Healthier Lifestyles App

Faculty of Science and Technology
Ambient Assisted Living
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Abstract

People with Down Syndrome compared to their peers without Down Syndromes are more likely to be obese, which can result to untreated hypothyroidism, but it can also be due to uncontrolled or lack information in regard to the number of calories in their daily intake as well as the level of physical activity. Some of the strategies in place are weekly group activities that are provided through organisations such as DSActive to help them socialise and take part in sport activities. To raise awareness of the calories in the food that are consumed on daily basis this research project aims to create a system to help people with Down Syndromes to understand harms of calories in food and to encourage healthy eating.

There are other measures in place to help people with Down Syndromes with controlling their weight and physical activity that are develop by Poseidon but it's hard to lose Wight without knowing healthy eating and this is the gap that this development is trying fill. This application is designed to be an easy to use and understand by using a combination of Poseidon approved symbols and images. This application was tested by people with Down syndrome and their careers and feedback was gathered through DSActive group meeting test. Results showed that both people with Down syndrome and carers found the application useful and liked the design, pointing out the opportunities for further development this application provides.

Acknowledgment

Each project in life teach us things that either we had known knowledge of just helps us to increase our knowledge on others things that we already know about. During this project I have learned much about struggle in life that we are facing in daily basis and we all need a bit of help or push to successes. Some of us need guidance and some need a bits more to be able to have a decent life and overcome their difficulties, just like this project which primarily aims to help people with Down Syndromes.

I faced many challenges during this project some were easy to overcome and some I needed a bit of assurance from friends, family and most importantly my supervisor Professor Juan Augusto who helped throughout this project by providing advice and continues feedback on my work.

I would like thank Professor Juan Augusto for giving me this opportunity to work on this unique project and his contribution in this project not only by providing feedbacks and guidance but his personal contributions in the Poseidon project and many of his works such as "User-Centric Software Development Process" which helped me in completion if this thesis.

I would also like to thank DSActive for their support and funding this project and specially Mr Alex Rawle DSActive Project Manager who helped me by providing many feedbacks and in evaluation of this project, Alex facilitated user testing and feedback gathering for this project and without his help this project would have never reach this stage.

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1. Introduction

Technology is finding its way through society and increasingly intertwining with our daily live from using mobile applications to control lighting in the house from distance to controlling health related issue, socialization between friends and family, that were almost made impossible because of long distance travel, entertainment from the comfort of ones sofa, getting the news from all around the world and many more. Its increasingly becoming challenging to build these technologies, engineers need to rely on a mix of system components, which are complex on their own and even more when combined. Although this is not entirely new in the Computer Science and Information Communication Technology fields, which have been developing systems of increasing complexity for decades. On the other had engineers in the 21st century is privilege with the rich history of tools and methods that are made available by their predecessors to increase productivity.

Engineers have been building application for decade's related issues above to improve the live style but there is always more to be done and areas that are in need of improvements and in this research project there is an specific area or group of people that has been undercooked needs looking at a unique group of people that are often forgotten or being ignored for unknown reasons by major research group in academic and non-academic institutions around the world, as well as giant tech and software development companies.

This thesis will be solely focused on people with Down syndrome (DS), on finding a technique to give them independent and full control of their day to day eating and learn about healthy eating to keep them fit and lose weight. To understand this project and the motivation behand it, it is very important to know what Down Syndrome (DS). Amongst the very few researches, the POSEIDON project has carried out a comprehensive research about ID and DS which will be used in this project with reference for guidance and compilation of this project.

A brief introduction in the next section of this report will give the reader information about DS, its types, characteristics of DS and finally understand their needs in order develop the application based on their needs.

1.2   What is Down Syndrome (DS)

It is important to mention and acknowledge people with Down syndrome are normal people just with extra especial needs like every other human being with feelings, abilities, strengths and weakness whatever their age.

People with Down's syndrome have always existed, but it was only in 1866 when an English doctor by the name of John Langdon Down published a description of the condition and it's common congenital chromosomal anomaly which occurs when there is one extra copy of chromosome 21 in cells in the body, it affect the physical development and learning abilities of people with DS. The incidence of DS is approximately 1 in 733 live births, making it the most common genetic condition in persons with special needs. There are three different types of DS, the first one is Trisomy 21 which effects 97% of cases, the second type is Translocation which effects only 2% of cases and third type is Mosaic which effects only, C. Wong, ET all. (2014).

- About 750 babies with Down's syndrome are born in the UK each year.
- Down's syndrome affects people of all ages, races, religious and economic situations.
- There are approximately 40,000 people with Down's syndrome living in the UK.

1.2.1 Down Syndromes Symptoms

People with DS are often carrying 9 different certain physical characteristics, NHS, (2018).

1. Below-average weight and length at birth.
2. Small nose and flat nasal bridge.
3. Small mouth with a protruding tongue.
4. Eyes that slant upwards and outwards.
5. Flat back of the head.
6. Broad hands with short fingers.
7. Reduced muscle tone that results in floppiness (hypotonia).
8. Big space between the first and second toe (sandal gap).
9. Their palm may have only one crease across it (single transverse palmar crease).

1.2.2 Personality

Although People with Down's syndrome do not have a particular personality to be categorized under as each individual is different, D S Society (2018) nevertheless there are some similar routine, order and consistency as a way of rationalizing and controlling their lives. Similarly, people with Down's syndrome may also use self-talk as a way of directing their behavior, expressing their feelings and making sense of what is sometimes a very confusing world.

1.2.3 Health issues

Health issues exist in each individual, but some have weaker response to some of the health issues and some recover better, IE (2013) people with DS have weaker response to some of the health issues such as,

- Congenital heart defects
- Susceptibility to infection
- Hearing (e.g. recurring middle ear infections), vision, thyroid and respiratory problems
- Obstructive digestive and neurological problems and leukemia
  DownSyndrome.

People with DS tend to live more socially isolated and sometimes there are issues related to their metabolism compounded with cognitive challenges which contributes to a tendency to obesity. So, there is a strong value on providing them support to increase their awareness of which food is better for them, which can be coupled with exercise and activity trackers to improve their fitness and health.

1.3   POSEIDON project

The POSEIDON research project (Personalized Smart Environments to increase Inclusion of people with Down's syndrome) is working within the European Union's Program aims to improve the live people with DS with the use Information and Communication Technology (ICT) as a tool to increase the quality of life and support a more independent life and inclusion in the society.

In order to understand and develop intelligent devices for more autonomy and independency is the way to helping people with DS, POSEIDON (2015) the Berlin Institute for Social Research (BIS) in collaboration with Sussex University, Fraunhofer Institute, Tellu and Middlesex University Poseidon project designed questioners with 35 question in English and translated in German and Norwegian addressed to their protégées and took half an hour to be completed.

Ten European countries Down syndrome associations showed their interest in the project and have sent questioners to all these different countries as well holding two workshops in Oslo in Norway and Mainz in Germany. All the questioners that were sent back to the DS associations were checked, it revealed that people with DS are generally familiar with ICT equipment's.
This has shown the Interest of people with DS to ICT which could be used in order to help them socialize with others, live more independent to be able to take a bus to home, going to supermarket, pay for foods or goods, eating out late night and sitting in a restaurant with friends which is very simple for those with no special needs but these are some of the barriers that people with DS are facing and the POSEIDON project , POSEIDON (2015) has created many application to help them with these activates such as,

- Navigational app: helps people with DS guide themselves including bus routes.
- Calendar app: helps them remember things during the day. For example, to remember what time they have to go to school and what are the things they need to put on the sack.
- Money Handling app: helps to practice with handling money
- Shopping app: helps them before they go shopping remembering how much money, they need and what they have to buy shown in the figure 8-9.

But still there are some gaps that need to be filled, which this research project aims to fill these gaps and help people with DS to live a full independent life.

1.4   Project funder background (DSA active)

DSActive is administered by Down syndrome is Accusations (DSA) working with children and adult with Down syndrome, operating in England and Wales was created in response to the awareness of the sedentary lifestyles of many children and adults with Down's syndrome and the subsequent health problems, including obesity, resulting from lack of exercise and participation in sport.

The aim of the organisation is to improve the lifestyle of people with Down syndrome's by providing sports activities such as football, tennis athletics and currently looking on creating an application to help people with DS to make healthier choice on their eating and drinking. Therefore, an application that can translate all the confusing calculations of calories and graphs that are currently used the healthy eating application to a sample and easy to understand concept.

Alex Rawle a Health, Wellness and Fitness Professional and DSactive project manager, has been the primary contact throughout this project between the Middlesex university research group and DSactive to provide feedback from main user in the organization and accommodate user testing.

1.5   DSA requirement

The requirement put forward by DSActive were to create an easy to use and easy understand application not only for those with reading and writing abilities but even the group of users without the abilities to read and write to be able,

- "To provide information on a healthy diet and to help people with Down's syndrome to make informative choices about their diet.
- To offer participants the chance to track their food consumption to reduce their awareness of their diet.
- To offer participant the chance to track their activity to increase their awareness of how much activity they do each day.
- To produce an app which is useable and suitable to the needs of people with Down's syndrome over the age of 16".

In another email below received from Alex Rawle project manager and in charge of this project he advised using symbols with colours as per below,

The preferred way of showing the benefited and harm of the food in this application requested by DSActive would be to replace the numeric calculations of the calories with smile faces in three different colours, each colour would represent how healthy or unhealthy their food is or has been and measure their progress by showing how many smile face they have achieved, *"The original message requesting the changes removed for privacy"*.

2. Literature Review

Studies shows that adults with DS are more likely to be obese compared to their peers. This can be as a result of untreated hypothyroidism, but it can also be due to excessive dietary intake in relation to the level of physical activity. There are many strategies to prevent this, such as reducing portion or avoiding surgery snacks, but the most effective strategy Saunders, R, ET al (2011) is to empower the users monitor their own weight and physical activity and their eating habit.

Research's also shows there are many simple and basic day to day life habits or transitions that are sample to other but found to be difficult for people with DS, S. Brigstocke, C particularly the basic of use Arithmetic and number.

A common characteristic is that peoples with Down syndrome have, Terje, G. et al (2017). tight schedules and time management. Mobility is a central issue and most interviewees indicate, they wish to be more independent in their mobility. They would like to go out in evenings unaccompanied or even travel abroad alone. It is also worth mentioning from one of the secondary users: "He is so proud when he does something by himself. Being independent would be a huge boost to his self- esteem and give him the confidence to try harder challenges." having an independent life without the need to depend on adult supervision is the most important step for them and this is the part where POSEIDON is introducing ICT to unable them have that transition.

Looking at section 1.3 of this thesis there are some application build to assist the primary users with living independently but there is more needed to be done to give them full control of their mobility and to be able do so, there are known general aspects of the POSEIDON-suite of services which are followed in POSEIDON apps to create applications and services to keep user-central focused, in application development are as following,

Personalization

Is keeping each individual user preference at the core of this research development that could be adjust to the needs of main users' people with DS who are in center of this development and secondary users are their career and family's.

The knowledge about end users by POSEIDON, Terje, G. ET al (2017) suggest keeping in mind the following challenges and Strengths for personalization of this development,

Challenges

- "they are often visually oriented end users.
- They may have visual and hearing impairment.
- They may have difficulty with fine motor skills.
- They may have difficulty with the short-term working memory.
- They may have difficulty with learning, conceptualisation, abstract thinking and problem solving.
- They may have a reading difficulty, and some do not read at all.
- They may have difficulty in the application of existing knowledge in new situations/contexts".

Strengths

- "they can master many activities of daily life with appropriate support or through repeating training over an extended period.
- They are often clever users of information technology such smart phones and tablet PCs".

2.1 Existing application

In this section of the thesis some of the existing and commonly used application for healthy eating and diet control are being looked at to understand the functionally of use and comment features between them.

1. MyfitnessPal

This application is the number one on the top 10 best apps for healthy eating of google search. The listing states, Allen, J. (2017) "MyFitnessPal offers a huge food database, listing over 5 million different foods. An effective calorie counter, it can take you less than 5 minutes a day to track your diet and exercise, meaning it's a quick habit to get into".
As shown in the figure 1, it uses numbers, calories, charts and diagrams to show the user progress and the number of calories they have burned by running, walking or any other exercises.

Not easy to login to the application the user must sign up and the process takes 5 mints to be able to use the application.
Background and text colours make it default to read the information, charts and graphs are not easy to understand, Allen, J. (2017).
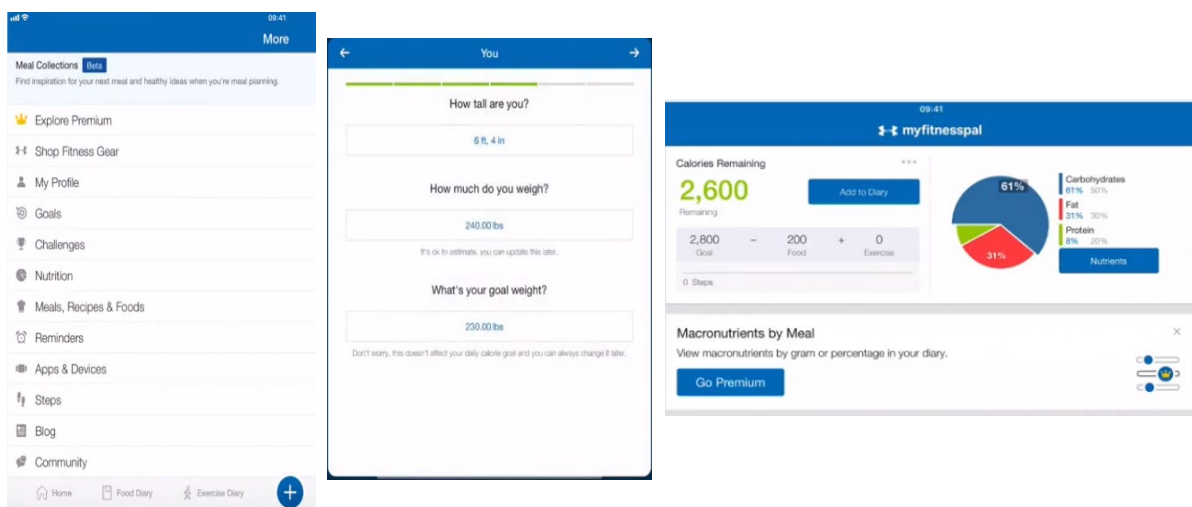
Figure 1　　　　**Allen, J. (2017)**

Features
- Access to Food Database - 6+ million foods in our database including global items and cuisines.
- Barcode Scanner - Simply scan barcodes to log foods. 4+ million barcodes recognized.
- Recipe Importer - Easily import the nutrition information for the recipes you cook.
- Restaurant Logging - Quickly log menu items from your favourite restaurants.
- Food Insights - Learn how to make healthier choices about the foods you eat.
- Personalized Experience - Create your own foods, recipes, and meals and save favourites.

- Calorie Counter - We automatically calculate the calories in your foods, meals and recipes.
- Track All Nutrients - Calories, fat, protein, carbs, sugar, fibre, cholesterol, vitamins, and more.
- Customize Your Diary - Log breakfast, lunch, dinner and snacks or create your own meals.
- Water Tracking - Log water in cups, ounces or ml. We save your recently logged amounts.

Negative point

- Requires the users to add their personal information, such as name, age, weight, height
- User are required to login using their personal information or using a social media account.
- It requires the user to read and understand each section, images and bright colours are used
- Not all the features are available for the user to use free user needs get the premium version by signing up to a monthly fee using their bank, credit card details or any other payment method.
- User needs to setup goals by manually entering the data into the application for accurate calculations of calories.

2. FatSecret

FatSecret shown in the figure 2 is 2nd on the top 10 application for healthy eating by google ranking , Allen, J. (2017) it helps the user to keep track of their food, exercise and weight, using the an online food databases and nutrition database and connect people global are looking to make a change for the better and start losing weight and achieve their goals by heathy eating with the following functionalities,

Features

- A barcode scanner and auto-complete functions.
- Health app, and Fitbit exercise tracking integration.
- An exercise diary to record all the calories you burn.
- A diet calendar to see your calories consumed and burned.
- A weight tracker.
- Reminders for meals, weigh-ins and journals.
- Notifications for support, comments and followers.
- Fantastic recipes and meal ideas.

Negative point

- Requires the users to add their personal information, such as name, age, weight, height
- User are required to login using their personal information or using a social media account.
- It requires the user to read and understand each section, images and bright colours are used.
- Not all the features are available for the user to use free, user are required to get the premium version by signing up to a $6.99/month $19.99/quarter $38.99/year fee using their bank, credit card details or any other payment method.

- User needs to setup goals by manually entering the data into the application for accurate calculations of calories. Allen, J. (2017)
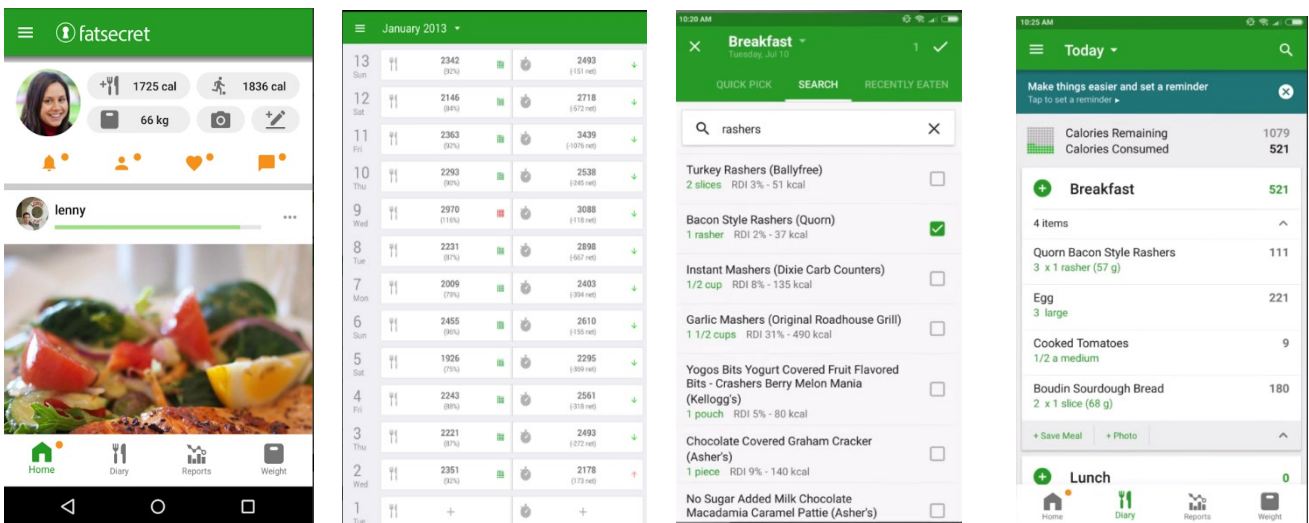

Figure 2   **Allen, J. (2017)**

3. Lose it!

Lose it, helps its users to by showing how many calories each item content by allowing the user to scan the barcodes of the foods and it automatically shows fat, sugar and other ingredients shown in figure 3. It also encourages users to eat more fruits and vegetables simply by giving challenges. Some of the colours use for text are disturbing the eyes of the users and makes it hard to read, links are close to each other which make it very easy to make mistake by click on the wrong link.
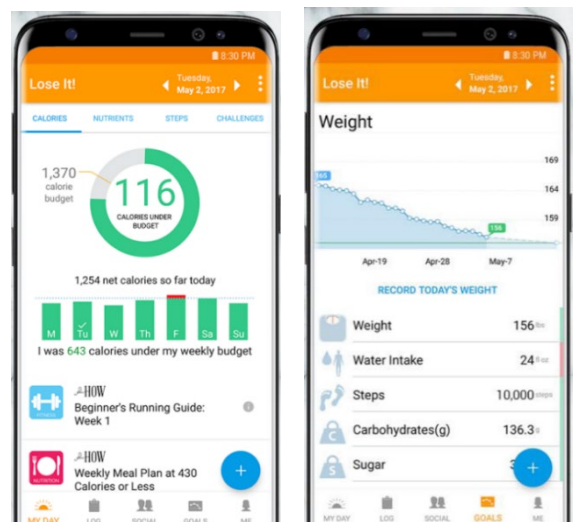
Features
- ✓ FitNow, Inc. (2018), Track more than just calories.
- ✓ Connect trackers, apps, & devices like Fitbit trackers.
- ✓ Step up your game with fun weight loss.
- ✓ Create your own private challenge with friends.
- ✓ Stay on track with Meal Targets.

Figure 3   **FitNow, Inc. (2018)**

4. My Diet Coach

My Diet Coach is a fun and interactive application shown in the figure 4, it provide healthy eating options for its users, Allen, J. (2017) it's on the top 8th application in the google healthy eating applications, this application motivate the users by allowing them to create their own avatar to help them stay on track, make healthy lifestyle changes, resist food cravings, avoid exercise laziness and other weight loss difficulties.

Features

- Helpful tips and tricks for common weight loss setbacks
- Keep photos that motivate you and be reminded about it!
- Your LOST weight counter (Your efforts are precious)
- Daily inspirational quotes
- Customize your avatar – Earn virtual fashion items
- Your avatar slims down with you
- Break your weight loss down into small victories
- Useful diet reminders
- Daily Challenges
- Food Cravings Panic Button -
- Weight and measurements charts

Negative Point

- Requires the users to add their personal information, such as name, age, weight, height
- User are required to login using their personal information or using a social media account.
- It requires the user to read and understand each section, images and bright colours are used.
- Not all the features are available for the user to use free, Allen, J. (2017), user are required to get the premium version by signing up to a $3.99/month or $19.99/year fee using their bank, credit card details or any other payment method.
- User needs to setup goals by manually entering the data into the application for accurate calculations of calories.
- Sharing personal information online such as user photo and location.

Figure 4   **Allen, J. (2017)**

5. MyNetDiary

MyNetDiary is paid application to download and subscription $8.99/month or $59.99/year shown in the figure 5. The app forecasts user daily weight loss based on calorie deficit, including food, exercise and steps. It's your coach-in-a-pocket, giving advice and tips on how to eat better and lose faster.

The application is not as clear on how it could be used, although it is not overloaded with the text or buttons but there is no clear indication on how it can be used.
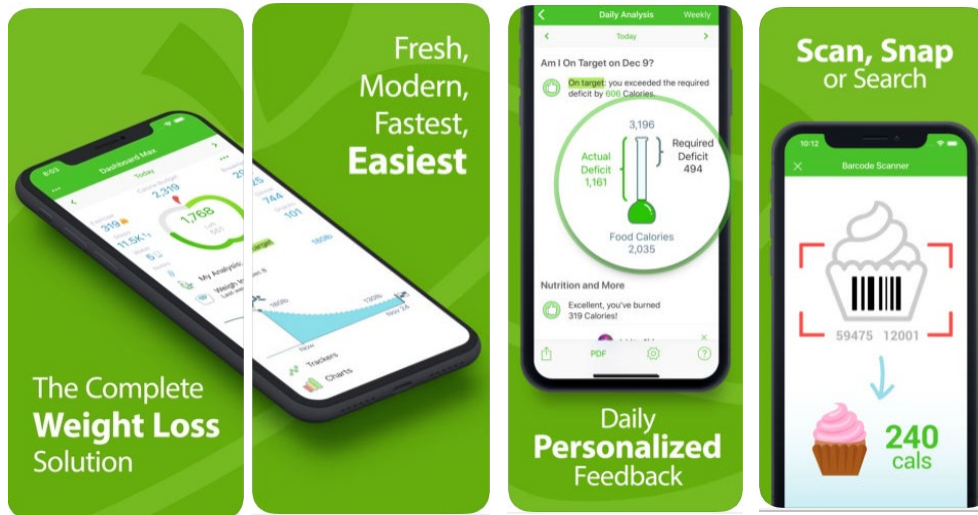
Figure 5   **Allen, J. (2017)**

Features
- Weekly diet analysis
- Up to 35 nutrients
- Recipe editor
- Plan macros
- Full set of charts

Negative Point

- Requires the users to add their personal information, such as name, age, weight, height
- User are required to login using their personal information or using a social media account.
- It requires the user to read and understand each section, images and bright colours are used.
- To download the application it will cost £3.99, user is required to get the premium version by signing up to a $3.99/month or $19.99/year fee using their bank, credit card details or any other payment method.

6.   Healthy Food

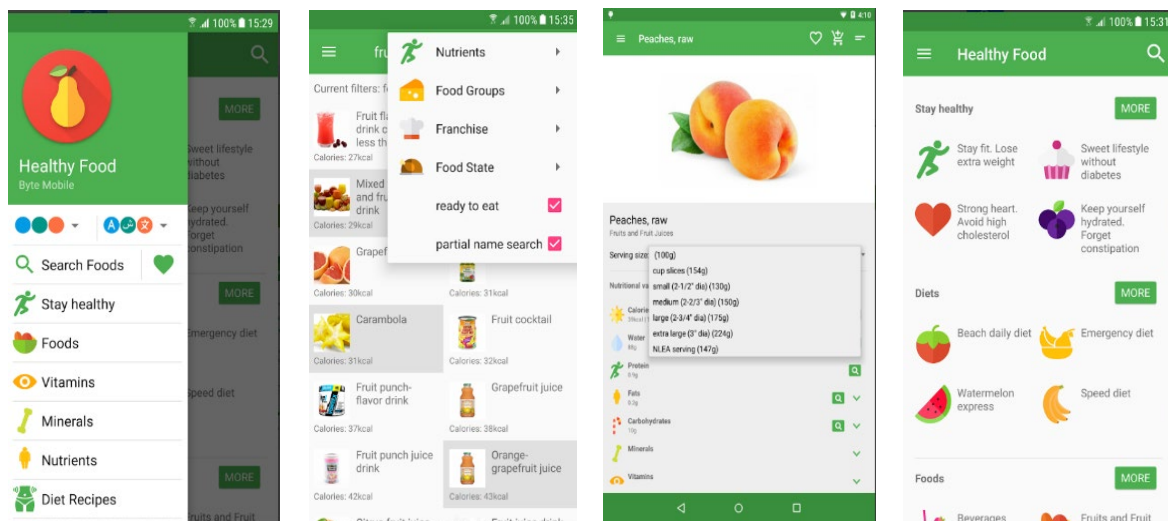**Figure 6**   **Healthy Food application**

Overview

Application in figure 6 allows the user to check the food calories and understand what each portion of the food contends, such as Vitamins, Mineral and nutrient. It allows user to create a profile using their personal information and to record what they are eating to keep them aware and altimetry keep them in shape.

- User can create a profile.
- Search for foods.
- Check for Diet recipes.
- Get information about the food nutrition and what it contends.

Each page is loaded with information and images, once clicking on the images it will open a second window content the item information, each button or link are squeezed which makes the selecting a page challenging.

Most importantly UI is designed in a way that if the user is not familiar with the application it's hard to understand what this application is made to do, and the features are not very clear.

2.1.1   Comparative Analysis

The purpose of the (Table 1) is to compare applications from (figure 1-6) and understand how easy it is using the feature these application, and if not what can be changed or what is/are missing. The parameters measured in the table1 refers to the main objective of this project while some of them need some clarification: BLE connection means the ability of the app to connect with Bluetooth Low Energy (BLE) devices, like heart rate monitoring bands, which can contribute to gather significant data.

Table 1 Applications comparison

	MyfitnessPal	FatSecret	Lose it!	My Diet Coach	MyNetDiary	Healthy food
Registration required	✓	✓	✓	✓	✓	✓
Records weight	✓	✓	✓	✓	✓	✗
Reminds to weigh	✗	✗	✓	✗	✗	✗
Weight feedback	✓	✓	✓	✓	✓	
Simple info display (table, charts)	✗	✗	✗	✓	✗	✓
Simple interface	✗	✗	✗	✓	✗	✗
Easy to reach features	✓	✗	✗	✓	✗	✗
Easy to understand (words, images)	✗	✗	✗	✓	✗	✓
Easy to read (text size, colours)	✓	✗	✗	✓	✗	✗
Tracks steps	✗	✗	✗	✗	✗	✗
Tracks calories	✓	✓	✓	✓	✓	✓
Reminds to exercise	✗	✗	✓	✗	✗	✗
Customizable weight goals	✓	✓	✓	✓	✗	✗
Customizable exercise goals	✗	✗	✓	✗	✗	✗
Profile creation	✗	✓	✓	✓	✓	✓
BLE connection	✗	✗	✗	✓	✗	✗
Scale connection	✗	✓	✓	✓	✗	✗

Studies shows, Oesterreich, D.et all (2015), more than half of people with DS are familiar with using smart phone, tablet, laptop and pc but looking at (figure 7) the percentage of those using tablets are higher and lease likely to request help with using tablets than using smart phones, how and why of this question was answered in an open-end question. "The smart phone is not as useful to my son visually or manually, too easy to make mistakes and cause frustration. The iPad is bigger and is useful for his self-esteem and his chill out time and he can use some of the features unaided".

Referring to (table 1) in almost all of the applications,
1. Have smaller buttons.
2. Close to each other which means making mistake easier.
3. Some colours are disturbing for the users to read,
4. Text size are small.
5. Not clear labelling of the pages.
6. Overloading contends information in some pages.
7. Keeping user in uncertainty of the next step.

People with DS are unlikely to be able to use above listed application without struggle or a family /career assistance. There are many other applications available to download from app store and google play which almost all of them designed to burn calories and provide guidance on how to exercise, recording weights for a wider range of user excluding people with special needs.

People with DS are more likely to use an application that are easy to use such as having bigger icons, button to click on, lease disturbing color to allow them read some of the text without having face any challenge to do so, and all these points are vital for this research and development process.

Therefore, this research development project is following the guideline from POSEIDON apps as mentioned in section 2 of this thesis as guidance for UI design as well as accessibility options. Some feature of the applications above will be use as guideline for improvement of MyDietControl app.
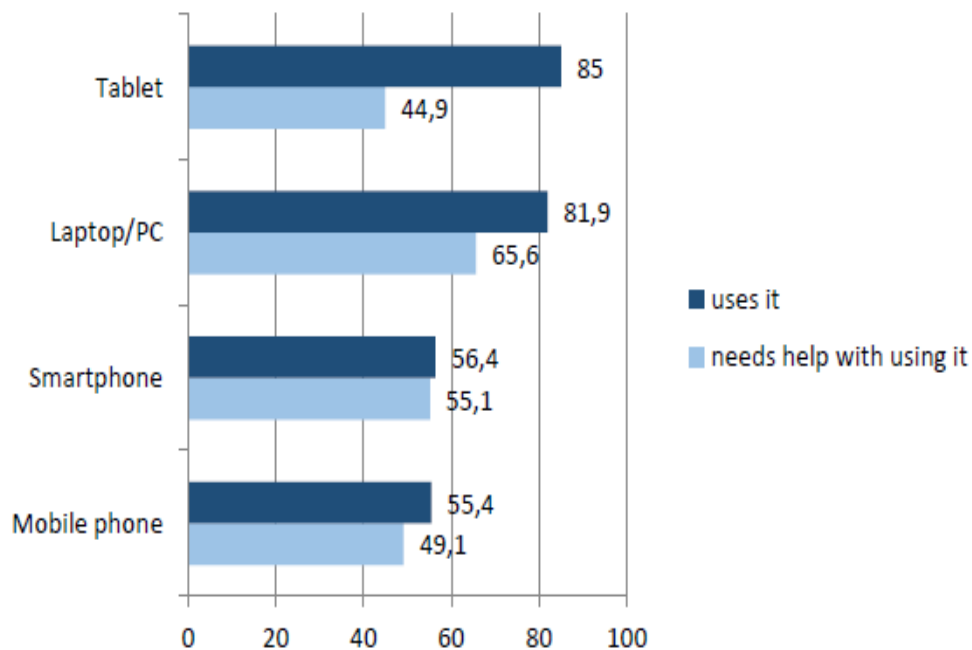

Figure 7   Owning Smart phone and tablets using application on them   POSEIDON (2015)

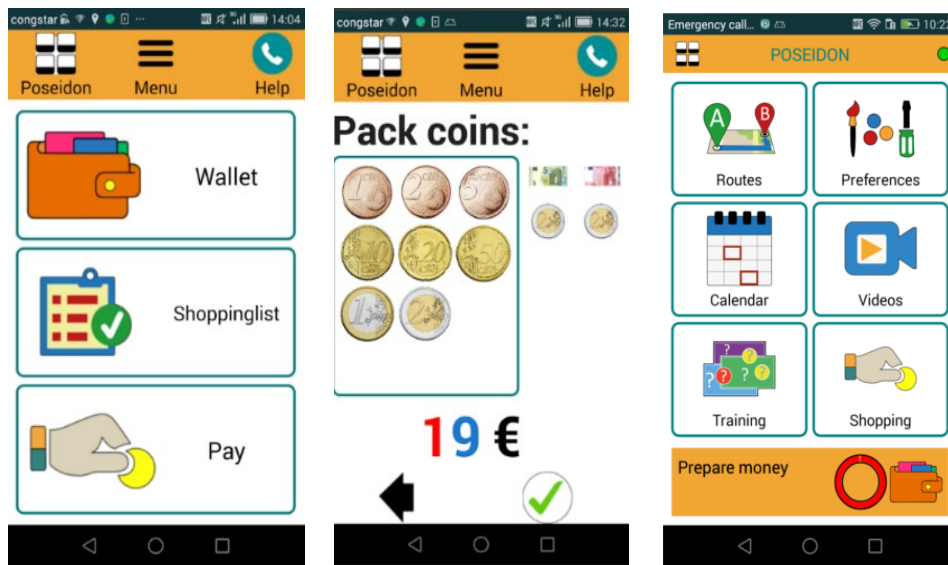## 2.1.2 Poseidon App (review)

Figure 8   **Poseidon (2017)**

As mention in section 1.3 of this thesis there are some application that helps people with DS with their mobility (figure 8), help the users to manage their Wallet by helping them understand the value of the money they have, shopping list that could be prepared by themselves and helping them get around by following the routes option.

This application meets all the requirement of use for the primary user, the color contrast is, icons, images and user interface are all according to the POSEIDON-suite of services as mention above.

This application (figure 9) is another example of the Poseidon application where once again meets all the POSEIDON-suite of services as mention above.
This application helps the user to trace their daily activities and is using the Fitbit technology where user can use wearables to check their heart rate, check how many calories they have born and count the number of steps they are taking, and it will send all of the data back to the application.

Figure 9 POSEIDON fitness tracker Poseidon (2017)

Overview
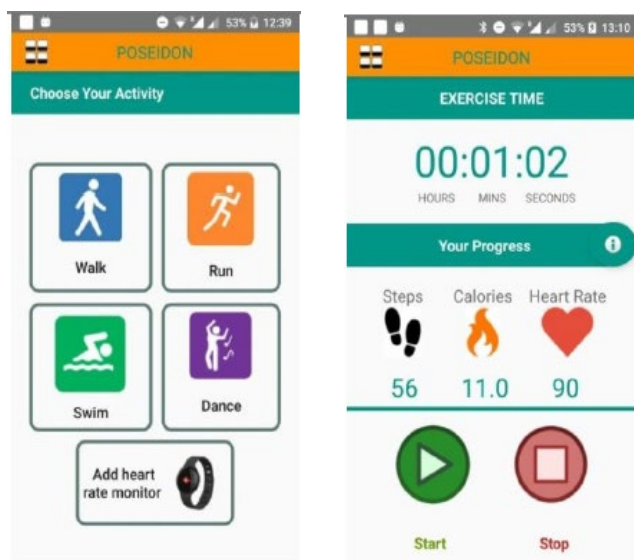Poseidon applications in figure 8 & 9 both meets the Poseidon guideline but none of the above application do.

2.2 Ethical Issues in Software Development

It is important to mention as a researcher and developer for this project, handling sensitive information such as personal information with maximum care to use their information correctly and not falsely advertise their information, (Data Protection Act 1998).

List of ethical issues to face as a developer and or a software company,

- ✓ Using illegal software without appropriate license.
- ✓ Rewriting engineering code without mentioning the source.
- ✓ Failing to address known bugs.
- ✓ Protecting client data privacy and safeguarding all the information that is being trusted to the developer.
- ✓ Creating a functional application under the term of the contract of time budget.
- ✓ Recording changes to requirement throughout the development process.

Also, the eFriend framework proposed by Auguto et al (2013a) advocate the development of an application or a system in a manner by which is explicitly aligned to priorities a number of articulated principles to empower users of intelligent environment systems are as following,

- "To deliver help according to the needs and preferences of those who are being helped.
- To preserve the privacy of the user/s.
- To prioritize safety of the user/s at all times.
- To adhere to the principle that the user is in command and the computer obeys, and not vice versa."

  (Augusto et al, 2015)

The ethical principle of developing a system is to concur the non-maleficence of the system throughout the development process by not developing a system to cause harm to the intended primary users and similarly understanding the principle of how the system could be beneficence for the primary user in terms of increasing their independency of making healthier choices and improve their healthy eating for people with down syndrome (Augusto et al, 2015).

The eFriend frame is consent of nine generic ethical principle as shown in table 2 and each of them raise legitimate ethical concern and some of them are mapped onto this project (Augusto et al, 2015) the mapping of eFriend principals started as early as intervening the slaveholders to gather the functional requirement to finalising the application development, as describes bellow,

- ⁂ Non-Maleficence and Beneficence
  - o The projects aim to enhance wellbeing of the primary users by giving them independence and social inclusion by allowing them to make healthier choices completely indignantly by display information in a context that is easy to understand, by incorporating measures to avoid any risks or harm by not storing any form personal information that could identify the user.

- ⁂ User centricity
  - o All Poseidon related project pursues a user-centric approach, as is this project aims to develop an assistive application in collaboration with primary user and their careers by keeping the user feedback at the hearth of the development by getting continues feedback via DSActive representative to insure the system delivers to its intends.

- ⁂ Reliability

- People with DS can be easily frustrated, therefore the system is made mad as sample and as informative as possible to avoid frustration, as shown in 16 to 23 the use small text is minimized, colours and images used to describe the harms and benefits of the food, drinks etc.
- Once the application is downloaded no internet connection is required for the application to run.
- No logging in is required.

Table 2   eFriend Framework 9 principal   (Augusto et al, 2015)

Generic Principles	Domain specific principles and practical guidelines
Non-Maleficence and Beneficence	• The system should avoid causing harm to any of the users • The system should proactively seek for opportunities to assist users • The system should actively benefit users by enhancing their welfare and quality of life
User-Centred	• Users should be placed at the centre of the development process • The type of technology and associated services should be agreed with users in advance • The system should be designed and implemented in accordance with users' wishes, ambitions and values • The systems should be customisable to dynamically evolving individual needs, preferences and requirements
Multiple User Groups	• The system should be aware of the different needs and preferences of all individuals in a multi-user environment • The system should consider how to balance the competing rights, preferences and requirements of different users
Privacy	• Users can specify privacy levels and preferences for different services • Users decide on, and can change, levels of acceptable recording, monitoring and tracking of activities
Data Protection	• Users have access to the sensitive information stored about them and can decide what can be done with this information • Users can determine levels of information-sharing and disclosure • The system should seek informed consent to secondary uses of personal data by 3rd parties • The system should adhere to recognised principles and good practices of data protection
Security	• The system should protect users and their information • The reliability and stability of systems must be ensured • The security of data transfer must be ensured • Adequate security measures and standards, appropriate to different environments, must be provided
Autonomy	• The system should support and enhance the independence and autonomy of its primary users • Users should have the freedom to override or "switch off" the system at any time if they find it unhelpful • Users should be trained to operate the system to the extent they wish • Users can determine for themselves degrees of protection, privacy and information-sharing
Transparency	• All users should be clearly informed of the pros and cons of the services offered by the system, including system capabilities, potential weaknesses, vulnerabilities and negative consequences • Users should be given notice of the existence of intelligent environment activity in an open manner • Background data processing, monitoring and surveillance should be made visible to users, where possible
Equality, Dignity and Inclusiveness	• The system should provide help regardless of age, technical background and ability • Affordability, fair provision, accessibility of technologies should be ensured • The system should accommodate different levels of cognition and competence • The system should reduce social isolation and not substitute for human care

2.3 Aim and Objectives

The aim is to develop an easy to read and understand mobile application running on android device to help people with Down's Syndrome make healthier choices on their eating to,

> ➢ Reduce unhealthy eating
> ➢ Give them healthier option throw out the day and encourage healthy eating.
> ➢ Raise awareness of the unhealthy foods
> ➢ Help them lose weight.

The objectives are as below

> ➢ Conduct an analysis, design, test and evaluation of the application.
> ➢ Create an easy to use and read application without reducing the app functionality.

2.4 Research Project proposal

The aim of this project is to understand the common problems of people with Dow's Syndrome are facing with using the already available healthy eating application and find a solution to eliminate those obstacle by creating design to provide healthy eating advice, healthy recipes, and a way of tracking food consumption, ultimately give them the freedom of making healthier eating choice using the application by them self rather than being told by their care takers and parents and some of these problems are explained section 2.19 in personas 1 to 3 of this thesis.

The main objective is to of the research is to find a way to minimize the number of obesities on those with Down's syndrome and helping them reduce diabetes.
After several meeting with DSA member regarding this matter and looking to find a suitable solution to this problem, the primary requirement for the application was as following.

2.5 List of functional requirements

Admin/Parents
1- Allowing the admin to add more healthy eating option for the specific users.
2- Checking what are the best healthy option for the day
   o Breakfast
   o Lunch
   o Dinner
   o Snacks
3- Display items to the users.
4- Allow parental/admin check.
5- Allow users to receive notification if some of the important items have not been used (water).
6- Allow parent to make comment and add more choices.

<u>Users</u>
7- Allowing the users more foods to the list when they want.
   - ➢ Breakfast
   - ➢ Lunch
   - ➢ Dinner
   - ➢ Snacks
8- Users should be able to access the app in any android mobile devise.
9- Users should be able to see their progress
10- Users should be able to choose from the list provided for them as a portion
11- Users should be able to check their daily, weekly and monthly progress on their healthy and not so healthy eating.
12- The users should be able to contact the app support (DSA) when they want to for support.

2.5.1   List of Non-functional requirement

1) The system will record the daily eating of the user after the user submit data to the system.
2) The system should be functional and available to users 24 hours per day;
3) The system must not take more than 5 minutes to recover from a system failure;
4) The system must have a friendly and self-explanatory interface to prevent misinterpretation of the information given;

2.6 Stakeholders

Stakeholder refers, C.Fontaine (2006) to any person, society, groups or organizations that somehow have interest or need to the project are considered stakeholders.
In case of facilitate ambient assisted living studies by Evans C. et al (2014) show these types of projects involves five different stockholders, which are then divided in to three levels shown in figure 10.

Primary stakeholder in the POSEIDON project are represent the individual who are directly affected or are the application is aimed for in this case, primary stockholder are people with down syndromes.

Secondary stakeholders are frequently in direct contact with people of Down syndrome's or in another word those who are involve directly in the life of the primary users or stakeholder, such as friends, family members and dedicated careers.

Tertiary stakeholders or users are those who are less involve with the day-to-day life of the primary users and these are from educational, work or health care person, such as school teachers, employers and work colleagues.
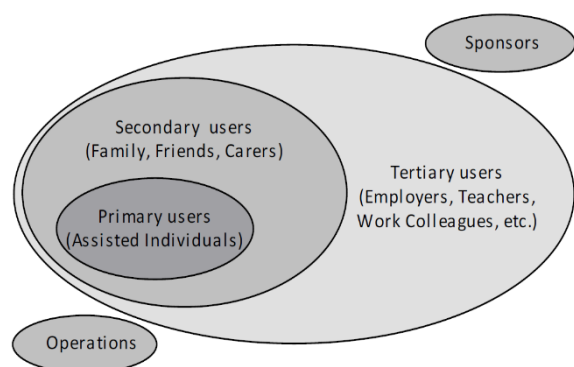

Figure 10   Categories of Stakeholder

2.7 Software & Hardware

The aim is to design as a web application with user friendly graphical user interfaces which should be widely supported by different platforms as well as being platform independent. Now a day's web developers are spoiled with chooses for developing web applications and stand-alone application such as Dreamweaver CS, Cloud9 IDE, HTML5, Adobe Edge Inspect, G(2006). And the list can go on. In this project Java was chosen as a development language and android studio as a platform, reasons behind is their functionalities and easier to use to create a better design.

Some of the other software that will be used in this project are
- Java
- SQL
- Power point
- Word document

Some of the hardware to be use are
- High processes CPU
- Ram
- Hard drive
- Mobile phone
- PC/Laptop

2.7.1 Operating system Analysis

An operating system is peace of software setting in a hardware such as computer, mobile, tablets and other similar devices to allow communication and handle everything that the users do from clicking a mouse to connecting a Wi-fi or Bluetooth. Each operating system is built run on a specific device by the manufacturers companies such as Android, Microsoft, Apple (iOS), Blackberry and other main brands, J, Vincent. (2017).

There are currently eight different operating system but the most used are mainly apple iOS and Google android which almost dominate the mobile industries as shown in (figure 11).

Operating System	4Q16 Units	4Q16 Market Share (%)	4Q15 Units	4Q15 Market Share (%)
Android	352,669.9	81.7	325,394.4	80.7
iOS	77,038.9	17.9	71,525.9	17.7
Windows	1,092.2	0.3	4,395.0	1.1
BlackBerry	207.9	0.0	906.9	0.2
Other OS	530.4	0.1	887.3	0.2
Total	431,539.3	100.0	403,109.4	100.0

Figure 11   current devices using Different Operating system   J, Vincent. (2017).

2.7.1.1 Apple iOS

Apple iOS are only operating on apple devices such as iPhones, iPods, iPads, MacBook's and some other apple devices. This makes the iOS operating software very specific and limited devices only as shown in figure 7 & 11 and therefore creating an application for iOS will limit user to apple products only and the aim of this project is to make this application available for as many users with DS as possible, Gsmarena (2018).

2.7.1.2 Google Android

On the other hand android operating system are running in almost 75% of other devices which makes it the most used operating system, not only the google devices are running on android operating system but all other major mobile brands such as HTC, Nokia, Alcatel, Huawei and many other are using android operating system, Gsmarena (2018).

2.7.1.3 Chosen operating system

The most common operating system in between people with DS and in general is the Android operating system as shown in (figure 11-12). Therefore, because of the limited time for development of the MyDietControl application the Android operating system will be used although it could be also added to the iOS operating system in late stage for further improvement as there potential to be improved more for all the devices without being to choose between the devices.

Figure 12   Gsmarena (2018)

2.8 Platform of choice

It is important for a successful software engineer to adopt a methodology and select a method of doing a project to ensure smooth and a flawless work is done. For this project the agile technique will be used solely because it is one of the most used and useful methodology that allow the developer consensually to check each phase at completion of each iteration.

2.9 List of final deliverables

➢ Functioning software application running with (SQL database)
➢ Literature Review
➢ Schematic models
➢ Expert Testing
➢ Evaluation/user testing

2.10 Systems development life cycle

The systems development life cycle (SDLC) is a theoretical project management model which is used to describe the phase involved in development of an information system project, which requires careful planning, execution and management from the very beginning through the maintenance of the completed application to increases efficiency and minimises the danger of item failure. Consequently, if not managed properly, the disadvantage would be blown-up budgets, stressed out developers, unhappy client and probably a very tight time frame to re-do the cycle TechTarget (2009).

The most commonly SDLC method used and known according to tochopedia.com is waterfall model, which involves taking the following order of in consecutive steps, planning, requirements gathering, design, development, integration, testing, installation and acceptance to be able to re-run each step for producing a new way to improve the prototype as the customers requires as shown in figure 13. Some methods work for different type of specific projects yet the fundamental component for project success is the manner by which closely the arrangement was followed Alhir,SS (2008).
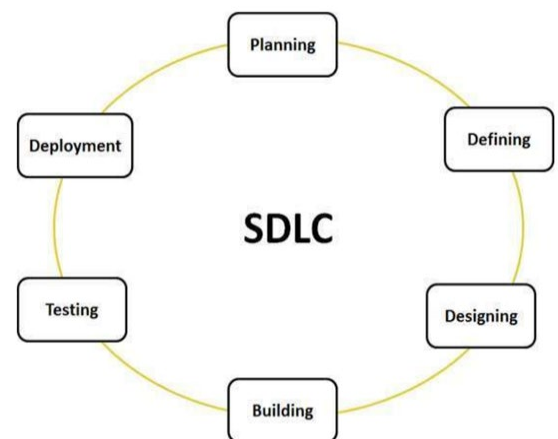

Figure 13   SDLC Diagram Sommerville, Ian (2011)

2.10.1 Planning

Initiation and planning is the first and the most important section of SDLC, this is the stage where the senior members, marketing managers and other experts come together to plan a project and conduct product success probability, financial and operational aspect and technical areas Sommerville, Ian (2011).

2.10.2 Requirements

Upon the completion of the first stage, the second stage will be the requirement gathering, to collect the right information in about the project; therefore, meetings will be arranged with clients to understand the user point of view and what they require from the product, Sommerville, Ian (2011).

2.10.3 Designing

Design stage is where the developer is creating a prototype of the system to present to the client, at this stage the client gets to choose make changes and add or remove any functionality that they do or do not require, Sommerville, Ian (2011).

2.10.4 Developing

Developing of the product starts at this stage of SDLC, where the coding language are being chosen as of the developer experience and knowledge of using the language, such as Java, C#, HTML and CSS. Sommerville, Ian (2011).

2.10.5 Testing

At this stage of the SDLC, the products all aspects will be tested such as fixtures, design, functionality, usability and very importantly does it meet the customers required design, Sommerville, Ian (2011).

2.10.6 Deployment

The final stages of the SDL is when a product is passing one or more integration, meaning completing one full scale and pass all the usability testing an inspection, Sommerville, Ian (2011).

2.11 Methodologies

In system engineering, system development methodology or software development methodology is a framework which is used for planning and controlling of the process of information system (IS) developing There are many methodologies available, and each one has its own pros and cons, depending on the project requirement and developer choices. These methods are not always the best option and they shine at their best only when the project to be applied to has certain characteristics, listed below are some of the most commonly used methods, Itinfo.am (2016).

1. Waterfall (a.k.a. Traditional)
2. Agile
3. Scrum
4. Spiral
5. Rapid Application Development (RAD)
6. Extreme Programming (XP)
7. Unified Process (UP)

2.12 Proposed features

The application will have certain generic features, these are presented in table 3, below. Additionally, functionality will be added to this list of features after receiving feedback from stack holders,

Table 3   Proposed feature for Healthy eating app DSA

Features	Actions
Adding as a portion	Allowing the users to choose each item as a portion.
Images	All foods, drinks and snacks are displayed as an image rather than just adding name.
Calories	Instead of counting the calories all the healthy option will be display as a happy face in green and unhealthy foods are displayed with an unhappy face.

Flexible GUI design	Software must be flexible with any types of android devices or screen resolutions size.
Summery	Summery are shown by the end of each day. Week and months yearly still to be decide.
Reviews	Users will be able to give their views and feedback
Choosing from list	Allowing the user to choose the available food, drinks and snacks from the list.
Adding more foods, drinks and snacks	Users and admin should be able to add or remove items from list.

2.13 Waterfall (a.k.a. Traditional)

The waterfall method, as the name suggested follows sets of steps shown in figure 14, in order to get to the next one in other word, each phase has its own distinct goals of development where phase one have to completed for the next to start and there is no turning back. "It is a popular method of the SDLC model for software engineering and often considered the classic approach to the system development life cycle", SegueTechnologies® (2018)
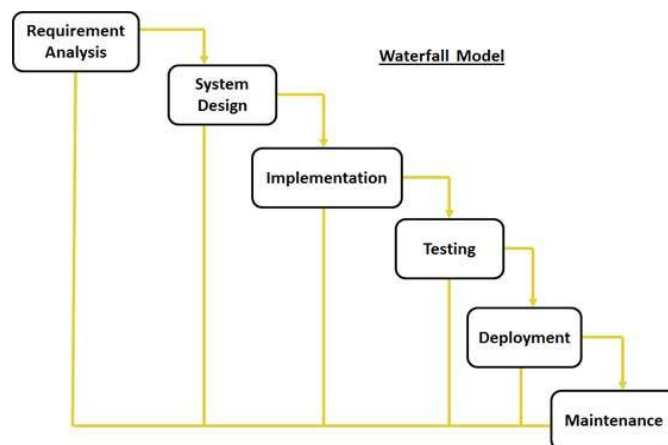
Figure 14   Waterfall Diagram   tutorialspoint (2017)

Advantages of Waterfall method:
The obvious advantages of the waterfall development method are that it gives full control to the developer on each department to stay focused on tasks designated and work to the schedule.

Disadvantages of Waterfall method:

- Testing only takes place at the end of project which make it is very difficult to go back and change if needs changes employed.
- There is no working prototype or software is produced until late during the life cycles which mean high risk and uncertainty. water
- Not cost effective for big projects for an ongoing project.

2.14 Agile

The word agile means the ability to move quickly and easily and the agile approach to the software development life cycle mean the same, as it allows the software developer to make important changes to the prototype and the project whenever necessary quickly and easily. This method is a "theoretical framework for software engineering promotes development iterations throughout the life cycle of the project." Within this method, there are a number of software development methodologies, which are sometime used as an individual method e.g. Dynamic Systems Development Model (DSDM), Scrum and Crystal Methods techalone(2017).

As mentioned above, the agile methods reduce risk of being unable to make changes to the project without going over the budget by allowing iterations throughout the life cycle of the project. The agile approach use iteration, which is a miniature software project of its own which includes all the necessary tasks such as planning, requirements analysis, design, developing, testing. This method also engaged the customers throughout the work by getting real-time feedback, communication via email or in most cases face-to-face to make sure the customer can see the product long before competition and allow the customers to having a saying throughout the project if they would like to make changes to the actual design, (Itinfo.am, 2016).

➢ Agile programing is similar to the Spiral methodology except that Agile has shorter iterations as shown in figure 15.

Advantages of Agile methodology
1. Customer satisfaction by continuing to deliver useful software
2. Offers More frequently a working software than any other methodology
3. Accepting late change
4. Effortlessness
5. Regular adaptation to changing scenarios.

Disadvantages of Agile methodology

- Time consuming as regular changes are made throughout the design.
- Deficiency of documentation on essential designing concept.
- Uncertainty of the final project can be created in some cases when engaging the customers through the design, which can take the project off track.

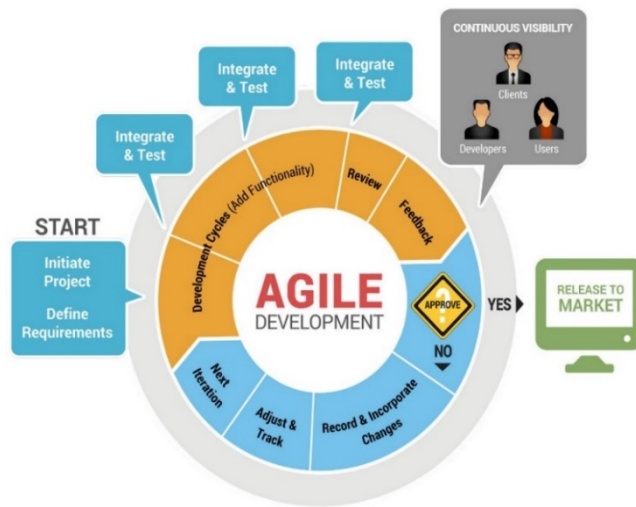- Limited to the professional programmers and senior developer only.

2.15   User-Centric Software Development Process, or U-C SDP

"Our User-Centred Software Development Process model is more specific than other well-known models which have been used for decades in software engineering; still it keeps a degree of generality to be applied to any area where user-centred systems are built. Intelligent Environments is one such area where users are at the core of systems conception and U-C SDP is well-suited to guide systems throughout all stages" Augusto, Juan Carlos (2014).

U-C SDP is a combination of waterfall and agile or Scram methodology but much more practical manageable chunks that keeps the user at heart of the development and reminding the developer along the process of the important stages, it also helps the deployment go faster through these cycles. User-Centric Software Development Process is preformed clockwise and there is a total of three stages in this cycle shown in (figure 16) which it initially starts at the centre of the cycle by interviewing the stakeholders and goes clockwise Augusto, Juan Carlos (2014).

A. Initial Scoping
  a. Interviewing stakeholders, each project start by meeting and interviewing the stakeholder and understanding their needs.
  b.   Define Required Services, translation the information gathered from the interview into the services.
  c. Define Required IEs Infrastructure, extracting the functional and none functional requirement from the interview.
  d. Initial Design and Prototyping design the first prototype and going back the stakeholders.

B. Main Development
  a. Design, after interviewing the stakeholder the using the data from the first stage a detailed system development and coding will start at this stage.
  b. Implementation and Testing, once the coding is done the system needs to be tested by the developer which will include software, hardware and human-computer interfaces.
  a. Verify Correctness, this stage will verify weakness of the system from the developer point of view and amendments will be made.

b. Interview Stakeholders, after the amendment the stakeholder will have a chance to test the system and provide feedbacks in terms of functionality and design.

C. Intelligent Environment Installation
   a. Equipment Validation. After completion of the implementation for feedback the system hardware, network and device interface such as server will needs to be setup and tested.
   b. Software Validation, software is deployed on the infrastructure and the behaviour of the system such as functionality, user interface, links, and navigation between pages can be tested by users.
   a. Services Validation, this will check if the system can do what it was intended to against the system requirement that were provided.
   b. Interview Stakeholders, once the first iteration is complete is goes back to the stakeholder to check the system.
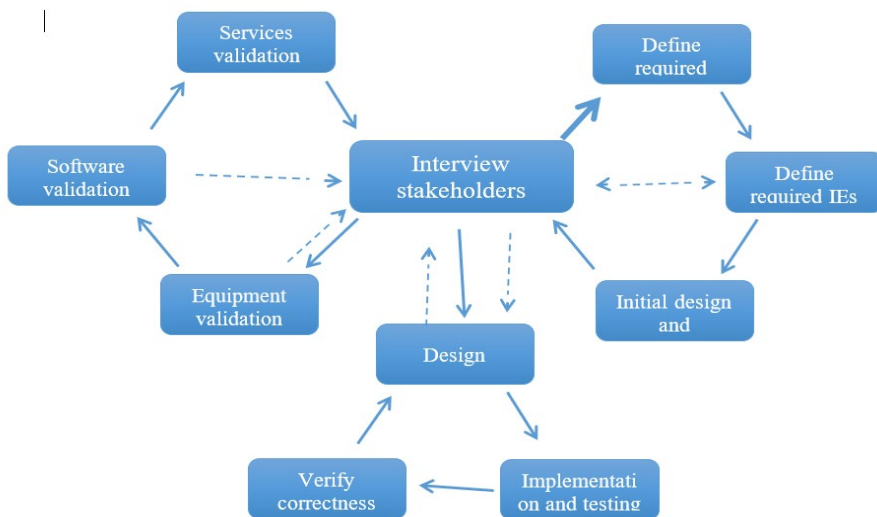
Figure 16   U-C SDP   Augusto, Juan Carlos (2014)

2.16   Chosen methodology

After comparing some of the available and most used methodology, the preferred methodology which is most suitable for the project is User-Centric Software Development Process, or U-C SDP some because of it is ease of use, limited time of delivery and number of people working on this project.

2.17   Use Case Diagram (UCD)

Use case diagram, is a graphic representation of a system to clarify and identify the system requirements. It shows a user interface and it clarifies the user involvement in a system figure 17.

It contains actor, use cases, Systems Boundary, association and note shown in table 4, to show the users functions in order to achieve a goa, (TechTarget (2009).

Table 4 Key Elements of the use case Diagram

Symbol	Name	Description
	Actor	An actor in a use case diagram represents a type of role that is placed by the user of a system. Typical examples of a user could be a human user or external hardware
	Use Case	Typically an Actor (user of a system) will be associated with a use case in order to process a particular systems specification; it is an action performed by the system
	Systems Boundary	Actors and use cases which are internal to a system are drawn inside a Systems Boundary for the purpose of separating actors who are external to the system.
	Association	An association is used to represent an existing semantic relationship between two elements of a use case diagram.
	Note	Essentially, a note does not hold any semantic force, however is included when need be to help indicate an action of a system further.

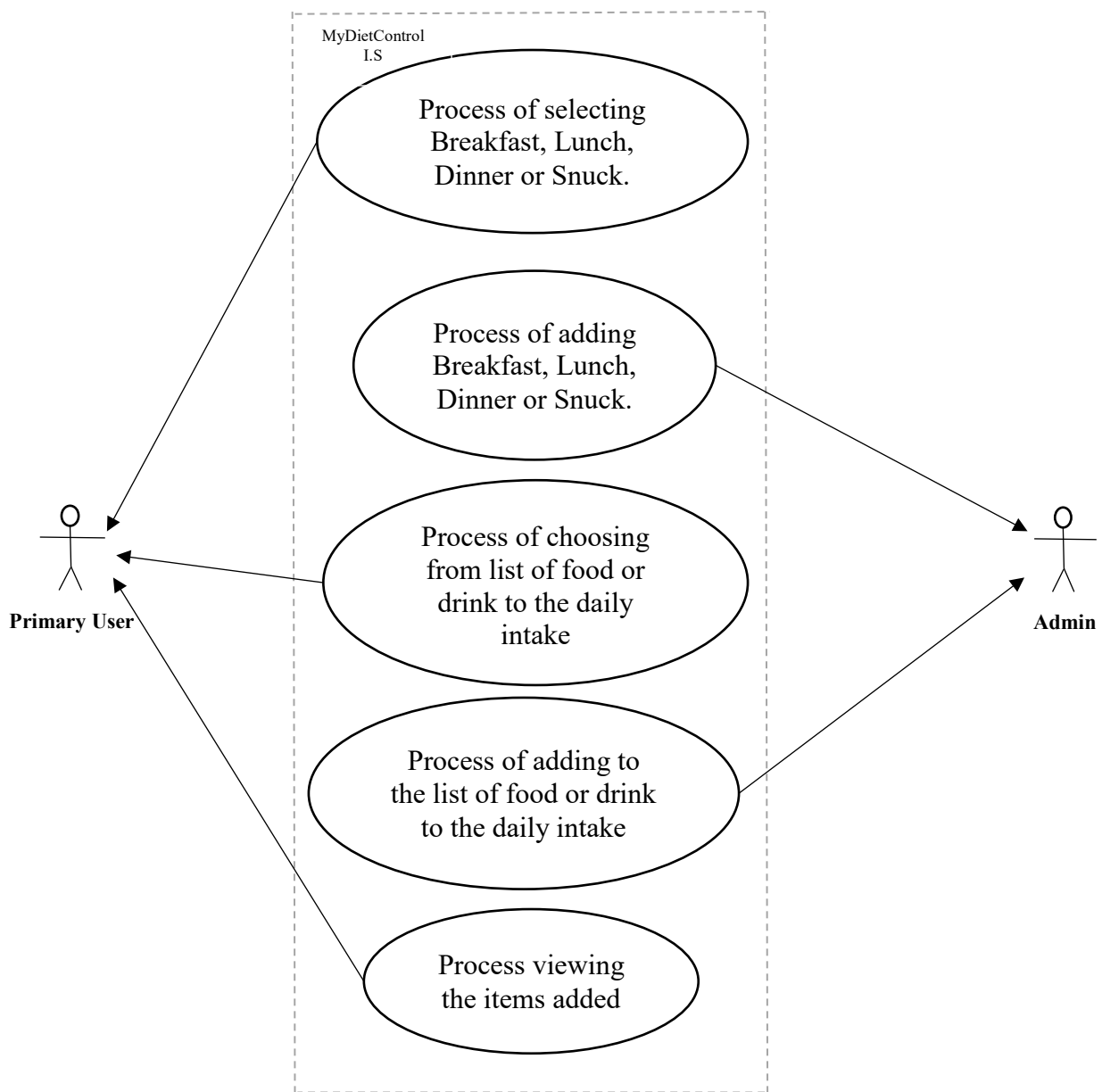## 2.18   Mydietcontrol Use case Diagram

Figure 17   Use case Diagram

2.19   Personas

Personas are typically created by a member of the design team responsible for requirements. It often help to define the initial set of user stories that needs to be explore. Personas representative of a range of user needs and desires and it use to better understand the specific needs of your target audience.

A total of three personas was created which are the realistic representations of the participant (People with Down's Syndromes), each persona is representing a group of the participant that took part in the research.

Although not all the user's scenario cannot be presented in this persona, but effort was made to explain a wider issue rage faced by people with down syndrome.

All the images are taken from google advance search for free images to use, and it will be destroyed after the competition of this project.

Personas 1

Persona 1 is representation if a user with down syndrome's, who is currently in employment, has finished school and in process of becoming a qualified first aider, he is currently struggling with his weight and would like to be able to use an application to reduce his weight by understanding his diet.

Personal Background
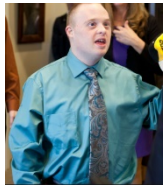
Name: James Stone
Age: 22
Location: London
Status: Single
Occupation: Coach Assistance

Goals	Challenges
• Stay healthy • Reduce his weight • Track their food consumption • Reduce their awareness of their diet.	• Understand how to use a diet app • Understand healthy diet

Bio:

James Stone finished school and at the age of 18 and managed to secure a position as coach assistance in DSActive London. He currently working toward getting his NVQ level 2 to become a qualified first aid to continue as coach assistance. He is putting on some weight and struggling to use the current available application for diet control as the information regarding calories in each portion provided in the application is very complicated to understand. As a coach assistance, it would be very helpful if he can understand what foods are healthy and which once to avoided so that he can lose a few stones.

Technology awareness

IT and internet

Reading and writing

Social Media

Mobile application

Feeling — Thinkin

Extrovert — Introvert

Sensing — Intuition

Judging — Perceiving

Persona 2

The second persona is representing a student with DS who is currently in education and have a better understanding of ICT equipment but still unable to use currently available application to understand his diet because it's default for him to understand and the way the application is working and the information's are very are written in small font.

Personal Background

Name: Adel Talbot
Age: 17
Location: Birmingham
Status: Single
Occupation: Student

Goals

- Finish his education
- Get good grades
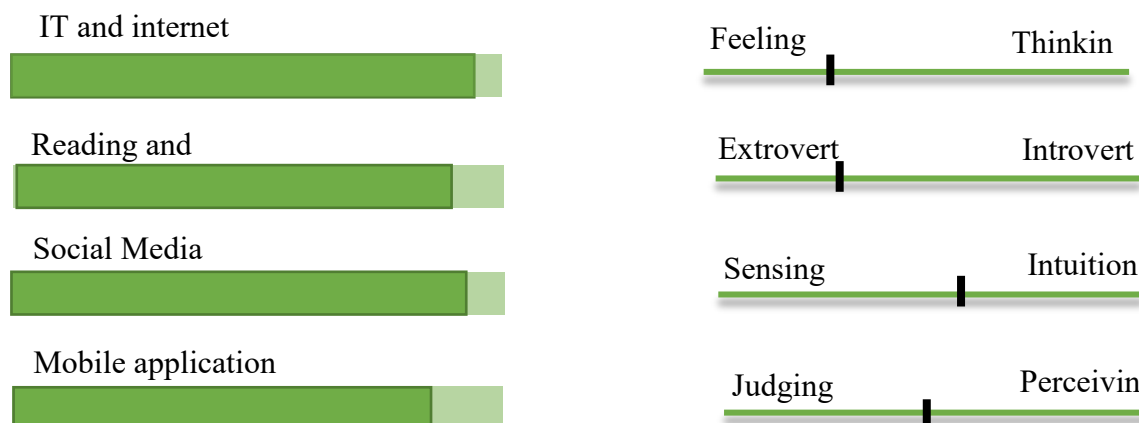- Track their food consumption

Challenges

- Distinguish between healthy and unhealthy food
- Be able to choose my own food and drink

Bio:

Adel Talbot, is currently doing his level 1 certificate in IT at Birmingham College. He is friendly, polite and kid personality. He is very good with using ICT equipment such as mobile phone and computer and he helps his friend with using the computer when he is DSActive office in London but unfortunately, he fined it default to use available diet application to understand what foods are good for him, he does not feel confident registering to any of these application using his personal information.

Technology awareness

IT and internet

Reading and

Social Media

Mobile application

Feeling — Thinkin

Extrovert — Introvert

Sensing — Intuition

Judging — Perceivin

Persona 3

The final person is representing people with DS that are unable to read, he is struggling to use any of the available application to understand his diet, but he is using one of the POSEIDON application to navigate his way around Leeds which his is very happy about. This gives him the freedom of moving around and meet his friends when he wants to without have to ask for assistance.

Personal Background

Name: James Order
Age: 35
Location: Leeds
Status: Single
Occupation: unemployed

Goals
- Be able to find a job
- Be more independent
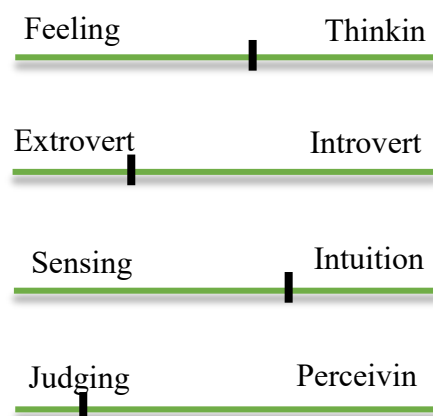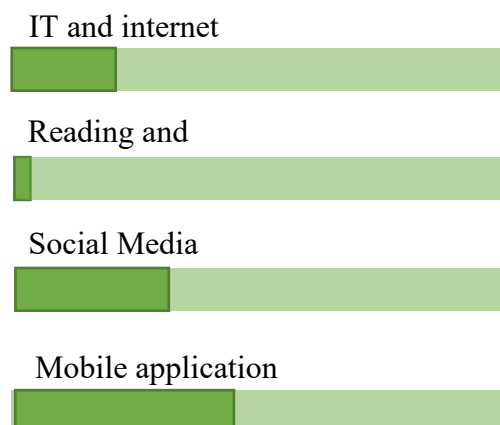- Be in control of my diet
- Reduce weight

Challenges
- Can't read and write
- Impossible to use diet app
- Track my daily consumption

Bio:
James Order is currently looking to work as a kitchen assistance in DSActive branch in Leeds, for him its default read book or get application to understand more a foods, drinks and snacks because he cannot read. Therefore, for him to be more independent and find a job as kitchen assistance it would be very helpful if he could use an application similar to POSEIDON negation application which he is currently using to take buses and find his way around Leads understand about food and drinks for him to gain his independency, find a job and tract his daily consumptions.

Technology awareness

IT and internet

Reading and

Social Media

Mobile application

Feeling — Thinkin

Extrovert — Introvert

Sensing — Intuition

Judging — Perceivin

3. Design

This chapter is consist of four section, Firstly the Poseidon UI principals will be looked at once again as it was touched on in the section 2 of this thesis, Secondly the 10 famous Nielsen's Heuristics design principle will be briefly described, Thirdly the architecture of the app will be explained and will be explained on which architectural pattern is suitable to be followed for its development. After this, a more detailed explanation of the functionalities of the app will be provided. Finally, the design of the user interface will be explained.

Furthermore, the purpose of this development is to design an application which can help raise awareness of harms and befits of food, snacks and drinks such as calories, fats and sugar contend in a very simple method of showing this is good, this is not so good, and this is bad. Ruther then showing different numbers and graphs which are mostly very confusing not only for people with DS but those with no special need, face challenges when using these applications.
Therefor it is safe to say none of the application in chapter 2 of this thesis fit this description of being sample and easy to use UI and to be able to design such an application following a specific principal is necessary.

3.1 POSEIDON UI Principals

Throughout this development the POSEIDON universal User Interface (UI) design guideline will be flowed as this design concept is known thorough other existing POSEDION application mentioned above which makes it accessible for all the primary user, although some of the concept are more default than other to achieve in this project but there is always room for further development and improvement as it is on all applications and services.

Principal 1. The User Interface is suitable and usable by all people with diverse abilities.

Principal 2. Accommodating wide range of abilities and preference. Users should be able to change fonts, color, image contrast etc. shown in table 5).

Principal 3. Simple UI design to allow user to navigate and use the application regardless of their knowledge, experience, language or abilities, (use of correct amount information not overloading with unnecessary text, images locations and the button or navigations links, format shown in table 5).

Principal 4. Information visibilities, the design should be able to communicate with the users regardless of their ambient conditions, (considering users abilities, the information should be displayed in a meaning full manner by using recognized symbols, images and texts).

Principal 5. Error prevention, minimizing forestation for the user when entering wrong information, the system should allow user to recover without going all around).

Principal 6. Size and space for user approach of use, icons and text should be spaced out to give the user freedom of use with confidence with fear of making the wrong selection.

Principal 7. Constancy throughout the design, identical design in all the pages should be maintained to avoid user's confusion and frustration.

Principal 8. Satisfaction, system should be enjoyable for the user this could be achieved by system behaving what the user expects.

Principal 9. Predictability, the user should know what to expect next, and this could be achieved by constancy of the system design, where a user presses a button for a service that specific service should be actioned or information to be display in this regard.
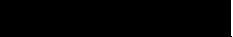
Table 5   Poseidon (UI) design guideline

Guideline subject	subject Preferences of people with Down syndrome	Implemented in MyDietControl
1. **Font**	• Bright, adding depth • Large • Bold • Stylized • No font decoration	✓
2. **Color**	• Darker: blue, purple, grey • Combinations of primary color • with high contrast • Tints and tones • Complimentary color • No dull color	✓
3. **Graphics/Images**	• Cleary identifiable • Naturally colored not digitally • Manipulated • With people of similar age or • older • Action images • Photographic better than • illustrated • Fun and whimsical illustrations	✓
4. **Animations**	• Bright color • With motion • Animating color • Personalized	No Animation is used in this application. ✗
5. **Buttons**	• Largest was clicked first • Dark background • Light text on top • Expected action clear • Framed • Arrows pointing to buttons • No spatial preference	✓

3.1.1 POSEIDON Colours

Part of the POSEIDON User interface design principals is the color palettes (table 6) for the system background which there are recognized and used in all the POSEIDON application families will be maintained in this application as this will help all the primary users using the POSEIDON application to be familiar with the patterns and color.

Table 6 Poseidon recognised colours

System: RGB code		System: Hex code		Colours
Black	R : 0 G: 0 B: 0	Black	#000000	
White	R: 255 G: 255 B: 255	White	#FFFFFF	
(POSEIDON) Turquoise	R: 53 G: 132 B: 140	(POSEIDON) Turquoise	#008080	
(POSEIDON) Orange	R: 241 G: 165 B: 50	(POSEIDON) Orange	#F1A532	
Red	R: 255 G: 0 B: 0	Red	#FF0000	
Blue	R: 28 G: 120 B: 204	Blue	#1C78CC	
Grey	R: 174 G: 167 B: 159	Grey	#AEA79F	

3.2 Heuristics Design principles

As well as following the POSEIDON principle for UI design, it is important to into account the Jakob Nielsen Heuristics Design principles of 10 basic general but vital principal of design Nielsen, J. (1994) which are as following,

1- Visibility of system status
Keeps the user inform of the next step throughout the design.

2- Match between system and the real world
Using the same design concept from POSEIDON allows primary user to recognise the app.

3- User control and freedom
Allowing users to navigate between the pages easily and freely by adding return button to allow user return to previous page.

4- Consistency and standards
All the pages are consistence throughout and all the options are in the same location as the previous page.

5- Error prevention
To avoid unnecessary error from happening by providing notation or any other form information to explain how each section are working.

6- Recognition rather than recall
Once again, by following the POSEIDON design principle user will recognise as the principles are used in other POEIDON applications.

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7- Flexibility and efficiency of use
Allowing the user to make multiple selection at once rather than completing one transection at the time

8- Aesthetic and minimalist design
Keeping the information brief and content to the point to prevent overloading the application.

9- Recover from errors
This principal helps the users to recover from an error by providing notification or notation marking the error stand out and provide instruction on how to recover or fix the issue.

10- Help and documentation
Help and documentation provide instruction on how to use different option if not a comment functionality or even if it is a comment fictionally it would make it easier for the user to use the system.

3.3 Architecture of the App

To better understand what type of application will best suit this development it's important to understand the different type of apps that exist for smartphones which are as follows,

- ✓ Native apps
- ✓ Mobile web apps
- ✓ Hybrid apps.

3.3.1 Native apps
Native applications are developed for a single mobile operating system exclusively, therefore they are "native" for a particular platform or device. They are installed through an app store such as Google play, android store and Apple app store. Native applications are compatible with other build in application like camera, music, GPS location services and contact list.

Advantage
- o High performance
- o Ensuring good user experience as developers use native device UI.
- o Access to wide range of APIs
- o No limitation on app usage

Drawbacks
- o Higher cost
- o Time consuming

3.3.2 Mobile web apps
This application is fully depending to use browser to run and are usually written in HTML5, JavaScript or CSS. These apps redirect a user to from the actual site to ad different URL.

Advantage
- o No installation required
- o Very minimum memory of the device is required to run.

Drawbacks
- o Cannot be run as a standalone application
- o Internet connection is required at all the time to run.

As this application is using online databases server to store all the information it allows access from any device whenever there is internet connection which could be an advantage either a huge drawbacks or because of the security of the confidential data stored on cloud which could hacked.

3.3.3 Hybrid apps

A mixture of both native and web apps creates a hybrid apps which is mainly website applications disguised in a native wrapper. Apps possess usual pros and cons of both native and web mobile applications. But Because of the nature of the application design full access to the device features and the UI should be as flexible as possible. This can only be achieved through native apps.

Advantage
- o Can be downloaded from google app store.
- o High performance could be achieved.
- o Built using multi-platform web technologies.
- o High performance
- o Ensuring good user experience as developers use native device UI.
- o Access to wide range of APIs
- o No limitation on app usage

Drawbacks
- o Internet connection required to run the backend data.
- o Can only be built for android devices.

3.3.4 Chosen application for this thesis

As per special request of the main stakeholders (DSActive) a Hybrid application will designed allowing the user to use the application without the need of having internet connection once its downloaded with the backend support (admin panel).

"The original message requesting the changes removed for privacy".

The application will not request the user personal detail or any information that could identify the user such as age, gender, email and other contact details (figure 18 to 25).

The application will run as a standalone application once it's downloaded but all the backend data will be put in using an online database which admin will have access to add or remove required files as shown (figure 26 to 29).

3.3.5 Application screenshots

As soon as the user open the application the will be automatically taken to home page of the application. The home page is consisting of main four activities displayed in the centre of the screen of the screen with large images and clear text with white background with four alternative options in the lower part of the screen as shown in figure 18.

POSEIDON design principal is be used in the application to help users understand and use the application better with no confusion.

User can select any of the activities by clicking on the icons, which are clearly displayed with space between them to avoid mistakes and cause frustration to the users while selecting. Principal five of the POSEDION principal.

The interface design is consistence throughout the pages and clearly labelled to keep the user informed of the page they are currently.

Specific icons that is known by the POSEDION project are used to all users understand and use the application regardless of their knowledge, experience, language or abilities.
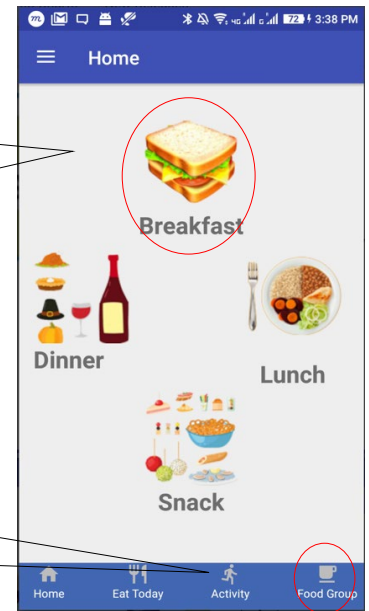

Figure 18   Home page

The return button shown in figure 19 is also added and top left corner of the application in all the pages to allow the user to return the previous page. The user can also use the return button of the android devices, which is the button right comer of the android devices.

The user can add by clicking on the plus button and select the number from list or just enter the number by using their phone keypad the amount in figure 20.
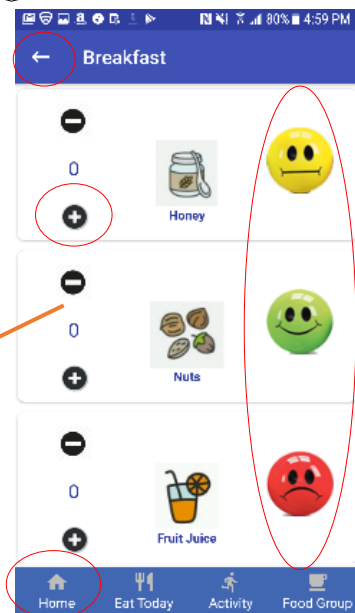

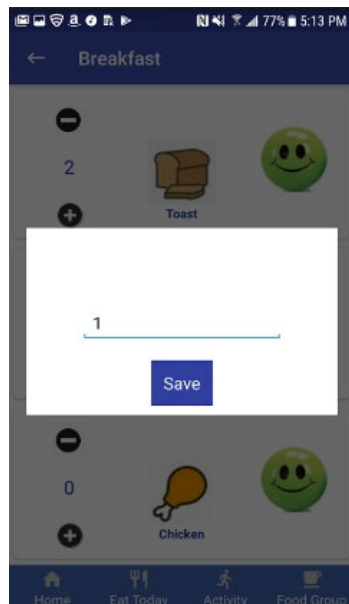**Figure 19   Breakfast page**

Figure 20   Add portion page

These icons are used to describe the food benefit in terms of calories.

At the end of each day or during the day the user can monitor his/her intake and can also check a
The user can select the calendar by simply clicking on the date showing in figure 21, and new window will
previous date using the colander displayed on the top of the screen.
open where the user can choose a date if they wish to or just cancel as shown in the figure 22.

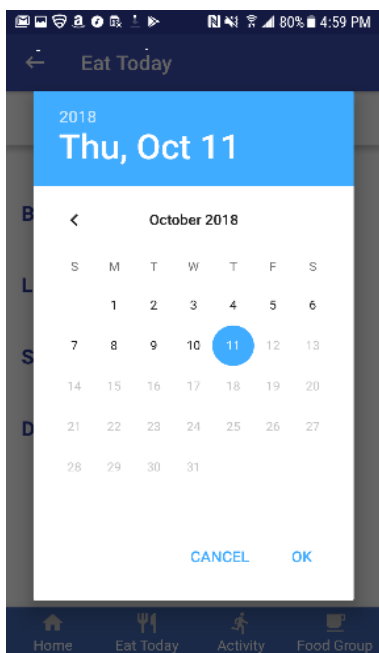Throughout the development a combination of two colours are used.
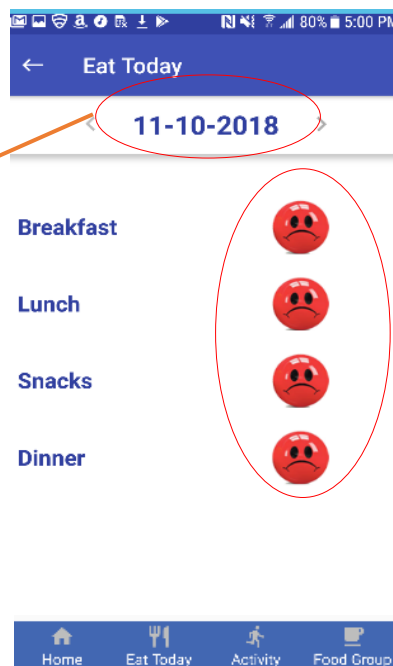

Figure 22   Calander

Figure 21   Day Sumary page

If the user consumed and added the unhealthier option, all day of have not recorded anything they will receive an upset face (figure 21).

The activity icon or section in figure 24 will take the user in a new page shown in figure 23, where user can record the time they have been playing.
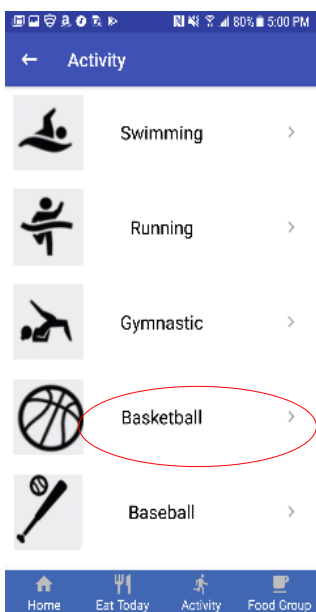

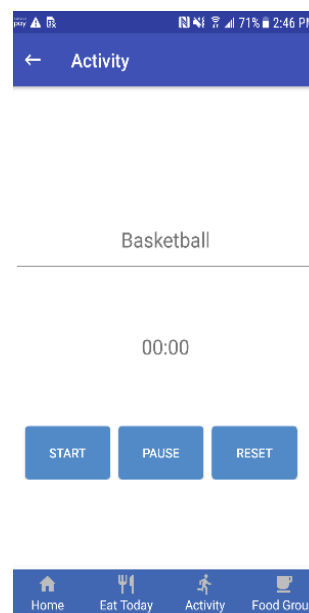Figure 24   Activity page

Figure 23   Activity summary

By clicking the food group section, a new page shown in figure 24 will open, where different food groups such as fruits and Vegetable drinks etc.

If the user clicks on any of the food groups in figure 25, a window will open contend information about that specific group, such as why you should have them how often to have and what amount of it is recommended etc.

People with Down syndrome's are more likely to forget how each step work. Therefore, the app is designed in a way that a maximum three steps to get the user where they want. Nevertheless, people with DS can get lost through screens. Therefore, the user will always be able to return to the home page by clicking the bottom left of the screen.
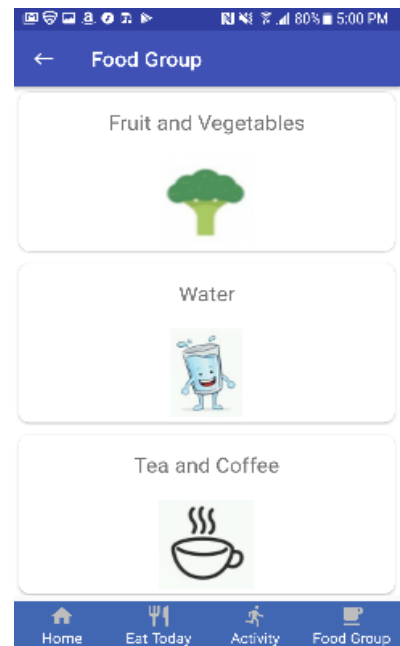

3.3.6   Admin panel

Figure 25   Food groups

The application panel (figure 26) is available online and only the authorised person/persons will have access to the credentials to login and make changes, add or removed an activity or filed. Once the changes made the aim is that the user will just need to update the application and all the changes should be applied to the application.
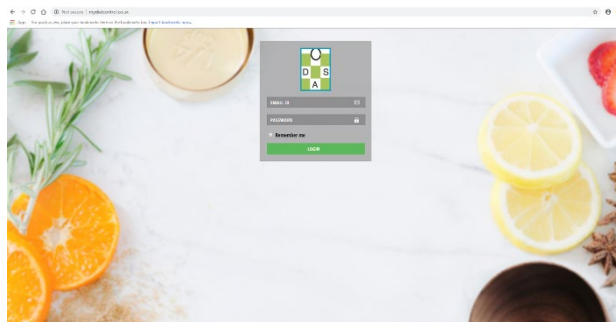

Figure 26   The admin panel

Using the username and password admin can login and they will be presented with the page below (figure 27) where they can make changes, add and remove the following,
- o   Food groups.
- o   Items (Foods, snacks and drinks).
- o   Activities.

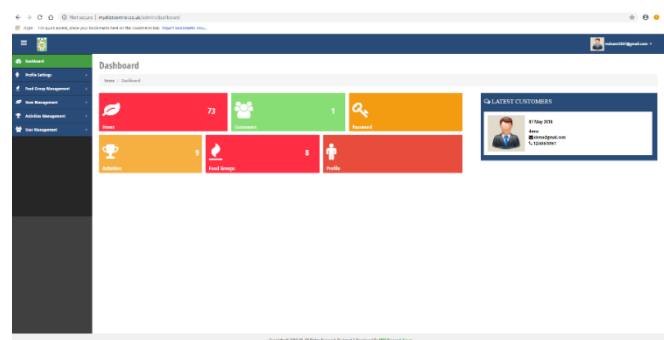Admin can also change the password for the admin page.

Figure 27   Dashboard

As mentioned above admin can add, remove or edit the food group management as shown in the figure 28.
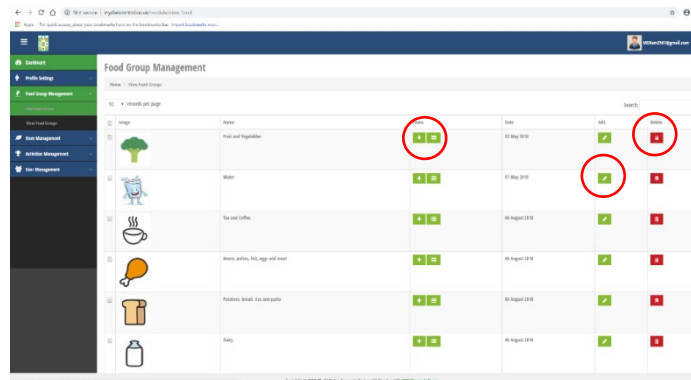

Figure 28   Food Group Management

In the add food group section a new food group could be created and depending on the food a face defending the food calories or health such as good, average or bad can be selected also an image can also be selected to represent that food group, as shown in figure 29.

Figure 29   Add food group

In the add item section a title and ab image is required to show what the item is, and it can be under either breakfast, lunch, Dinner, snacks or all as shown in figure 30.

Figure 30   Item management

Under activities management (figure 31) admin can add, edit or remove an activity. These will show once the update is applied to the application in the user device.
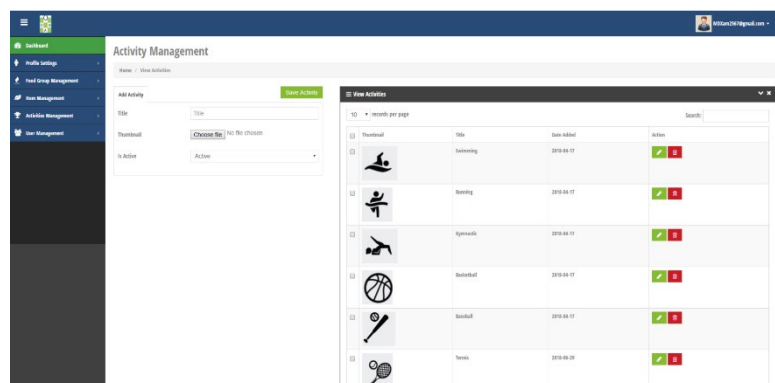

Figure 31   Activity management

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3.4 Design of the user interface

A combination of Jacob Nielsen's heuristics and Poseidon UI principles from section 3.1 and 3.2 of this Thesis to create user centric and functional application, some of the most important principals that are used in this application are,

- o Visual design
- o Terminology and symbols
- o Interaction

3.4.1 Visual design

One of the most important elements that has been looked at the design of this application is the visual design as mentioned in the chapter 2 of this thesis. People with Sown Syndrome's have visual difficulties with high contrast between colours therefore, the application is built without decorative elements, disturbing animations, or other design elements which could be difficult for the user to interact.

Throughout this design the approved colours from table 6 in section 3.1.1 is, which are POSEIDON approved colours and can create resemblance between the POSEIDON families and untimely can relate these colours is used to help the primary user use the application.

3.4.2 Terminology and symbols

As mentioned in the chapter 2 of this thesis, DS people have difficulties when reading, therefore using symbols and characters that are easy to understand and read is very important. Throughout this development a combination of Poseidon approved words with symbols, icons and images is used.

As one navigates through the app can see that the symbols used are very simple. POSEIDON provides developers with an extent catalogue of icons; more icons are added to the Poseidon library which could be very useful for developer and users to understand and navigate their way around the application

3.4.3 Interaction

The UI should allow the user to navigate their way around and understand what to do from the first time a user interacts with the application, there should be no need to learn a new functionality or new ways of interaction. Following the Poseidon design principals will allow the users to use the application if they have ever used another Poseidon application as they are already familiar with the design, colours and icons.

It is vitally important to bear in mind that user will make mistakes and therefore measures such as having all the links in the bottom of the page, using clear large icons will minimize this, as can be seen in section 3.3.4 of this thesis.

4   Development

In this chapter the process of the development of the application will explained and the different between the develop app in this thesis and other available application will be looked at, such as presenting the content to the user, user interface and other functionality of the app.

4.1 Presentation information to the user

As mentioned in the section 3.4 of this thesis, information was presentment in the most sample structure as possible using Poseidon approved images, icons and minimizing the use of words, as some DS people may have a reading difficulty, and some do not read at all.

One of the most challenging part of this development creating was finding a sample way that is not so complicating and easy to understand of presenting the benefits and harms of the food, drinks and snacks to the primary users, as almost all of the available application that are used for diet control are calculating calories on each portion/portions and sometime understanding all of those number are very difficult and can put many of their users off because of the way the information's are presented.

The answer for presenting this information in this application was using three sample Emoji's as shown in (figure 19), the first Emoji was a happy smiley face in green presenting a healthy food, Mutual face in yellow presenting average food and finally sad face in red presenting a bad food to eat to the users.

4.2   Calculating the total

The foods, drinks and snacks are presented in portions with images and once the user is selecting the number of different portions they have eaten it will be stored and the totals is shown in the eat Today page which is in the bottom of all the pages in the application.
If the user had selected more healthy options they will see the green smiley face, eaten unhealthy food then it will be shown in red sad face as shown in the (figure 21).

4.3 Data Storage

As explained in the section 3.3.3 and 3.3.4 of this Thesis the hybrid application is stored in the uses device and more importantly DSActive requested that no logging in should be required for the user and data should be stored in the individual user device to avoid data confidentiality breach. Therefore, no personal details of the users such as name, locations, age, gender, email or contact details is requested by the application and no registration for the use of the application is required.

User activities on what they have consumed will be stored in each individual user's devices and once the application is deleted all the data will erased with the application.

5 Validation

Validation is carrying out to examine and confirm that the system hardware, software and service are ready for the user to testing.
As explained in section 2.15 of this thesis, after implementation the application firstly, the compatibility of the application with the proposed hardware will be examine by installing the application on a compatible piece of hardware, in this case, a mobile phone to make sure that the application is compatible with the app.

Secondly, the software is deployed on the infrastructure and the behaviour of the system such as functionality, user interface, links, and navigation between pages can be tested by the developer and make changes if required.

Lastly, a service validation will check if the system can do what it was intended to against the system requirement that were provided by the main stakeholders in section 1.5 under DSActive requirement.

After completing the validation phase, the application will be prepared gathering feedback from primary users (people with Down's Syndromes), in order to prepare for user testing there are five important steps that needs to follow,

1. Define testing protocol.
2. Participant gathering.
3. Ethical terms and conditions.
4. Inform the participant.
5. App release and test.

5.1 Define testing protocol

It is very important to understand what material is required to carry out a user testing, how it's going to be carried out, how long it would take and how many users are required to participate. Because of the sensitivity of the group of the participant for this project it's important to understand if any additional arrangement needs to be made for the users to participate, further arrangement was made in order for a DSA member to carry out the testing the DSActive main office.

5.2 Participants gathering

All the participants, their families and their caretakers were contacted and consent using the information sheet, participant form and consent form shown in figure 38 to 40 in section 8.1 sent to Alex Rawle via email for taking part the evaluation of this application and their availability was confirmed via DSActive representative Alex Rawle in group meeting in DSA headquarter.

5.3 Ethical terms and conditions

To work with real people with condition it's important to get the consent of the Middlesex university ethical society and DSA to confirm that they support this research. A letter was sent by the DSActive as shown in figure 32.

5.4 Inform participants

A participant information sheet which content relevant information regarding the application, title of the project, propose and value or project, invitation to participate, information about the organisers was send to Alex via email to forward to the primary users, their family and careers, shown in figure 40.

5.5 App release and testing

Application and the admin panel were uploaded, and they are now live released to the participants to conduct the test.
This application can be download via google app store for free and it only requires the users to be contact to the internet when they need to download for the first time and its fully functional whiteout internet after the download. Although the application will only get the update when they are connected to the network and an update is available.
The application will not require any registration or logging and all the data is stored in the user device.

The testing was carried out in two section, firstly it was test by the DSActive employee and only after their specification the application was passed over to the participant to test.

Unfortunately due to changes requested by the DSActive advising remove the logging page from the application, we were to not able to get Middlesex University ethical community approval on time to be present at the time of user testing, therefore the only data that was collected were from the open ended question that was posed by the employee to the participant as shown in the section 5.7 in table 7.

Down's Syndrome Association
A Registered Charity No. 1061474

DSActive
Activities for people
with Down's syndrome

Dear Sir/Madam,

This letter is to confirm the support of the Down's Syndrome Association for the ethical approval of the Healthier Lifestyles App Research Project being carried out by Middlesex University Computer Science department.
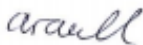
The Research Project has been sponsored by the Down's Syndrome Association's DSActive programme, which provides opportunities for people with Down's syndrome to lead healthy and active lives. The DSActive programme have been involved with the project from the start, and participated in the design of the Participant Information Sheet, Consent and Release forms.

In terms of the collecting of the data from the participants, we confirm that a member of staff from the Down's Syndrome Association's DSActive programme will be present at all times during data collection. All members of staff who work for the programme are trained in the safeguarding of children and vulnerable adults, are trained in the ethical procedures of the Down's Syndrome Association, and are experts on Down's syndrome who deliver training to sports clubs all across the country. Before any participant can provide their feedback on the app, they must have given their consent to be involved and we must have the consent of their legal guardian. We will be recruiting participants from a DSActive football session and from our Down2Earth group, a group of adults with Down's syndrome who meet regularly to discuss all the Down's Syndrome Associations latest resources.

The data collected during the process will be stored securely by the Down's Syndrome Association, the data will be password protected and saved on our secure server. Only members of staff from the DSActive programme and the Services Director of the Down's Syndrome Association have access to the server. All information will be anonymous and will be destroyed 6 months after the end of the project.

We hope this letter is able to reassure the committee that the data collection process will be conducted with this highest possible ethical awareness, and to confirm that the Computer Science department of Middlesex University have the full support of the Down's Syndrome Association.

Yours Faithfully,

Alex Rawle
DSActive Project Manager
Down's Syndrome Association
alex.rawle@downs-syndrome.org.uk
0333 1212 300

Figure 32   Ethical approval of the project by DSActive Page 1-1

5.6 Feedback gathering

Throughout this development DSActive was involve in testing and providing feed in many occasions, the application was design to allow users register (Figure 33) and data to be stored online but this was voted down because of the user details sensitivity as shown in figure 37 in email from Alex Rawle direct contact to DSActive, the Home page (figure 34) has also been changed after DSActive testing, and many other changes has been made through this development hence time taken to complete this project.
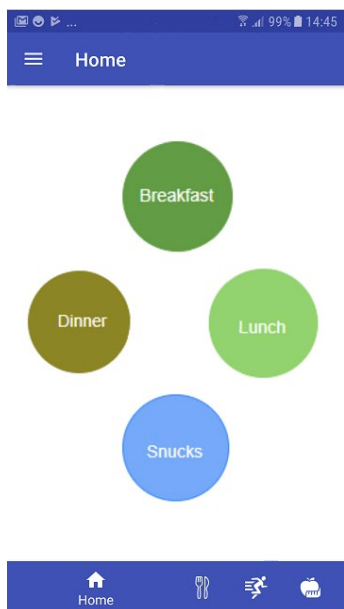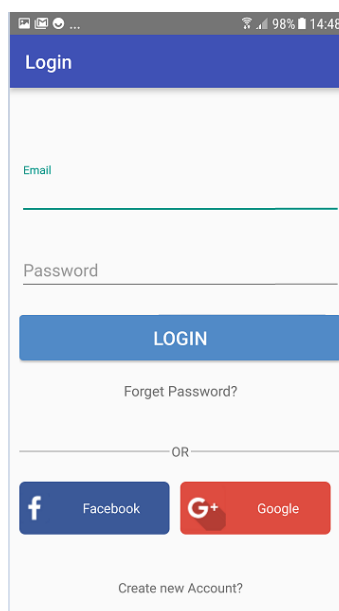

Figure 34   First design Homepage

Figure 33   First design Login page

5.7 User testing

Once DSActive member board was happy with the final version it was then tested by the primary user, where a total of six users took park in validation and a summary of the feedback is shown in the table 7.

Table 7 Assessments Log from DSActive send via email by DSActive Representative

Participants (PwDS or Carer?)	When (approximately, e.g, month/year)	Where	Assessment exercise	Positive Outcomes	Aspects for future improvement
PwDS 1	June 2018	Langdon Down Centre, TW11 9PS	Testing of the app	Liked the app, found it easy to use, learned more about healthy food, found it easy to record activities engaged in	More food choices, more activity choices
PwDS 2	June 2018	Langdon Down Centre, TW11 9PS	Testing of the app	Liked the app, found it easy to use	Larger text, larger images/icons

PwDS 3	June 2018	Langdon Down Centre, TW11 9PS	Testing of the app	Liked the app, found it easy to use, learned more about healthy food, found it easy to record activities engaged in	No dancing icon within activities
PwDS 4	June 2018	Langdon Down Centre, TW11 9PS	Testing of the app	Liked the app	More food choices, more drinks choices
PwDS 5	June 2018	Langdon Down Centre, TW11 9PS	Testing of the app	Liked the app, found it easy to use, found it easy to record activities engaged in	More activities
PwDS 6	June 2018	Langdon Down Centre, TW11 9PS	Testing of the app	Liked the app, found it easy to use, learned more about healthy food, found it easy to record activities engaged in	More foods, more activities

5.8 Result

Looking at the table 7 of users testing results, all of the user who participated in the user testing were satisfied with the application and requested more items to be added to the list but more data could have been gathered if the test could have been carried out in present of the researcher, to record the users behaviour's while testing the application.

6 Conclusions

In conclusion, a healthy eating android application was created in this project, to improve the people with Down syndrome's healthy eating practice, reduce obesity between people with DS and give them more independency by allowing them to make healthier choices.

As explained through this thesis the application is taking all the confusing calculation of numbers diagrams and large paragraphs and translating them into sample Poseidon approve symbols and images that are easy to understand not only by people with down Syndromes, but it could be used by general users as well.

For completing this project, it was necessary to study and analysis many of the available and existing application in the market and compare those to what the primary user requirement were to understand what was missing. By looking at the table 1 (Applications comparison), many amendments was required if the developer was to make their application according the Poseidon specification.

Some of the noticeable different between the developed application (My Diet Control) and the existing application in section 2 of this thesis are shown in table 8,

Table 8   MyDietControl app comparison

Existing application	MyDietControl App
Have smaller buttons.	Use clear and large buttons see (figure 18 to 25).
Close to each other which means making mistake easier.	Using a maximum of four clickable links and leaving space in between as shown in figure 18 to 25 in section 3 of this thesis.
Some colours are disturbing for the users to read,	Use of Poseidon approved colours as shown in table 5.
Text size are small.	Use of large text in line see (figure 18 to 25).
Not clear labelling of the pages.	All the icons are ladled see (figure 18 to 25).
Overloading contends information in some pages.	Minimizing the amount of information in one page, see (figure 18 to 25).
Keeping user in uncertainty of the next step.	Using the Poseidon design approved layout making it easy the user to easily use the application, see (figure 18 to 28).

Some of the other different between the MyDietControl application and the compared application are,

- ✓ No logging in required for the user to use the application (Hybrid application).
- ✓ No data is stored in cloud.
- ✓ No personal information is required at any time of using the application.
- ✓ No internet connection is required except when it's downloaded, or an update is available.

7 Future work

As of every development there are more to be done to make the application better, some of the possible improvement that were requested by the user after testing were,

- ➢ Adding more food, snack and drinks options, requested by participant 1,4 and 6 in table 7.
- ➢ Adding more activities in the activity section requested by participant 1,4,5,3 and 6 in table 7
- ➢ Making the text, images and icons larger requested by participant 2.

Most of the future work can be med by adjusting from the admin panel but for a complete improvement the above needs to be carried out separately.

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8 Appendix

Key Objective for the DSAactive Nutrition App

DSActive
Activities for people with Down's syndrome

Key objectives for the DSActive Nutrition App

1. To provide information on a healthy diet and to help people with Down's syndrome to make informed choices about their diet
2. To offer participants the chance to track their food consumption to increase their awareness of their diet
3. To offer participants the chance to track their physical activity to increase their awareness of how much physical activity they do each day
4. To produce an app which is useable and suited to the needs of people with Down's syndrome over the age of 16

Alex Rawle DSActive Project Manager ....

Prof. Juan Carlos Augusto Middlesex University ....

Abdullah Mohammedi Msc Student ....

Figure 35   **Key objective of the application (**This was sent on the 17/11/2018).

Message removed for privacy

Figure 36   **Alex Rawle advising to use symbols in three different colour instead of colourise**

Figure 37   **Alex Rawle advising to create standalone application**

DSA requirement send DSActive

Title page
Icon on phone/tablet – DSActive logo?
Have a picture of the DSActive logo as start-up page – only lasts for a few seconds
Home Screen – picture for each icon

My Page Icon

Healthy Eating Information icon

What I ate today?

How am I doing?

Activities

My Page – we have to be careful to only collect the information we need due to privacy laws

Nickname
Reason for wanting to use the app:
- To learn more about food
- To increase my activity
- To record what I eat

Data protection statement
"We will only collect the data we need from you so you can use this app. We do not collect any personal data, and any data we do collect is stored safely so no one else can see it. If you have any questions then please contact the DSActive team on dsactive@downs-syndrome.org.uk or call 0333 1212 300"

We can use this statement on the app for people with Down's syndrome, then if we could also link to the data protection section of our website so parents can read more if they want to. https://www.dsactive.org.uk/data-protection-cookies-policy/

Healthy Eating Information

Picture of the Eatwell Guide – can click on each section to find out more – if not possible we can just have our own pictures for each food group

Separate pages for each food group – with a picture, some information, some examples, which face

Food Group	Information	Examples	Face
Fruit and Vegetables	These are really good for you. You should try to each at least 5 different ones each day	Banana, Apple, Orange, Carrot, Broccoli, Tomato	
Beans, pulses, fish, eggs, meat and other proteins	This helps you get stronger after exercise. Try to eat some 3 times a day	Chicken, Beef, Tuna, Salmon, Beans, Lentils, Eggs	
Potatoes, bread, rice, pasta and other starch carbohydrates	These should be the main part of each main meal. Try to eat wholegrain versions if you can	Potatoes, Bread, Rice, Pasta, Wholegrain Cereals	
Dairy	Have some of this each day but not too much. If you don't like it there are other alternatives you can try	Milk, Cheese, Yoghurt, Soya milk, Rice milk	

Oils and Spreads	Only use a little bit of these, for example when cooking	Olive Oil, Sunflower Oil, Margarine, Butter	🙂
Sugary foods	These foods are bad for you and you should try to not have them	Sweets, chocolate, ice cream, crisps, biscuits	👎
Water	Drinking water helps your body work better. Try to drink at least 6 glasses a day		👍
Tea and Coffee	These drinks can taste nice but try not to drink them too much		🙂
Fruit Juice	These drinks can be bad for you if you have them a lot so only have them as a treat	Apple juice, orange juice, squash	🙂
Soft drinks	These drinks are bad for you and you should try to not have them	Coke, Fanta, Lemonade, Red Bull	👎

👍	These foods are good for you and you should eat them everyday

🙂	These foods are okay for you but you should not eat them too much.

👎	These foods are bad for you and you should try not to have them.

What I ate today?

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Breakfast	👍						
Lunch	👍 🙂 👍						

Dinner	👍 (green)	👎 (red)	🙂 (yellow)													
Snack	👎 (red)															
Drink	🙂 (yellow)		🙂 (yellow)	🙂 (yellow)												
Activity	👍 (green)															
End of the day	👍 (green) = 🙂 (yellow) = 👎 (red) =															

Total number of each face at the end of each day – Each day it says well done you got X number of green faces – only positive and encouraging messages
For example:

Well Done!

Today you got 4 green faces!

Keep up the good work!

How am I doing?
Progress measured two ways – through number of faces, through amount of activity

Activity Progress

Hours being active / Week

Total hour

Values: Week 1 = 3, Week 2 = 3.5, Week 3 = 2, Week 4 = 4

Number of faces this week

Number / Faces

- Green = 8
- Yellow = 10
- Red = 3

Number of faces per week

Number / Weeks

	Green	Yellow	Red
Week 1	8	10	3
Week 2	9	8	4
Week 3	9	9	3
Week 4	11	9	1
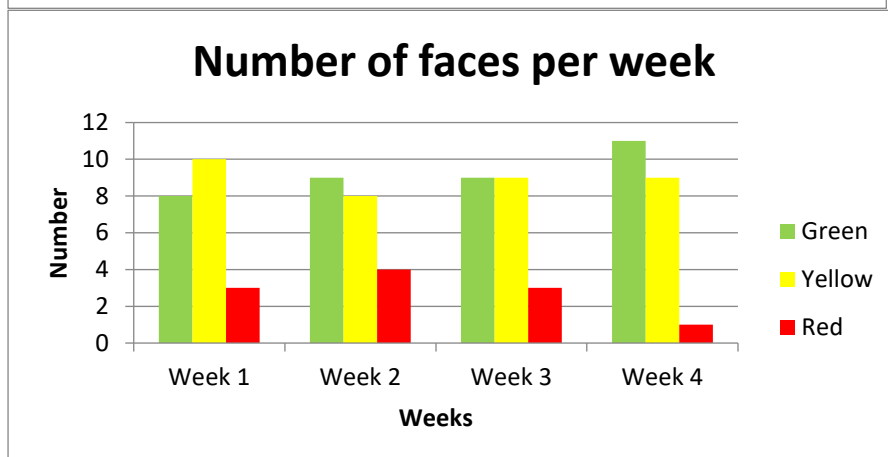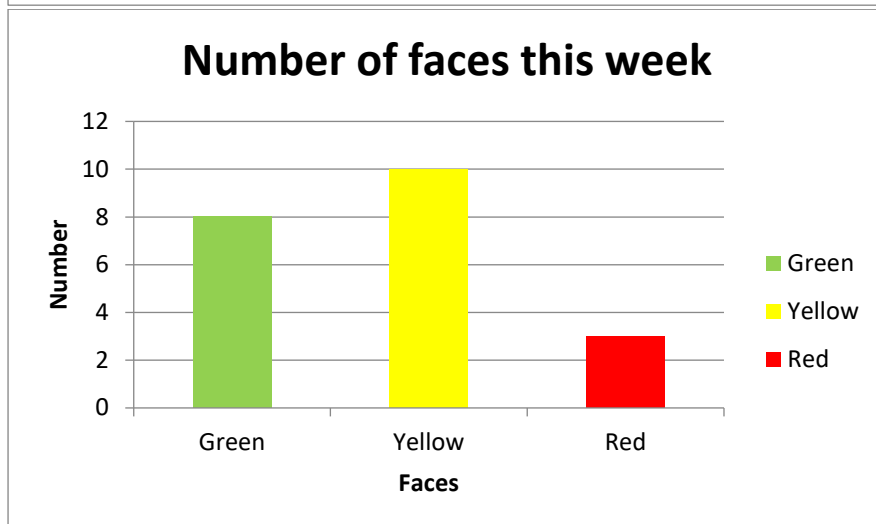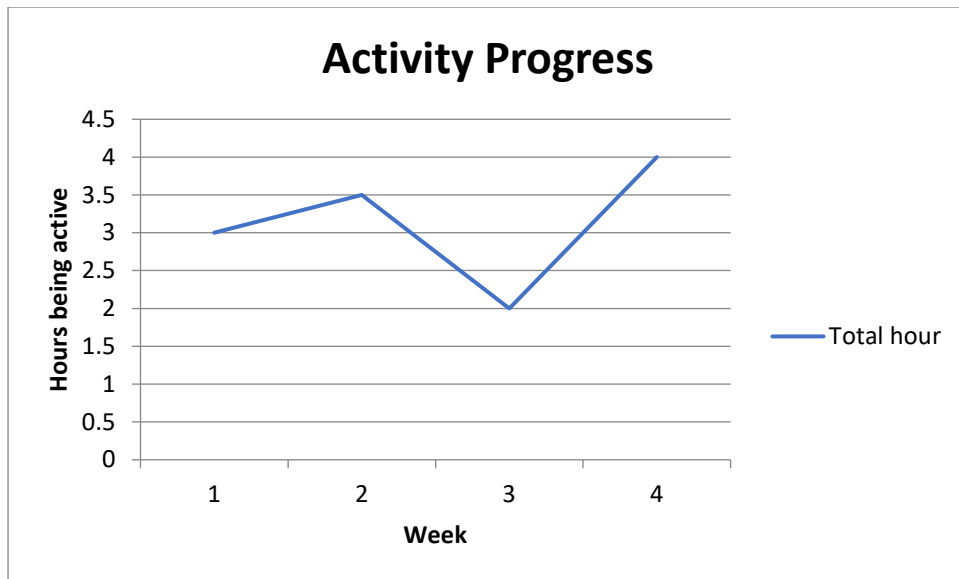
Activities

Walking, Running, Swimming, Gym, Dancing, Sport -> we can check these are appropriate in the consultations

Would be great to have a link to the DSActive Easy-Read section of our website on this page
https://www.dsactive.org.uk/easy-read/

Stopwatch feature – measure the amount of time participating in that activity, progress is purely measured on time not by intensity of activity to avoid making it too complicated

A minimum of 1 hour of activity is enough to earn a green face on the table

Consent Form

Consent Form

Healthier Lifestyles App Project

Please tick the appropriate box:

I am participating in this project as a

☐ Primary User (person with Down's syndrome)

☐ Secondary User (parent or carer of person with Down's syndrome)

☐ Tertiary User (professional supporting people with Down's syndrome)

--Thank you for considering taking part in this research. If you have any questions please ask a member of the project team before you decide whether to take part. You will be given a copy of the Consent Form and Information Sheet to keep and refer to at any time.

Please tick or initial each box to agree to below.

☐ I confirm that I have read and understood the information sheet dated......
(version....) for the above study

☐ I have had time to consider the information, ask questions and have had these answered satisfactorily.

☐ I understand that my participation is voluntary and I am free to withdraw at any time without giving any reason, without my care or legal rights being affected.

☐ I understand that if I withdraw from the study, the data collected up to that point will be destroyed.

☐ I understand that my personal data will be safely stored and destroyed one year after the end of the project.

☐ I understand that the data may be published but this will be without reference to my personal details.

☐ I agree to the interview being audio recorded so that my comments can be typed up and used for research data.

☐ I agree to take part in the study

[Type here]

Figure 38   **Consent Form Page 1-2**

Participant _____I am over 16 years of age [   ] *tick*

Address _____

Signature _____

If you are signing for the participant, please read and sign:
I have read the above release and agreement and I fully understand the contents.

I confirm that if the photographs/videos are of persons in my care that I am entitled to sign this form on their behalf.

I am signing for the participant who is unable to sign for his or herself [   ] *tick*

Name _____I am over 18 years of age [   ] *tick*

Relationship to the Participant_____

Address _____

Signature _____

Signatures witnessed by:

Witness name _____I am over 18 years of age [   ] *tick*

Address _____

Signature _____

[Type here]

Figure 39   Consent form Page 2-2

Participant Information sheet

Participants Information Sheet

<u>Section A: The Research Project</u>

Title of the Project

Healthier Lifestyles App

Purpose and Value of Project

To encourage healthier lifestyles in people with Down's syndrome, with emphasis on nutrition and weight management. The app will be developed for mobile phones running on Android to assist with weight management and nutrition.

Invitation to Participate

We would like to invite you to take part in our research project. Our invitation is open to people with Down's syndrome who will benefit from the technology as well as their parents and carers. Professionals who support people with Down's syndrome are also invited to participate in this research.

Who is organising the Research?

This is jointly developed by Middlesex University and the DSActive team, a programme run by the Down's Syndrome Association to provide sporting opportunities for people with Down's syndrome.

Contact for further information

If you require further information about the project please contact Vanda Ridley or Juan Augusto who are points of contact for the project in the UK.

Alex Rawle (DSActive)

Email: Alex.Rawle@downs-syndrome.org.uk

Dr Juan Carlos Augusto (Professor of Computer Science, Middlesex University)

Email: j.augusto@mdx.ac.uk

Figure 40   Participant information sheet Page 1-2

Middlesex
University

Section B: Your participation in the research project

Why you have been invited to take part?

As potential direct or indirect users of the technology that will be developed, we are inviting you, who may be a person with Down's syndrome, a carer or parent or a professional supporting people with Down's syndrome, to tell us about the challenges you face to exercise more and to eat healthier food. We want to see if we can develop technology which will help people with Down's syndrome to be healthier through physical activity and food. If you are a parent/carer/ you can support the person with Down's syndrome you care for and help them contribute to this project. If you are a professional your input will also be vital in ensuring the developers of the technology get the information they need to develop the right products.

Can you refuse to take part?

Taking part in this project is entirely voluntary. You can choose to be involved or not and you can stop taking part at any time.

What will happen if you agree to take part in our Pilot Study?

The purpose of the Pilot studies is for end users to be able to test the products that have been developed by the project team and provide feedback.

You have been invited to participate in this pilot study to test the technology that has been developed by the project team. You will be asked to try new technology products for a period of a few weeks (less than a month). After trying the technology we would ask you what you think about the product and how it might help people with Down's syndrome to live more healthily. Full instructions and a guidance manual will be provided to all participants.

What will happen to any information/data we collect from you?

The information we collect will be typed up by the project team. All of the information will be kept anonymous. The information will be analysed and will help develop the final technology products. Some results of this project may also be published but the publications will not include any specific information which identifies anyone who takes part in the project.

Who will have access to the personal data collected and where will it be kept

Any personal information that is collected by the DSA will not be shared further. It will be stored on a server at the DSA which will have password protected access only by the person involved in the project. All personal information will be destroyed 6 months after the end of the project.

Figure 41   Participant information sheet Page 2-2

Release form

Release Form

To the participant:

I give permission to the Down's Syndrome Association (DSA) and their partners from Middlesex University in the Healthier Lifestyles App Project the right to photograph/video me and to use these photographs/videos. This includes reproducing these photographs/videos in articles, books, exhibitions, conferences websites, blogs; Facebook, Twitter and other social media; and for any other purpose deemed reasonable at any future date solely in relation to the work of this project

I have read and understood the above information and agree to my image being used for the purposes of the Healthier Lifestyles App Project

Participant _____I am over 16 years of age [ ] *tick*

Address _____

Signature _____

If you are signing for the participant, please read and sign:

I have read the above release and agreement and I fully understand the contents.

I confirm that if the photographs/videos are of persons in my care that I am entitled to sign this form on their behalf.

I am signing for the participant who is unable to sign for his or herself [   ] *tick*

Image Release Form

Figure 42   Image release form Page 1-2

Name _____ I am over 18 years of age [   ] *tick*

Relationship to the Participant _____

Address _____

Signature _____

Signatures witnessed by:

Witness name _____ I am over 18 years of age [   ] *tick*

Address _____

Signature _____

Photographer/Video

Name: _____ Signature _____
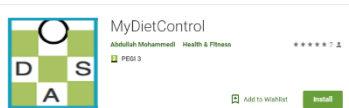
Date of signatures: _____

Image Release Form

Figure 43   Image release form Page 2-2

8.1 Appendix B

The application is life in google play store, which can be accessed by Clicking on https://play.google.com/store/apps/details?id=c.aktechnologies.dietcontrol

Admin Panel available at http://mydietcontrol.co.uk
User name: mdxam2567@gmail.com
Password: Available on request

Application admin panel is hosted on https://www.123-reg.co.uk/secure
User name: am2567@live.mdx,ac,uk
Password: Available on request

8.1 Appendix B