves accordingly. Bullying is also an issue, not only for speech and language impairments but also for disabilities of any kind.

We also looked at existent Speech-Impaired Applications and we found few similar ideas to ours but most of them are charged to download and use.

As mentioned before, our initial idea is to work on a project that excite us and, at the same time, help other people in giving them a chance to make their lives a little easier somehow.

The first step was to look everywhere to understand the problem we were planning to work on and how we would solve it. Then, to think how our idea would stand out from the ones that are on market already.

1.2. - Project Goal

Aiming to bring some comfort and ease people's lives who were victims of a cerebrovascular accident (also known as CVA) and, as a consequence, lost either their ability of speaking and compromised their movements, we intend to build up a mobile application so that these target people can feel more integrated in society.

We would like to take their conversation skills to a higher level, enabling them to keep up simple conversations without embarrassments and frustrations. This project would be a type of AAC[2] so that users can break the silence and be heard.

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[2] Refer to 1.1.2 - Inspiration section for further information.

We also intend to implement sentences with human emotional intonations rather than electronically such as current text-to-speech applications. To achieve it, we plan to record sentences which are frequently used on a daily basis.

Moreover, it would assist their carers which will let them react more quickly and properly whenever an emergency situation arises and communication is made crucial.

1.3. - Project Objectives

We will work effectively as a group in order to deliver a fully functional mobile application and its documentations. By fully functional, we intend to have it available on Google Play so that any Android user may download and install it in their devices.

At first, the core idea is to have an application with buttons displaying keywords (however, some of them will display sentences) and whenever the user taps them, a male voice sentence will be spoken out. Later on, we intend to create a login page which will enable different users to create an account in which they can specify their age range as well as their sex so that different interfaces will be allocated for example, interfaces for children, teenagers and adults. Also, these users will be able to bookmark their favourite sentences to assist them with faster response and create customizable buttons, which will require a database implementation. The latter refers to enabling users to upload a figure picturing a movement and someone else would record a sentence related to it.

We also intend to talk with professionals that have developed similar or interrelated technologies, to ensure we are covering the technological parameters this type of application requires.

An interactive and responsive user interface should be designed by using an intuitive colour scheme and display of buttons that will be easy to handle, even by those people with impaired movements, focusing on a faster navigation that will be achieved by the use of icons for the main categories.

We plan to promote user testing and analysing how intuitive the application can be, whether they will easily be able to navigate through different interfaces and take notes of any possible difficulties they may have.

1.4. - Tools & Technologies

Below are the types of technologies and tools we long to use in order to make our mobile application become true. Except for Android Studio IDE, we have already been familiar with all of the following.

1.4.1 - Android Studio

Our Application will be built using Android Studio which is an official free Integrated Development Environment (IDE) piece of software, designed specially for Android application developments. It is available for download on Windows, MacOS and Linux operating systems.

None of us have knowledge on this tool yet however, as far as we have searched, we realised that Android Studio is enhanced with simple features that make the virtual testing faster and is equipped with user-friendly UI (User Interface) according to Rootinfosol.com. (2018).

Developers can use the drag and drop APKs (Android Application Package), multi-touch actions (pinch and zoom, pan, rotate, tilt) and can also create / add indexable URL (Uniform Resource Locator) links to the application according to Jamal Eason (Eason, J., 2016).

Our application will be focused on Android OS and Android Studio can assist us when checking compatibility and performance on a wide range of Android devices and also offers faster deployments of fresh builds without the need of restarting the application or building a new APK every time. The IDE also offers the IntelliJ IDEA interface which makes code writing and analysis easier, faster and much more accurate.

1.4.2 - Java

The programming language we intend to use to build our Application is Java which has been one of our main modules during our information technology course.

Java is object-oriented, cross-platform software. Its motto is "Write Once, Run Anywhere" (WORA) because of Java Virtual Machine (JVM).

We expect the application complexity to become a challenge and it will require some additional revision of certain topics previously studied and deeper search in others throughout its development.

1.4.3 - XML

Extensible Markup Language (XML) will be the language used for designing the layout of the UI (User Interface). It was designed to store and transport data as well as to be self descriptive. Android Studio offers a feature to build XML layout using a drag-and-drop interface, which makes the work very straightforward.

1.4.4 - Web Development - PHP / HTML5 / CSS3

A website will be developed to provide information about the application, documentation, new releases in future, upgrades, updates and support via a contact form. In order to achieve this, we will need to design and develop a website using PHP to carry out small server-client tasks, such as the contact form and HTML5 and CSS3 to structure the webpage.

1.4.5 - System Analysis

Overview and detailed description of the problem, possible solutions, requirements for the design of the system. Use case scenarios to describe the possible situations concerned to the Application System response to the user. Diagrams to trace the route of the application system.

1.4.6 - Database

Initially, a database implementation is not being considered for the prototype and for the first version of our Speech-Impaired Application. Nevertheless, we intend to keep working on it even after the project presentation and then, a database, such as MySQL or MariaDB, might become necessary. We have already ideas for the future versions for instance: creating a login for each user; once past the authentication, we intend to implement extra tools for example: making users able to bookmark their most used buttons and customization as previously described in 1.3 Project Objectives.1.5. - System Deliverables

1.5 - Working System

At first, we are building and directing our system to Android OS because according to Statista.com (2018), "the second quarter of 2018, 88% of all smartphones sold to end users were phones with the Android operating system" against 11.9% iOS.
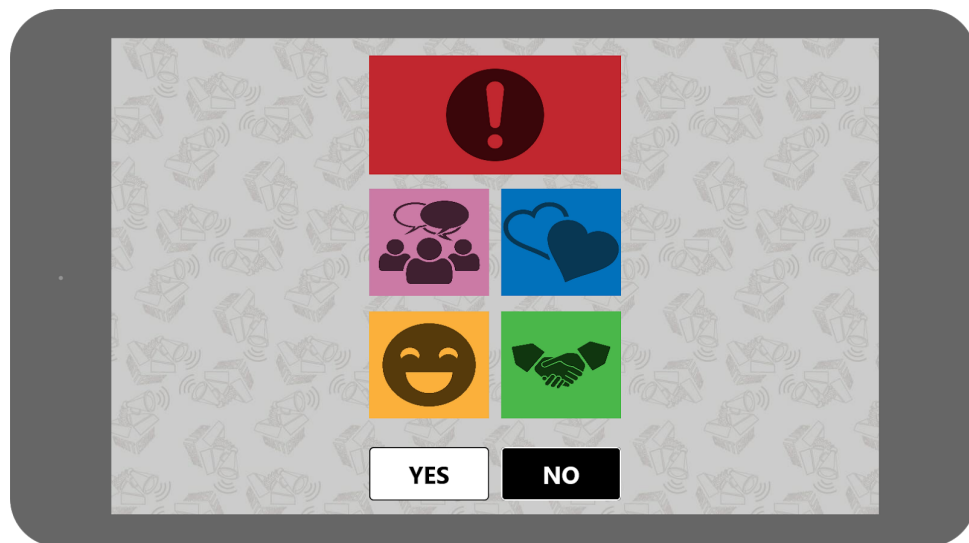
Figure 1: Main Menu[3]

The system is composed by a main "Menu" page with 5 buttons (Emergency, Daily Chat, Feelings, Fun, Greetings, respectively) and 2 extras buttons for "Yes" and "No" placed within the screen. Every button has a distinct icon which will direct

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[3] Icons were especially designed for this project by Clayton Crispim.

the user to a different interface displaying the most used daily sentences in order to provide an easier way to communicate.

We considered the "YES" and "NO" buttons as "critical buttons" because they can be used as many as needed and fit in any kind of situation. This way, the user does not need to navigate to a specific interface everytime they need to tap "YES" or "NO" for questions that require similar answers, such as "Are you hungry / comfortable / fine?" etc.

This is the complete map of the application, containing all the categories and its respective sentences:
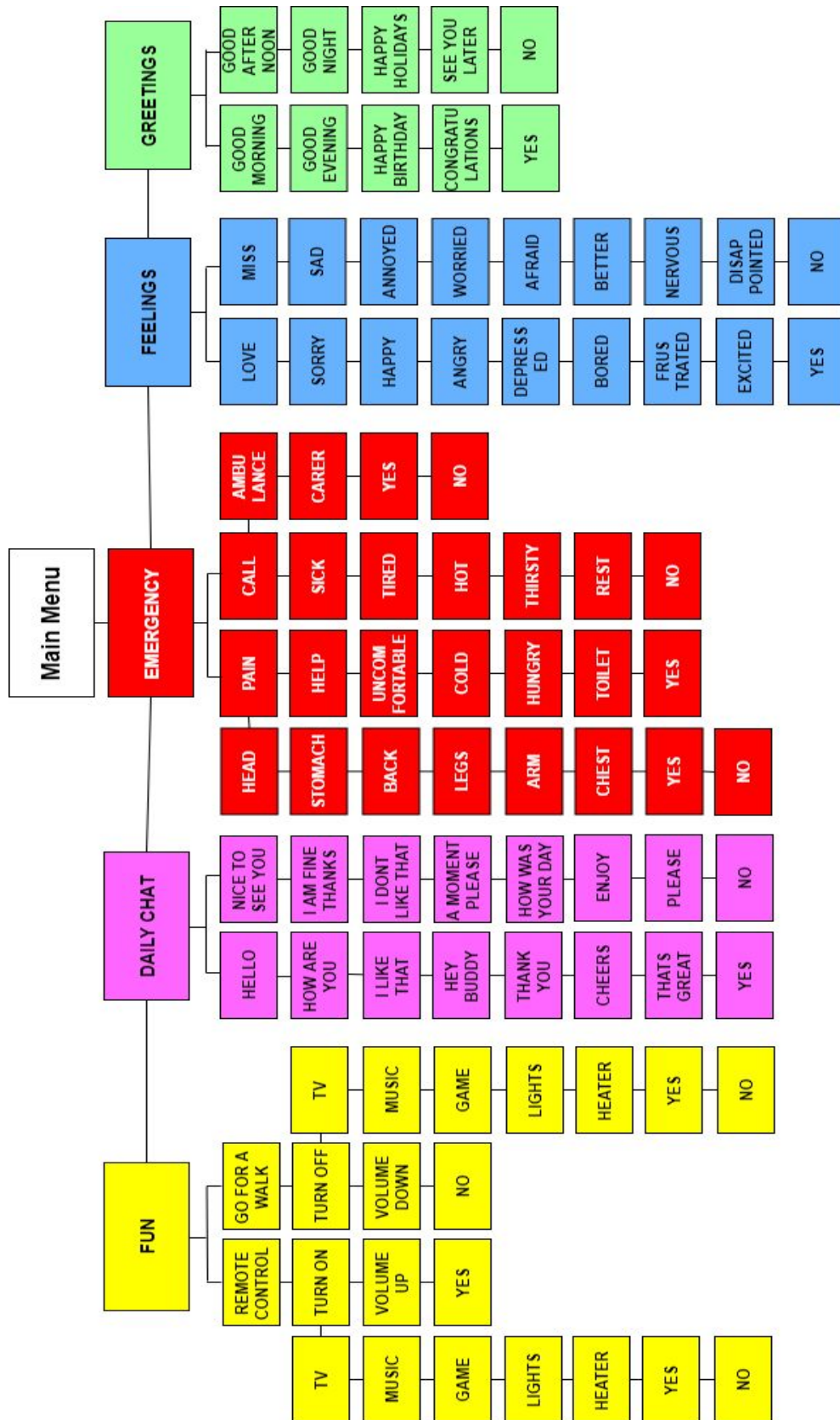
Figure 2: Map Of The Application

1.5.1 - Colour Psychology Applied To The Working System

We created each button using different colours and each one of them was was based on the Colour Psychology concepts. The general definition of Colour Psychology is the study of the perceptions, sensations and reactions people have to certain colours, as described in Colour-Affects (Colour-Affects.co.uk. 2018).

It is different from colour symbolism, which can be predefined according to pre-established concepts, e.g. based on culture and religion, as it is pointed in En.wikipedia.org. (2018). Color psychology. Even though colour perceptions are subjective, their effects are universally felt and it can be globally applied as a rule, e.g. colours in traffic signs. Additionally, Colour Psychology relates to the spontaneous reaction in the person's mind and it has been object of studies for centuries, according to the website Ethos3 - A Presentation Design Agency. (2018).
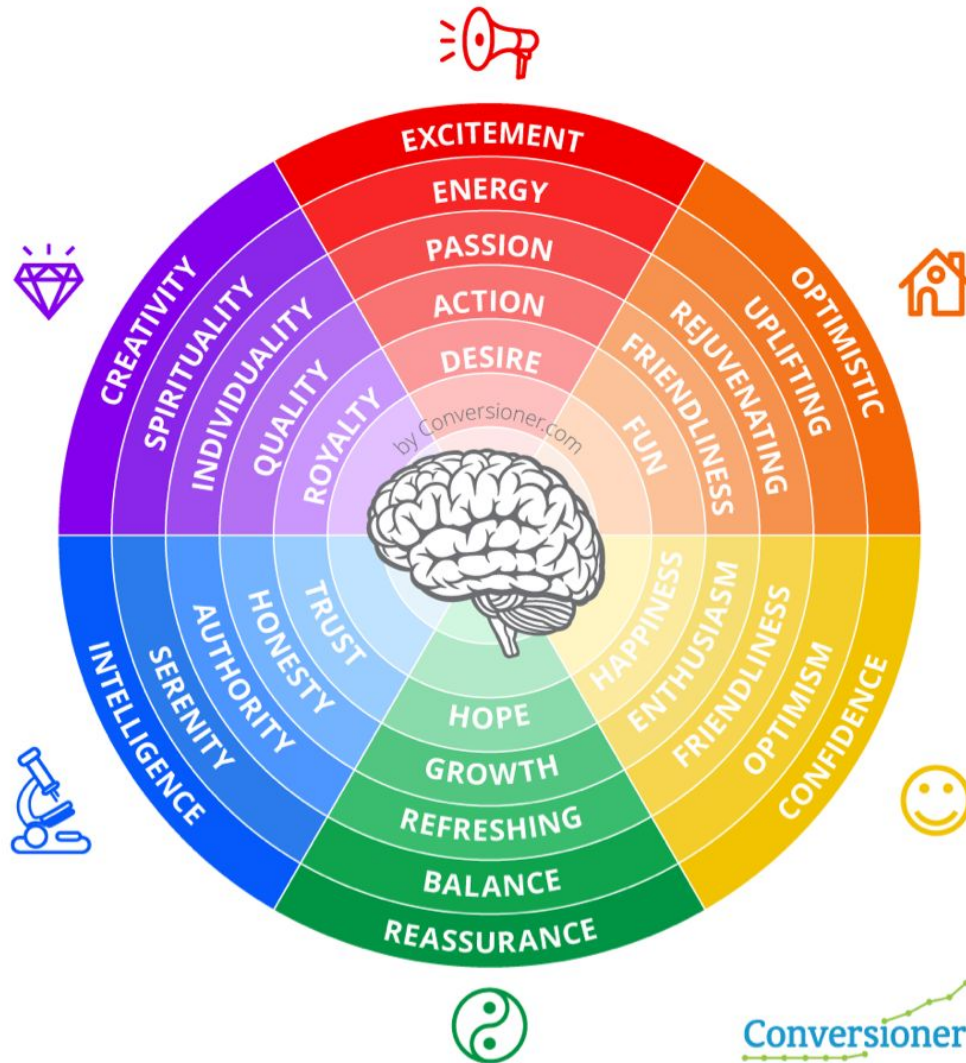
Figure 3: Color Psychology Diagram By Conversioner [4]

As shown on figure from the previous page, the Color Psychology diagram has many versions and slightly differs from each other when it concerns the whole scope of feelings / sensations, although they are very similar and interconnected.

An example of how this psychology field is largely used is the 2015 Disney movie, *'Inside Out'* which tells a funny story about what happens inside our brain, demonstrating it with 5 colours for different emotions (joy, fear, anger, disgust and sadness).

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[4] Source: https://www.conversioner.com/blog/color-psychology

Furthermore, an explanation brought by one of the group members, Clayton Crispim, a graduated Designer with qualification in Digital Design by the Brazilian Osasco City's university *Unifieo*, is that Colour Psychology is essentially used in many visual communications such as leaflets, posters, logos, brandings, websites, magazines, advertising, movies etc, as a subtle way to evoke people's emotions and reactions, transmitting at the same implicit company's concepts.

Taking similar Colour Psychology parameters into consideration, we associated each button of our application to similar or interrelated feelings. Below are the examples of icons and colours for the menu options. The sub-buttons of the menu, with the keywords, will also have the same tone of colour.

Figure 4: 'Emergency'

Emergency

Probably the most common and obvious colour designation to a purpose, the red colour for emergency in our application meant to highlight the option that transmit a sensation of urgency and immediate attention.

Figure 5: 'Daily Chat'

Daily Chat

Placed between red and magenta colours gama, the magenta-pink colour for 'Daily Chat' concerns emotions / characteristics which goes from 'action' to 'discernment', and these are the ones people use to engage in a conversation.

Figure 6: 'Feelings'

Feelings

The blue colour is commonly associated to a deeper type of feelings, such as 'trust', 'belief', 'faith', 'honesty' etc. Thus, sentences that express affection are inside this category.

Fun

Even though the colour related to 'fun', according to the Colour Psychology diagram of Figure 5.3, is the orange colour, we chose the yellow colour because visually is more suitable for the interface's background and due to its proximity with that colour in the colour spectrum, always evoking feelings interrelated to 'fun', e.g. 'happiness' and 'enthusiasm'.

Figure 7: 'Fun'

Greetings

This was maybe the hardest colour to associate because the green colour does not relate necessarily with anything similar to a 'greeting'. Although the green colour is in between blue and yellow in the colour spectrum, which respectively has 'trust' and 'friendliness' characteristics associated with them.

Figure 8: 'Greetings'

1.5.2 - How Can Colour Affect Business

It is believed that colours can be directly connected to individual experiences, for example, most people associate colours to gender when we see that baby girls should wear pink meanwhile baby boys should wear blue. Nonetheless, Joe Hallock's, Helpscout.net. (2018), who works on "Color Assignment", is able to demonstrate "the supremacy of the color blue for both genders and the disparity between groups on purple". Hallocks reminds us that most Western societies are the individuals who most repondended his questionnaires.

According to a study called "Impact of colour on marketing" also mentioned in Helpscout.net. (2018), 'up to 90% of snap judgments made about product can be based on color alone, depending on the product'. Studies also demonstrate that colours have directly influence on how customers view the "personality" of the brand or company, not to mention that our brain tends to recognize brands for example, if we think of Coca-Cola, the colour that comes up on our mind is red; if we think of Fanta then it is orange, Sprite - green and so on. As colour has that power of

association, it can be considered an important point when creating a new product and brand.

1.6 - User Documentation & Manual For Prototype

User documentation is an essential deliverable when deploying an application as it provides the user means to understand the program features and how it works, helping them to fully take advantage of the product and reducing frustration of not knowing how to handle the application properly.

Taking this into consideration for the prototype of our software application, our intention is to provide users with two basic documentations:

- **Functional Description Document** - as the name suggests, this document will contain a brief summary of the system, describing its functionality and features and it will also provide an idea of what the user can expect from the system. The System Requirements will be outlined in this document as well.

- **User Manual** - the user manual has the objective to guide the user throughout the application, providing detailed instruction on how to use the system step-by-step. A non-technical language will be utilised so that it can be easily comprehended.

1.7 - Evaluation of System Based on Testing

Functional testing is considered a crucial phase during the development of systems and applications as it is used to verify if the program meets all the requirements proposed on the specifications and performs as expected.

For our project, we have opted to perform the usability testing, to check if the application will provide the results expected by end users. To do so, we will utilize the black box technique and request a few tasks to be executed by a certain amount of people and compile the results.

Chapter 2

2.1 - System Analysis

The best way to start a project is by making a plan, writing down ideas, making decisions, identifying and assuming risks. Therefore, the more organized and detailed a plan is, the greater are the chances of achieving success. So why would system analyses be so important to a project?

According to the dictionary Merriam-Webster systems analysis is "...the act, process, or profession of studying an activity (such as a procedure, a business, or a physiological function) typically by mathematical means in order to define its goals or purposes and to discover operations and procedures for accomplishing them most efficiently."

Once the decision of the idea for the project is made, it is necessary to list the requirements to understand the need of the program. When assigning any large project, it is important to draw the best path to follow, a type of framework, to be aware of the phases that the process will take such as planning, analysing, designing, implementing, installing and maintaining the program.

A good analysis of the system cannot only "predict" the program properties and functionality itself, but also makes it possible to draw different scenarios of the interaction between the user and the application, covering different behaviours, use cases, chances of failures or possible "bugs" in the program, in order to mitigate problems or risks during the development of the system.

Changes about the design of the system may occur during the process of development of the program, although the objective and the main purpose will still be the same, a premade general analysis and design will implement improvements in the functionality of the program and support of the user.

2.2 - High-Level Description Of The Program & A Full List Of Requirements For The Proposed System

Our objective is planning, modeling, writing a piece of code and implementing it as an application to be used by Android operating systems. To achieve our objective, we are using Android Studio, an application for Android devices that works as an IDE (Integrated Development Environment), and the languages used to develop our program are Java (classes and methods - buttons and actions) and XML (design).

As previously described in the "1.1.3 Overall Problem Description" section in Chapter 1, we were not able to find much technical information concerned to the problem we are trying to solve. Moreover, the applications that already exist on the market have their downloading under payment.

Taking into careful consideration all the information collected from not only our questionnaire but also videos and study cases related to people who are speech-impaired, our personal judgement, decisions and scope explained in this report will attend their needs in a general form.

2.3 - Requirements

Requirements are important for a successful development systems. It will ensure based on a general overview that the necessary precautions will be taken and best decisions for a greater performance will be made.

R1. Keep a list of most used sentences on diverse daily based scenarios and divide them into categories.

R2. Record a set of sentences and split them according to each category and interfaces such as Daily Chat, Fun, Greetings, Feelings, Emergency;

R3. Work out to display the right keyword or sentences according to the tapped button of the chosen interface;

R4. Manage to play the right verbal sentence according to the button tapped by the user;

R5. Cope with subinterface special buttons inside the "Emergency" and "Fun" options, such buttons are 'pain' and 'call' for Emergency and 'volume up', 'volume down', 'turn on', turn down' for Fun. These special buttons should open another interface and display extra buttons;

R6. Cope with the same button being tapped several times;

R7. Make sure the sentences played will not sound robotic which would give the application a less humanized characteristic;

R8. Work out to display the "Yes" and "No" options on top of every different interface of the program;

R9. Improve the user's navigability between the interfaces according to their needs or depending on how the conversation flows.

R10. Ensure the application will be fully installed in the user's device so that he would not need internet connection.

Use Case: Speech-Impaired Application

Actor: User with disability or difficulty to speak

Goal: Mobile Speech-Impaired Application

Overview

Focused on users with partial or total disability to speak, this application can be divided up to three categories: Child, Teenager and Adult. Every category has its own particularity, and the reasons for the disability can vary. However, for this project, the Application will be concerned about cases where the disability was triggered by an accident at some point of their lives.

The Application will be written based on what we judged to be the most used daily sentences. These sentences will be divided in different categories such as Emergency, Fun, Daily Chat, Greetings and Feelings. When the user desires to speak, instead of struggling to type some text in, he will tap buttons on the screen which will speak out for him.

Cross-Reference:
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10

Typical Course of Events of the system:

Actor Action:

1. Open the application by pressing ChatterBox logo on the screen of the device to get into the Main Menu of the program;

4. Choose one of the five different options for interfaces displayed on the Menu.

6. Choose a sentence or expression adequate for the conversation.

System Response/Task:

2. Launch the application.

3. Display the main Menu with five options divided in categories.

5. Display the interface selected by the user, bringing up the sentences according to the chosen option.

7. Process the sentence chosen by the user and play sentence back to the user.

Figure 9: Expanded Description of the *'Speech-Impaired Application'* Use Case

2.4 - User Interaction Diagram Of The Program
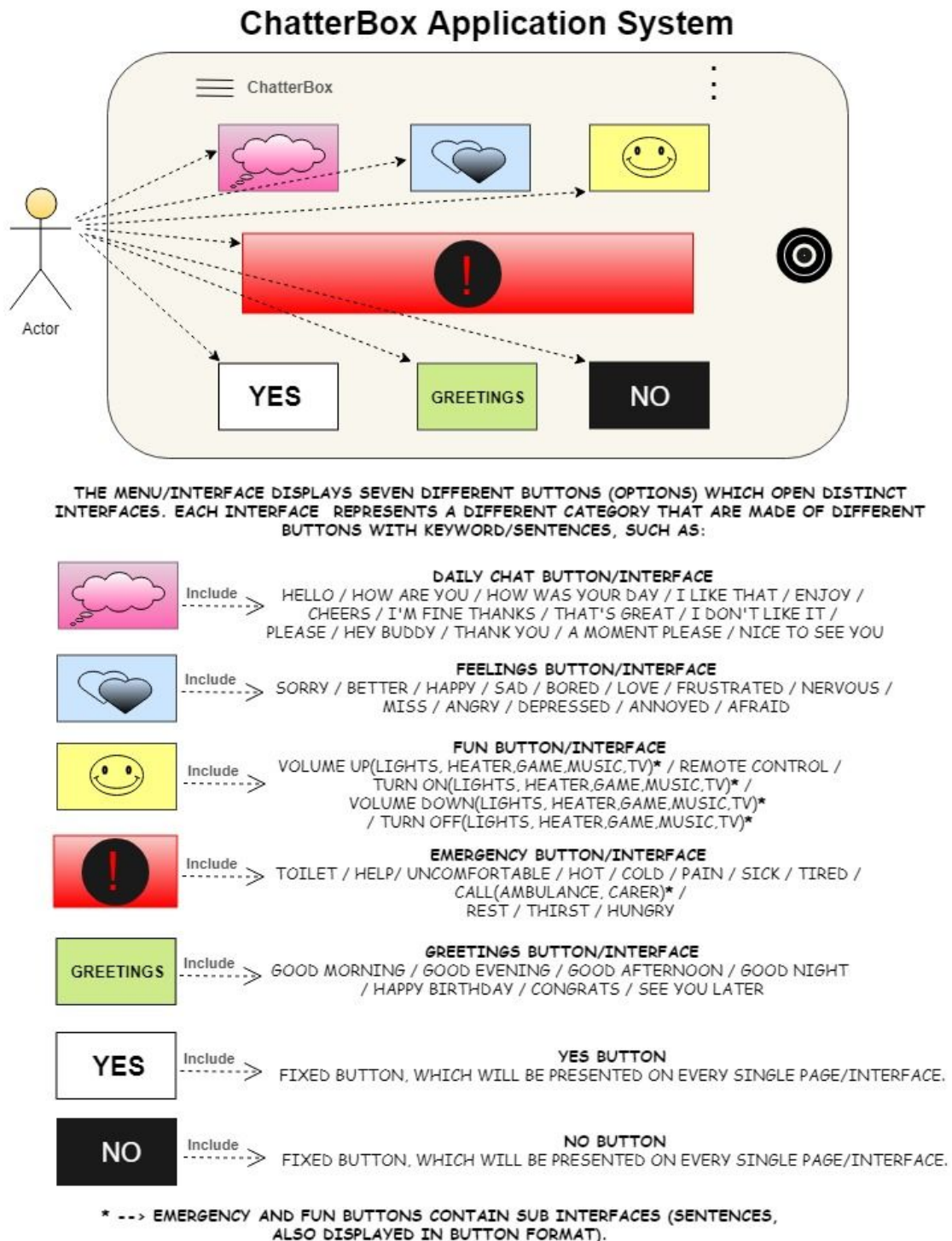
Figure 10: Overall User Interaction Diagram

2.4.1 - If The User Taps **Emergency** Button
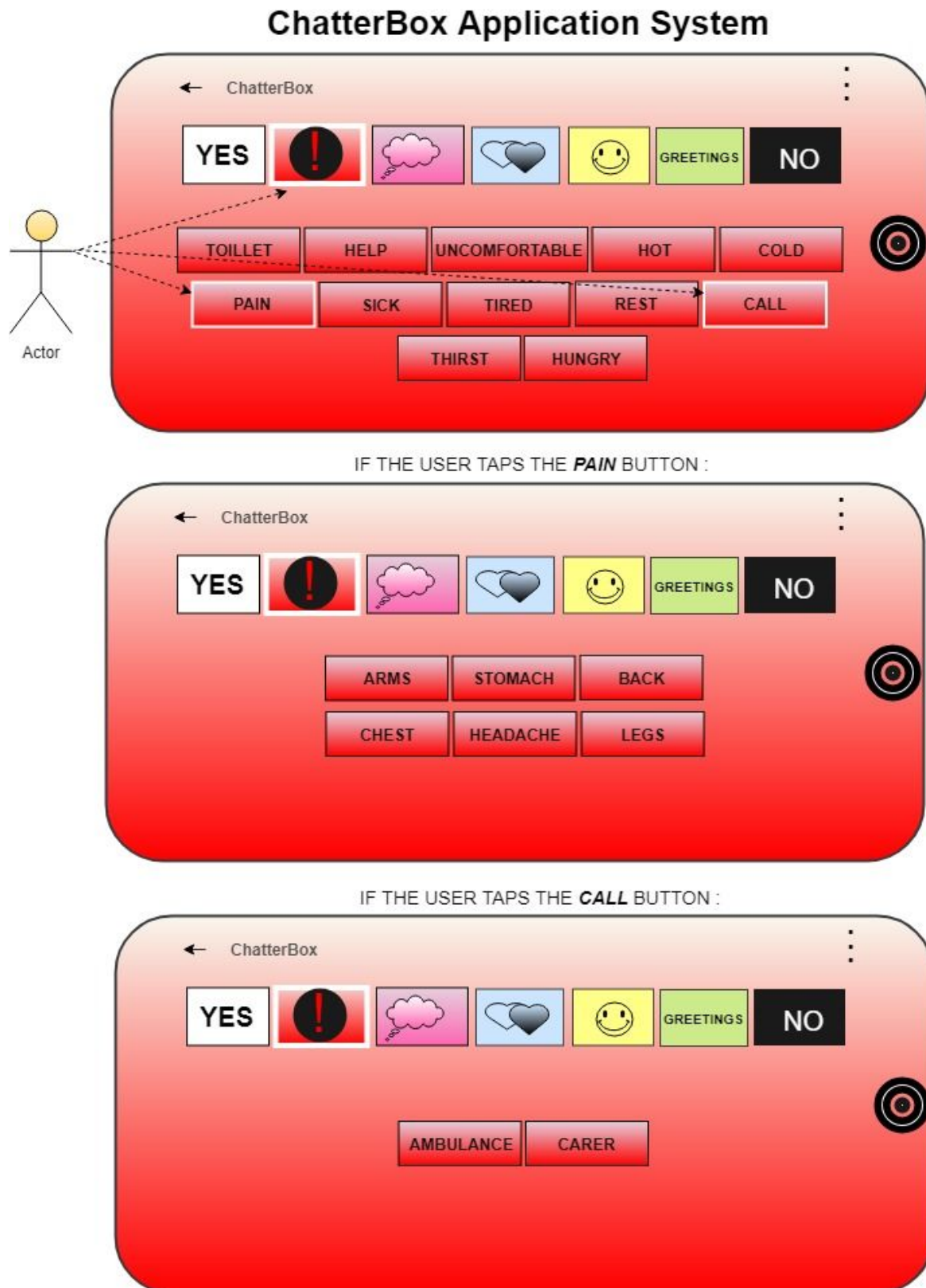
Figure 11: User Interaction Diagram - Emergency Interface

2.4.2 - If The User Taps **Daily Chat** Button

ChatterBox Application System
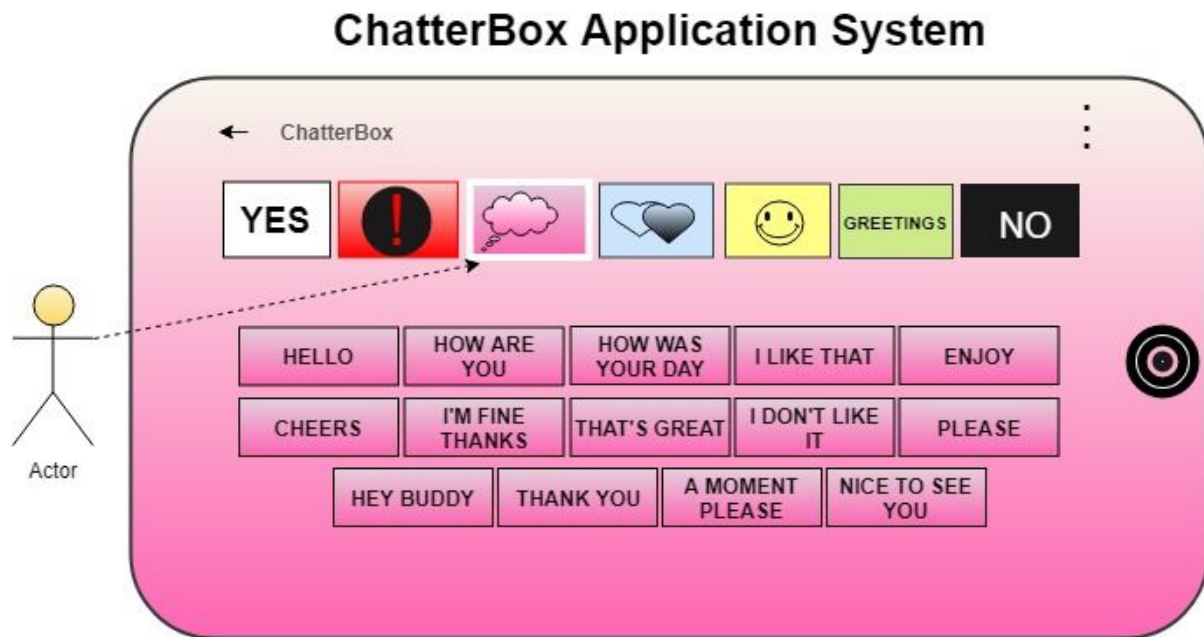
Figure 12: User Interaction Diagram - Daily Chat Interface

2.4.3 - If The User Taps **Feelings** Button

ChatterBox Application System
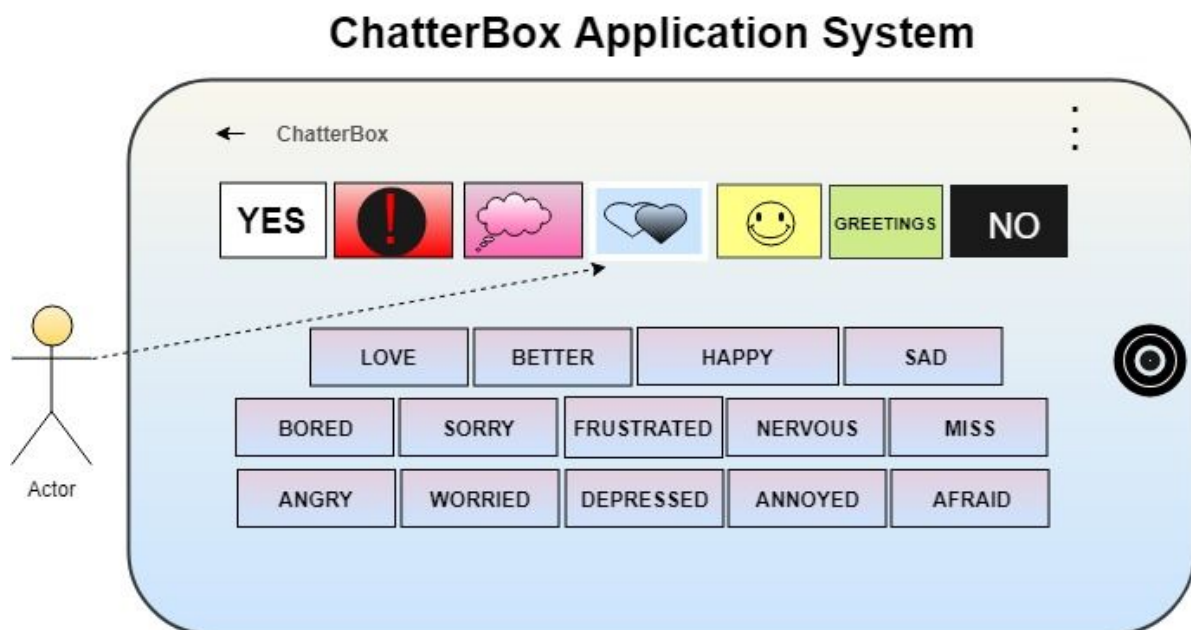
Figure 13: User Interaction Diagram - Feelings Interface

2.4.4 - If The User Taps **Fun** Button

ChatterBox Application System
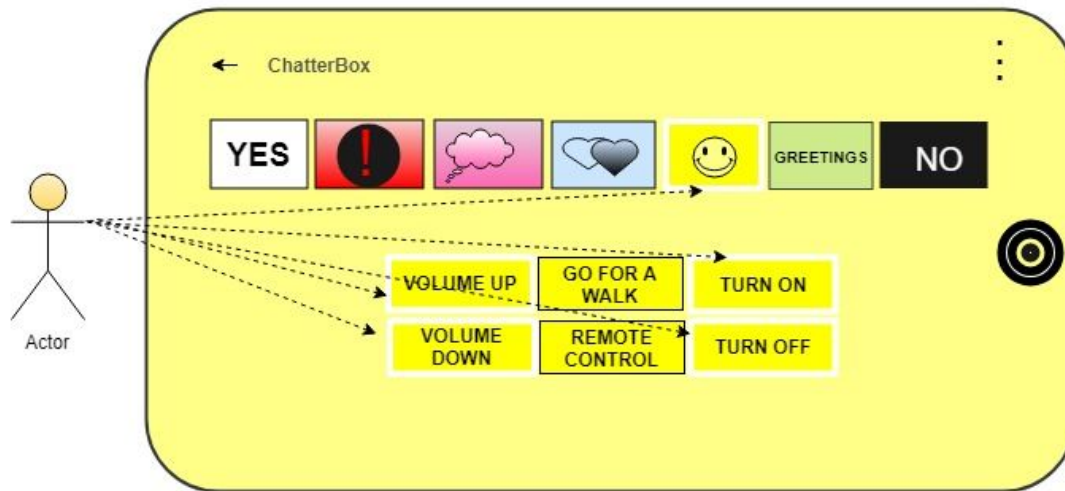
IF THE USER TAPS THE *VOLUME UP / DOWN - TURN ON / OFF* OPTION / BUTTON :
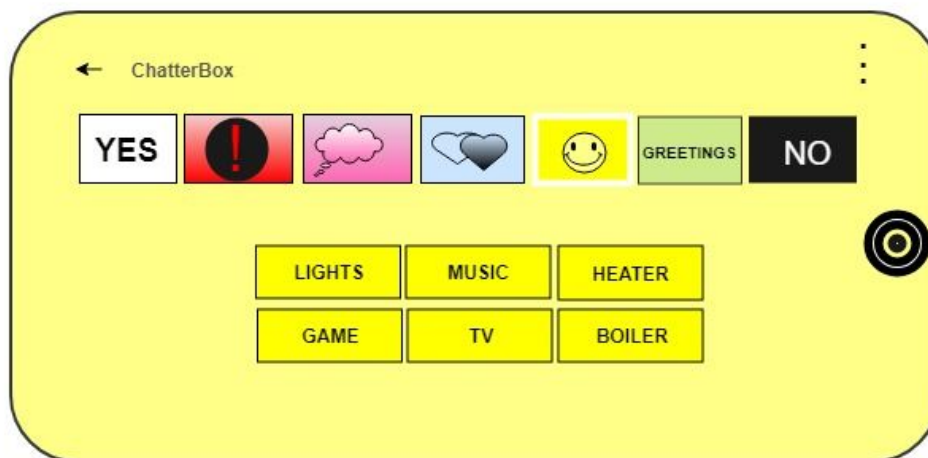
ASSUMPTIONS: *VOLUME UP, VOLUME DOWN. TURN ON AND TURN OFF* BUTTONS WILL OPEN INDIVIDUAL INTERFACES ALTHOUGH THE OPTIONS FOR ALL OF THEM ARE THE SAME. THIS WAY WE DON'T FIND IT NECESSARY TO DRAW THREE EXTRA INTERFACES REPRESENTING THE SAME OPTIONS.

Figure 14: User Interaction Diagram - Fun Interface

2.4.5 - If The User Taps **Greetings** Button
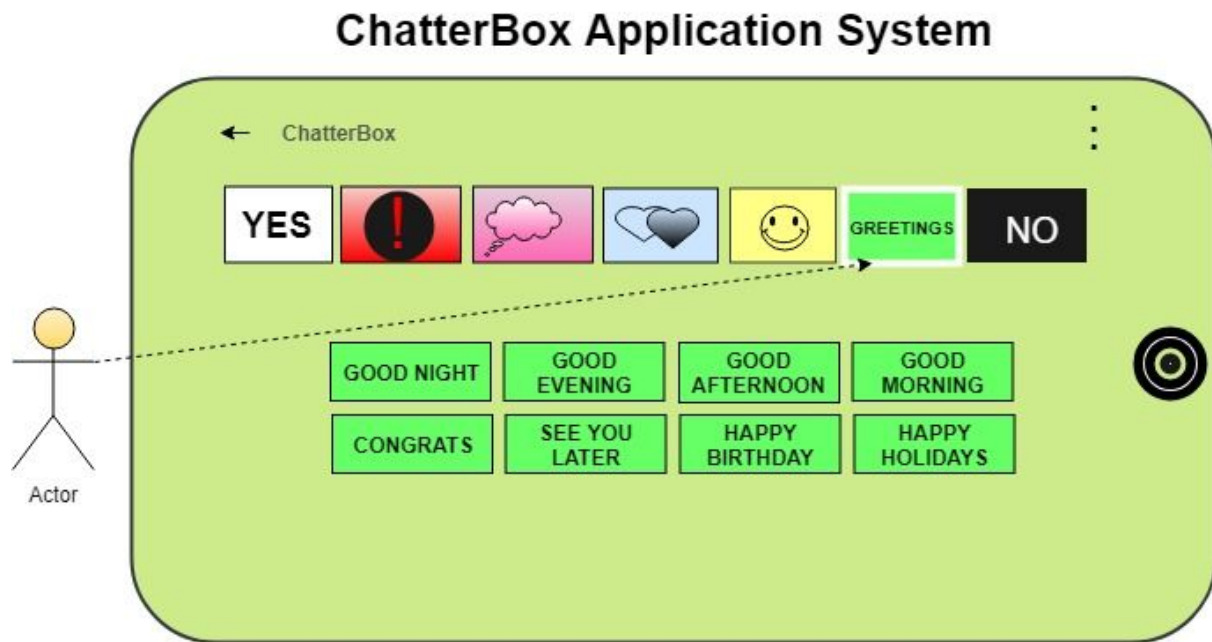
Figure 15: User Interaction Diagram - Greetings Interface

2.5 - General Use Case Diagram Of The Program
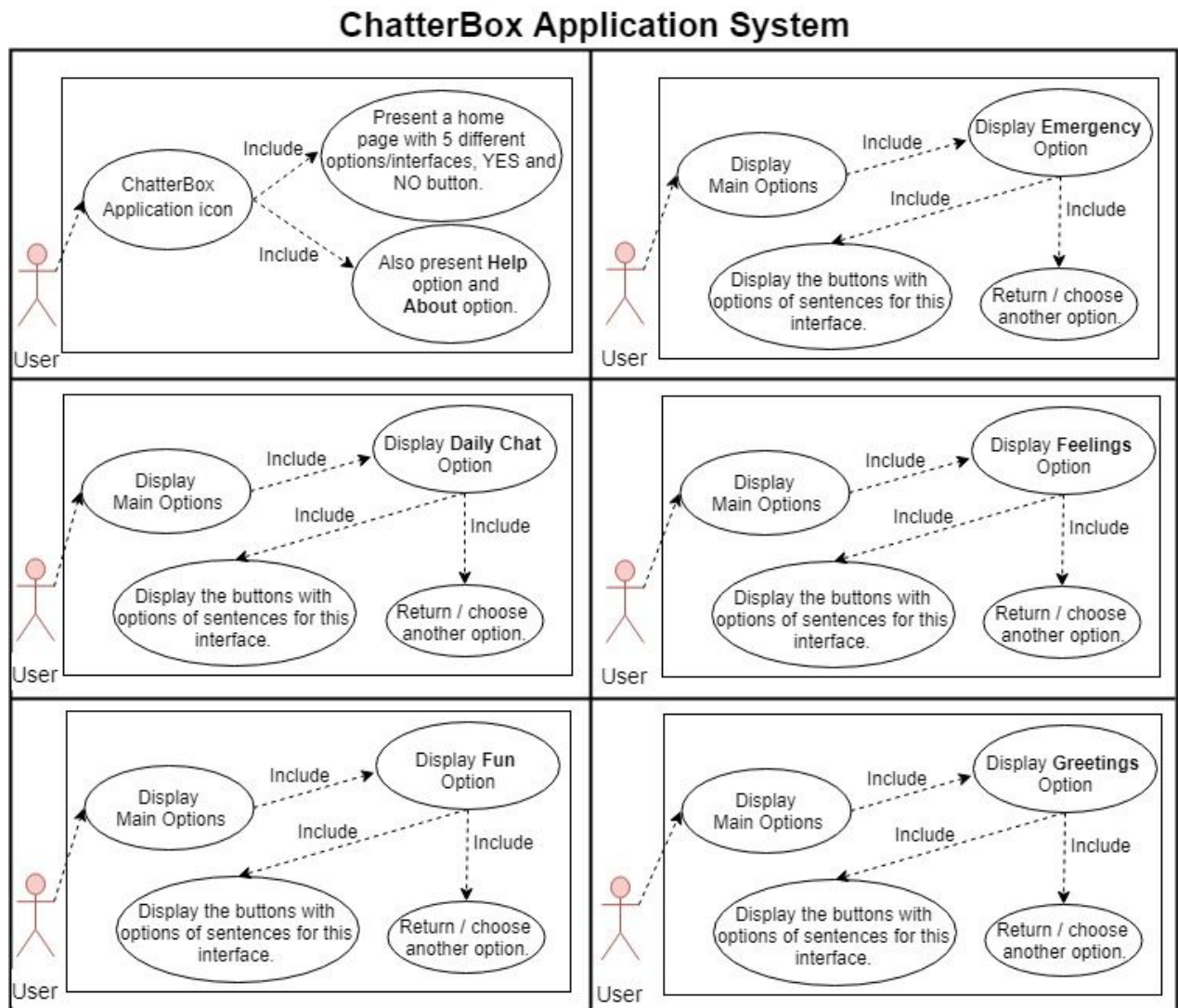
Figure 16: Use Case Diagram

2.6 - High Level Class Diagram

Britton and Doake says, on page 117, "the class diagram is central to object-oriented analysis and design, it defines both the software architecture, i.e. the overall structure of the system, and the structure of every object in the system. We use it to model classes and the relationships between classes, and also to model higher-level structures comprising collections of classes grouped into packages."
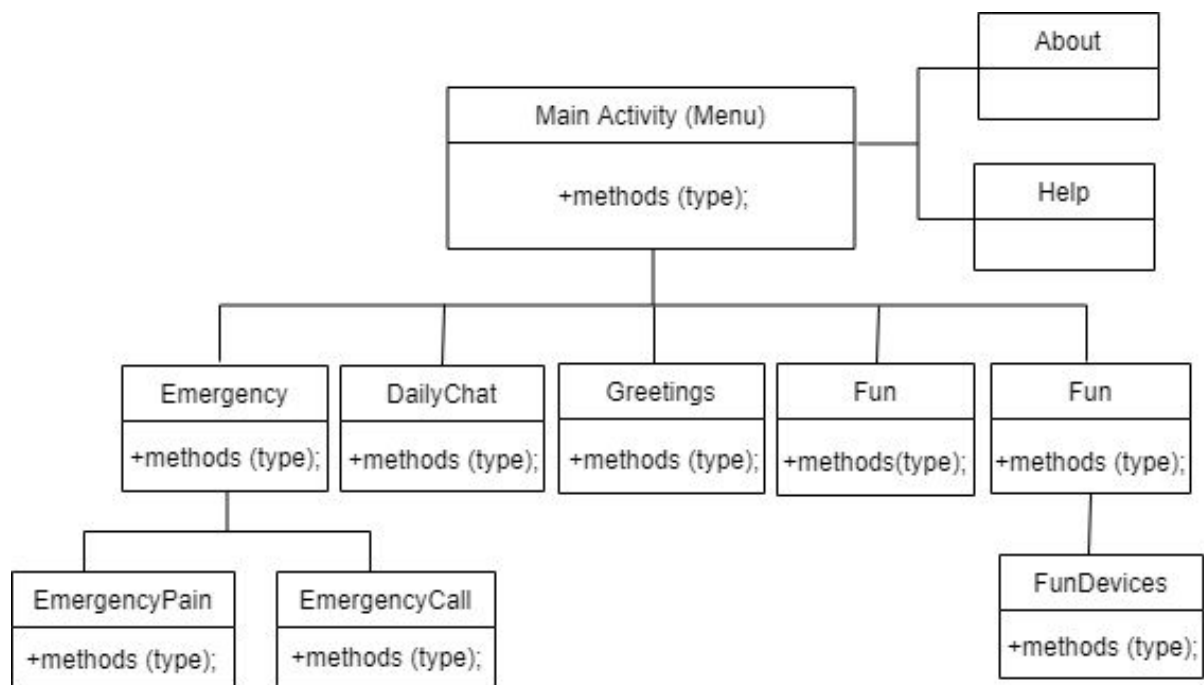
Figure 17: High Level Class Diagram

2.7 - Activity Diagram - Entire Flow Of The Activity Of The Running Program
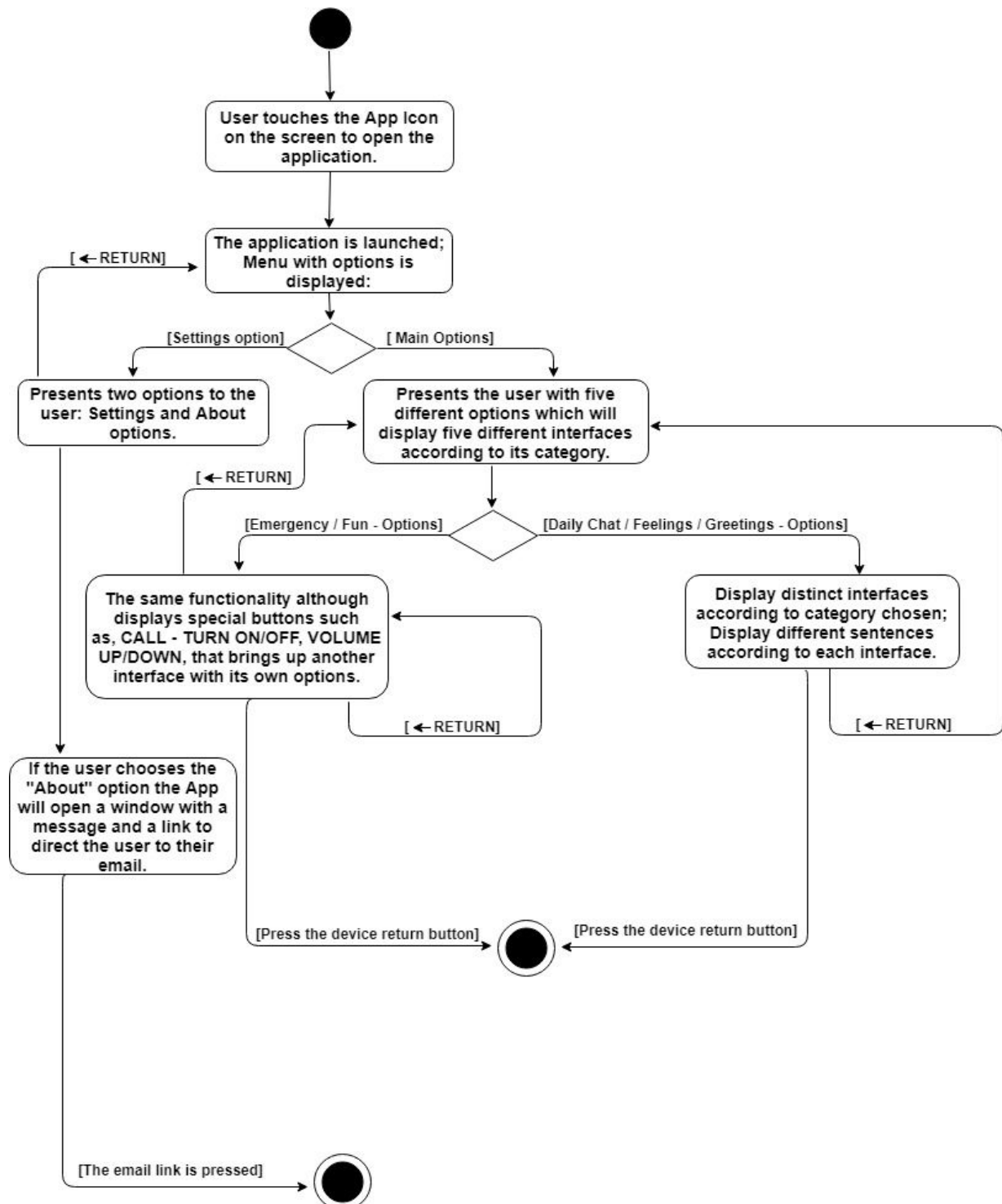
Figure 18: Activity Diagram

2.8 - User Story Detailing User Interaction With The Application Following The Agile & Extreme Programming Practices

Scott W. Amber says in his website, Agile Modeling, that "User Stories are one of the primary development artefacts for Scrum and Extreme Programming (XP) project teams. A user story is a very high-level definition of a requirement, containing just enough information so that the developers can produce a reasonable estimate of the effort to implement it."

Figure 19: User Story Cards.

Chapter 3

3.1 - System Design

In this chapter, we will explain the main concepts used in the design of our application, the User Experience Design, the User Interface Design and the Functional Design and discuss how those concepts helped us to build ChatterBox.

One of our main concerns, since the start, were the User Experience (UX) and User Interface (UI) design. Those are concepts walk side-by-side, however, as a matter of fact, they are two distinct concepts. Here we explain the ideas behind those concepts a bit better and how we implemented their approaches on our application.

3.2 - User Experience (UX) Design

User Experience Design can be defined as the process that focus on the overall improvement of the user's satisfaction when one interact with a product or application, by enhancing the usability and providing a pleasure interaction between product and user. It accomplishes its objectives by understanding the needs of the users, their abilities and also their limitations.

Peter Morville (Moville, P. 2004), an information architect and president of Semantic Studios, have designed a diagram (shown on the following page), called User Experience Honeycomb, that illustrates the aspects an application must consider in order to provide a meaningful user experience.

Figure 20[5]: User Experience Honeycomb by Peter Morville

The honeycomb illustrates the facets of User Experience:

- **Useful**

The product should be useful and fulfill a need.

In the case of our application, we judge ChatterBox to be a useful tool to speech-impaired people and hope it will fulfill a need of this audience, which is to help them to better express themselves.

- **Usable**

Content should be simple and easy to use.

We tried to keep the design of the application as simple and clean as possible, opting for the display of buttons that leads the user to desired functionality.

- **Desirable**

  Visual aspects should be attractive and used to evoke emotion.

  The choice of colours and design of the icons used on ChatterBox were carefully thought and planned to transmit emotion and convey a sense of comfort

- **Findable**

  Content should be easy to find and to navigate through.

  ChatterBox's interface was designed in a way to make navigation simple and easy.

- **Accessible**

  The application should be designed in a way it can provide the same user experience to people with disabilities as others.

  This was one of our priorities, from the choice of the colours, that was tested for different levels of color blindness to the disposition of the buttons, as some of the users might have a compromised movements of the hands.

- **Credible**

  Users must trust in what you provide them.

  This aspect of the honeycomb is more related to the accuracy of information provided to users, and we believe the research behind ChatterBox add this credibility to application.

- **Valuable**

  Product must deliver value to a user.

  We have to ensure that ChatterBox will fulfill everything that is promised for: an application that will help speech-impaired people to better express themselves.

3.3 - User Interface (UI) Design

The design of the User Interface (UI) is likely to be one of the most important and a key element when developing an application. It is the area that focus in trying to understand and predict the user's need and translate them into the elements implemented in the interface, that should be simple to understand and navigate through.

Since the beginning, the User Interface has been one of our main focus; to design and develop a friendly and intuitive UI, especially taking into consideration the public that our application target, speech impaired people, where in many cases the user may also have some movement restrictiveness.

With that in mind, we based the design of our application in four basic premises of the user interface design:

1) **Keep The Interface Simple**

To have a clear interface, displaying on the screen the minimal as possible, avoiding unnecessary elements.

2) **Create Consistency & Use Common UI Elements**

By using common User Interface elements, such as buttons and breadcrumbs, and by creating a pattern in the interface's layout, we expect the user to be able to easily navigate throughout the system and feel comfortable in use it

3) **Use Strategic Colours & Texture**

Again, the colours of the icons were carefully chosen using the Colour Psychology concepts and this concept was also transferred into the design of the application, as for example, the background of each interface matches the hue of its button, in an attempt to make the user, even subconsciously, identify in which interface they are.

4) Be Purposeful Regarding The Layout

This premise regards to where buttons are displayed and its size, based on its relevance. For instance, we decide to have the Emergency button larger than the others and as well place it on the top of the menu, judging it to be more crucial than the others.

Taking those four premises into consideration, we have decided to create a clean Main Menu, where the user will be presented merely with five different options to be chosen from, Daily Chat, Emergency, Feelings, Fun and Greetings, and each of which, when pressed, will lead the user to the respective interface.

Once in the selected interface, a fixed Menu will be displayed on top of the screen, enabling the user to navigate through other interfaces without the need to go back to the Main Menu to select another option. Also there, it will be displayed buttons of sentences that when pressed, will play the according audio, allowing the user to express themself.

3.4 - The Application - Wireframes

Here we present the wireframes for the entire application. It was designed using Mockplus, a prototyping application.

3.4.1 - Main Menu
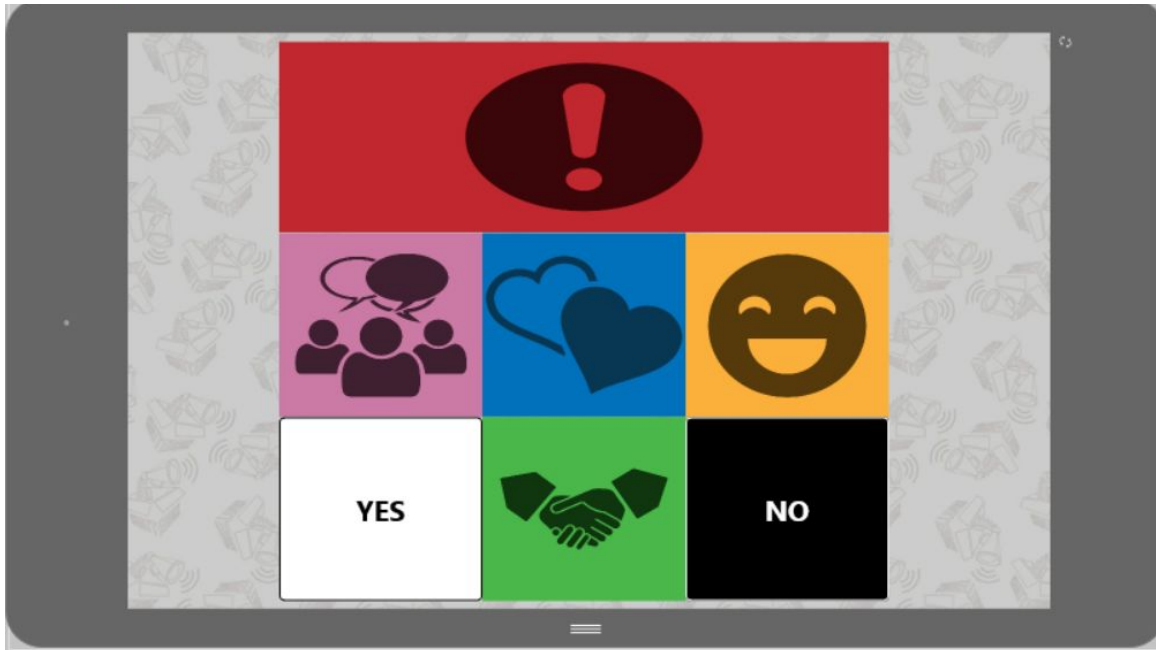
Figure 21: ChatterBox Main Menu

Figure 21 shows the first screen the user will see once the application is launched on an android mobile or tablet, the main menu. It will present to the user with five option of interfaces plus two extra buttons of yes and no, that when pressed will play each of those words.

On the top of the Main Menu interface, the bigger button with an exclamation mark is the emergency button, that when clicked will open the Emergency Interface.

In the middle row, the left button is the Daily Chat button that when pressed will lead user to the Daily Chat Interface.

The central button on the Main Menu is the Feelings button that will direct user to the respective interface.

In the middle row, the right button is regarding the Fun interface, that will redirected the user there when selected.

In the middle of the bottom row, between the yes or no button, is the button for the Greetings interface, that when pressed will open the last of the five interfaces.

3.4.2 - Daily Chat Interface
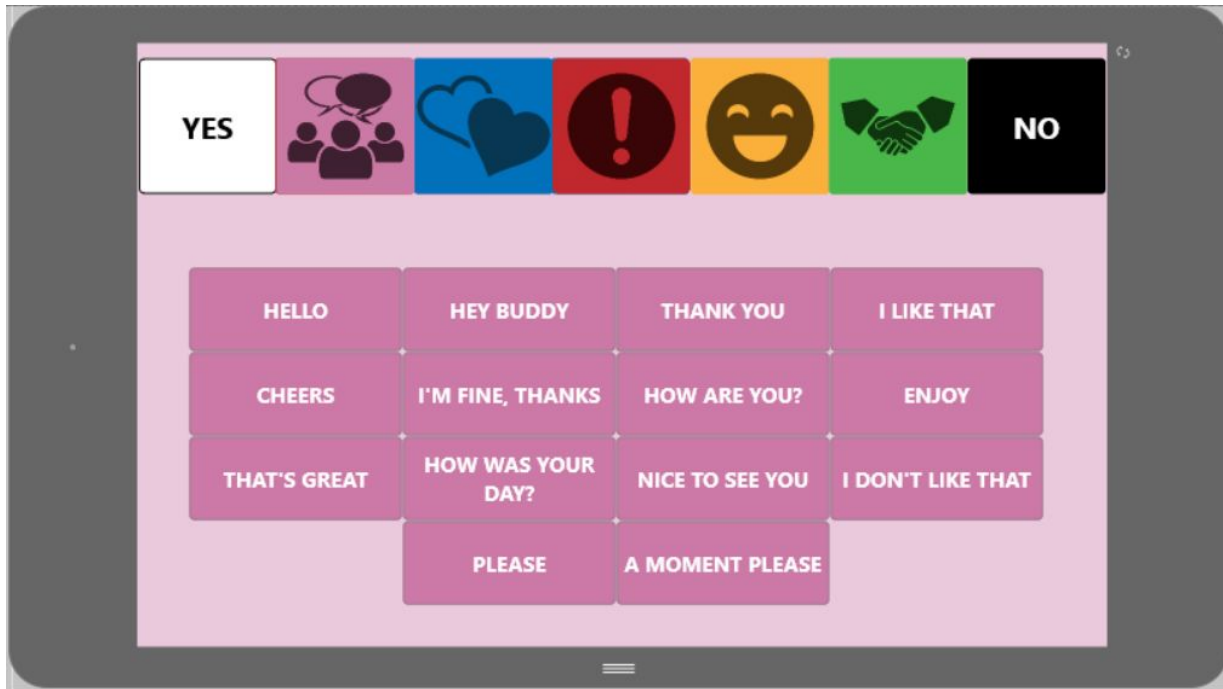
Figure 22: Daily Chat Interface

Daily Chat interface presents to the user a few buttons that contains common phrases uses in daily conversation and when pressed will display the respective audio for that sentence.

3.4.3 - Feelings Interface

Figure 23: Feelings Interface

The Feelings interface contains buttons that when pressed will enable the user to express certain feelings. The buttons contains basic key words but when pressed it will play a complete sentence, like for instance, the button Love, when selected it will play the sentence "I love you".

3.4.4 - Emergency Interface
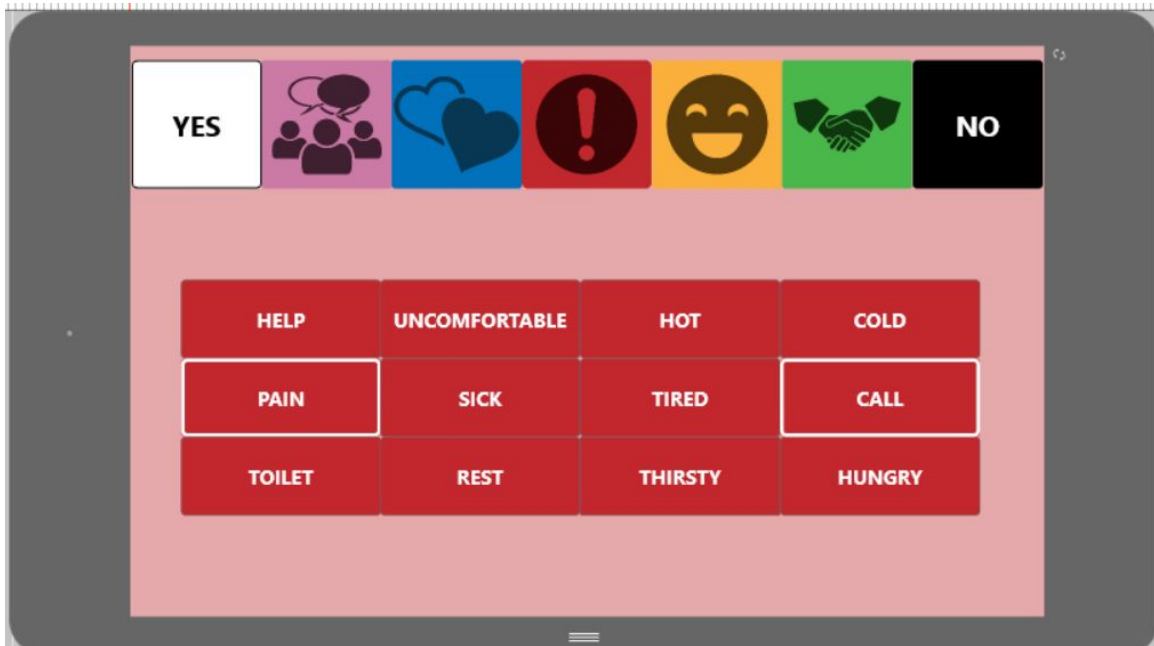
Figure 24: Emergency Interface
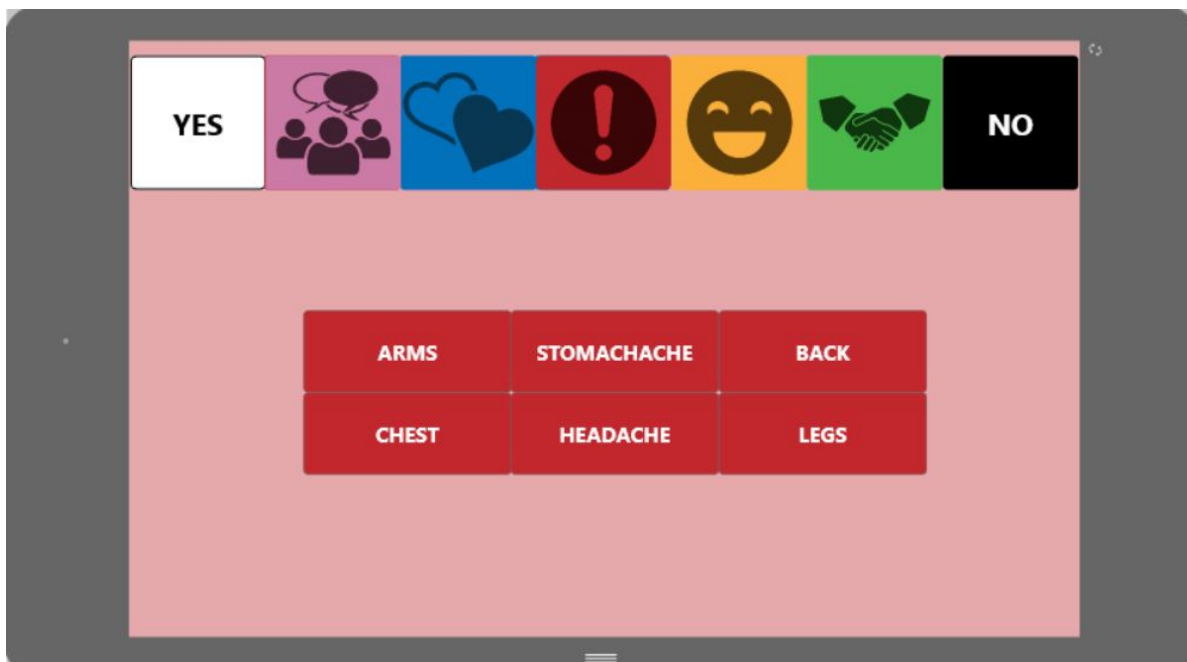
Figure 25: Emergency - Pain Interface

Figure 26: Emergency - Call Interface

The Emergency interface was created with the intention of letting the user express themselves in a case of certain urgent events such as feeling sick, in need of help or in pain. When pressed, the buttons Pain and Call (highlighted with a white border) will play the sentences, "I have pain" and "Call" respectively, and will open a sub-interface (Figures 25 and 26, respectively), where the user can better explain the situation.

3.4.5 - Fun Interface
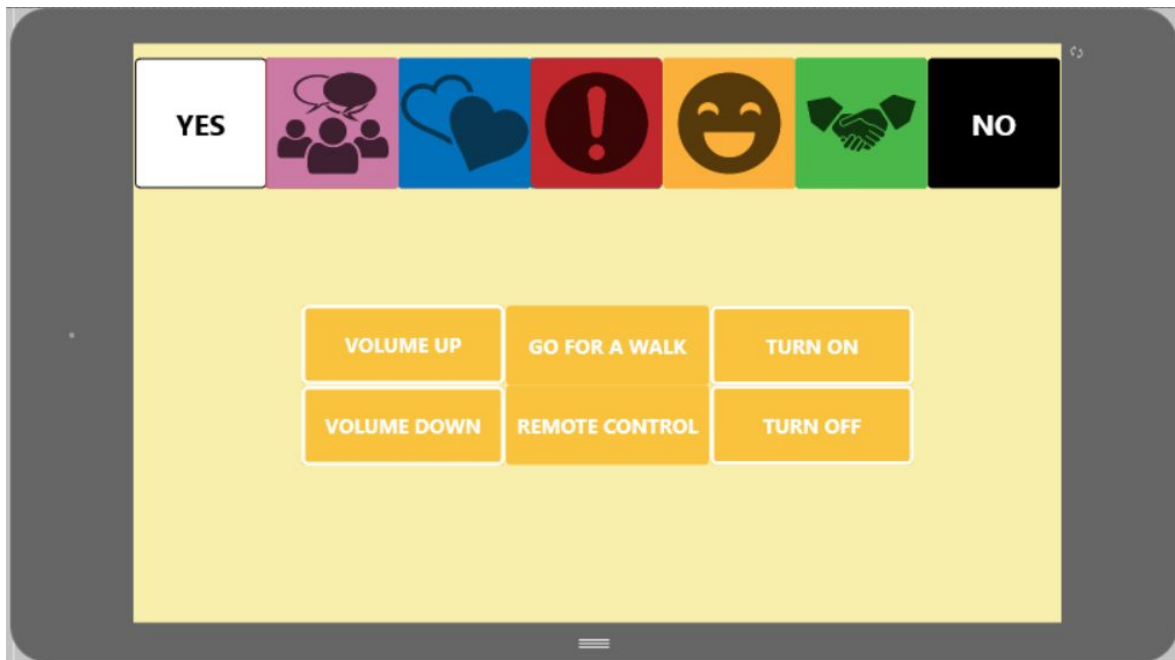
Figure 27: Fun Interface
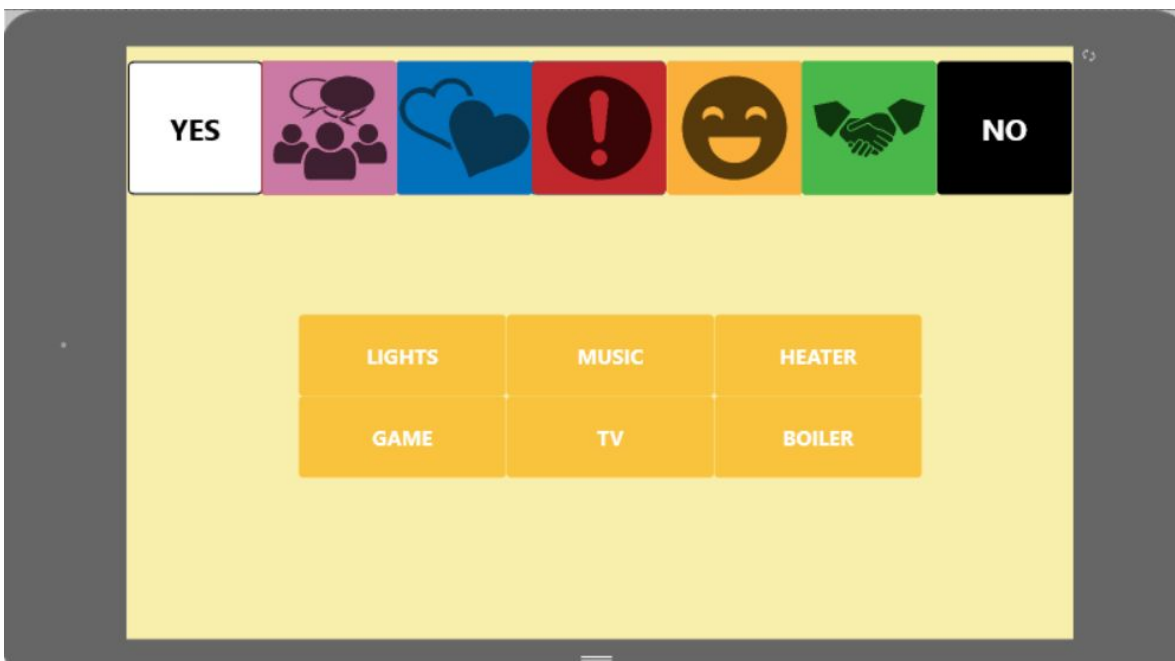
Figure 28: Fun - Volume Up, Volume Down, Turn On & Turn Off Interfaces

The fun interface allows the user to request some actions related to a leisure time, such as turn on the tv or music. The buttons Volume Up, Volume Down, Turn On and Turn Off will redirect the user to another interface (figure 28), where the user will be able to determine the device which those actions should be performed.

3.4.6 - Greetings Interface
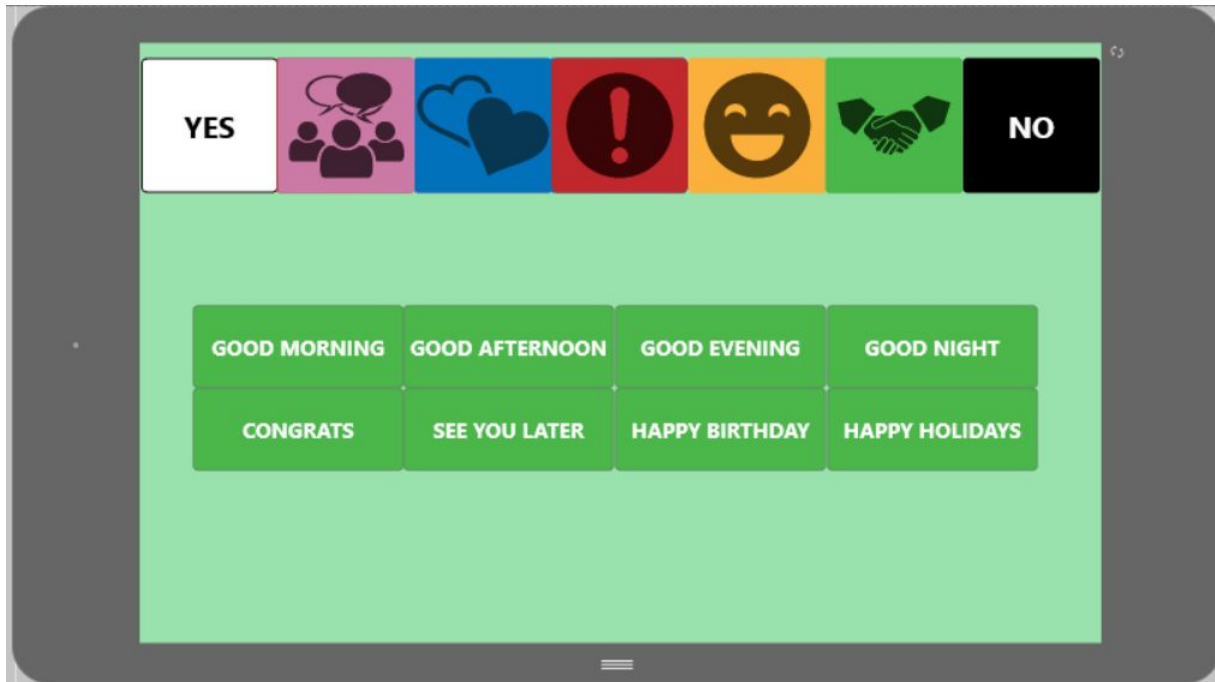
Figure 29: Greetings Interface

The Greetings interface contains buttons that when pressed will give the user the opportunity to greet someone else.

3.5 - Functional Design

The functional design refers to the design used to build software. The objective of the functional design is to make sure each component of the software has a single responsibility.

3.5.1 - Sequence Diagram

Britton and Doake also says, on page 156, "programmers, maintainers and developers need a route map to guide them; this is provided by the sequence diagram. The specification of the functionality in a sequence diagram is literally a sequence of messages, but the object-oriented code underlying the sequence of functionality in the diagram jumps about because the code is structured into classes not functions. Sequence diagrams show clearly and simply the flow of control between objects required to execute a scenario."
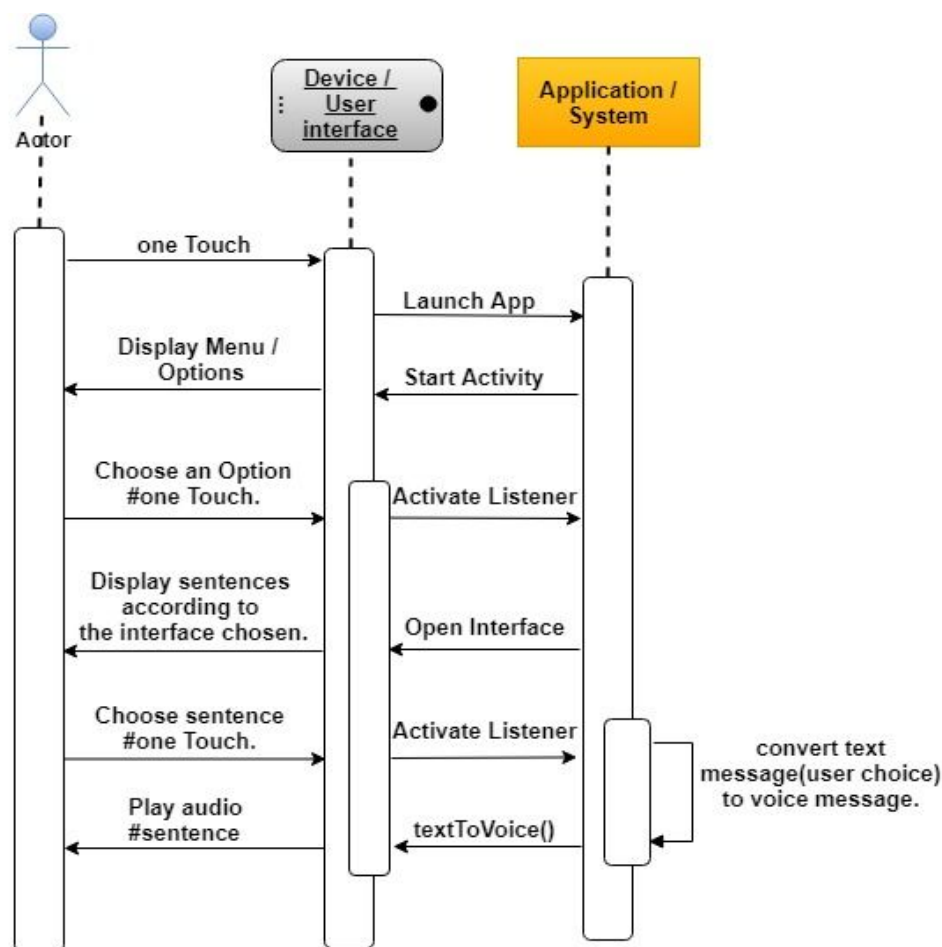
Figure 30: Sequence Diagram

3.5.2 - CRC Cards

Britton and Doake lets us know, on page 117, "the aim of the CRC card technique is to divide the overall functionality of the system into responsibilities which are then allocated to the most appropriate classes. Once we know the responsibilities of a class, we can see whether it can fulfil them on its own, or whether it will need to collaborate with other classes to do this."

Interface **MenuInterface**	
• RESPONSIBILITIES: • Allow navigation to Emergency • Allow navigation to Daily Chat • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to Main Menu	

AppCompatActivity	
• Create Instances • Listen/ respond to events (selected option)	

About	Superclass: AppCompatActivity
• RESPONSIBILITIES: • Create Instance of About • Display Information • Return to Main Menu	• COLLABORATORS: • AppCompatActivity

MainActivity	Superclass: AppCompatActivity
• RESPONSIBILITIES: • Create instance of Main Menu • Display options • Support user's action • Allow navigation to Emergency • Allow navigation to Daily Chat • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to About • Close Application	• COLLABORATOR: • AppCompatActivity

DailyChat	Superclass: AppCompatActivity
• RESPONSIBILITIES: • Create instance of Daily Chat • Display options • Support user's action • Allow navigation to Emergency • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity

Emergency	Superclasse: AppCompatActivity
• RESPONSIBILITIES: • Create instance of Emergency • Display options • Support user's action • Allow navigation to Emergency Call • Allow navigation to Emergency Pain • Allow navigation to Daily Chat • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity

EmergencyCall	Superclass: AppCompatActivity
• RESPONSIBILITIES: • Create instance of Emergency Call • Display options • Support user's action • Allow navigation to Emergency • Allow navigation to Daily Chat • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity • Emergency

EmergencyPain	Superclass: AppCompatActivity
• RESPONSIBILITIES: • Create instance of Emergency • Display options • Support user's action • Allow navigation to Emergency • Allow navigation to Daily Chat • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity • Emergency

Feelings	Superclasse: AppCompatActivity
• RESPONSIBILITIES: • Create instance of Feelings • Display options • Support user's action • Allow navigation to DailyChat • Allow navigation to Emergency • Allow navigation to Greetings • Allow navigation to Fun • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity

	Superclass: AppCompatActivity
Fun	
• RESPONSIBILITIES: • Create instance of Fun • Display options • Support user's action • Allow navigation to DailyChat • Allow navigation to Emergency • Allow navigation to Feelings • Allow navigation to Greetings • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity

	Superclass: AppCompatActivity
FunDevices	
• RESPONSIBILITIES: • Create instance of Fun • Display options • Support user's action • Allow navigation to DailyChat • Allow navigation to Emergency • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Greetings • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity • Fun

	Superclass: AppCompatActivity
Greetings	
• RESPONSIBILITIES: • Create instance of Greetings • Display options • Support user's action • Allow navigation to DailyChat • Allow navigation to Emergency • Allow navigation to Feelings • Allow navigation to Fun • Allow navigation to Main Menu	• COLLABORATORS: • AppCompatActivity

Figure 31: CRC Cards For ChatterBox Application

3.5.3 - Class Diagram

Figure 30 represents the interface and classes used to build ChatterBox application.
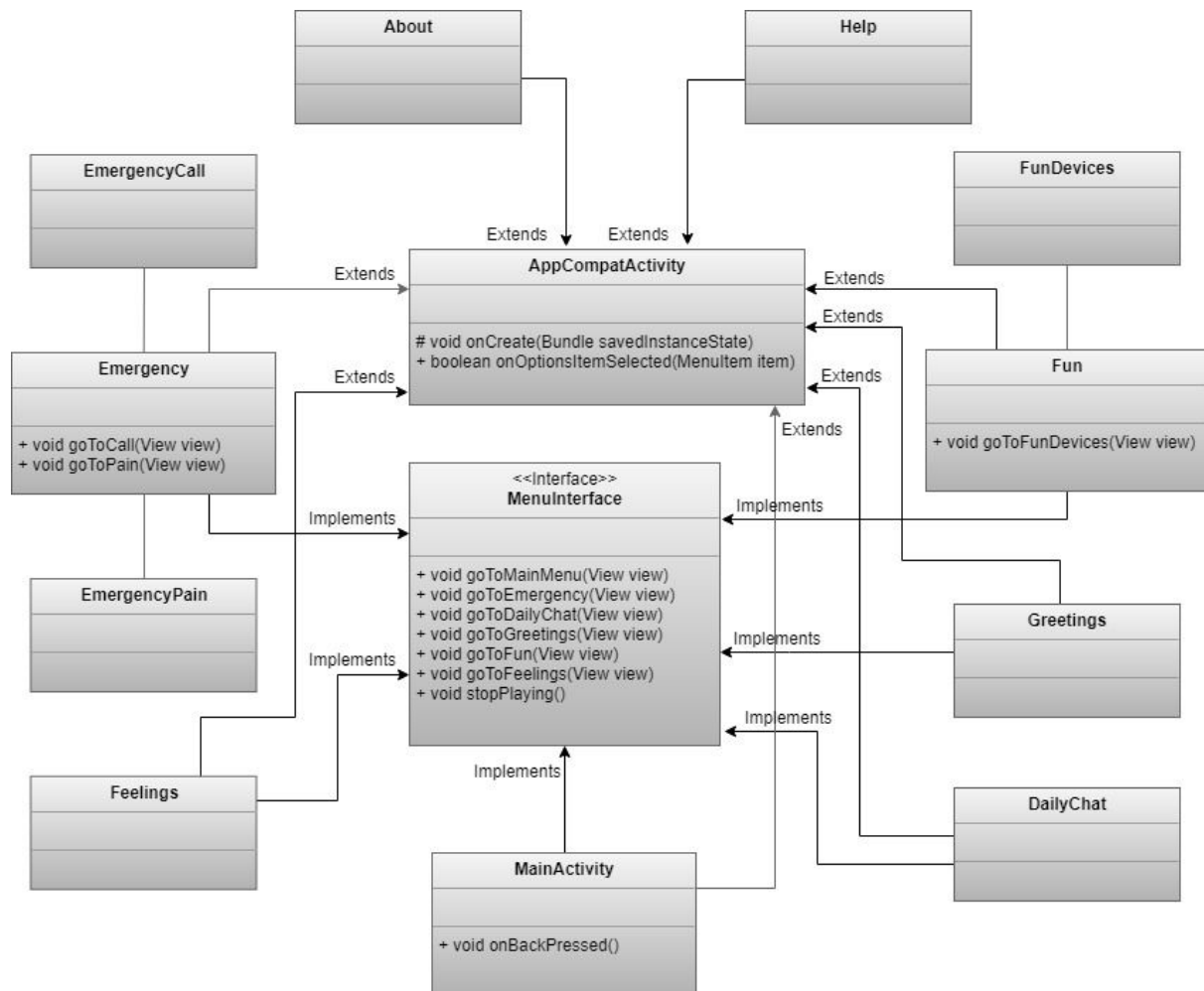
Figure 32: Detailed Class Diagram

Chapter 4

4.1 - Implementation Of The System

In this chapter, we will explain the tools that we used to develop our software such as technologies, languages, framework, architecture as well as new ideas that arose when we encountered problems during the prototype development.

The implementation part was very special for us because it is the section that brings all our ideas and planning into the real world, it uses the structure created during architectural design added to the results of system analysis to construct system elements that meet the user's needs and system requirements built in the previous life cycle phases.

One important aspect that should be highlighted during the whole project development is that we always tried to maintain our focus on the user experience.

We believe that communication is very important to any human being in every way so we built the software as simple as we could promoting friendly user interface and aiming to reach a large amount of speech impaired people to help them enhance their lives.

4.2 - Architecture & Implementation Considerations

Our application was basically built under the folder structure of Android Studio which stores the projects by default in the home folder of the user within the AndroidStudioProjects as well as the architecture of MVC (model, view and controller), which is already implemented in Android Studio. The "app" folder is responsible for holding the most relevant files related to the application and the most interesting files live in the "src" folder.
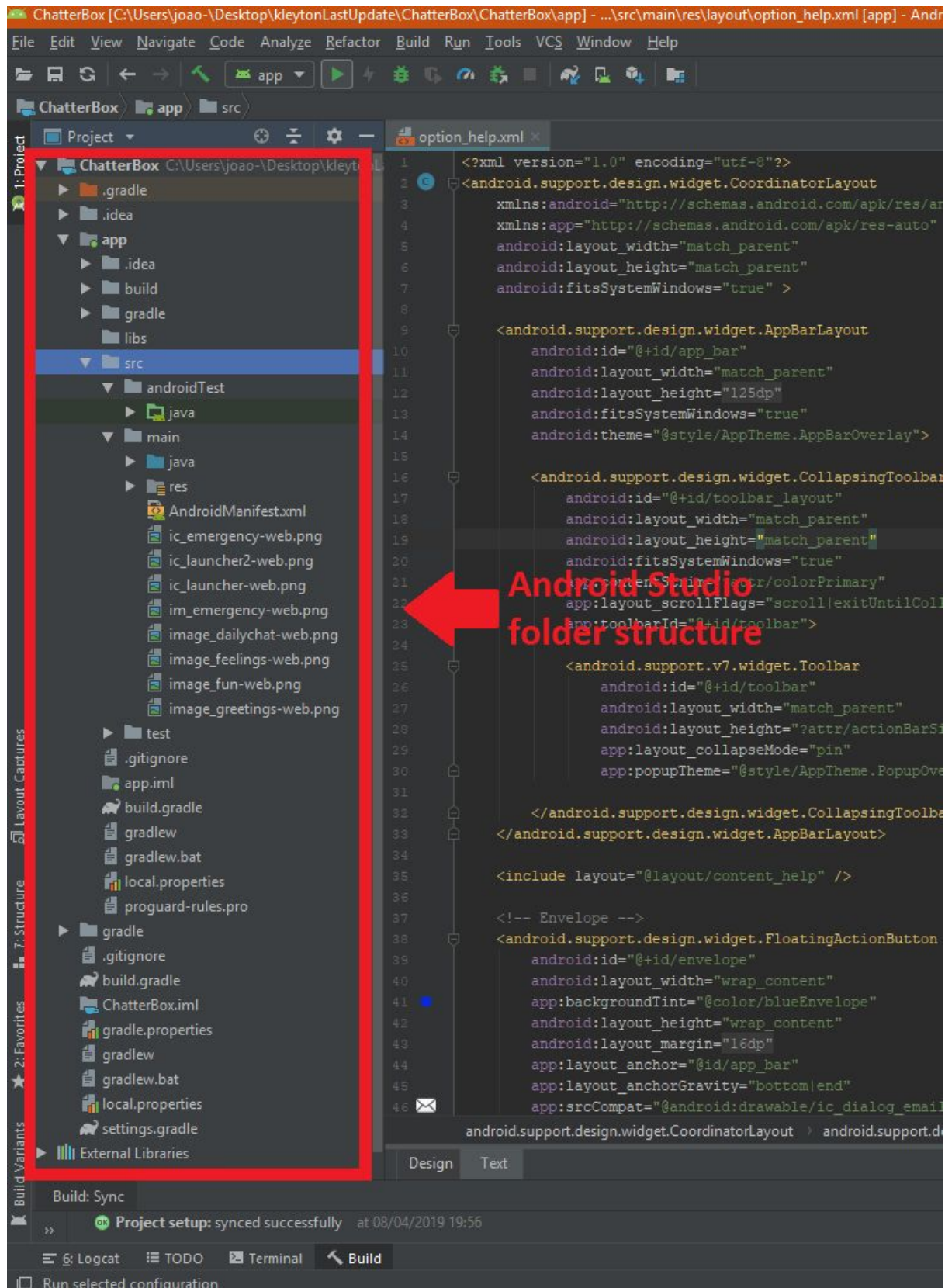
Figure 33: Android Studio folder structure (Android Studio Environment)

We implemented our code following the DRY (Don't Repeat Yourself) and the SOLID (Single Responsibility, Open/Closed, Liskov Substitution, Interface Aggregation, Dependency Inversion) principles. Our application only needs internet connection in case the user wishes to send feedback to developers, otherwise, once downloaded, the app works fully built on top of Android Operating System.

The front-end of our app and the resources are defined by various XML files in Android Studio and, in relation to data management, we decided not to use database on the first version of our software.

Another important point is the fact that we built the entire app with a special attention on the memory side objectifying the application as a whole to be light and to not compromise the device's memory space.

Throughout the development process, we had to use different android versions to check the code behaviour on different devices as well as multiple screen size emulators to make sure it would meet the necessary responsiveness.

New ideas were emerging along the way so we implemented breadcrumbs and borders on the top menu to guide the user through a number of interfaces.
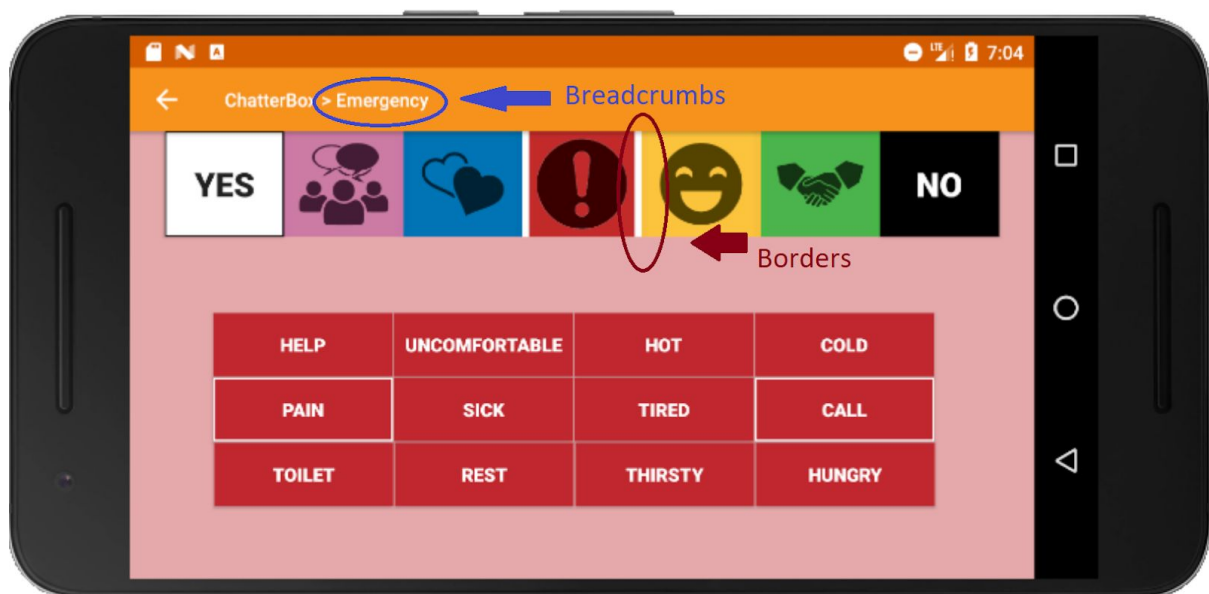
Figure 34: App Interface With Breadcrumbs & Borders

We also added a help section with full app usage description and an email link that bridges users to developers in case they wish to make any contact.
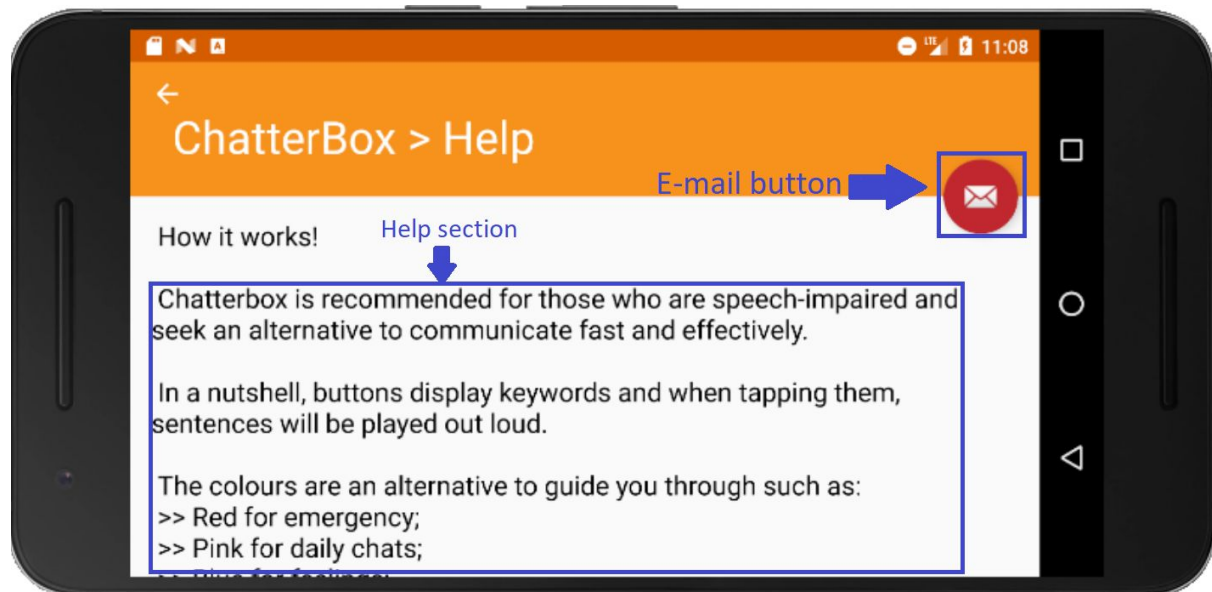
Figure 35: App Interface Showing Help Section & Email Button

4.3 - Technologies Used

After we decided what the subject of our project would be, we looked for software solutions available in the market but we found only few options and, among them, some were paid so we decided to build our idea for android users for free.

Android is a software stack for a wide range of devices that includes an operating system based on Linux. The diagram on the following page shows the android platform stack.

Android is the world's most popular mobile operating system and unlike IOS, windows or blackberry, Android is not linked to any hardware manufacturer making it easier for its development to grow.
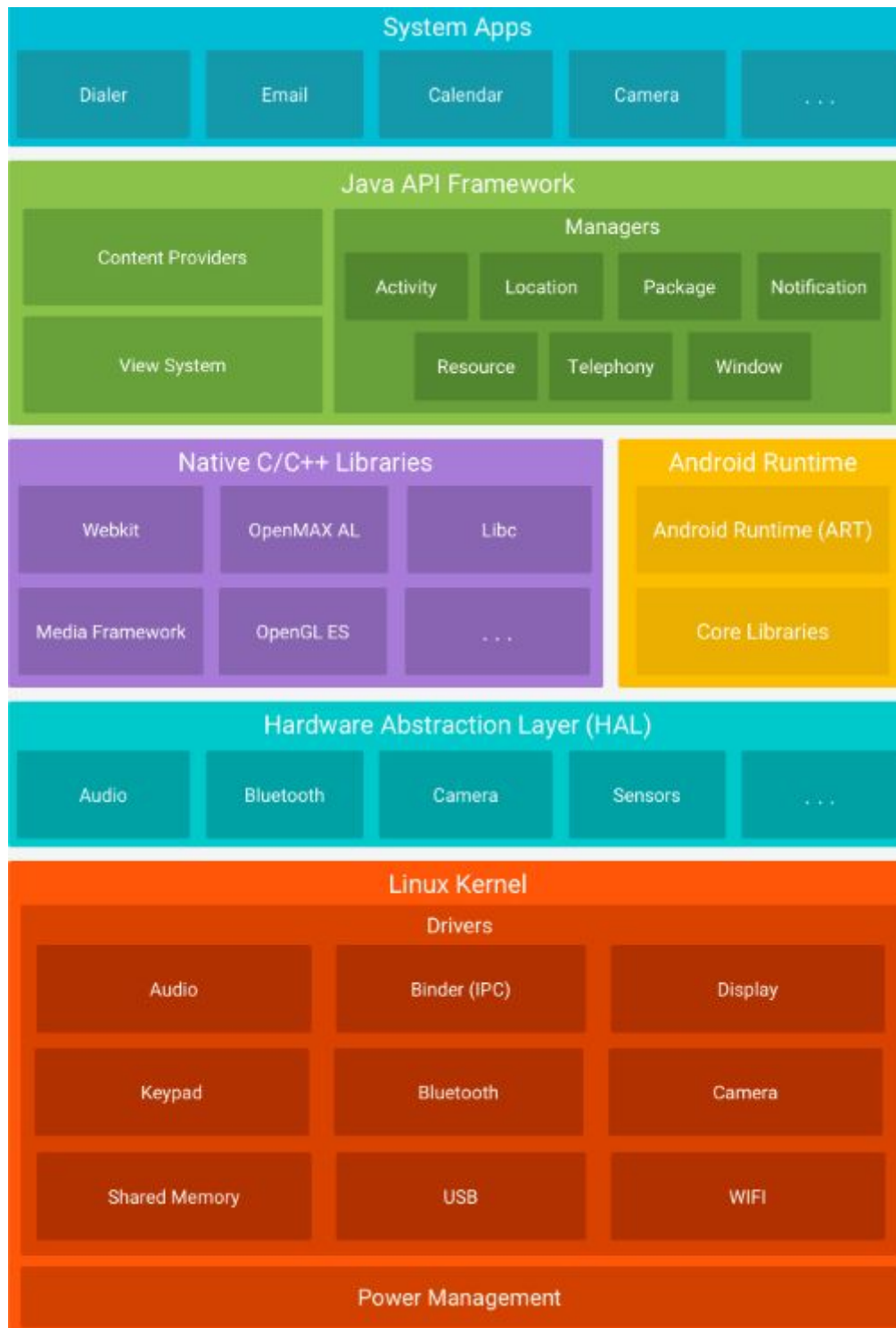
Figure 36: Android Software Stack by developer.android.com

It is known that there are about 2 billion of Android users and the Android's share of the global mobile operating system market is 85% according to Craig Smith of the expandedramblings.com.

Our project's code was developed using Java programming language, JDK (Java Development Kit) and API level 18 (android version device must be at least 4.3 (Jelly Bean)) in Android Studio powered by the latest Android SDK (Software Development Kit) version which is a set of essential tools used to develop applications for Android platform and includes a debugger, an emulator, required libraries, documentation for the Android application program interfaces (APIs), sample source code and tutorials for the Android operating system as per Techopedia website.

Android Studio is the official IDE (Integrated Development Environment) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development and counting on Gradle system an advanced built toolkit, used to automate and manage the build process, while allowing the developer to define flexible custom build configurations according to Android Studio, Wikipedia.

All the UI (User Interface) and the layout of our app was designed using XML (Extensible Markup Language) which is scalable and made to describe data. XML as itself is well readable both by human and machine and is used to design layouts in Android due to its lightweight language so it did not make our layout heavy abhiandroid.com.

In Android, there are several XML files used for several different purposes such as:

- Layout XML files: Used to define the actual UI (Buttons, Text Views, etc).

- Manifest XML file: Used to define all the components of our application.

- Strings XML file: This xml file is used to replace the Hard-coded strings with a single string. This file enhances the reusability of the code.

- Styles XML files: We define our custom themes and styles in this file.

- Drawable XML file: These are xml files which are used to provide various graphics to the elements or views of application.

- Colour XML file: We simply define the colours in this file and used them in our app from this file.

- Dimension XML file: This xml file is used to define the dimensions of the View's.

In relation to the audios, we used our personal phones to record the sentences. However, the recording was only possible in format m4a so we decided to convert them to mp3 for two reasons: m4a was developed by Apple Inc. so compatibility might be an issue for a lot of Android devices and when we converted mp3 files to m4a, we noticed they became smaller.

Finally, as mentioned before, we did not use database for the first version of our prototype because we did not want our users to be dependent on internet connections.

4.4 - Problems Encountered

When we decided to build the project in Android Studio, we found challenges as we had never used the IDE before so we had to learn how the actual platform works so it took us some time and lots of research to handle the system at its best. In specific, we spent a good number of hours to find out how to make our application responsive for various screen sizes and that how to implement audios to the buttons.

After successful endeavours, we had a tremendous bug - the audios would stop playing for a number of times because of its cache been overloaded, as a result, we had to do more search to overcome it.

Unfortunately, the app will not be available for different operating systems such as Apple iOS, BlackBerry OS and Windows OS for the moment but who knows what tomorrow brings.

Chapter 5

5.1 - Testing & Evaluation

"Testing shows the presence, not the absence of bugs" (Dijkstra, E., 1969).

5.2 - Functional Correctness

Functional correctness aims to verify if the input/output of the system works as specified in the requirements.

5.2.1 - System Tasks Should Be Able To Perform (Part Of Requirements)

Open application when clicked on ChatterBox icon.

Display main menu.

Display desired interface when selected.

Play audio from requested sentences/buttons.

Return to a previous interface.

5.2.2 - Set Of Inputs And Correct Outputs

- **Buttons commons to all interfaces**

Input: Tap Button	Emergency	Daily Chat	Feelings
Output: Display interface	Emergency	Daily Chat	Feelings

Input: Tap Button	Fun	Greetings
Output: Display interface	Fun	Greetings

Input: Tap Button	Yes	No
Output: Play audio	"Yes"	"No"

- **Daily Chat Interface**

Input: Tap Button	Hello	Hey buddy	Thank you	I like that
Output: Play audio	"Hello"	"Hey Buddy"	"Thank You"	"I Like That"

Input: Tap Button	Enjoy	Cheers	I'm fine, thanks	That's great
Output: Play audio	"Enjoy"	"Cheers"	"I'm fine, thanks"	"That's great"

Input: Tap Button	Please	How was your day?	I don't like that
Output: Play audio	"Please"	"How was your day?"	"I don't like that"

Input: Tap Button	How are you?	A moment, please	Nice to see you
Output: Play audio	"How are you?"	"A moment, please"	"Nice to see you"

- **Feelings Interface**

Input: Tap Button	Love	Better	Happy
Output: Play audio	"I love you"	"I'm feeling better"	"I'm happy"

Input: Tap Button	Sad	Bored	Sorry	Frustrated
Output: Play audio	"I'm sad"	"I'm bored"	"I'm sorry"	"I'm frustrated"

Input: Tap Button	Nervous	Miss	Angry	Worried
Output: Play audio	"I'm nervous"	"I miss you"	"I'm angry"	"I'm worried"

Input: Tap Button	Depressed	Annoyed	Afraid
Output: Play audio	"I'm depressed"	"I'm annoyed"	"I'm afraid"

- **Emergency Interface**

Input: Tap Button	Help	Uncomfortable	Hot
Output: Play audio	"Help"	"I'm feeling uncomfortable"	"I'm hot"

Input: Tap Button	Cold	Sick	Toilet
Output: Play audio	"I'm cold"	"I'm feeling sick"	"I need the toilet"

Input: Tap Button	Rest	Thirsty	Hungry
Output: Play audio	"I need to rest"	"I'm thirsty"	"I'm hungry"

Input: Tap Button	Pain	Call
Output 1: Play audio	"I have pain..."	"Call..."
Output 2: Display Sub- Interface	Emergency-Pain	Emergency-Call

- **Emergency Pain Sub-Interface**

Input: Tap Button	Arms	Stomach	Back
Output: Play audio	"...in my arms"	"...in my stomach"	"...in my back"

Input: Tap Button	Chest	Head	Legs
Output: Play audio	"...in my chest"	"...in my head"	"...in my legs"

- **Emergency Call Sub-Interface**

Input: Tap Button	Ambulance	Carer
Output: Play audio	"...an ambulance"	"...the carer"

- **Fun Interface**

Input: Tap Button	Go for a walk	Remote control
Output: Play audio	"Let's go for a walk"	"Pass me the remote control, please"

Input: Tap Button	Volume up	Volume down
Output 1: Play audio	"Volume up..."	"Volume down..."
Output 2: Display Sub- Interface	Fun-Devices	Fun-Devices

Input: Tap Button	Turn on	Turn off
Output 1: Play audio	"Turn on..."	"Turn off..."
Output 2: Display Sub- Interface	Fun-Devices	Fun-Devices

- **Fun Devices Sub-Interface**

Input: Tap Button	Lights	Music	Heater
Output: Play audio	"...the lights"	"...the music"	"...the heater"

Input: Tap Button	Game	Tv	Boiler
Output: Play audio	"...the game"	"...the tv"	"...the boiler"

- **Greetings Interface**

Input: Tap Button	Good Night	Good Evening	Good afternoon
Output: Play audio	"Good night"	"Good evening"	"Good afternoon"

Input: Tap Button	Good morning	Congrats	See you later
Output: Play audio	"Good morning"	"Congratulations"	"See you later"

Input: Tap Button	Happy birthday	Happy holidays
Output: Play audio	"Happy birthday"	"Happy holidays"

5.2.3 - Test Cases For Functional Testing

Three different test cases were applied during the functional testing of the application, and test case with id TC02 and TC03 had to be repeated (TC04) after some changes were made in the system as it failed to meet the requirement in the first attempt. The results are displayed below:

Test Case ID	TC01
Test Case Summary	To verify if the output provides the expected output
Related Requirement	R4, R5
Prerequisites	Application installed on an Android System
Test Procedure	1. Tap ChatterBox icon on Android system to open the application 2. Tap every button in the application to check outputs.
Expected Result	1. Application should open when tapped 2. Buttons should either, open required interface or play respective sentence
Actual Result	1. Application opens as expected 2. Buttons open required interface or play respective sentence
Status	Successful
Created by	Jacqueline Medeiros
Date of Creation	20/03/2019
Date of Execution	23/03/2019
Test Environment	Android OS - version 7.1.1

Test Case ID	TC02
Test Case Summary	To verify if the application handles buttons being pressed multiple times
Related Requirement	R6
Prerequisites	Application installed on an Android System
Test Procedure	1. Tap ChatterBox icon on Android system to open the application 2. Tap buttons several times (up to 100)
Expected Result	1. Application should open when tapped 2. Buttons should either, open required interface or play respective sentence
Actual Result	1. Application opens as expected 2. Interfaces opens as expected, sentences stopped being played after 15 taps
Status	Failed
Further Action	Report bug to developers so it can be fixed
Created/ Executed by	Jacqueline Medeiros
Date of Creation	20/03/2019
Date of Execution	23/03/2019
Test Environment	Android OS - version 7.1.1

Test Case ID	TC03
Test Case Summary	To verify if the application will not break in case multiple buttons are pressed at the same time
Prerequisites	Application installed on an Android System
Test Procedure	1. Tap ChatterBox icon on Android system to open the application 2. Tap several buttons at the same time
Expected Result	1. Application should open when tapped 2. Application should not play the sentence if more than one button is pressed at the same time
Actual Result	1. Application opens as expected 2. Application plays the sentences simultaneously
Status	Failed
Created/ Executed by	Jacqueline Medeiros
Date of Creation	20/03/2019
Date of Execution	23/03/2019
Test Environment	Android OS - version 7.1.1

Test Case ID	TC04 (Repeating testing TC02 and TC03 after changes were made in the program)
Test Case Summary	To verify if the application handles buttons being pressed multiple times
Related Requirement	R6
Prerequisites	Application installed on an Android System
Test Procedure	1. Tap buttons several times (up to 100) 2. Tap more than one button simultaneously
Expected Result	1. Buttons should either, open required interface or play respective sentence 2. Application should not play the sentences simultaneously and not break
Actual Result	1. Interfaces open and sentences are played as expected 2. Application does not play sentences if more than one button is being pressed
Status	Successful (bug Test Case TC02 and TC03 fixed)
Created/ Executed by	Jacqueline Medeiros
Date of Creation	20/03/2019
Date of Execution	08/04/2019
Test Environment	Android OS - version 7.1.1

5.3 - Usability Testing

The usability testing is a method used to evaluate the ease of use of an application by having it tested by real users.

5.3.1 - Objectives

The objectives of the usability test on ChatterBox application are:

1. Verify if the user interface of the application is effective;

2. Determine usability issues (navigation errors, difficulty to locate and perform requested actions);

3. Establish level of user-satisfaction.

5.3.2 - Methodology

Test will be conducted by Orange Inc. team - Clayton, Jacqueline, João Pedro, Kleyton and Maria Fabiana along with a CCT College faculty member. Five random students from Business Faculty will be selected and presented with basic information about ChatterBox then, mobile devices containing ChatterBox application will be handed over to them and so they will be asked to perform five tasks (see item 5.3.3 Usability Scenarios below). Each member from Orange Inc. team will be responsible for watching an individual performance from a test participant and take notes regarding the time to complete the test, the number of errors and whether each task was successfully completed. Participants will be asked to answer a questionnaire containing six rating scale questions about their impressions of application.

5.3.3 - Usability Scenarios:

Participants will be presented with five scenarios and asked to completed the following tasks:

1. Scenario one: you wish to express someone that you love them;

2. Scenario two: you would like to ask someone "How are you?";

3. Scenario three: you need someone to call an ambulance for you;

4. Scenario four: you want someone to turn on the music for you;

5. Scenario five: you would like to wish someone a happy birthday.

5.3.4 - Usability Metrics

The ISO 9241-11 describe usability as being the "extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

As stated by ISO 9241-11, it is recommended that usability metrics include measurement of:

- **Effectiveness:** related to the precision and thoroughness with which users achieve predetermined goals.

- **Efficiency:** The assets spent in relation to the precision and thoroughness with which users achieved those goals.

- **Satisfaction:** The comfort and acceptability of use.

We have covered all those three metrics in our testing and the results can be checked on the following topics.

5.3.4.1 - Usability Metrics and Results For Effectiveness

Effectiveness is considered a fundamental usability metric, even though it does not provide understanding on how the tasks were conducted or why users failed to complete them, if that is the case. It can be measured by analysing the completion rate and number of errors.

1. Completion Rate

Completion rate, also called success rate, is one way to measure effectiveness by getting the percentage of users who were able to complete the tasks successfully. To find this percentage, we have to divide the number of users who correctly achieved the goal in the scenario by the amount of total users.

Following, we display the equation applied and the results obtained from the test:

$$Effectiveness = \frac{Number\ of\ Users\ Who\ Completed\ the\ Task}{Total\ Number\ of\ Users} \times 100\%$$

$$Effectiveness\ Task\ 1 = \frac{5}{5} \times 100\% = 100\%$$

$$Effectiveness\ Task\ 2 = \frac{5}{5} \times 100\% = 100\%$$

$$Effectiveness\ Task\ 3 = \frac{3}{5} \times 100\% = 60\%$$

$$Effectiveness\ Task\ 4 = \frac{4}{5} \times 100\% = 80\%$$

$$Effectiveness\ Task\ 5 = \frac{4}{5} \times 100\% = 80\%$$
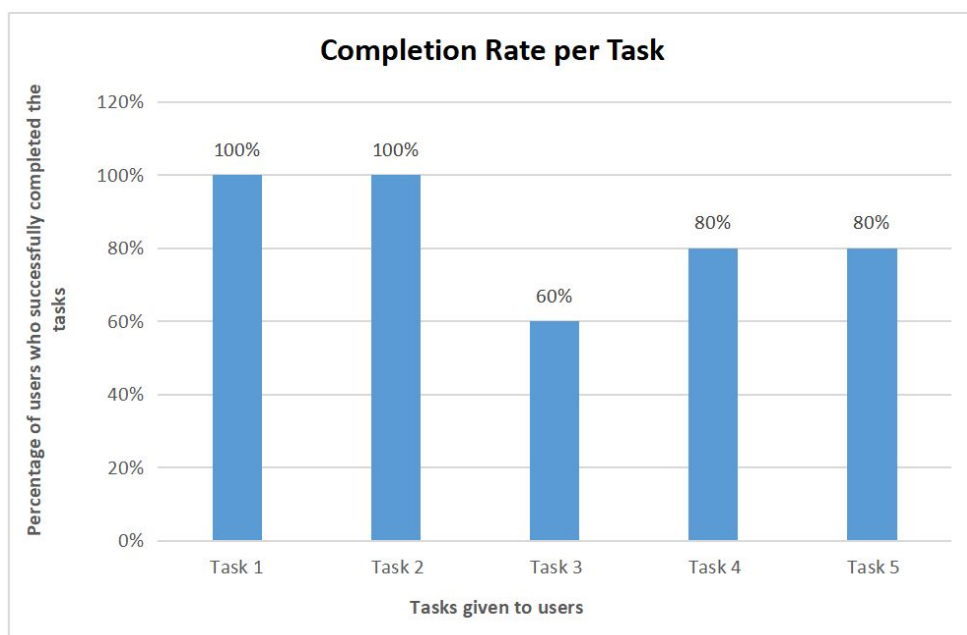
Figure 37: Effectiveness Results Displayed In A Bar Chart

According to Jeff Sauro (Sauro, J. 2011), founding principal of MeasuringU, a company that provides statistics and usability consultancy, "a task is considered good enough for now if there is evidence from testing that at least 70% completed the task on their first attempt", and as result of a research he performed, the average of completion rate is 78%.

As can be seen in the results of the test performed with ChatterBox, apart from task 3, all tasks had an above average completion rate.

2. Number Of Errors

Another way of measuring efficiency is by counting the number of errors users made while performing the tasks. For this test performed by Orange Inc. team, we considered to be an error mistake users made regarding the button they had to press (if they did not press the correct button for the specific sentence they were looking for, we counted that as an error). The results were as following:

- Number of errors task 1 = 0 (none of the five users made an error in this task).
- Number of errors task 2 = 1 (one of the five users made one error in this task).
- Number of errors task 3 = 4 (three users made errors in this task - one user made two mistakes while the others made one each).
- Number of errors task 4 = 6 (only one of the users did not made any error in this task - two users made one and two users made two mistakes).
- Number of errors task 5 = 6 (two users made errors in this task - one user made two and the other made four mistakes).

In his research, where he analysed results from 719 tasks performed by users utilizing software, Jeff Sauro (Sauro, J. 2012) observed that 2 out of 3 users made errors and only 10% were able to perform the tasks without committing any errors.

5.3.4.2 - Usability Metrics and Results For Efficiency

Efficiency relates to the measure of speed, on how fast a user takes to accomplish a goal. It can be calculated by using a time based efficiency and an overall relative efficiency equation.

1. Time Based Efficiency

Time based efficiency is directly related to the effectiveness as to find the efficiency, we divide the effectiveness by the time user spent on each task in relation to the total number of tasks and total number of users.

Following is the equation applied and the results obtained in this metric:

$$Time\ based\ efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}}{NR}$$

Where:

N = Total number of tasks (5)

R = Total number of users (5)

n_{ij} = The result of task "i" by user "j"; if user completed the task successfully n_{ij} = 1, otherwise n_{ij} = 0.

t_{ij} = The time user "j" spent to complete task "i" in seconds.

$$ChatterBox\ time\ based\ efficiency =$$

$$\frac{\frac{1}{35}+\frac{1}{26}+\frac{0}{47}+\frac{1}{40}+\frac{0}{50}+\frac{1}{9}+\frac{1}{12}+\frac{0}{16}+\frac{0}{15}+\frac{1}{10}+\frac{1}{25}+\frac{1}{15}+\frac{1}{39}+\frac{1}{33}+\frac{1}{19}+\frac{1}{22}+\frac{1}{19}+\frac{1}{41}+\frac{1}{40}+\frac{1}{30}+\frac{1}{11}+\frac{1}{24}+\frac{1}{34}+\frac{1}{23}+\frac{1}{22}}{5x5}$$

$$ChatterBox\ time\ based\ efficiency = \frac{1.031}{25} = 0.041\ goals/second$$

2. Overall Relative Efficiency

Overall relative efficiency is calculated through users who successfully completed a task in relation to total time taken by all users.

For this calculation we used the equation and obtained the following results:

$$Overall\ Relative\ Efficiency = \frac{\sum\limits_{j=1}\sum\limits_{i=1} n_{ij}t_{ij}}{\sum\limits_{j=1}^{R}\sum\limits_{i=1}^{N} t_{ij}} x100\%$$

Where:

N = Total number of tasks (1)

R = Total number of users (5)

n_{ij} = The result of task "i" by user "j"; if user completed the task successfully $n_{ij} = 1$, otherwise $n_{ij} = 0$.

t_{ij} = The time user "j" spent to complete task "i" in seconds.

For this metric, we will first calculate the efficiency for each task separately, and then get .

$$Overall\ Relative\ Efficiency\ Task\ 1 = \frac{\big((1x35)+(1x9)+(1x25)+(1x22)+(1x11)\big)}{(35+9+15+22+11)} x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 1 = \frac{(102)}{(102)} x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 1 = 100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 2 = \frac{\big((1x26)+(1x12)+(1x15)+(1x19)+(1x24)\big)}{(26+12+15+19+24)} x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 2 = \frac{96}{96} x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 2 = 100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 3 = \frac{\big((0x47)+(0x16)+(1x39)+(1x41)+(1x34)\big)}{(47+16+39+41+34)} x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 3 = \frac{114}{177} x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 3 = 64.41\%$$

$$Overall\ Relative\ Efficiency\ Task\ 4 = \frac{\left((1x40)+(0x15)+(1x33)+(1x40)+(1x23)\right)}{(40+15+33+40+23)}x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 4 = \frac{136}{151}x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 4 = 90.07\%$$

$$Overall\ Relative\ Efficiency\ Task\ 5 = \frac{\left((0x50)+(1x10)+(1x19)+(1x30)+(1x22)\right)}{(50+10+19+30+22)}x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 5 = \frac{81}{131}x100\%$$

$$Overall\ Relative\ Efficiency\ Task\ 5 = 61.83\%$$

$$ChatterBox\ Overall\ Relative\ Efficiency=$$
$$\frac{\left((35)+(9)+(25)+(22)+(11)+(26)+(12)+(15)+(19)+(24)+(0)+(0)+(39)+(41)+(34)+(40)+(0)+(33)+(40)+(23)+(0)+(10)+(19)+(30)+(22)\right)}{(35+9+25+22+11+26+12+15+19+24+47+16+39+41+34+40+15+33+40+23+50+10+19+30+22)}x100\%$$

$$ChatterBox\ Overall\ Relative\ Efficiency = \frac{529}{657}x100\%$$

$$ChatterBox\ Overall\ Relative\ Efficiency = 80.52\%$$

5.3.4.3 - Usability Metrics and Results For Satisfaction

The level of satisfaction can be analyzed through questionnaire given to users to answer, after the test session is completed. The questionnaire helps to capture the user's opinion about the application.

Orange Inc. has chosen to use four questions from SUS (System Usability Scale) and two questions from ASQ (After Scenario Questionnaire), that will help us to measure the level of satisfaction in test and task level, respectively.

The questionnaire given to the users was as follows:

Please, rank each question from 1 to 5 based on how much you agree with the statements bellow. 5 means you agree completely, 1 means you disagree vehemently.

1. I thought the application was easy to use.

Strongly Disagree				Strongly Agree
1	2	3	4	5

2. I found the application unnecessarily complex.

Strongly Disagree				Strongly Agree
1	2	3	4	5

3. I felt very confident using the application.

Strongly Disagree				Strongly Agree
1	2	3	4	5

4. I thought there was too much inconsistency in the application.

Strongly Disagree				Strongly Agree
1	2	3	4	5

5. Overall, I am satisfied with the ease of completing the tasks given in the scenarios.

Strongly Disagree				Strongly Agree
1	2	3	4	5

6. Overall, I am satisfied with the amount of time it took to complete the tasks requested in the scenarios.

Strongly Disagree				Strongly Agree
1	2	3	4	5

The first four questions were taken from the previously mentioned SUS, that is widely used to measure test satisfaction and it is composed of a total of ten questions. For our testing purposes though, we have opted to only use four of those questions and therefore decided to analyze and place the percentage of the user's answers instead of the SUS calculation method. The final two questions are related to the overall satisfaction of the user in completing the scenarios. To better analyse the results, we placed the percentage of the answers into a table, that can be seen below.

QUESTIONS	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I thought the application was easy to use.	0%	0%	40%	20%	40%
2. I found the application unnecessarily complex.	40%	40%	0%	20%	0%
3. I felt very confident using the application	0%	0%	60%	20%	20%
4. I thought there was too much inconsistency in the application.	60%	20%	0%	20%	0%
5. Overall, I am satisfied with the ease of completing the tasks.	0%	40%	0%	20%	40%
6. Overall, I am satisfied with the amount of time it took to complete the tasks.	0%	0%	0%	60%	40%

Figure 38: Test Results In Percentages

We were very pleased with the result received from the qualitative test performed with the students from the Business Faculty. The results were positive amongst the bigger majority of the participants. 60% of them thought the application was easy to use and 40% had a neutral opinion. When it comes to complexity of the application, 80% of the participants did not find that ChatterBox was a complex system to use. None of the testers felt hesitant about using the application, although 60% were in between (had neutral opinion), 20% felt confident and 20% felt very confident about using ChatterBox. 80% of the people tested did not agree that the system was inconsistent. The overall satisfaction with the ease in completing the tasks were 60% and 100% of the participants were satisfied with the amount of time it took to accomplish the tasks given to them.

5.4 - Commercialization

Our intention by performing the usability testing for the Business Faculty had the objective of collecting feedback regarding the user experience of our application, however, we left the session with more than we expected.

Charlie Dayman, the lecturer who welcomed us in his class, not only allowed us to interrupt his lecture to execute the testing, but also used our prototype as a study case. As a result, the business students brainstormed ideas about how we could generate revenue from ChatterBox, such as:

- Contact institutions involved in target market, such as Nursing Homes, The Irish Heart Foundation, Hospitals, Parkinson's Association of Ireland with the objective of obtaining a minimum threshold of users and reviews to create a solid reputation before deploying our application on Google Play;

- Set out a business plan for future administration of the app, involving future development, registration of the brand, application versions, costs and profitability;

- Deliver a free version to the general public where basic features will be available and provide a premium one for those who wish to obtain extended features.

"...Set out a plan of what your revenue stream is going to be and how you are going to collect it by this I mean where is the money coming from for future administration of the app, ongoing development and profitability. With this in mind I would suggest offering a download with just the basics to 'wet the appetite' of the user and then for every update charge. You could probably do this as a phase 1, phase 2, phase 3 etc. The important thing here is to ensure that each phase offers something of extra value. Naturally you charge for this." - Charlie Dayman.

Keeping this positive overview and precious words of advice in mind, we intend to proceed with a business plan to launch our product into the market.

Chapter 6

6.1 - Website

URL: http://www.claytoncrispim.com/OrangeInc/ChatterBox/

6.2 - WordPress

The ChatterBox website was developed using WordPress version 5.1.1–en, which is an open-source content manager that runs PHP (Hypertext Preprocessor - web development language) and SQL (Structured Query Language - data manipulation and database management language). It has hundreds of themes/templates, many of them are either for free, with basic features, or have priced upgradable extensions. In either way, it is possible to add implementations using a GUI, a plugin which also offers a user interface or implement the PHP and CSS source codes. The theme used to develop this website is the *VW Gardening Landscaping Version: 0.2*.
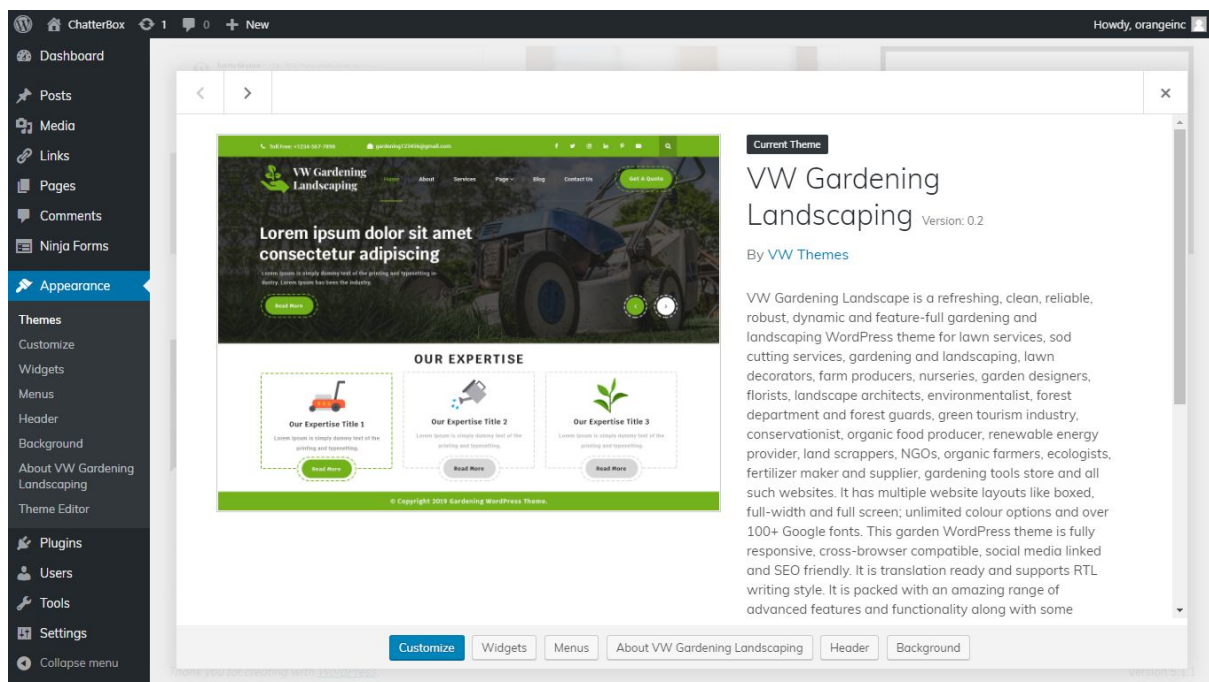
Figure 39: VW Gardening Landscaping Theme Via WordPress

6.2.1 - Customization

The customization of this theme has two parts: theme customization and theme editor.

6.2.1.1 - Theme Customization

The theme customization tool is integrated with the theme itself. Through this tool, some pre-defined styling characteristics can be changed. The *VW Gardening Landscaping* WordPress theme comes with the following options for customization: *Theme Typography, Site Identity, Colors, Header Image, Background Image, Menus, Widgets, Homepage Settings* and *Additional CSS*.
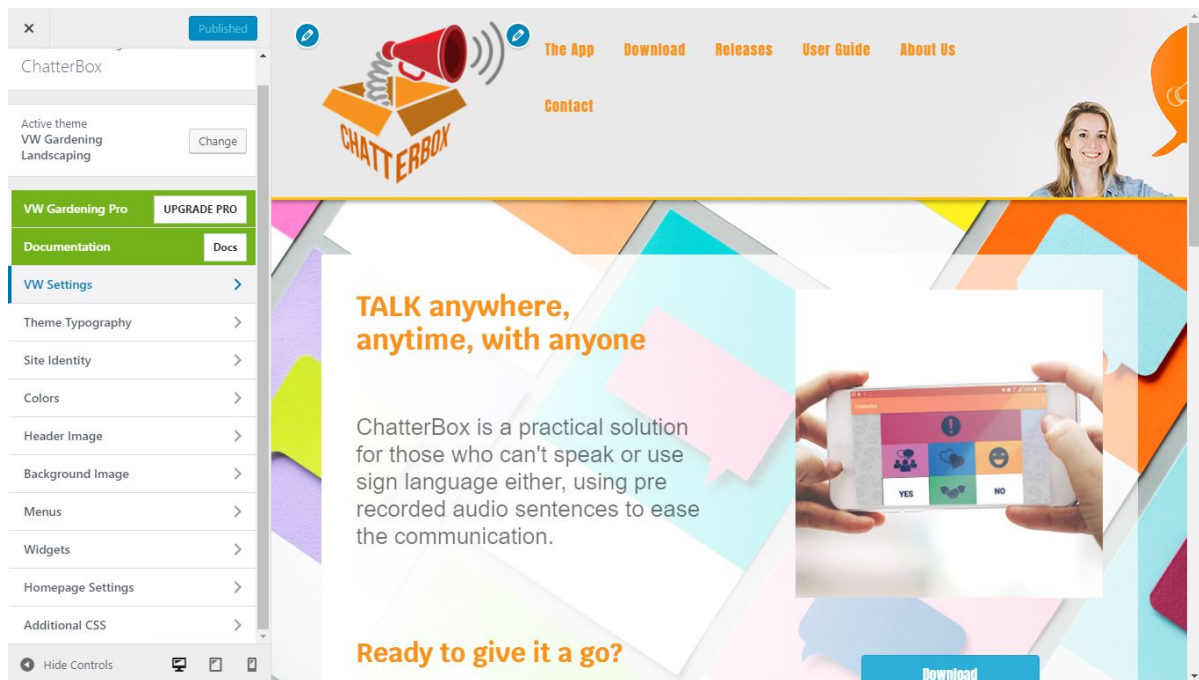
Figure 40: Theme's Main Menu (left) & Website Preview (right)

These are the theme sections that where customized:

- Theme Typography

    Font family, height, colour and weight for both content and headings.

- Site Identity

    Logo, site title and site icon

- Colors

  Background color

- Header Image

- Background Image

- Menus

  MainMenu

- Homepage Settings

  Static page

- Additional CSS

  Extra CSS formatting was added for buttons and general align

6.2.1.2 - Theme Editor

This section of WordPress provides all the current theme's source codes for styling (CSS) and functionality, such as PHP and JavaScript files.

These are the parts of the theme which codes were altered or implemented:

- Theme Header (header.php)

```
12  <html <?php language_attributes(); ?>>
13
14      <head>
15          <meta charset="<?php bloginfo( 'charset' ); ?>">
16          <meta name="viewport" content="width=device-width">
17          <link rel="profile" href="<?php echo esc_url( __( 'http://gmpg.org/xfn/11', 'vw-gardening-landscaping' ) ); ?>">
18          <?php wp_head(); ?>
19      </head>
20
21      <body <?php body_class(); ?>>
22
23          <div class="home-page-header">
24              <?php /* get_template_part('template-parts/header/top-header'); *//* DISABLED BY ME*/?>
25              <?php get_template_part('template-parts/header/middle-header'); ?>
26          </div>
27
28
29  <script type="text/javascript">
30
31
32
33  </script>
```

Theme Header
(header.php)

Image Attachment Template
(image.php)

Main Index Template
(index.php)

no-results.php

page-template ▶

Single Page
(page.php)

Search Results
(search.php)

Search Form
(searchform.php)

Sidebar
(sidebar.php)

Single Post

Figure 41: Theme Header Source Code (header.php)

The highlighted snippet code shows the part of the respective code which is responsible for the theme's very top bar (Figure 42).

Figure 42: Theme Header - Top Header (header.php)

It has been disabled simply because an extra bar with telephone, email, social medias and search bar is not necessary at this moment of the project. Besides that an eventual contact with the team can be done via 'Contact Us' page.

- Theme Footer (footer.php)

Figure 43: Theme Footer Source Code (footer.php)

This snippet code above corresponds to the 'Orange Inc.' logo and copyright credit line insertions (Figures 43 and 44).

Figure 44: Website Footer

6.2.1.3 - Beaver Builder

Beaver Builder is the WordPress page builder, that helps to organize sections of the website using bootstraps parameters by default. It is possible to insert media, set new styling parameters and advanced settings, such as animations.

This tool was used to do small changes and insert arbitrary HTML[6], once some customizations were not working the way expected via the theme's CSS[7] files, due to the several PHP functions wrapped around the theme.
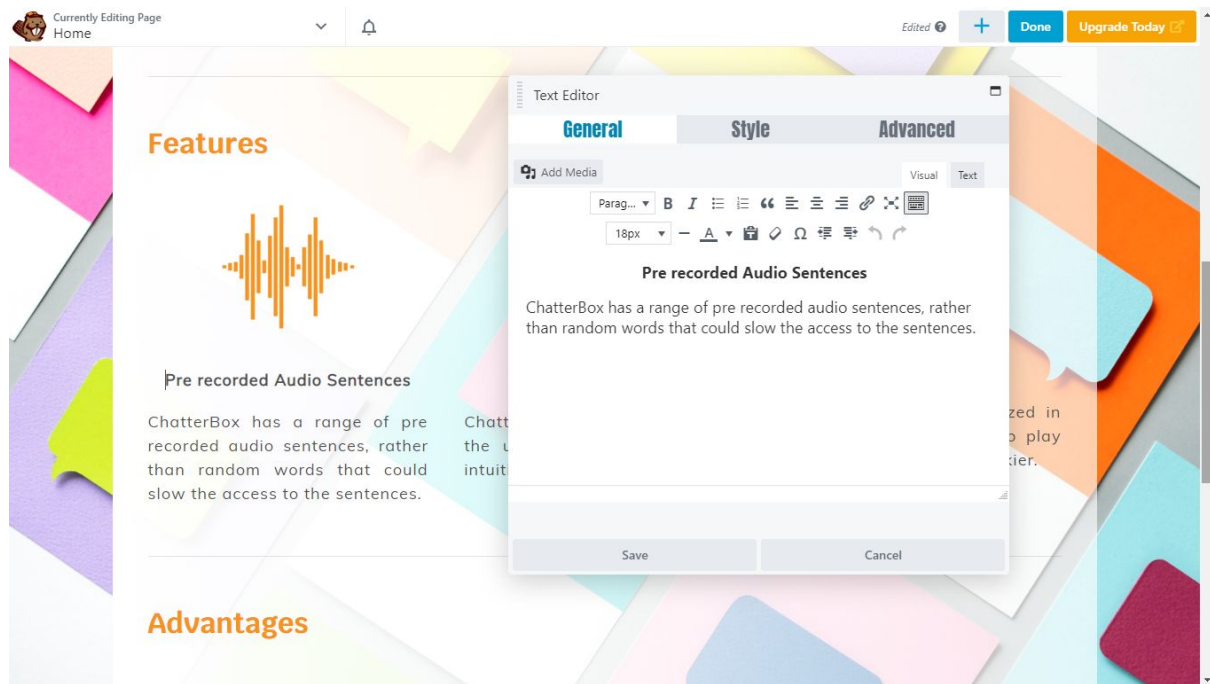
Figure 45: Beaver Builder Visual Text Editor

Figure 46: Beaver Builder HTML Editor

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[6] Hypertext Markup Language - used for creating both web pages and web applications.
[7] Cascading Style Sheets - used to describe the style and layout of web pages and web applications.

6.2.1.4 - Theme - Original & Customized

Figure 47: VW Gardening Landscaping Theme
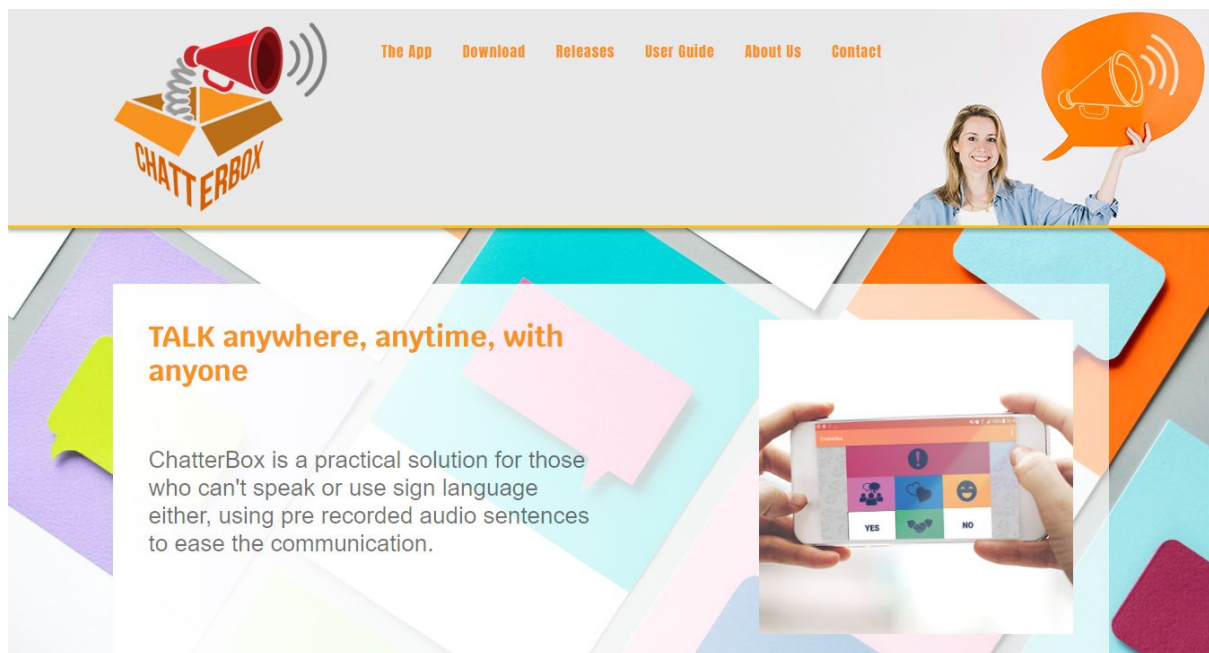
Figure 48: ChatterBox Main Page Using A Customized Version Of The Theme

6.2.1.5 - Ninja Forms

This WordPress plugin allows the developer to add editable forms. Thus, the contact form at the 'Contact' page is made with the Ninja Forms plugin, as it can be seen in the images bellow.
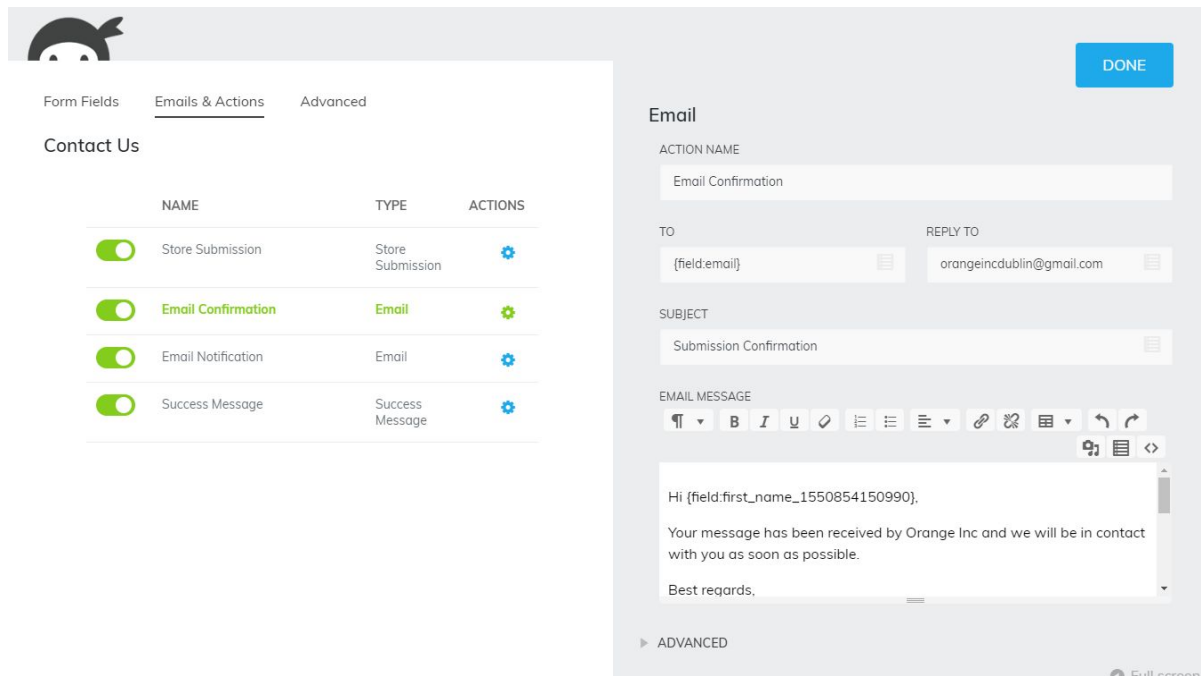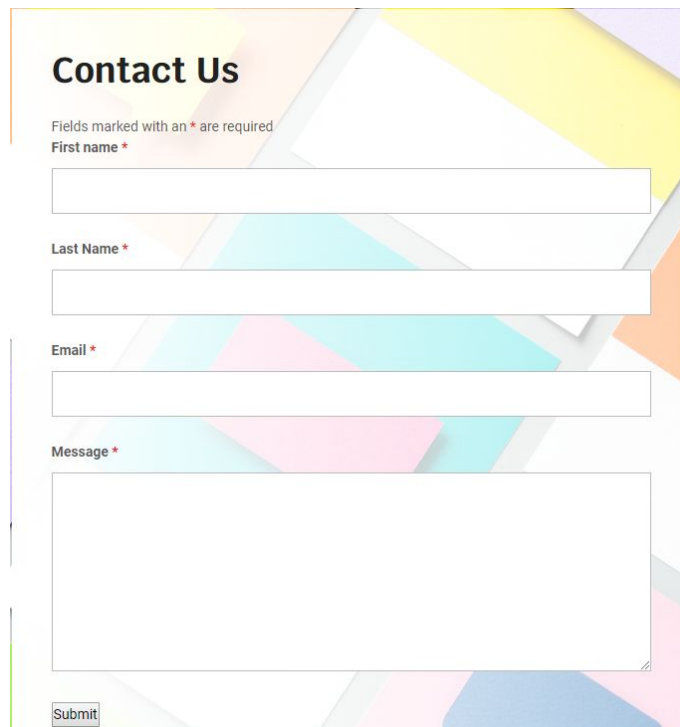
Figure 49: Ninja Forms Settings

Figure 50: The Operating Contact Form

Chapter 7

7.1 - Conclusion & Further Work

Researching for ideas and inspiration to develop this project, we came across with several IT projects that made us realize the unkind reality of the low number of projects destined to people with some kind of impairment. Even though IT students usually feel tempted to create something outstanding and innovative as a final year project, we felt that creating a technology that could allow people to have a better quality of life would bring us a greater level of fulfillment. Therefore, having ideas for this project meant to bring a meaningful feeling of social contribution.

We are convinced that ChatterBox is a project that has a great potential to grow and our intention is to keep working on it to improve the application and deliver a tool to a public that lack options of applications of this type. We believe that the next step of this project is to make the difference in many lives and give those who lost their hopes the chance of being integrated in society again.

The feedback acquired during the testing with the business group was of great importance to us, not only because of the results we were able to collect but also for the reassurance of the cause we are trying to reach as well as the potential ChatterBox has become something even greater than was initially thought.

It is a wonderful work, and we do not have words to describe how happy we are with the results we have got and the motivating overviews such as the one Charlie Dayman gave us *"Congratulations on an exceptional presentation. I found your 'app' to be very creative and timely in terms of the aging population of Ireland. From a future business operational perspective I do have a couple of comments/ideas that you might find helpful but first I must admit that I believe your app has considerable potential if its marketed correctly.", "I believe the app have a global reach, it is simple to use and very well presented."*. Because of that, we believe that we took only the first steps on this challenging journey.

From the testing outputs and feedbacks, we brainstormed improvements that could possibly take place in the future versions of ChatterBox and these includes:

● Develop a database, where users will be able to customize the application, which includes adding their own sentences, interfaces and have a favourite button (where they will be able to add their most used sentences);

● Give an option to user so they can choose between female and male voice options;

● Integration between application and website, where the user could administrate and make changes to the application via website (adding a sentence in the website, for instance, would be integrated on the application to that related account);

● Enable remote communication access (name brainstorming: BoxTime), where a user would be able to communicate remotely with another person that has the application.

We would like to finish our report by thanking everyone that, in one way or another, contributed to the completion and success of this project specially Graham Glanville, Michael Weiss, Greg South and Charlie Dayman along with the fourth year CCT Business class 2019.

We would not have achieved this outcome if our project had not progressed on regular group meetings led by companionship amongst the group members, and the several brainstorming sessions and researches that we performed since the very beginning as well as the guidance of our supervisor, Greg South. Since the early stages of this activity, he brought great clarity in his recommendations in order to guide us throughout the steps that were either necessary or compulsory. Our meetings were a valuable opportunity to set our minds on the academic requirements, in addition to his own experience as a member of panels.

It has been a long journey with a lot of obstacles. There were times of despair, thinking that the only solution left was to abandon everything, nonetheless, we persevered and now we can say the final project is done and how rewarding it is,

especially because since the very beginning we have always kept in mind the fact that we wanted to make people's lives easier, bringing technology closer and we hope, somehow, we have achieved this accomplishment.

7.2 - Recommendations

We are proud of what we have achieved with this project, it goes beyond what we truly expected to reach out. We cannot say that there is a formula for the success but there are few tips and steps that might help you to get the results you are expecting for, or even further.

Working in group is a challenge, working in a big one cannot only be a challenge it can also become a disaster if it does not start with a good plan. Planning is the first and most important key of the success for any satisfactory results. For first and most important, picture how a good team work would be, then make sure to have on your group people that will give as much as you would to complete proudly the work ensuring that those people will be looking at the same direction as you and they will be working as hard as you. If possible, work along with friends, good and focused ones. It is vital having everyone in the same page.

Do not jump into coding straight away. If this is the case, take a moment, plan how the documentation will be structured and stored (Google Drive, Microsoft One Drive, any cloud based scheme), keep track of every idea, decision and group meetings, create a way to communicate to each other not only informally (WhatsApp group) but also formally (emails) to make sure that you have a backup of whatever happened during the process. Documentation is a huge part, don't underestimate it or leave it for later.

Communicate - do not presume that everything is clear enough and does not need an extra explanation. Not everybody has the same point of view that you do. Listen, respect people's opinion, differences and suggestions. Be aware that decisions are made in group, even if your decision sounds great it might not be the best one for the sake of the whole group.

Do not get lost, we know that is a possible and easy thing to happen especially when we have so many other things going on with college at the same time, set up weekly meetings (hours or even few minutes to catch up with the evolution of the project), take note of everything, we also know that everybody has different schedules but, this is something that should be a common interest among the members of the group. It is a huge project, assigning tasks and deadlines is not just a necessity, it is crucial to ensure that no one will be overloaded, everyone is particularly good at doing something, take advantage of it.

Appendix A: Project Planning

I - General Project Plan

This is our General Project Plan, it shows initially the time we expect to take until the conclusion of each step of our work with this Project. The deadlines are subject to change, as we might have new or different ideas and decisions, from the ones we had/made at the beginning, and also possible complications during the process of development and advancement of our Application.

General Project Plan

Task Description	Sep / 2018	Oct /2018	Nov /2018	Dec /2018	Jan /2019	Feb /2019	Mar /2019	Apr /2019
1. Starting Up								
1.1 - Research and Decision(Idea)	■	■						
1.2 - Application Name		■						
1.3 - Application Logo		■	■					
1.4 - Research (problem Solution)	■	■	■					
1.5 - Decision for the Application Design		■	■	■				
2. Documentation								
2.1 - Documentation Structure/ Format			■	■	■	■	■	■
2.2 - Chapter 1 -Introduction(Idea)			■	■				
2.3 - Chapter 2 -Systems Analysis					■	■		
2.4 - Chapter 3 - System Design					■	■		
2.5 - Chapter 4 - Implementation of System						■	■	
2.6 - Chapter 5 - Testing and Evaluation							■	■
2.7 - Chapter 6 - Conclusion								■
2.8 - Chapter 7 - Website								■
3. App Development - Android Studio								
3.1 - Voice recording						■	■	
3.2 - Research (Insert voice rec.)					■	■		
3.3 - Build an App prototype				■	■	■		
3.4 - App improvement (Responsiveness)						■	■	
4. Website								
4.1 - App website						■	■	

Figure 51: General Project Plan Description

II - Detailed Project Plan

Detailed Project Plan

Task Description	Assigned to	Helper Bkup	Status	Deadline	Problems / Issues	Concluded
1. Documentation						
1.1 - Documentation Structure/ Format	Group	Group	✓			✓
1.2 - Improve deliverable A - Chapter 1	Fabiana	Group	in progress...	Part I - 20.02.19 Part II-06.04.2019	Waiting on Greg's Analysis...	✓
1.3 - Chapter 2 -Systems Analysis	Fabiana	Joao/Jacqueline	in progress...	Part I - 27.02.19 next date to be revised and redone by: Part II-15.04.19	Waiting on Greg's Analysis. Got review from Greg on 02.04.2019 ,sent out an email to Michael Weiss asking him his help and opinion about our user diagrams.	✓
1.4 - Chapter 3 - System Design	Jacqueline	Joao	in progress...	Part I - 27.02.19		✓
1.5 - Chapter 4 - Implementation of System	Joao	Kleyton	✓	24/04/2019	Testing Procedures with 4th year students at Bernard Shaw classroom on the 17th of April to analyse how user friendly our App is, the feedback was amazing.	✓✓
1.6 - Chapter 5 - Testing and Evaluation	Jacqueline	Joao	in progress...	Part I - 03.04.2019 - Part II 24.04.19		✓
1.7 - Chapter 6 - Recommendations	Fabiana	Group	in progress...	24/04/2019		✓✓✓
1.7 - Chapter 6 - Conclusion and further work	Group	Group	in progress...	01/05/2019		
1.8 - Chapter 7 - Website	Clayton	Group	in progress...	10/03/2019		
2. Application Development - Android Studio						
2.1 - Voice recording	Kleyton	Joao	✓	Part I - 20.02.2019	Getting the group of sentences(voice record) for the same interface but diffferent buttons.	✓
2.2 - Research how to insert voice recording on AS	Joao	Group	✓	Part I - 20.02.2019	Implementing Audio Manager class and need to debug (app crashes after 32 played voices).	✓✓✓✓
2.3 - Build an app prototype	Kleyton	Group	✓	Part I - 20.02.2019	Getting familiar with this new tool	
2.4 - App improvement (Responsiveness)	Kleyton	Joao	in progress...	Part I - 27.02.2019	Searching / The 'envelope' was tricky to make it responsive	✓
3. Website	Clayton	Group	in progress...	06.03.2019		
4. User Cases Experiences						
4.1. User feedback	Group	Group		From 07.04.19 to 05.05.19	Try to get more feedback of our actuall application as we possibly can.	✓
5. Report Revision						
5.1. Report Revision Meeting	Group	Group		Part I - 10.04.19	Meeting with the whole group to discuss what we are keeping/changing on our report.	✓
5.1. Report Revision Meeting	Group	Group		Part II- 24.04.19	Second group meeting, to proceed oon the revision of the report..	✓

Figure 52: Detailed Project Plan Description

III - Chronological evolution of our work:

Brainstorm (Name suggestions):

Names suggested:
Out, talk, talk out, speech, express, speech impairment, let out, chatterbox, chat, speak, prude

Votes:
Kleyton: chartterbox
Fabi: ChatterBox(my own idea)
Joao:chatterbox

Figure 53: Application Name Brainstorm

Ideas for the logo: (by Fabiana and Clayton):
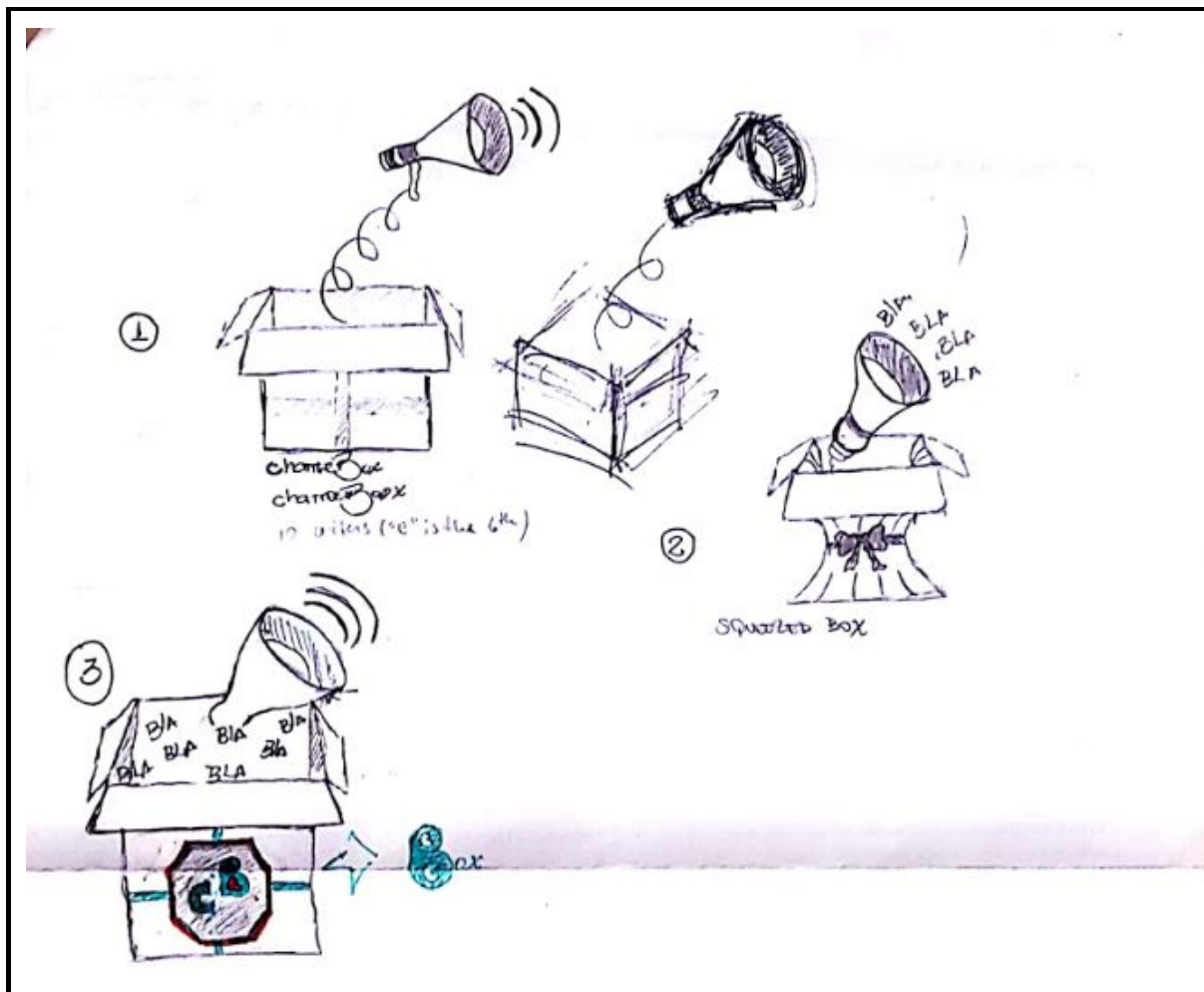
Figure 54: Logo Ideas

First scope of our menu interface:
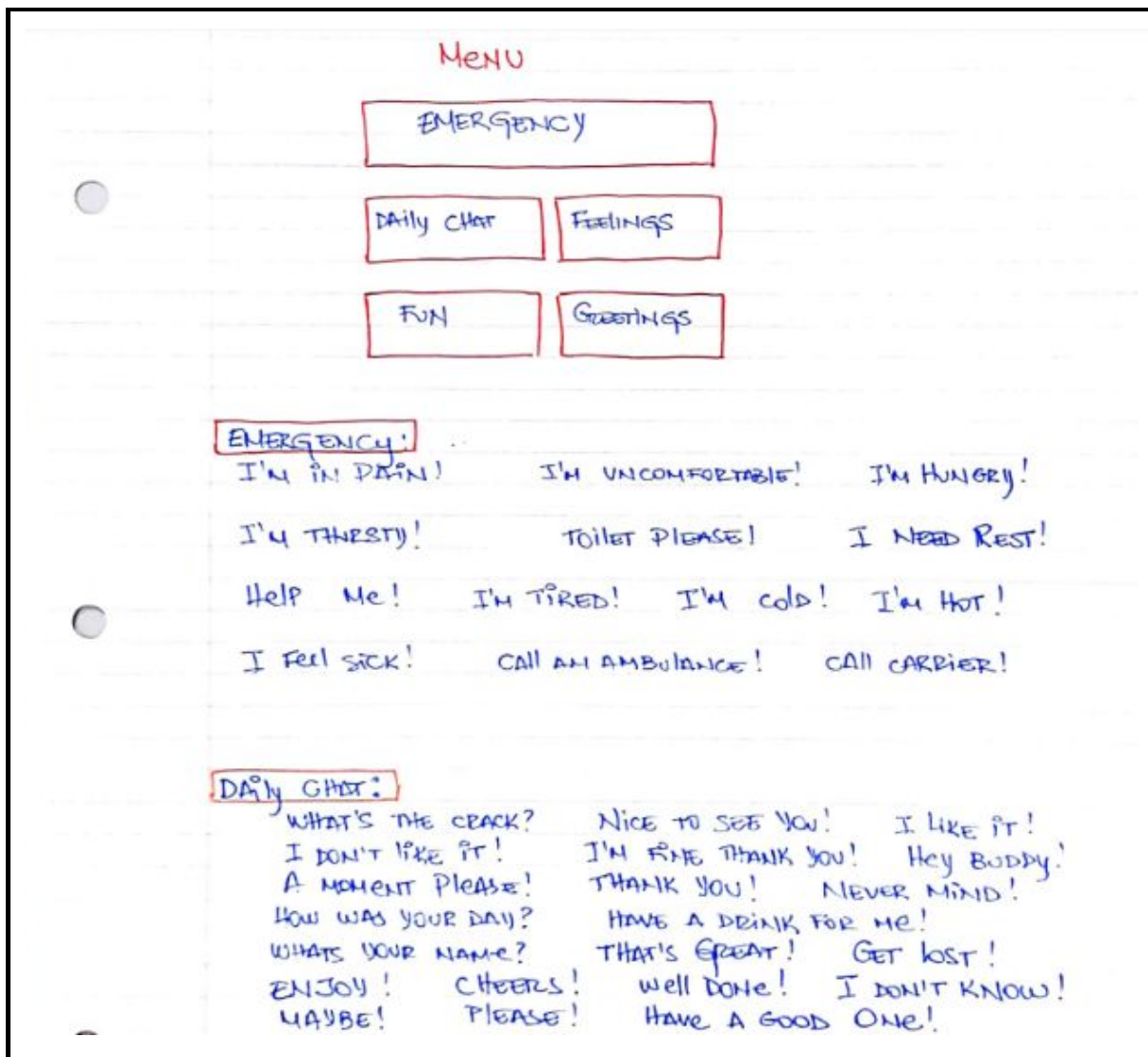
Figure 55: Menu Interface Scratch

Website map - First draft:
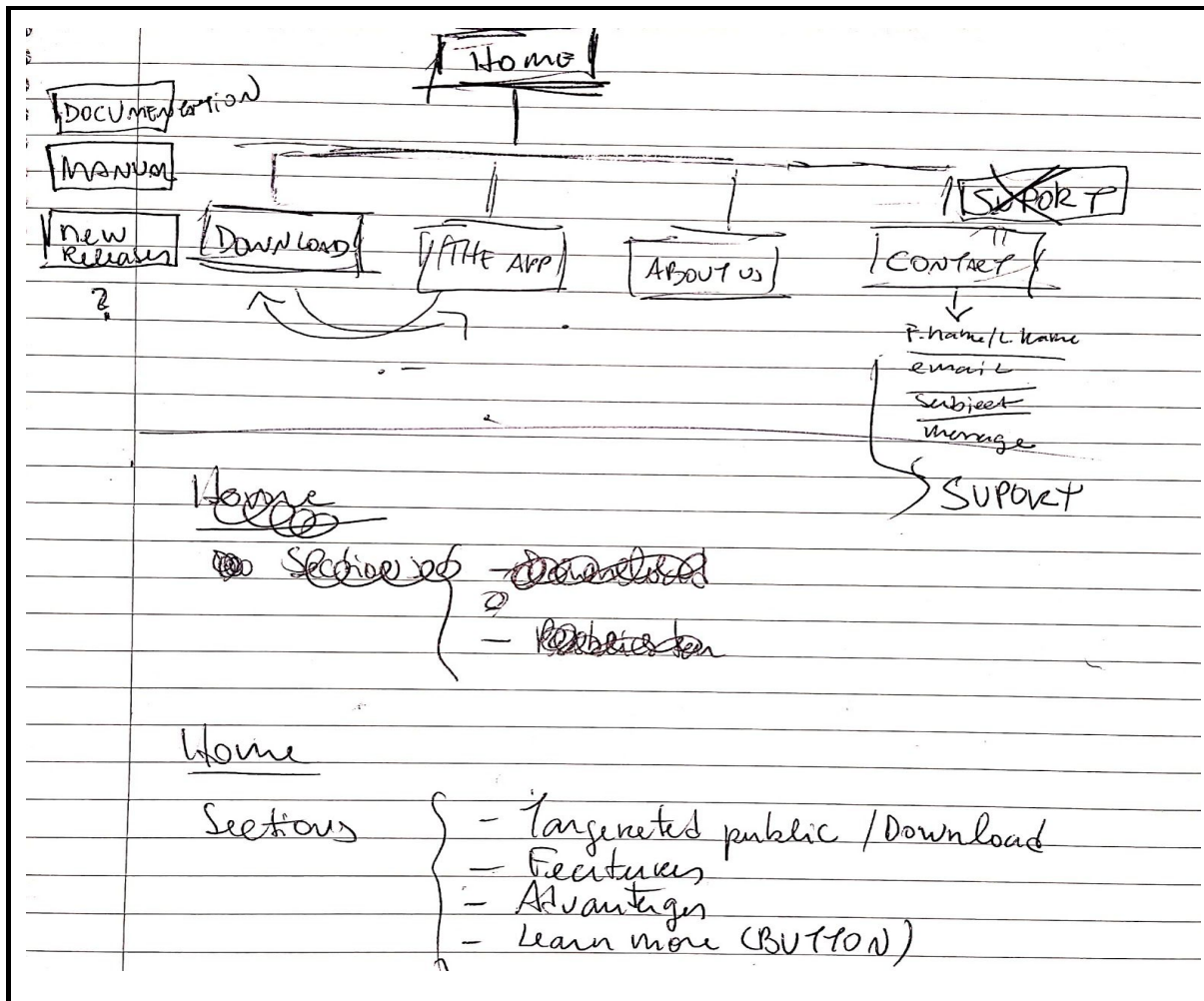
Figure 56: Website Scratch
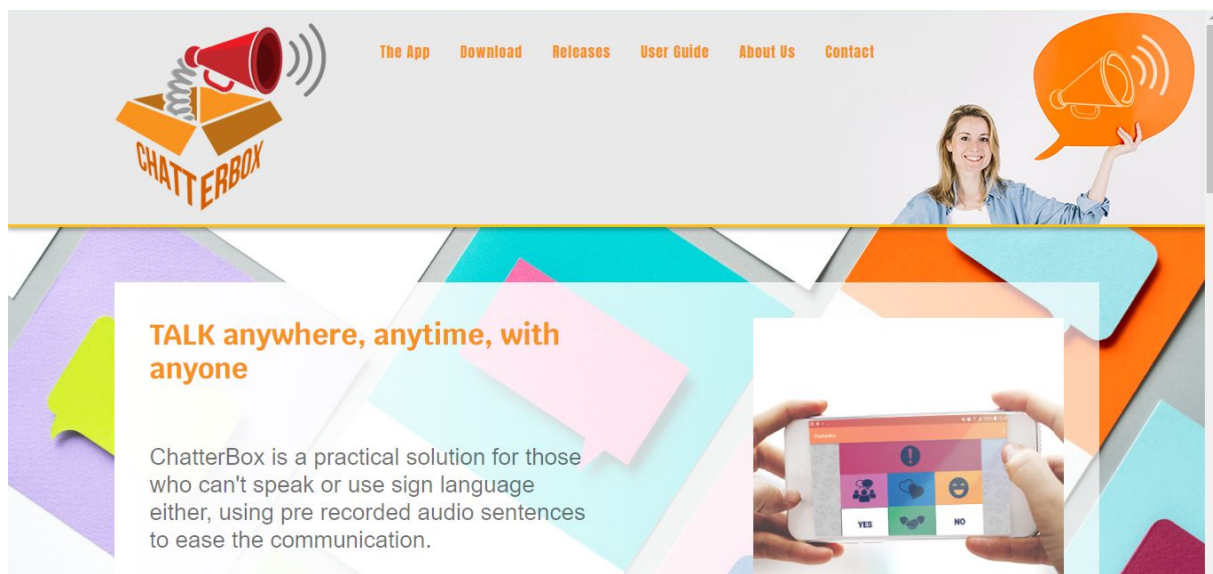
Figure 57: Website - Home Page[8]

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[8] For further details, visit our page: http://www.claytoncrispim.com/OrangeInc/ChatterBox/

The Application - Final Result

We personally showed our application to some of our friends and they shared their opinions about what we could do to improve the user experience.

Widely questioned was on which interface the user was actually browsing - we soon identified the user was a little lost and unsure what to do next. In order to fix it, we implemented breadcrumbs, which is a small text path often located at the top of a page[9], and borders around the main menu buttons such as Emergency and Greetings.

A Back Arrow navigation button on the top left corner was created for Daily Chat, Feelings, Emergency, Fun and Greetings interfaces. As an alternative, users can also use the built-in hardware back button most Android phones have.

On the main menu, three dots (one above the other) on the top right corner was also implemented to represent a menu icon for "About" and "Help":

- the "About" interface thanks the user for downloading the app, displays the app version as well as the logo.
- the "Help" interface contains a straightforward explanation about how to use the app, the representation of the colours[10] and there is also a link to ChatterBox website.

Below, you can see the evolution from wireframes to the final result of the application based on those feedbacks.

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[9] Source: https://yoast.com/breadcrumbs-seo/ [Accessed on 02nd April 2019].
[10] Refer to topic 1.5.2 - Colour Psychology Applied To The Working System page 23 for further information.

First wireframes of our ChatterBox application:

MENU

EMERGENCY

DAILY CHAT | FEELINGS

FUN | GREETINGS

Daily Chat

HELLO	NICE TO SEE YOU
HOW ARE YOU?	I'M FINE, THANKS
I DON'T LIKE THAT	I LIKE THAT
HEY BUDDY	A MOMENT PLEASE
THANK YOU	HOW WAS YOUR DAY?
CHEERS	ENJOY
THAT'S GREAT	PLEASE

YES | NO

Greetings

GOOD MORNING	GOOD AFTERNOON
GOOD EVENING	GOOD NIGHT
HAPPY BIRTHDAY	HAPPY HOLIDAYS
CONGRATULATIONS	SEE YOU LATER

YES | NO

Fun

REMOTE CONTROL	GAME
TURN ON	TURN OFF
VOLUME UP	VOLUME DOWN
GO FOR A WALK	WORRIED

YES | NO

Turn on...

| TV | MUSIC |
| LIGHTS | HEATER |

YES | NO

Turn off...

| TV | MUSIC |
| LIGHTS | HEATER |

YES | NO

Emergency

HELP	CALL
PAIN	SICK
UNCOMFORTABLE	TIRED
COLD	HOT
HUNGRY	THIRSTY
TOILET	REST

YES	NO

Call...

AN AMBULANCE	CARER

YES	NO

Pain...

HEADACHE	STOMACHACHE
BACK	LEGS
ARMS	CHEST

YES	NO

Feelings

LOVE	MISS
SORRY	SAD
HAPPY	ANNOYED
ANGRY	WORRIED
DEPRESSED	AFRAID
BORED	BETTER
FRUSTRADED	NERVOUS
EXCITED	DISAPPOINTED
YES	NO

Second version of ChatterBox wireframes:

Screen 1 — MENU

MENU

- EMERGENCY
- DAILY CHAT
- FEELINGS
- FUN
- GREETINGS
- YES
- NO

Screen 2 — Daily Chat (EMER / FEEL / FUN / GREET)

HELLO	NICE TO SEE YOU
HOW ARE YOU?	I'M FINE, THANKS
I DON'T LIKE THAT	I LIKE THAT
HEY BUDDY	A MOMENT PLEASE
THANK YOU	HOW WAS YOUR DAY?
CHEERS	ENJOY
THAT'S GREAT	PLEASE

- YES
- NO

Screen 3 — Feelings (EMER / D. C. / FUN / GREET)

LOVE	MISS
SORRY	SAD
HAPPY	ANNOYED
ANGRY	WORRIED
DEPRESSED	AFRAID
BORED	BETTER
FRUSTRADED	NERVOUS

- YES
- NO

Screen 4 — Emergency (D. C. / FEEL / FUN / GREET)

HELP	CALL
PAIN	SICK
UNCOMFORTABLE	TIRED
COLD	HOT
HUNGRY	THIRSTY
TOILET	REST

- YES
- NO

Screen 5 — (D. C. / FEEL / FUN / GREET)

AN AMBULANCE	CARER

- YES
- NO

Screen 6 — (D. C. / FEEL / FUN / GREET)

HEADACHE	STOMACHACHE
BACK	LEGS
ARMS	CHEST

- YES
- NO

Prototype interfaces:

Figure 58: Dashboard - Main Menu
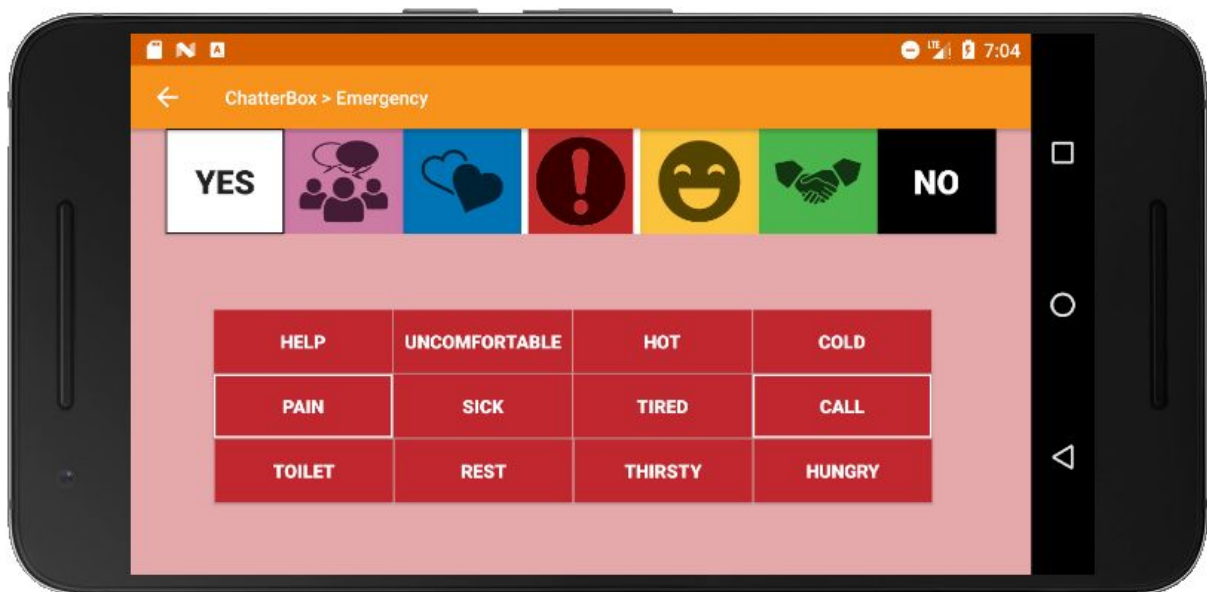
Figure 59: Emergency
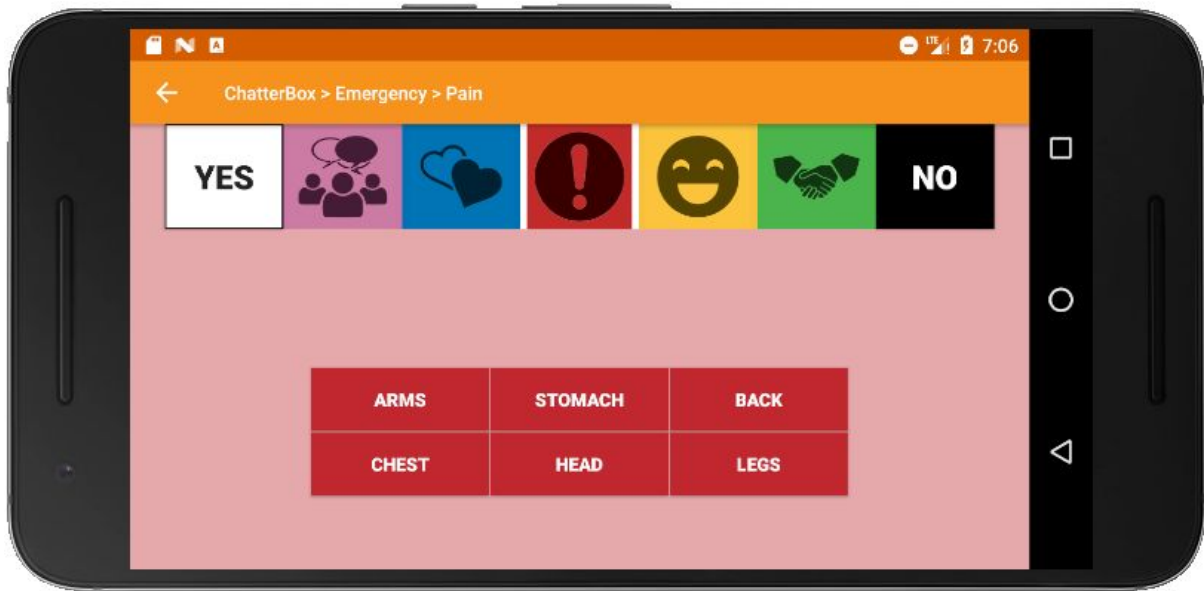
Figure 60: Emergency - Pain
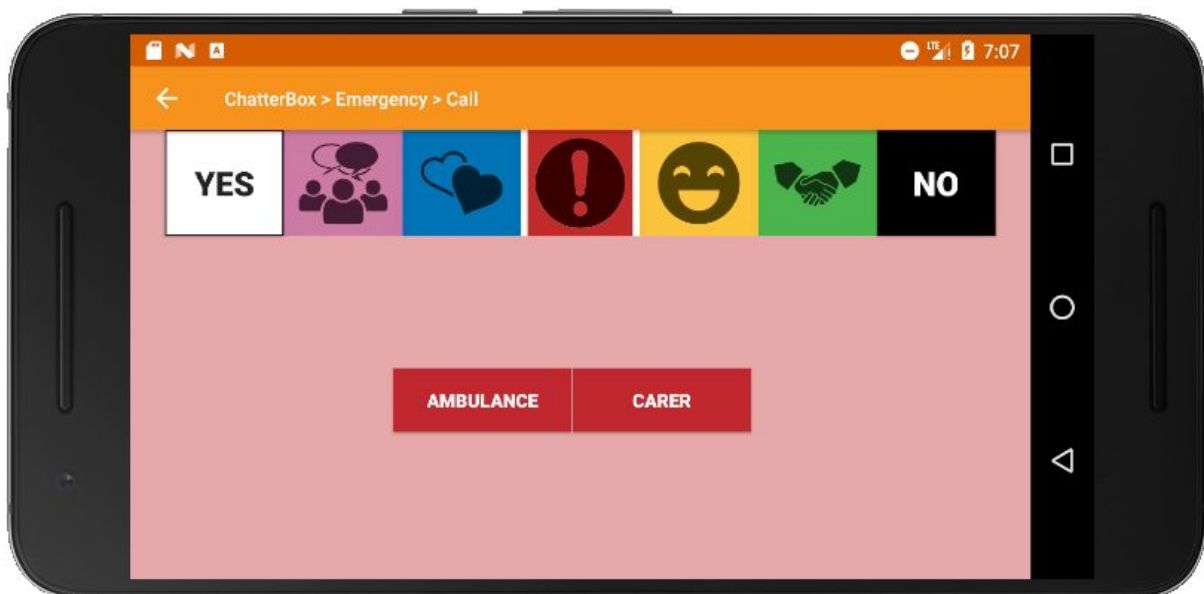
Figure 61: Emergency - Call
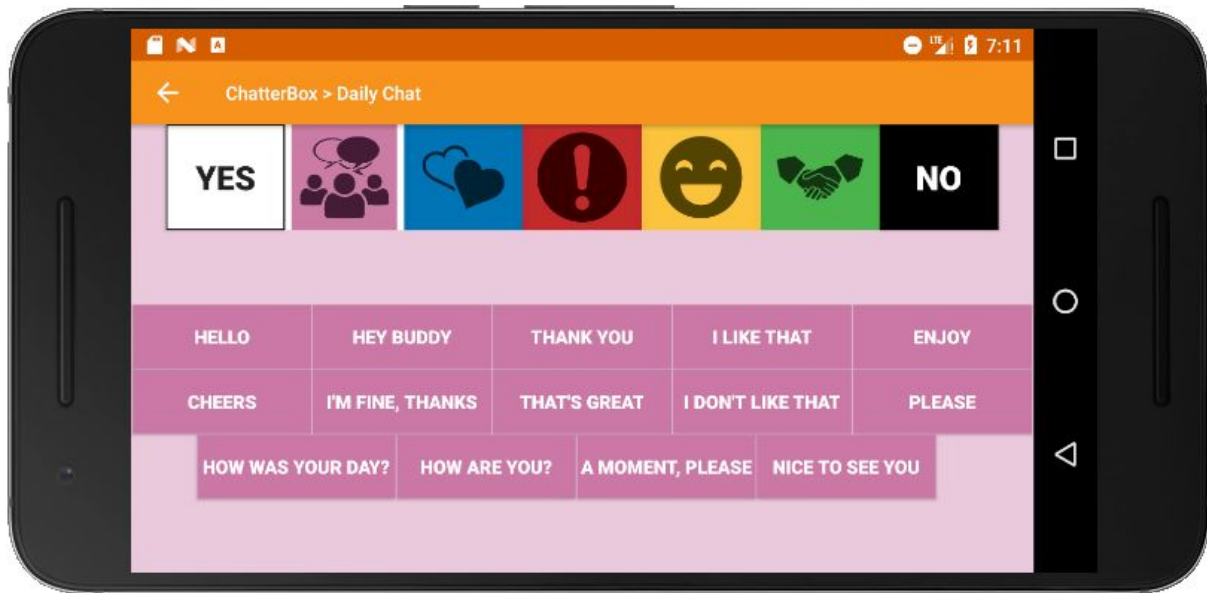
Figure 62: Daily Chat
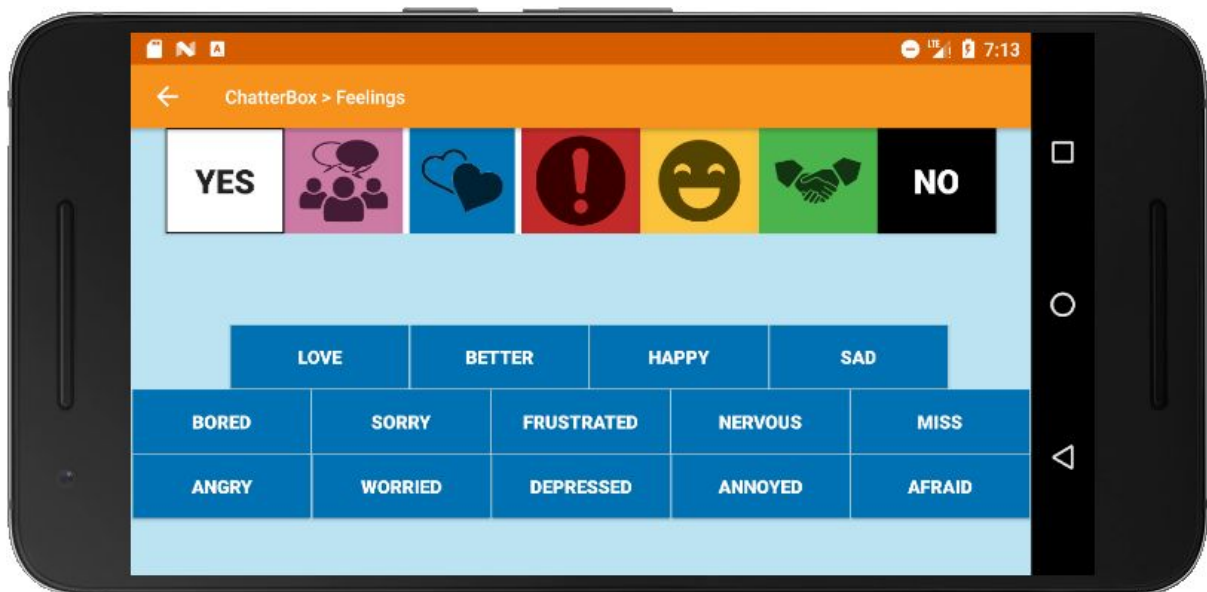
Figure 63: Feelings
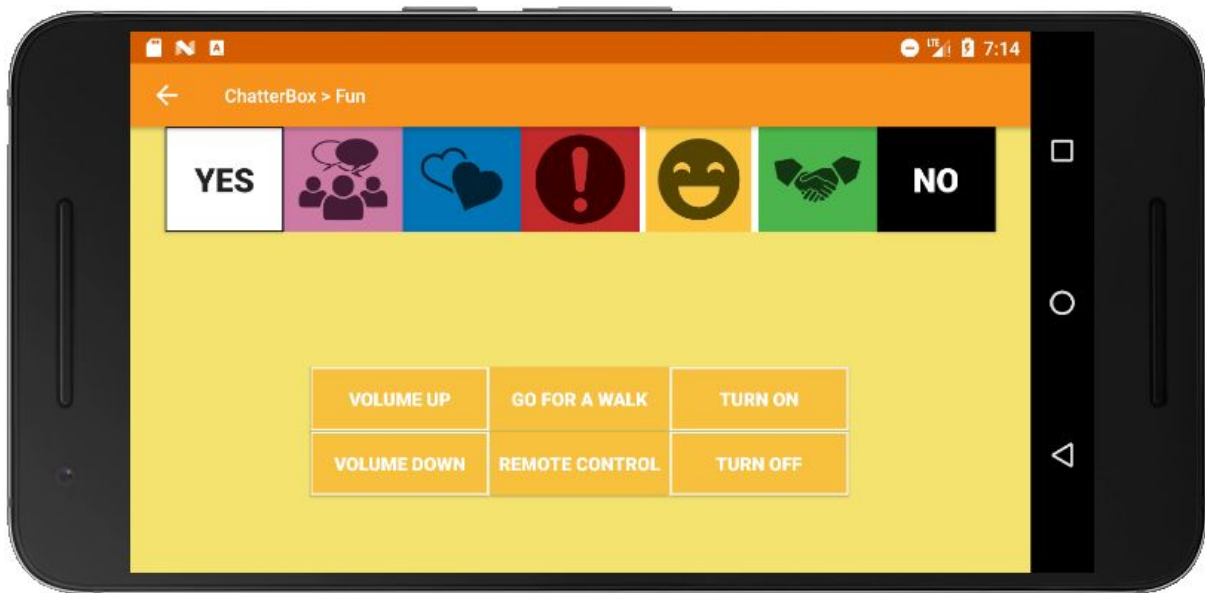
Figure 64: Fun
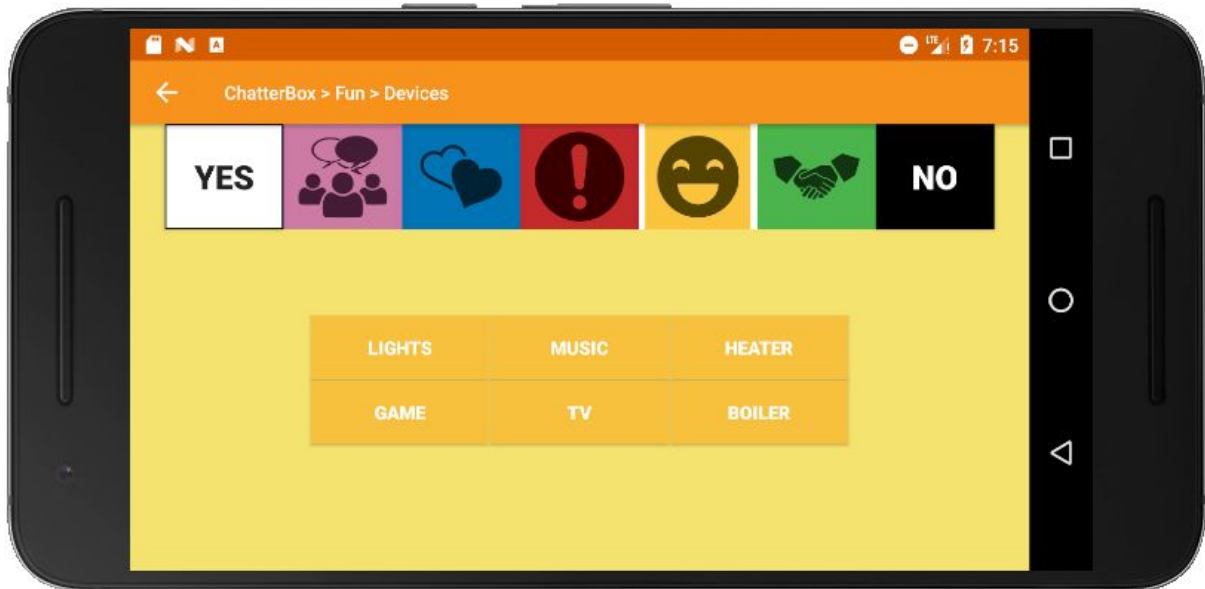
Figure 65: Fun - Devices
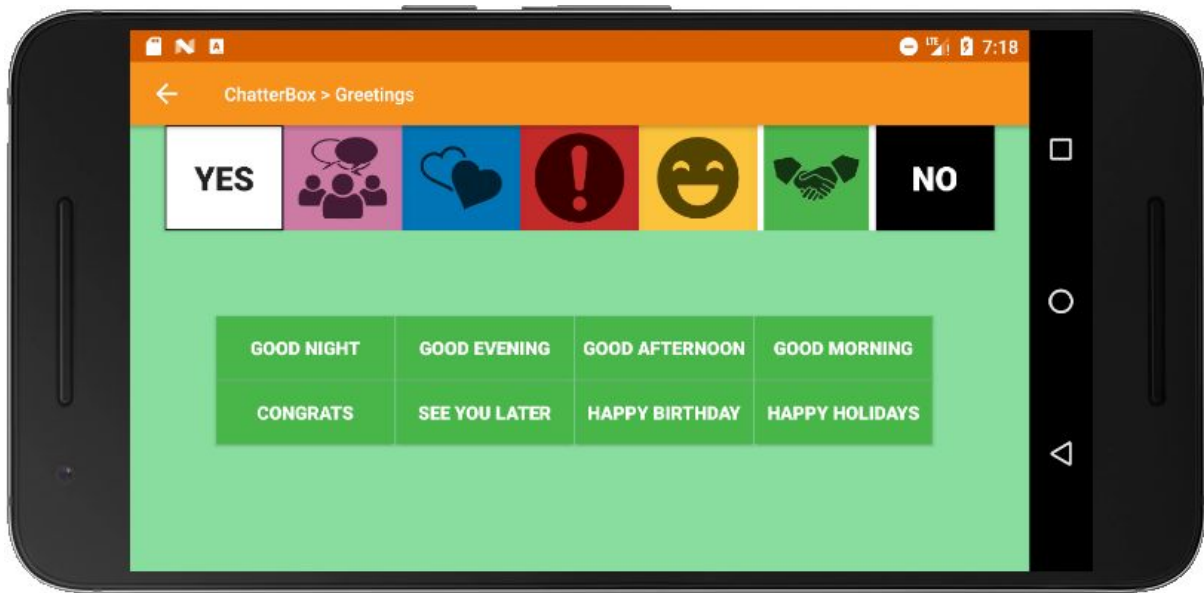
Figure 66: Greetings
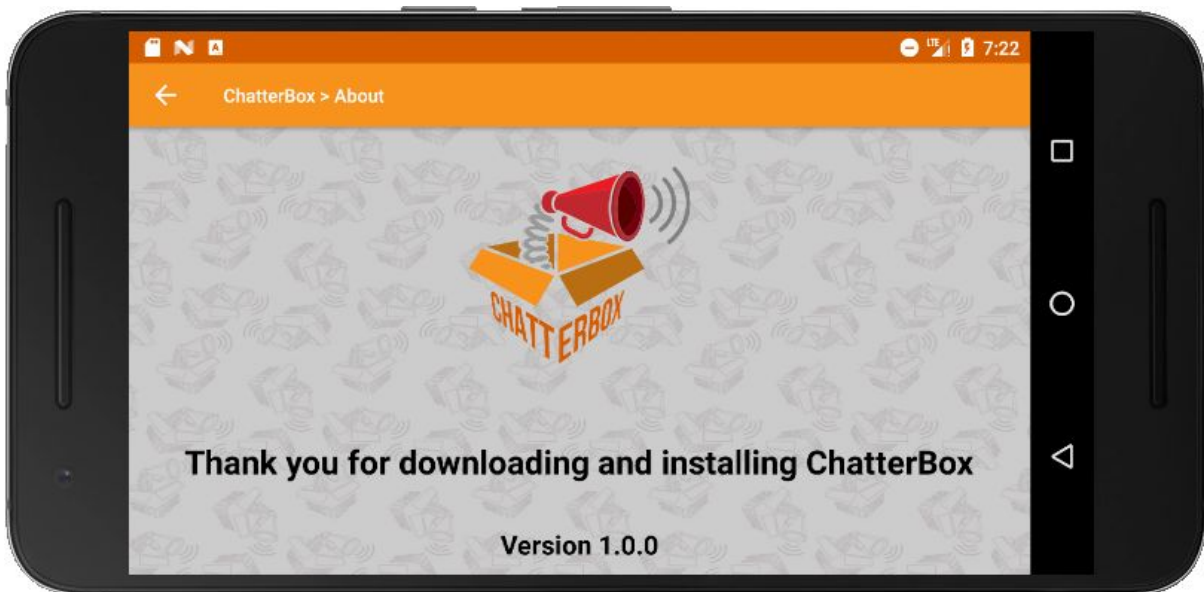
Figure 67: About
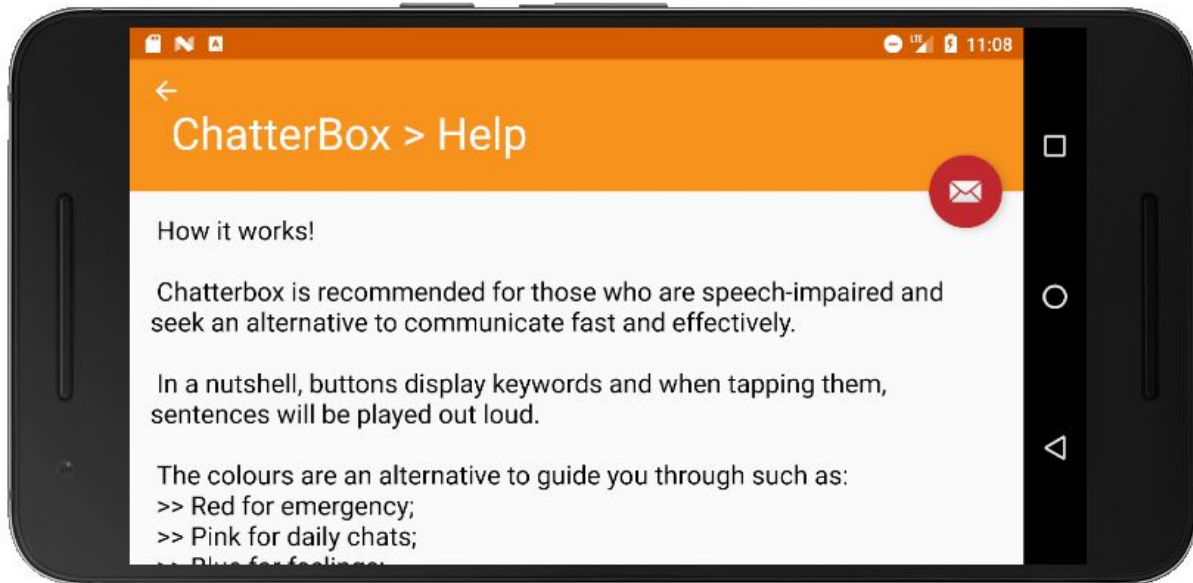
Figure 68: Help

Appendix B: Group Journal

24th September, 2018.

We, as a group, got together today at 3pm in the library to discuss new ideas for our project. Among 11 initial ideas, we came down to 3 which we all decided to put on hold until we have a quick chat with Greg South the following day and see what his thoughts are about so that a best decision should be made.

The 3 ideas for the project are:
- **Online Blood Bank System** - A management system that helps both donor and receiver to ease the search for the correct blood type.
- **College Application For Students** - An application that displays the student information as well as get their solicitations such as letters, transcript of results, exams/assignments revision etc.
- **Speech Application** - The aim of this application is to help people either with speaking problems or who do not speak, to communicate through pre-recorded sentences, accessed through a practical GUI.

25th September, 2018.

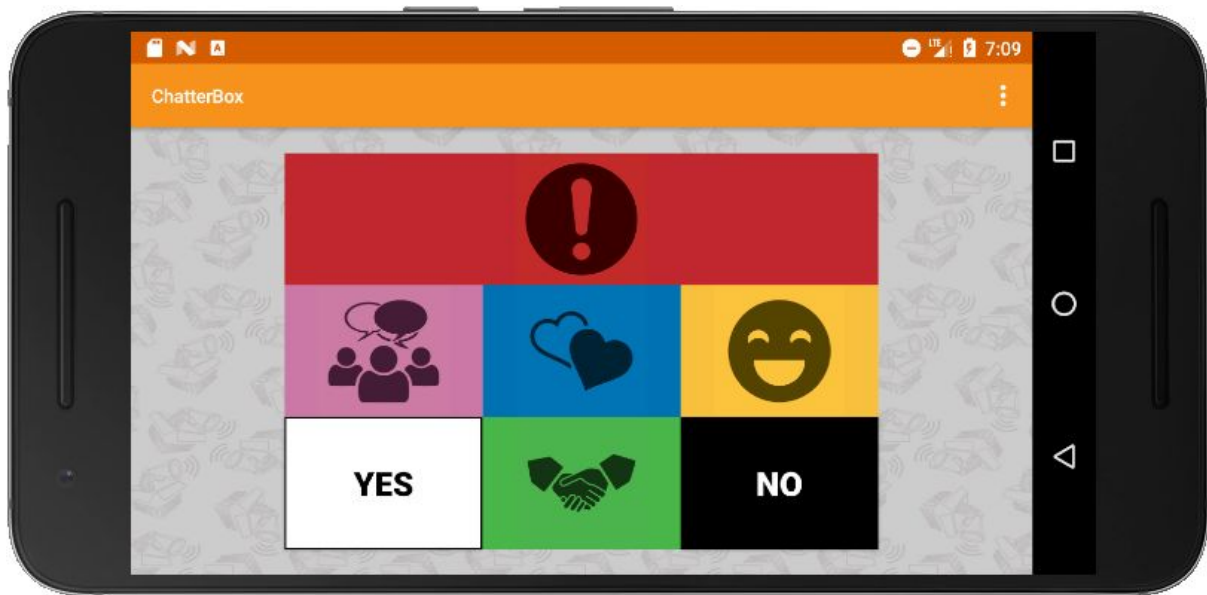Short meeting with the Lecture Greg South at 11.30am in the Westmoreland Classroom.
The purpose of this meeting was to expose and explain our finalists ideas from our previous meeting, seeking for his point of viewing/advice as a Lecture/Professional about any particularity that could support our decision and see better which of them could cover all the requirements and work for best results.

26th September, 2018.

Meeting at 10am at CCT- in the Wilde Classroom to talk about the information and decisions needed for filling the Project Proposal and Group Registration form, to be submitted by next Wednesday (03/10/2018).
We have also brainstormed few names for our App, and set individual Tasks about the research part, to find ideas of solutions for problems solving concerned to our project and which step would we be taking next.

In addition to this we have created an Asana (project management tool) profile, to help us to organize and assign individual tasks, and to keep track of the deadline.

26th September, 2018.

Meeting around 12 noon at CCT, in the Boole Classroom to watch the BBC documentary "The Big Life Fix" about how technology has changed and improved the lives of people who have disabilities. We focused on a case of a British man who had a stroke and from this point we started taking notes of the technological stages, challenges and processes the tech team faced.

8th October, 2018

Meeting after the Mandatory Lab Session, around 12 noon, in the slot that primarily would be filled by the Advanced Databases class with the lecturer Noel Cosgrave. But due to the lecturer's call in sick, the class was cancelled.
During the lunchtime, we visited the Advanced Hearing AID on 12 Aston Quay, Temple Bar, to ask for information regarding institutions that work with speech-impaired people.
Back to college, we chose the application's logo among three concepts previously designed, considering the most readable option.

The application`s GUI was also discussed in this meeting. We had already searched for applications' dashboards, for reference purpose. Thus, we decided which is the best position for the dashboard, menu buttons throughout the layouts, as well as the use of icons for the main menu/dashboard due to their immediate recognition. We did not decided at this point which colours would best serve the application when it comes to consider colour-blinded people. We are going to be doing further tests.
In order to have more information about the subject, as well as schedule interviews with professionals and carers, we emailed/phoned the following institutions/hospitals: Beacon Hospital, Irish Deaf Society, The Irish Association of Speech & Language Therapists (IASLT), Cluas and Health Service Executive (HSE), and phoned Irish Heart Foundation.

Until the conclusion of this report, only the Beacon Hospital and HSE emailed us back. The Beacon Hospital says on that email our message was forwarded to the pertinent department. No new reply has been made until now. The HSE recommended that we should contact the HSE Speech & Language Therapy Services for further advices regarding our request or contact the employee responsible in the Speech and Language Therapy Manager in the Eye and Ear Hospital in Dublin, both of which will be done soon.

The Irish Heart Foundation said that a professional who had worked with that specific public would call back, although we also did not receive any call until the end of the meeting.

Lastly we decided to do a more detailed search for the types of speech-impairments in order to develop an application that effectively attends the person's need. Each group member will be responsible to search and start paraphrasing the content in individual documents, which will be added in future as part of the general report.

11th October, 2018

Meeting at the Boole Room, at 09:30, to start defining the menu options of our application. We opted for the following main options:

1) Emergency
2) Daily Chat
3) Feelings
4) Fun
5) Greetings

Having defined these main options, we brainstormed the sentences for each category. We also discussed about which buttons should be fixed and that the keywords of each sentence should be highlighted in order to ease its finding.

The Beacon Hospital gently answered our email, giving the contacts of The Central Remedial Clinic, National Rehabilitation Hospital and an Aids and Appliances working group. We will be contacting them and try to schedule a meeting in order to exchange some ideas.

17th October, 2018

During the Applied Technology Group Project class, we learned who is our project supervisor, Greg South, and we sent him an email straight away in order to schedule tomorrow, 18th October, in the morning.

After the announcements and during the rest of the class we discuss about the position of GUI elements and which colours will be used in the buttons. We decided that the buttons to play the words "Yes" and "No" should be in all screens. We also chose the following colours for the dashboard and menu buttons, considering the emotional and psychological meaning of colours:

Emergency - Red
Daily chat - Pink
Feelings - Blue
Fun - Yellow
Greetings - Green

18th October, 2018

Meeting at Boole room at 9:30am. We had a wider discussion about the colours for the app's buttons, icons, background and also logo`s background colour, once it is part of its visual identity.

Using Adobe Illustrator we applied many colours in its colour UI to check if the buttons and icons are visible and following the concepts of Colour Psychology, which is the study *"based on the mental and emotional effects colors have on sighted people in all facets of life"*. For each new colour we applied a new colour-blind test was made on the website Coblis - Color Blindness Simulator.

We have also decided to create a background art with the app's logo, similar to what it is seen on WhatsApp default background image, but using a draw version of the logo.

The logo's background colour was also discussed and repeating the same previous tests we decided for a right complement to the logo's colours.

22nd October, 2018

First meeting with our project supervisor, Greg South, in the Mezzanine at 11:45am. We were asked what is currently our biggest difficulty at this first stages of our project, which is the collection of solid information about speech-impairment, more specifically the challenges in the communication between the patient and the carer.

We were also asked to show what we have been doing up to now. Thus we presented our application's logo, the detailed GUI wireframes with all the sentences we have pointed by far and the buttons' icons.

Greg reminded us to reference all our research and data presented that comes from other sources and previous studies, such as the Colour Psychology that we used to relate the buttons with a feeling referenced colour.

He also recommended that us should start thinking of the technical aspect of your project, for instance, what technologies we will be using such as Java, MySQL, PHP, TypeScript, etc.

25th October, 2018

Meeting at Boole room at 9:00am. Having the book *'A Student Guide to Object-Oriented Development'* as a parameter, we started working on the Problem Definition, more specifically on *'Problems with current system'*, *'Objectives of new system'* , *'Scope of new system'* , *'Recommended action'* parts, and part of *'Preliminary ideas'*, which includes a user survey. This last one, requires CCT's authorization due to the General Data Protection Regulation - GDPR, thus this part of the Problem Definition is currently holding off.

08th November, 2018

Meeting at Boole room at 09:30 am. We tried to get to a conclusion regarding the 'Individual & Group Assessed Contributions' for semester 1, which few questions were raised about which 'Deliverables' should be sent. We finished the 'Problem Definition' part that concerns the risk factors of this project.

Moreover, we briefly talked about which what types of technologies should be implemented for the application development.

13th November, 2018

Meeting with our supervisor, Greg South, on his office at 2:30 pm. We brought to his attention our questions regarding the deliverables we must send before the end of the semester. We learned that the part corresponded to Deliverable A: Quality (Structure, Research, Referencing) of Project Proposal is going to be the "Chapter 1" of our project academic report . This part is the one we must aim and structure accordingly, which means with introduction and respective references.

Greg asked us about the emails we have sent, concerning what type of questions and information we were looking for, in order to narrow our field research and possibly focus in just one source. He also informed us that he has sent both questionnaire and replies from our sources to the Dean of School, Graham Glanville, with his feedback. He told us that Graham

will be providing his views about this tomorrow in the Applied Technology Group Project class.

We also learned that the Deliverable 2: Self Evaluation Report 1 is already being done via Google Form, which we sent weekly with the individual contribution we have done to the project.

15th November, 2018

Meeting at Boole room at 09:30 am. After meeting with Greg South on the 13th of November and refined some questions that we were concerned with in the past few weeks, today Jacqueline Medeiros and Joao Pedro Haddad concentrated on filling the CCT Preliminary Ethics Approval Application because we need the CCT`s Dean assent to start our external information research. Clayton Crispim, Kleyton Soares and Maria fabiana Nunes focused on the chapter one of our final report development.

22th November, 2018

Today on our weekly meeting at Boole room we read the whole document regarding the chapter one of our final report`s development. We spoke about every single topic of the report and we made some alterations we thought were relevant and Kleyton Soares is going to review everything after the changes made. This week we also met with our group supervisor Greg South on the 20th of November and we had a productive conversation about the first deliverables.

27th November, 2018

Meeting with our supervisor Greg South who gave us his first insights about our chapter 1. He gently provided a sheet of paper with his words of advice. He also answered our questions regarding the Group Project Handbook mainly about the deliverables for this semester. He showed us some previous Group Projects and advised us to borrow these from Dermot Glanville so we may have a closer idea of what to do.

28th November, 2018

Meeting at Connolly Room, at 9:00 am, in the class slot of Applied Technology Group Project. Having Greg South's considerations from the previous day's meeting, we worked to do small, although relevant changes in the Project Report - Chapter 1. The changes involved the subchapters Introduction, Project Goals, Project Objectives, System Deliverables, User documentation & manual for prototype and List of References.

11th December 2018

Meeting with Greg South in the classroom where we discussed the final details of chapter 1. He emphasized the difference between Goals and Objectives which we still need to improve in the document. Kleyton Soares also showed him a prototype which made him enthusiastic and started questioning us about new limits for the application such as having at least some sentences linked up with the buttons and creating new features for example, enabling users to customize their own sentences.

12th February 2019

Meeting with Greg South in his office where we discussed the results of the first semester deliverables. We expressed our disappointment and concerns with the results provided to us and discussed how we should proceed from now on.

Later that day, a quick reunion with the members of the group took place after Remo's class, in the Yeats Room, where Fabiana showed us a few changes she has already made on Chapter One, and a spreadsheet she created, where we assigned tasks, responsibilities and deadlines for the next phases of our project.

20th February 2019

Group meeting in the Wilde classroom around 10:45 a.m. after the "DevOp" speaker, we went through the java code and functionality of our application, to understand how it actually works on the background so then we would get the idea behind the scenes and also explain it better on our chapter two, as we have a topic designated to the explanation of the whole java code present in our project.

We will follow the deadlines and tasks assigned to us according to the ones described on our Project_plan spreadsheet last week, next week we will then, revise these tasks and if everything goes well and we don't get any issue with the conclusion of the tasks assigned, we will re-assign new tasks to the group member from there on.

26th February 2019

Meeting with Greg South in his office where we raised a few doubts regarding the project, specifically how to proceed with information/ research we have done and we did not mention on Chapter One (delivered on the first semester), due to the GDPR policy.

We also asked about the request of two Class Diagram on the Student Handbook, in Chapters Two and Three, and he explained that one would more simple, a first attempt of brainstorming what classes would be needed to build the application and how they would interact with each other where the second one should be more detailed, containing attributes and methods. A question on whether or not is necessary a Java Code explanation on Chapter 2 was raised by the group and Greg said that maybe a only for a few code snippets but not the entire program.

We also showed Greg South our application prototype, which, at this stage, some of the sentences are already being played and also, the website for the application, that is under construction.

27th February 2019

Group meeting at Wilde classroom from 9.15am to 10.00am, then a break of 30 minutes for lecture talking, meeting kept going from 10.40 till 11.30.
We updated and uploaded on base camp our last version of Project Proposal Report to be analysed by Greg and we will be waiting on the follow up to change or modify chapters 1 and 2.
We are following our project plan described on our Project_Plan spreadsheet, the meeting purpose was to emphasize the tasks for this week, update the spreadsheet and put an initial deadline for the website conclusion.

2nd of April 2019

Meeting with our supervisor Greg South on the Mezanino to present our Application working for the first time and align the topics we are still missing on the report. The application seems great, intuitive and perfect functionality, we still have the "32 /15/ depends on the device memory bug" to debug, but everything else is great.

We also presented him our website, he loved it, said it seems very professional and clear, we discussed about chapter 2, change the name of the use case diagram, Greg suggested us to talk to Michael Weiss about it, and do a simpler use case diagram, also discussed about chapter 5 - Testing -and he suggested us to talk to Graham about the possibility of testing our application with a professional that deals with people that have the same problem we are trying to solve.

We spoke about the grading scheme that wasn't well/happily presented on the week before.

Meeting went well, now that we have Greg's analysis on the documentation we can proceed with changes and the development of our Report. For now we are happy so far, with all the positive feedbacks.

3rd of April 2019

Meeting at Wild class between group's components to discusses our tasks for next week. We have to try to finish as much as we can Chapter 2, 3, 6, 7 which are already in progress as we have been working on it as much as we can, the chapters are already assigned to each responsible for it. Next week we will meet again and go through the whole report together to decide what to change or what is missing that needs to be added.

We also had a meeting with Graham, he tested our application, he made us few questions about the application and about the report, he was quite amazed about it, he congratulated us for the great work we have been doing as a team.

We asked Graham, as suggested by Greg, about the possibility of testing our device with a professional, although Graham said that from his point of viewing, there is no need for that although what we can do is run few tests within CCT, with Business students, with the main purpose of testing the functionality of our Application and getting some feedback about user friendly of our app.

10th of April 2019

Meeting at Wilde class we pointed the tasks we completed last week (chapter 2, 4 and 7) and we also discussed the next steps to complete our documentation specially testing and conclusion.

We had a meeting with Graham where we asked suggestions about our documentation and got some feedbacks to be added highlighting the importance of amending a new chapter called "recommendations" for the future students to have as a reference when reading our project.

Another great achievement for our project will be the testing session scheduled for next wednesday 17/04/2019 at CCT, with Business students, with the main purpose of testing the functionalities of our Application and to get some feedback about the friendly usability built in our prototype.

17th of April 2019

Meeting at the Wilde classroom at 9 am, we discussed the testing session that was scheduled to take place today in the Bernard Shaw room with the 4th Year CCT Business students and we simulated the tasks beforehand the practical session.

At 10 am, Greg South brought us to Bernard Shaw room so we presented the overall idea and the app itself to the whole class. The students were divided into five groups and then we performed the testing session.

After testing the app with the groups and raising the data we planned to get, we presented our website to the students and got some feedback from them.

The presentation was a success and turned into a brainstorm emphasizing the business side of the idea. The testing session lasted 1 hour and 15 minutes in total.

24th of April 2019

On the 23th of April we had a meeting with our group supervisor Greg South at his office where we discussed many aspects that will be approached on the project's final presentation day (video, speech, prototype demo, etc...) and Jacqueline showed him the final output taken from the testing session with the CCT business students.

Today 24th of April meeting at the Wilde classroom Kleyton Soares organized the aspects that should be involved in the conclusion. We assigned the subjects to each member of the

group to get an overview of the final structure and from that we will filter the necessary lines to be included in the conclusion topic that is going to be written next week 1st of May 2019.

1st of May 2019

Meeting at Wilde class at 9 a.m. until 11.30 to read, put together and format the "Conclusion & Further Work" chapter that we had divided in topics in the previous week. We also worked on the edition of our screencast video.

2nd of May 2019

Meeting at Bernard Shaw classroom at 9:30 in which we discussed the conclusion section and executed some small updates. Regarding the project body, we included more contents, edited some topics and reviewed the entire project to make sure it has no spelling errors.

7th of May 2019

Quick meeting with Greg South to go through the final details of our project. Also a group meeting that started at Westmoreland classroom and continued at Yeats classroom to read, format and work on the final changes of our report.

Appendix C: Research Approval Letter

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24th September 2018

RESEARCH APPROVAL LETTER

To Whom It May Concern

This letter is to confirm that the BSc in IT (Level 7, Year 3) candidates below have received academic ethical permission to conduct the following research with permission from CCT College Dublin (CCT), Dublin 2, Ireland.

Candidates	Clayton R. P. Crispim - Student ID: 2016212
	Jacqueline Medeiros - Student ID: 2016273
	João P. H. Oliveira - Student ID: 2016220
	Kleyton Soares - Student ID: 2016144
	Maria Fabiana N. Santos - Student ID: 2016153

Faculty: Information Technology / Computer Science

Research Title: Communication App for the Speech-Impaired

Research Description: 'We are going to create a mobile application for Speech-Impaired people, especially those who had a normal life but due to a stroke or an accident, they can't speak anymore and sign language is not an option either'.

'Our goal is to assist these people by providing an interface that allows them to communicate with verbal communicators in a group setting'.

Data Collection: October 2018 to April 2019 (Online Questionnaire & Interviews)

The data collected above cannot be used for any future projects other than what is specified above. Data collected is for academic purposes and cannot be used in any attempt to commercialise this project.

If you require any further information, please do not hesitate to contact me.

Graham Glanville
Ethics Board Chair (Dean of School)
Email: graham.glanville@cct.ie

Figure 69: Research Approval Letter

Appendix D: Satisfaction Feedback

Attached you may see the users' satisfaction questionnaire feedback referred to page 80.

Please, rank each question from 1 to 5 based on how much you agree with the statements bellow. 5 means you agree completely, 1 means you disagree vehemently.

1. I thought the application was easy to use.

Strongly Disagree — 1 — 2 — 3 (✓) — 4 — 5 — Strongly Agree

2. I found the application unnecessarily complex.

Strongly Disagree — 1 — 2 (✓) — 3 — 4 — 5 — Strongly Agree

3. I felt very confident using the application.

Strongly Disagree — 1 — 2 — 3 (✓) — 4 — 5 — Strongly Agree

4. I thought there was too much inconsistency in the application.

Strongly Disagree — 1 — 2 (✓) — 3 — 4 — 5 — Strongly Agree

5. Overall, I am satisfied with the ease of completing the tasks given in the scenarios.

Strongly Disagree — 1 — 2 (✓) — 3 — 4 — 5 — Strongly Agree

6. Overall, I am satisfied with the amount of time it took to complete the tasks requested in the scenarios.

Strongly Disagree — 1 — 2 — 3 — 4 (✓) — 5 — Strongly Agree

Please, rank each question from 1 to 5 based on how much you agree with the statements bellow. 5 means you agree completely, 1 means you disagree vehemently.

1. I thought the application was easy to use.

Strongly Disagree				Strongly Agree ✓
1	2	3	4	5

2. I found the application unnecessarily complex.

Strongly Disagree ✓				Strongly Agree
1	2	3	4	5

3. I felt very confident using the application.

Strongly Disagree		✓		Strongly Agree
1	2	3	4	5

4. I thought there was too much inconsistency in the application.

Strongly Disagree ✓				Strongly Agree
1	2	3	4	5

5. Overall, I am satisfied with the ease of completing the tasks given in the scenarios.

Strongly Disagree				Strongly Agree ✓
1	2	3	4	5

6. Overall, I am satisfied with the amount of time it took to complete the tasks requested in the scenarios.

Strongly Disagree			✓	Strongly Agree
1	2	3	4	5

Please, rank each question from 1 to 5 based on how much you agree with the statements bellow. 5 means you agree completely, 1 means you disagree vehemently.

1. I thought the application was easy to use.

Strongly Disagree ___ Strongly Agree

| 1 | 2 | 3 (X) | 4 | 5 |

2. I found the application unnecessarily complex.

Strongly Disagree ___ Strongly Agree

| 1 | 2 | 3 | 4 (X) | 5 |

3. I felt very confident using the application.

Strongly Disagree ___ Strongly Agree

| 1 | 2 | 3 (X) | 4 | 5 |

4. I thought there was too much inconsistency in the application.

Strongly Disagree ___ Strongly Agree

| 1 | 2 | 3 | 4 (X) | 5 |

5. Overall, I am satisfied with the ease of completing the tasks given in the scenarios.
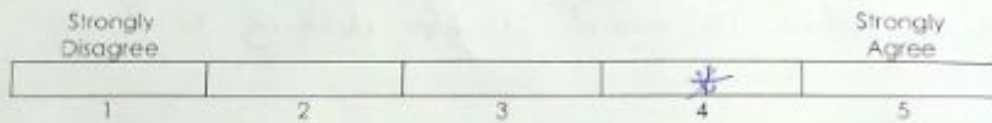
Strongly Disagree ___ Strongly Agree

| 1 | 2 (X) | 3 | 4 | 5 |

6. Overall, I am satisfied with the amount of time it took to complete the tasks requested in the scenarios.

Strongly Disagree ___ Strongly Agree

| 1 | 2 | 3 | 4 (X) | 5 |

Please, rank each question from 1 to 5 based on how much you agree with the statements below. 5 means you agree completely. 1 means you disagree vehemently.

1. I thought the application was easy to use.

Strongly Disagree				Strongly Agree
1	2	3	4 ✶	5

2. I found the application unnecessarily complex.

Strongly Disagree				Strongly Agree
1	2 ✶	3	4	5

3. I felt very confident using the application.

Strongly Disagree				Strongly Agree
1	2	3	4	5 ✶

4. I thought there was too much inconsistency in the application.

Strongly Disagree				Strongly Agree
1 ✶	2	3	4	5

5. Overall, I am satisfied with the ease of completing the tasks given in the scenarios.

Strongly Disagree				Strongly Agree
1	2	3	4 ✶	5

6. Overall, I am satisfied with the amount of time it took to complete the tasks requested in the scenarios.

Strongly Disagree				Strongly Agree
1	2	3	4	5 ✶

Please, rank each question from 1 to 5 based on how much you agree with the statements bellow. 5 means you agree completely, 1 means you disagree vehemently.
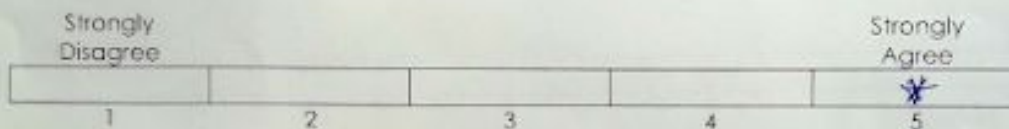
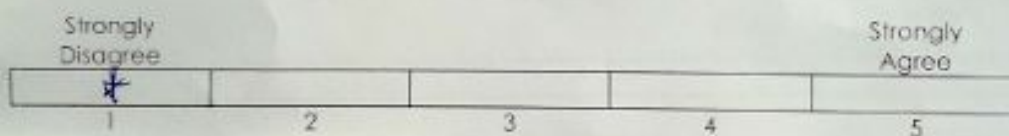1. I thought the application was easy to use.

Strongly Disagree				Strongly Agree
1	2	3	4	☒ 5

2. I found the application unnecessarily complex.

Strongly Disagree				Strongly Agree
☒ 1	2	3	4	5

3. I felt very confident using the application.

Strongly Disagree				Strongly Agree
1	2	3	☒ 4	5

4. I thought there was too much inconsistency in the application.

Strongly Disagree				Strongly Agree
☒ 1	2	3	4	5

5. Overall, I am satisfied with the ease of completing the tasks given in the scenarios.

Strongly Disagree				Strongly Agree
1	2	3	4	☒ 5

6. Overall, I am satisfied with the amount of time it took to complete the tasks requested in the scenarios.

Strongly Disagree				Strongly Agree
1	2	3	4	☒ 5

* Label Menu Icons

* Add a home button that allows you to go back to the main menu at one go.

* Add an emergency icon that only has ambulance button on the home screen to avoid double clicking to call.

Appendix E: Individual Contributions

Clayton Crispim - 2016212

My contributions to the project, at this stage, consist on the parts I will be pointing out bellow:

- First ideas - I did a research about projects that could be suitable for final students and presented what I found to the group so it could be discussed.

- Application's name brainstorming - After choosing what application we will be developing, based on my experience as Digital/Graphic Designer, I proposed a brainstorm session in order to help us to choose a name for the application. Thanks to it, among many words associations, the term 'chatterbox' came out. I knew that a product name is crucial to build the visual aspects that would and will come with it in the next stages of the project, such as logo, icons, GUI and website.

- Logo - I asked the group to send me some references of what they would like to see in the logo or the thoughts the name 'chatterbox' brings to their minds. Based on their references I drew three concepts of logo and presented to the group. Having the concept approved for us, on which I also expressed my considerations based on Graphic Designs concepts, I designed the logo using Blender 3D to help to design the logo letters with a realistic perspective and then I re-drew them on Adobe Illustrator, adding the rest of elements seen in the logo.

- Colour Psychology Research - I carried out a research about Colour Psychology to support the reason why we are using certain colours for the GUI and icons.

- Icons - Having the categories we wanted to divide our 'chatterbox' application, I designed two icons ('Emergency' and 'Fun') from scratch and re-designed more three based on icons which I had already developed previously ('Daily

Chat', 'Feelings' and 'Greetings'). I also used Adobe Illustrator to design these icons.

- GUI Ideas - Once this part has also its crucial portion of visual communication, I suggested that we searched for references, though this time for GUI and based on what we found I expressed my considerations about what would be better options for a practical and ergonomic graphic user interface.

- Group Journal - I did some group journals where I detailed what we had done or discussed on each of our weekly group meetings and meetings with the project's supervisor, Greg South.

- Final Report - I wrote the sub-chapters 'Working system' and 'Colour Psychology applied to the working system', with the contribution of Fabiana Nunes.

- Basecamp - I create the group account and project on Basecamp. I have been feeding the tool with notifications, meetings schedules and messages through 'message board' and 'campfire.

- Website - I developed the website using WordPress, therefore I was also responsible to implements its functionality through code source customization.

- Graphic Design and Photo Manipulation - In order to populate the website with images related to each section, I searched for pictures and then I digitally manipulated them.

- Screencast - My group mate, Fabiana Nunes and I worked together in the production of the screencast video.

Self Evaluation

I believe that the most challenging part of this project was writing the chapters. I contribute to chapter 1 and wrote chapter 6 (Website) entirely. I do not consider academic writing one my strong skills, even doing it in my mother tongue. The

reason why is because I consider rather difficult to organize the content in a correct way. And obviously I more likely to make mistakes when I am not writing in my native language, even though I really try hard not to do it, which makes the tasks harder, once I have to stop writing in order to check dictionaries and English grammar websites.

Concerning the three things I would have done differently. The first of them would be integrated the website with the application system, implementing a database if necessary, which I strongly believe would it be. The reason why I would like to have it already done is because Web Development was the path I intended to follow in I.T. , therefore having this part of the project done would add great value to my academic experience and to my professional curriculum.

The second thing I would have done differently is the logo. I do not mean I am not happy with the logo the group helped me to design, it works perfectly for what we need at the moment. Although, I can see some small issues, such as having a single version of it and not a horizontal version to better fit in a website header. This logo symbol and name are a single squared image and it can be hard to read in case the logo needs to be scaled down.

The third thing is to do a deeper study about Android Studio, so I could help to improve the interface and do the proper implementations. Once I designed the icons and presented the directions based on the Colour Psychology concepts to the group, it would be natural to me implement the Graphic User Interface in this case as well.

Jacqueline Siqueira de Medeiros - 2016273

My contribution to this projects was as follows:

Project idea - My first contribution to the group project on the first semester was to raise a relevant idea for an application, which was an application to avoid the waste of food.

Research - After we have decided on what idea we would follow, I looked for specialists in the speech impairment area, someone that could help us understand the needs of people who suffers with this problem. Even though I found a specialist in St. James Hospital, no inquiries were made as we were put on hold due to GPDR.

Wireframes - I designed the wireframes (version 1, version 2 and version 3 - the final version, and all of them can be found in this report) for the application using Mockplus, a prototyping tool.

Chapter 1 - I helped on topic Overall Problem Description, and researched and wrote the topics User Documentation and Manual for Prototype and Functional Testing and Usability Testing.

Chapter 3 - this chapter required a substantial amount of research under the topics User Experience and User Interface Design. All the topics and diagrams in this chapter was written and designed by me, apart from topic 3.5.1 - Sequence Diagram that was written and designed by Maria Fabiana and was initially on Chapter 2.

Chapter 5 - this chapter was very challenging to write as it demanded research, planning, decision making and analysis of results. Firstly I had to research about different testing techniques and which one we could apply to our project. After deciding on the Usability Test, I had to structure it to fit our purposes (think of the objectives, methodology, scenarios and questionnaire we would apply) and figure

out how to carry them on. After the testing was complete, I had to analyse and transcript the results to the report. All the topics in this chapter was written by me.

Chapter 7 - On the conclusion chapter I wrote about the potential of ChatterBox, how the feedback we had from the business group reassured our work and how we intent to keep working on the project and all the further work we are planning to do and also the final thanks (paragraph 11 onwards).

Testing - Beside writing the chapter on testing (chapter 5) I also performed a few tests on the application to see if it was in accordance to the requirements. Plus, I led and instructed the other members of the group on how to proceed and perform the acceptance test on the Business Faculty class, which we did together.

Group Journal - I registered some of our group meetings to the group journals.

Revision and configuration of documentation - I reviewed and configured certain parts of the document (for instance, Reference List and some items in the main document).

For me the most challenging part was to balance the time requested for this project with other commitments (for instance, I had to request Thursdays mornings off from work so I could attend the group meetings). But in the end it was all worth it, as I believe we achieved our goal and delivered a good work.

If I could do something differently I would say that I would like to have got more involved in the developing part of the project. Fortunately we intend to carry on with the project, and there are loads more to be done, therefore, my intention is to take part in this process.

I believe the most interesting part of the project is to see the final result. When looking back at the first wireframes and comparing to what the application looks now, we can clearly see how much the project evolved based on researches and hard work of all the group members. I must state how pleased I am with all the members of this group, even though some few moments of tension arose, which is completely

normal due to the pressure and complexity of this project, the respect and companionship always prevailed.

João Pedro Haddad Oliveira - 2016220

First Ideas - We needed to raise ideas at the very beginning and from the suggestions choose one to be the theme of our project so my first contribution was suggesting the bank blood system and the CCT Student app.

Research - After the final idea was voted by the group members I performed researches trying to find statistics about speech impaired people in Ireland, and I also sent some emails to people who could potentially help us on the project but unfortunately I found only few relevant information then Kleyton Soares and I went to a hearing aid shop attempting to get some useful advice.

Brainstorms - We had several group meetings where we discussed the path that our project would take and I tried to engage as much as I could making suggestions such as the idea for implementing colour psychology to be used in the app and Clayton Crispim carried out further research on it or when we got together to decide the colours and design that would compose our app and many others.

Chapter 1 - For the chapter one I did the organogram which is responsible for describing the contents in the app, Project Objectives, Android Studio in the tools and technology, I also reviewed and complemented some topics but in overall everybody worked on this chapter together. Jacqueline and I filled the Preliminary Ethics Approval application.

Group Journal - For the group journal I wrote few of them after our weekly meetings and Supervisor meetings at CCT college.

ChatterBox application - I was responsible for developing the media player on the application. The idea is to output sentences out loud every time a button is pressed so the users can express their basic needs through the interfaces. I did

several researches on audio implementation tutorials, Android Media Player, Audio Manager as well as tutorials on Android Studio and its features.

App debugging - I debugged a problem in the audio system. When testing the app I found that after using the audio feature for some time (depending on the android OS version) the app would stop playing the sentences forcing the user to shutdown the software and then restart it to get the audio working again for some more time. After many researches and tests I was able to implement a code method that corrected the problem.

Chapter 4 - I was assigned to write the chapter 4 of the project which consists of describing the system implementation, system architecture, the technologies used in the software and the problems encountered along the way.

Conclusion - Our conclusion was divided in five main topics so each group member could write some lines to be included in the text. I was responsible for the topics "Learned a lot" / "regular supervisor meetings" / "regular group meetings". After putting together all the ideas I was assigned to joining and connecting the pieces in just one conclusion.

Testing Session - We performed a testing session with the fourth year CCT Business student and it was more than we ever expected. Each member of our group applied the test to the five different groups and after data collection we had a brainstorm in the classroom where we could answer questions regarding our application and we could get useful feedbacks from the business perspective.

My biggest challenge in this project wat getting familiar with Android Studio, Audio manager and Android Media Player as well as the debugging task took me a lot of time and research. Another big challenge was to manage personal life, work and college assignments in what made time seem to be so short and sometimes got me thinking that I would not be able to keep up with all the contents and deadlines but now seeing our prototype working fully and this high level project documentation

completed I realise that everything worked so fine which gives me a rewarding feeling of accomplishment.

The whole project was a beautiful idea but for me the most interesting part was to learn the Android Studio environment and its folder structure and if I could change something I would have interacted more with the documentation part and I wish we had implemented more features in our app prototype but unfortunately we ran out of time. In overall I feel very satisfied with the project results and I consider myself very lucky to be involved in this group project where everyone worked so hard and aiming the companionship as the first priority.

Kleyton Soares - 2016144

I am responsible for the idea of creating a mobile application especially for people who had a stroke and need an alternative to communicate, such inspiration came from a BBC documentary called "The Big Life Fix" episode number 2. I found it quite interesting and decided to propose to my peers. Lucky me, this idea was accepted and this project is the result of it.

Based on the idea, I started looking for statistics in Ireland and in the world about people in these conditions but unfortunately I was not so successful so I went to two different hearing aid shops (one with Joao Pedro Haddad and the other with Maria Fabiana dos Santos Nunes) and talking to one of the clerks, he recalled there is no such question in statistics questionnaire in Ireland as presented on page 13. However, he kindly put us in touch with an expert to whom we sent an email and provided the answer as described on page 15.

Moreover, I set up a Google account so that we could store everything in the cloud using Google drive. The minor trouble we had is that Google could not keep track of individual contribution because everyone has been accessing the drive with the same credentials. I might suggest to do it different next time.

I have been responsible for the project formatting and revision which has been quite a challenge due to its complexity and length.

During the Christmas holidays, for personal purpose once I intend to follow the Software Development career, I started reading and watching tutorial about Android Studio and thinking about the project code implementation in spite of being told a number of times learning a new feature would not be ideal therefore, a better decision could not be made because Android Studio is perfect for Android app development. So, I began 'playing' with it and then I realized what I was doing was actually the initial prototype. When classes resumed and I showed what I had done to my peers, they were all amazed which made me carry on with their help. I coded the main Java classes and the different XML layouts to make the app responsive for phone with 5" screen sizes or so as well as 7" and 10" inches tablets. The voice

recording was also made by me and implemented by Joao. Many times, I disturbed Clayton for the different versions of the icons when adding to the application until I learned about how to convert them to image vector formats. Fabiana and Jacqueline were also very helpful when it came to sharing their opinions and testing.

I must confess I did not write a lot of the minutes but I did a few. However, I attached and formatted 90% of them to this document.

My personal mobile phone has an embedded feature which permits to record the phone screen and that is what I used to record the overall features of the application which was attached to the screencast - a short video presentation.

When it came to the conclusion, we all wrote some and I was responsible for the two first paragraphs. I also co-helped with the development of 'Overview', 'Inspiration' and 'Project Goal' sections of the chapter. I also wrote 'The Application - Final Result' on page 101 to demonstrate how the app evolved from wireframes to its final interface.

I was also present and performing the testing session with Business students. At the end, their lecture used our application as a case study which was very beneficial for us as well so I had the opportunity to present the application further and was able to answer questions related to the application with the help of my team. It served us as a mock presentation.

The biggest challenge for me was getting comfortable in using Android Studio especially when it came to make the app responsive for different screen sizes. The reward was certainly seeing it working fully in my own phone device. I am very proud to talk about the project as well as showing the final product to my friends. Their reaction is always unanimous: speechless.

Nonetheless, there is one thing I would love to get working despite of trying really hard but unfortunately I ran out of time. I wish I could have implemented an abstract class and its subclasses would be 'Emergency, 'Emergency_Call', 'Emergency_Pain', 'DailyChat', 'Feelings', 'Fun', 'Fun_Devices' and 'Greetings'. This

way, DRY (Don't Repeat Yourself) concept would have been reinforced. Also, it would be wonderful if we had had the voices recorded in a studio rather than home but hey, I have accomplished a lot more in the app development than initially expected.

Maria Fabiana Nunes dos Santos - 2016153

These are some of the tasks I carried out during the process of development of our amazing project:

Name of the Application - The name for *ChatterBox* was one of my ideas. Working as a nanny before, I used to like the way Irish people call their kids when they are learning how to talk, little chatterbox.

Idea of the Logo - The idea of the logo was also my drawing. I got a piece of paper and drew three different ideas and the group voted for the final one. Clayton implemented as he is the designer of the group. The original drawing can be seen on the chronological timeline (page 98) of our project.

Abstract and Acknowledgments - I structured and wrote these two topics.

Group Journals - Everybody has written it whoever would get a chance to do it first, it was never a problem, I personally did a few of them.

Chapter 1 - I did good part of it, few topics (Introduction - not all of it, Empirical Research, Tools & Technologies - Databases, System Analysis, how colour can affect business), the hardest step, sometimes, is to start something so I started the introduction and everybody else put along their thoughts and complemented what eventually I would have missed or forgotten to mention so, I will not point out because, in fairness, everybody worked on this chapter together. Also, after the feedback we had from the first deliverable, I was the one fixing the topics we lost marks, certainly we did agree about what to put there, but I formally wrote them down in the end.

Chapter 2, 3 - The system analysis introduction, high-level description, requirements, use case scenario, all the different diagrams - user interaction for all the different interfaces of our app, general use case diagram, high level class diagram, sequence diagram - on chapter 3, activity diagram, user story.

Recommendations Subchapter - For the recommendations subchapter (we had a brainstorm to put the ideas we would like to pass along) then I turned the ideas into the text described in this topic.

General Project Plan Spreadsheet - The general schedule plan with deadlines for the conclusion of the overall.

Detailed Project Plan Spreadsheet - A detailed project plan spreadsheet with different tasks assigned to each member of the group, a deadline to follow and description of any issues or problems we faced during the project.

Chronological Evolution of our Work - Created the topic and uploaded the figures for brainstorming, ideas for the logo (scratch) and first scope of menu interface.

Testing performance and presentation - We performed a testing script with the 4th year Business students in CCT, the class was divided in 5 groups so each team member was responsible for a distinct group.

Conclusion and Further Work - We divided our conclusion in topics so this way everybody would get a chance to participate in it. My part in the conclusion was the one that talks about researches.

Screencast Video - I am the one who did the script and put together the story and animation for our screencast video along with Clayton Crispim's help, we edited the video, so the final results were our job.

For me, the biggest challenge was always to try to balance this project, personal life, work, and still keep it a high level distinction final project. Researching and putting it together are always very hard, specially when we have to build a whole application and we do not have a sample or an example to follow. At the same time it is our own work, and I am proud of we did it so well.

 Working in a big group can be very challenging, but also a bless if everybody works as a team. I am thankful for all the effort and dedication of each member of

this group, and to be honest I do not think I would change a thing or do differently, maybe I would take back some of the stressful moments that we ended up taking on the group, most of us had those, but it is fine, it was a lot on our plate.

Thank you guys, I do not have words to describe how delightful I am for being part of this hard but beautiful job, it would not be possible without you all, and without the words of advice from our wonderful supervisor, Greg South.

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