# FACULTY OF SCIENCE, ENGINEERING AND COMPUTING

## School of Computer Science and Mathematics

## MSc DEGREE

## IN

User Experience Design

CI7800 Digital Media Final Project

FINAL PROJECT REPORT

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Project Title: **Paprus** (IoMT)

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Supervisor: Jay Kiruthika

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**Kingston University** London

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I would also like to acknowledge Mr Martin Colbert, my course leader of the School of Computer Science and Mathematics for User Experience Design at Kingston University as the second reader of this project, and I am gratefully indebted to his/her for his/her very valuable comments on this project.

Finally, I must express my very profound gratitude to my parents and to my girlfriend for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

Author

Bikash Chintak Dash

## Abstract

Beginning in 1501BC the study of medical science was proposed by author named Der in the most rational and scientific terms. The book comprises of 48 major cases of treatment and surgery mentioned in details. The vast majority of the papyrus is concerned with trauma and surgery on the verso (Sullivan 1996). Reflection in today's words the Internet of Medical Things (IoMT) is an expression that describes all medical devices connected to a healthcare provider's computer system through the internet. These devices can generate, collect, analyse and transmit healthcare data.

**Objective** Designing an application ecosystem that works across 3 platforms with respective native design interfaces. The application will have small interactions and more informative experience for the user to automate process of recovery and maintain a good health.

**Materials and Methods** An interdisciplinary project compiled of various hardware and sensors to feed data in a real-time scenario for the application. Paprus will use Internet of Medical Things (IoMT) connecting three Apple devices and using iOS platform for future development.

**Results** Through a user-centred design process, the researcher targets to smoothly merge one application design seamlessly along the different aspect of recovery method. Paprus will reflect information with transparency and proper user-interface communication. The realtime notifications will help user-updation simultaneously and participate in the recovery, actively managed by a dashboard with medical support. Most of the user activity will be server-time generated also can be managed manually.

**Discussion** By consolidating the currently scattered and siloed device data into one ecosystem, Paprus can improve access to the broader aspect of patient evaluation irrespective of the diagnosed disorder. The Paprus ecosystem decouples diabetes apps, eating disorder app, and fitness app for heart patients from respective devices, allowing software developers to build innovative apps without requiring them to design a user centred experience or an unique way of completing the application at the backend. It allows people to be diagnosed of any disorder and adapt to the necessary method of recovery with user privacy.

**Conclusion** Devices in IoMT include wearables, remote patient monitors, sensor-enabled devices; which perform the primary interactions with the user, extract data with precision to understand and study recovery and health equilibrium. The major devices to be used in the solution are Smart Jars (to monitor users diet), Smart Bins (to monitor the food discarded) and Smart Wearables. The solution focusses on logging the user diet and monitoring the health of the user for a healthy lifestyle or recovery. An overview of smartphone use in physical & behavioural health care besides discussion on a chance of integrating mobile technology into clinical practice. The report will further outline the discussion of limitations, practical issues and recommendations.



**Keywords:** smartphone, wearables, mobile device, mHealth, apps, technology, IoMT devices

# 1. Introduction

Major problem within the health sector is an irregularity in food habits. Some researchers suggest “circadian rhythms” can be disturbed due to the irregular food habits and skipping of meals. Humans have a higher risk of type 2 diabetes, high blood pressure and obesity. They also quoted that 80% of central Europe are likely to be affected by social jetlag. Though the major focus for this project was towards the eating disorder, though the disorder’s cause is not specific the process of treatment is well-tailored. The treatment needs a thorough monitoring of your diet and logging your diet and emotion using an application which is monitored by a clinician or your local GP. The idea was first discussed in previous specialisation topic *Grossify* which can be referred for in-depth understanding.

## 1.1 Literature Review

To develop a product solution for a multi-disciplinary mHealth Application integrated with Internet of Medical Things (IoMT).

The product solution focusses on keeping a track of diet in real-time by logging the quality and well as the quantity of nutrients consumed with every meal; allowing for the integration of data important to the monitoring of the targeted user specific ailments. The product also combine the user profile with that of the health professionals; nutritionist and dietetics technicians, registered (NDTRs).

The product makes the user validation along with the bio-technical sensor data that helps the application’s logic perform the user evaluation with certain factors such as Heart rate, Blood Oxygen and Continuous blood glucose monitoring. The major factor rolling for the Type 1 diabetics patient is to keep an track of the insulin sensitivity factor (ISF). The bolus in the current system is controlled with volume and time constrain.

*“The research concluded The evolution of SWS and their ability to track mobility, health indicators, and symptoms have great potential that can revolutionize the healthcare system and change patient behaviour. Driven by the quantified self, emerging patient driven healthcare models are contributing to shaping a positive future for healthcare with the patient at the epicentre.”* (Appelboom et al., 2014)

Eating disorder is a factor triggered by various emotional and behavioural flux that causes psychological distress. This leads to a lots of discomfort and might affect physically due to the forced activity by the patient. That leads to indigestion, purging and binge. The application therapy is more suitable for the vulnerable section of the society those exceed the standard BMI index or are prone to low BMI index. These are the target users who can carve the journey for a better living

habit with minimal interaction with the application and wider visualization for the critical index to alert the triggers.

The application focus on all the eating disorder which are being generalized with the perspective of design and framing an application the paper quoted for right user aesthetics and adherence. *“Providing users with a variety of rich content, personalization functionalities, and allowing them to use the app with- out many restrictions are very important.” (Alqahtani and Orji, 2020)*

The special case of angina where the heart muscles are prone to suffer a cardiac stroke due to less blood supply. This is an ideal case where the user can employ use a wearable application which can calibrate the heart rate and the ECG of the person in real-time and evaluate with other sensor values. This will help the user understand the triggers and push the variable for more potential work with low risk of heart stroke. (Angina (Chest Pain), 2020)

### 1.2 Justification

Smart wearable devices has an enormous potential to integrate technology, study the human body closely with the most real-time and accurate information. As we deal with three major problems to be discussed in the project those are Eating Disorder, Diabetics and Fitness of a user.

- The major challenge is making the applications seamless across all platforms, to make the data flow convenient and easy for the users that thereby drive their actions in light of the data.

- To design the interface for the  eating disorder patient it needs to log the emotional inputs in span of a specific session.

- To design physiological evaluation tests like CIA, EDE-Q and monitoring the body physic using IR camera with a simple user interaction to evaluate.

- To design a seamless application for Type 1 diabetics to monitor the CMI and CGM in real-time using watch and pump with CGM.

- To design an application for Angina (Cardiovascular Disorder) to evaluate the body calories and efficiency to help the user analyse the triggers and ease the physical stain with interactive exercise.

### 1.3 Previous Works & Dependency

The previous work is based on the principle that tracks the food items form the kitchen inventory. The devices give the real-time information for the quantity of food required for cooking and logs it in as the standard quantity of user-intake per session. The application was also framed to generate information sufficient to suggest the prevalence of BED (Binge Eating Disorder). It also included actions to integrate the components (Smart Jars) with the application. The application lacked the capacity to cross verify the emotions of the user with a real-time value along with other indicators.

## 2. Chapter 1

### 2.1 Aim of Project

To develop a product solution for a multi-disciplinary mHealth Application integrated with Internet of Medical Things (IoMT).

The product solution focusses on keeping a track of diet in real-time and log the quantity of food consumed per meal that is further updated in the user profile. Where user can integrate smart watch or any health application to enhance the accuracy of body calories gained or lost. The product also focusses on binding the user profile with the clinician's and the Nutrition and dietetics technicians, registered (NDTRs).

### 2.2 Design Aim:

To design an application environment for minimal interaction to log emotions and check alerts using a smart watch.

To design a mobile application that visualises and manage the health information and food inventory in real-time.

To design a dashboard for the clinicians to manage the patients' and monitor the health in real-time.

### 2.3 Objective

The objective of the solution is to provide the accuracy in food intake

- Real-time monitoring
- Analyse the progress of the user
- Predict the user behaviour with respect to food cycle
- Maintaining a clean diet threshold
- Log of dietary for clinical purposes
- Log of emotions

- Maintaining diet consistency
- Monitoring sugar intake
- Monitoring groceries

The motive that drives the application principles are well defined with purpose certain objective may not be reflected in the application which are not necessary but can be a part of future work if the application is developed for a service based product.

# 3. Chapter 2

## 3.1 Diabetics:

The focus of this product for CGM (Continuous Glucose Monitoring) is on both Type 1 & Type 2. Both type of diabetes are diverse in their causes and roots, common ground being an unbalanced level of insulin that disturbs the sugar (glucose) level in blood.

Type 1: In this case the insulin secreted by pancreatic gland is destroyed by body's immune system. A disease which is autoimmune and is common among the youngsters and children. The cure for this is yet to be discovered and the cause is yet to be established. Complication in a long run can push the person to seizures, comas, kidney damage and cardiovascular disease.

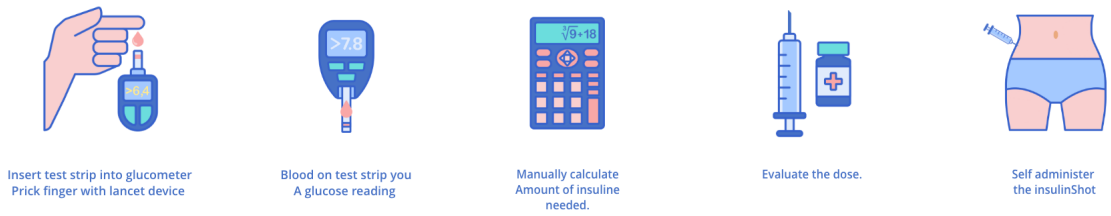
Type 2: The sugar (glucose) level in blood is quite high which results in wreaking of the blood vessels all over the body and create complications. The complications can lead to tiredness, blurred vision, slow healing, obesity etc.

The frequency of CGM is higher for type 1 compared to type 2, to define the target audience we have 44.7% of people under 40 affected with type 1 (left) while 41% are affected with age group of 40 – 64. Again looking at the stats for type 2 (right) the under 40 age group is the least affected compared to 40 – 64 which is 43%. This gives us clear idea of the target age group I.e 40 – 64 which has a difference of 1.9% between type 1 & type 2. Looking at both the type of diabetes the severity is more for the case of type 1category.

### 3.1.1 Daily Task for Type 1 diabetes: (Content to be replaced with Chapter 3 (4.2))

- Insulin Dose for long time period
- Periodic blood test (in a day)
- Carbohydrate count for each meal
- Post meal insulin shot

### 3.1.2 Process for Diabetics:




To evaluate the total amount of required insulin needed the factors are:

- Carb to insulin ratio
- Corrective insulin amount
- Insulin amount in the body

### 3.1.2 Formulas:

- Carb Insulin: insulinCarb = carbAmount / carbFactor
- Carb Insulin: insulinCarb = carbAmount / carbFactor
- Correction Insulin: insulinCorrection = (bgReading - bgTarget) / sensitivityFactor
- Insulin OnBoard: insulinPerHr = insulinPrev / 3
  (Note: 3 is the number of hours it takes insulin to run its course)

- timeElapse = timeCurrent - timePrev
  (Note: if timeElapse is >= to 3 insulinOnBoard = 0)

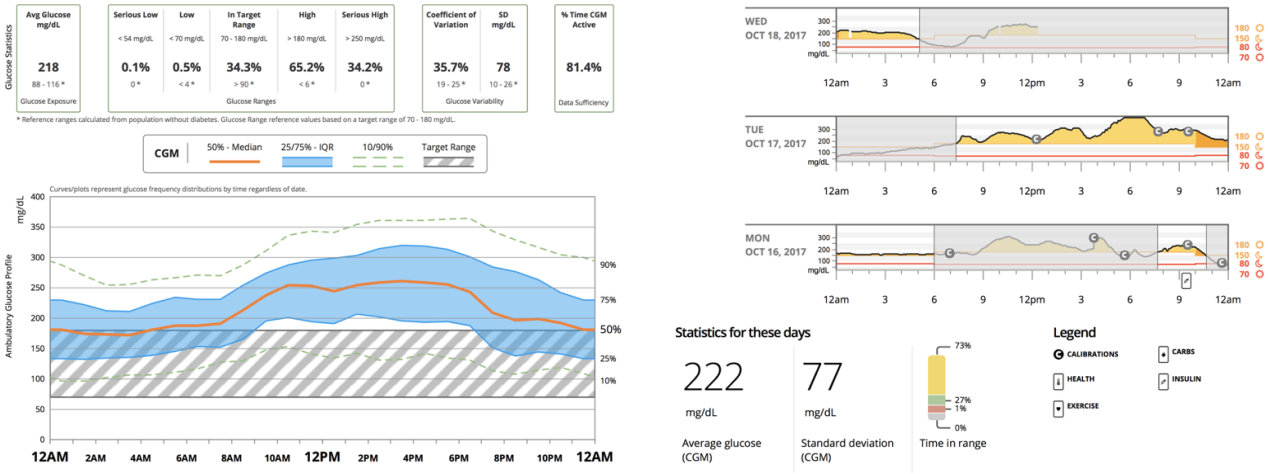
- timeLeft = 3 - timeElapse
- insulinOnBoard = insulinPerHr * timeLeft
- Total Insulin take: insulinTotal = (insulinCarb + insulinCorrection) – insulinOnBoard

### 3.1. Research:

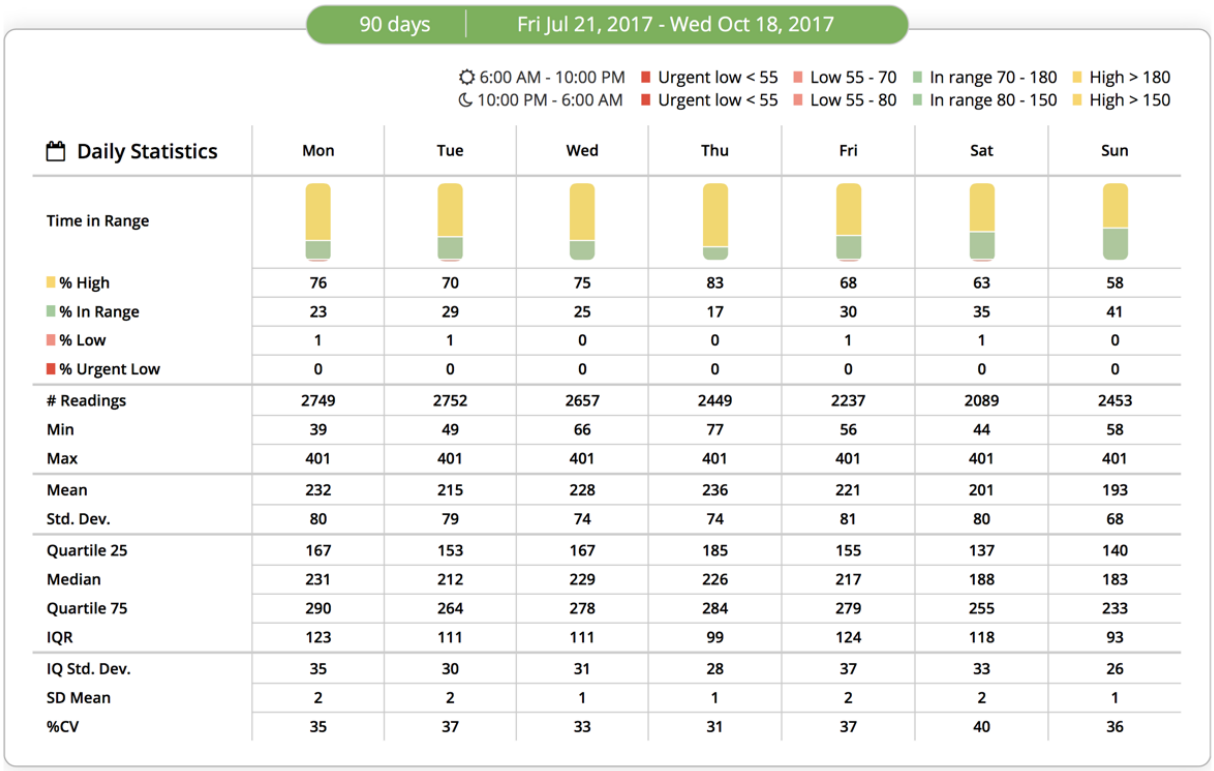
The data to be established should be analysed and studied before displaying the same on the UI. The best product to mirror is Dexcom G6 CGM (Continuous Glucose Monitor) the technology can be segmented in three parts such as sensor, transmitter and receiver.

The application uses concept over two different brand such as Apple and t:connect. Those can be successfully connected with the solution as we have smart watch, smart container, smart pump which can be all integrated together in a seamless solution.

Below is an example of data collected from the sensor:




- The files are not convenient to access as they have to be downloaded from the web portal.
- The reports are not well organised or labelled in a readable format.
- Indicative data sheet for a session (day/time).



90 days | Fri Jul 21, 2017 - Wed Oct 18, 2017

6:00 AM - 10:00 PM Urgent low < 55 Low 55 - 70 In range 70 - 180 High > 180
10:00 PM - 6:00 AM Urgent low < 55 Low 55 - 80 In range 80 - 150 High > 150

| Daily Statistics | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| Time in Range | | | | | | | |
| % High | 76 | 70 | 75 | 83 | 68 | 63 | 58 |
| % In Range | 23 | 29 | 25 | 17 | 30 | 35 | 41 |
| % Low | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| % Urgent Low | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| # Readings | 2749 | 2752 | 2657 | 2449 | 2237 | 2089 | 2453 |
| Min | 39 | 49 | 66 | 77 | 56 | 44 | 58 |
| Max | 401 | 401 | 401 | 401 | 401 | 401 | 401 |
| Mean | 232 | 215 | 228 | 236 | 221 | 201 | 193 |
| Std. Dev. | 80 | 79 | 74 | 74 | 81 | 80 | 68 |
| Quartile 25 | 167 | 153 | 167 | 185 | 155 | 137 | 140 |
| Median | 231 | 212 | 229 | 226 | 217 | 188 | 183 |
| Quartile 75 | 290 | 264 | 278 | 284 | 279 | 255 | 233 |
| IQR | 123 | 111 | 111 | 99 | 124 | 118 | 93 |
| IQ Std. Dev. | 35 | 30 | 31 | 28 | 37 | 33 | 26 |
| SD Mean | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| %CV | 35 | 37 | 33 | 31 | 37 | 40 | 36 |

### 3.2 Eating Disorder:

As discussed earlier about the disorder the major factor to monitor can be in established in the following sequence :

- The user needs to practice certain type of treatment.
- The user needs to make journey map or follow a journey map for the recovery.
- The user needs to be in regular touch with a therapist or a person assigned/volunteered for the role.
- Knowing the triggers and avoiding them e.g. Keeping a note of your disgust to learn adaptive and receptive practices.
- The sensor receptors learn adaptive pattern quickly.

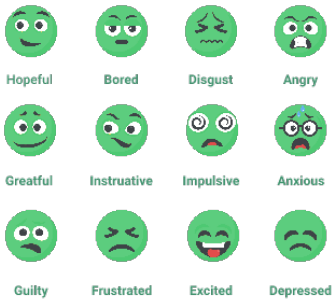
The standard method to evaluate the disorder type and level includes certain research methods and practiced questionnaires such as:

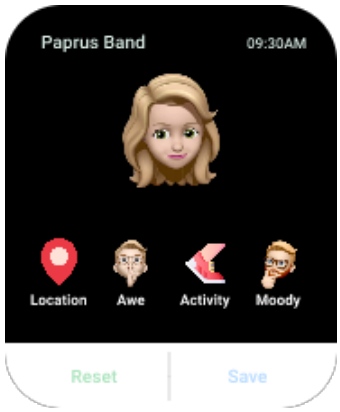
- Eating Disorder Examination 17.0D (Christopher G Fairburn)
- Eating Disorder Examination 17.0D/C.1 (Rachel Bryant-Waugh)
- Clinical Impairment Assessment Questionnaire (CIA 3.0) Bohn and Fairburn, 2008

- Eating Disorder Examination Q4 (Fairburn & Cooper)

The product has a paprus care section which has digitized clinical assessment to evaluate the user emotions and body image reflex to validate the responses.

To validate the emotions visual representation and visual continue with all aspect of the user we need to have a hex of #59CB7D which was a palette from green colour. Which creates a senses of harmony and promotes decisiveness. With the list of emotion set.




To detect the triggers and tally with the feelings we used different devices with different features incorporating design screens and devices.

### 3.3 Angina (Cardiovascular Disorder):

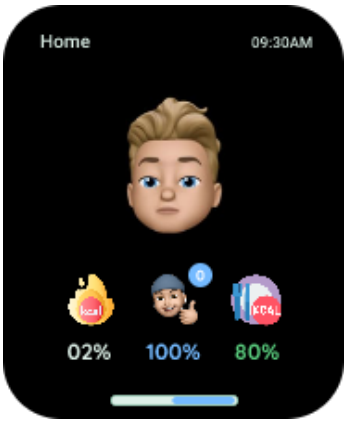
The heart rate for the user is really low and things get difficult with certain risk to live in day-to-day activity which includes :

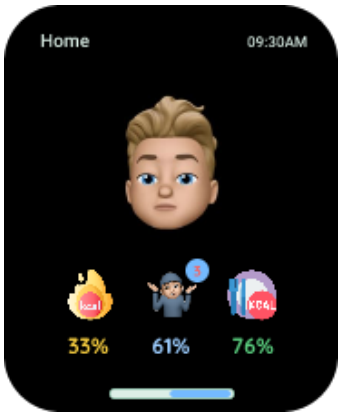
- Unhealthy cholesterol levels
- High blood pressure
- Smoking
- Diabetes
- Overweight or obesity
- Metabolic syndrome
- Inactivity
- Unhealthy diet

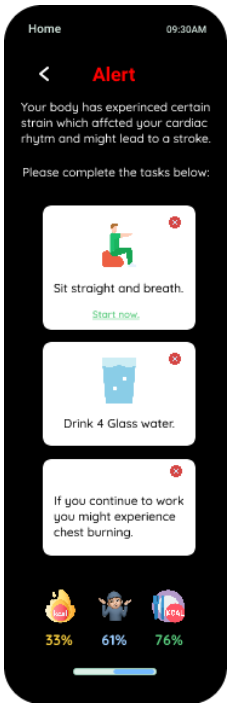
The user needs to be diagnosis first to receive a proper treatment. To perform these tests the user needs to take an inclusive approach such as:

- EKG (Electrocardiogram)
- Stress Testing
- Coronary Angiography and Cardiac Catheterization

But the user can be monitored with the body movement when the watch is calibrated this can notify the user before any potential threat such as calories burnt and calories remaining. This also monitors the risk and alerts with micro animation and notification.



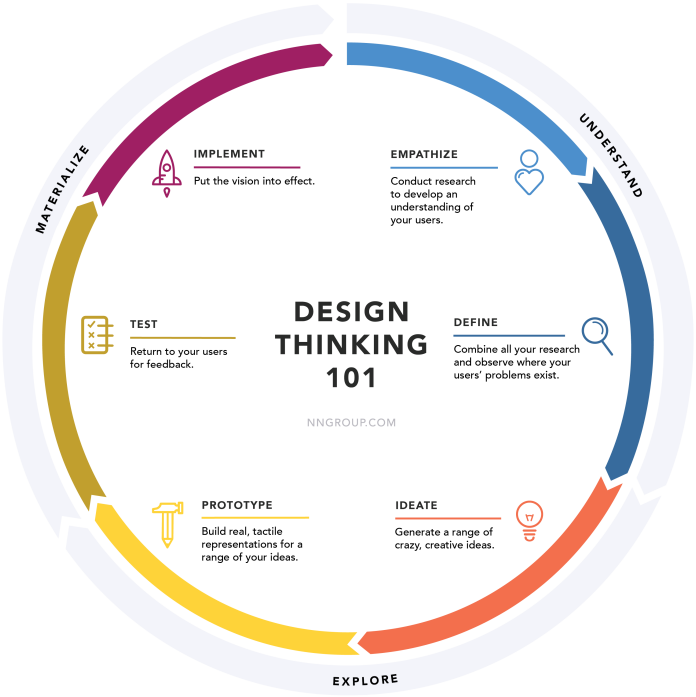



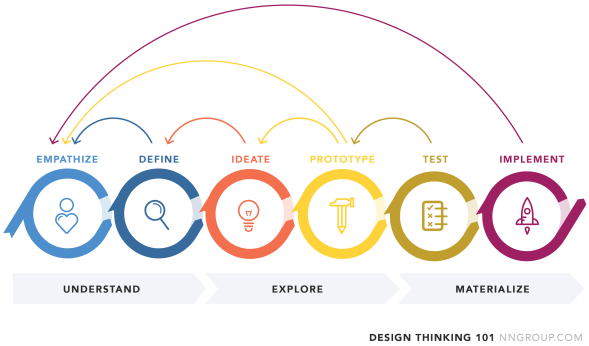

# 4. Chapter 3

## 4.1 Design Process:

The research method applied in this project is Design Thinking 101 method by Nielsen Norman Group with an ideology of supported by an accompanying process.



The basic design thinking process was used to achieve low-fidelity model and other interaction points  which were discussed with an project overview session by two participant with the project at its low fidelity stage.




The method was made flexible to monitor and process the design thinking parallel with two different device and platform.

### 4.2 Insights and Feedback:

The  survey conducted with and overview/walkthrough to collect user insights for an possible human error and open suggestion for the redesign of the application from the low fidelity design to high fidelity design. While in certain cases where the wearable design had a high fidelity design as the interactions were really minimalistic with respect to the low proportion ratio of screen. Each of the information was logged with confidential approach to collect useful insights.

Interviewer Name: Kiran Khan

Interview Duration: 34:30 sec

Comments: *“its quite nice application for people with disorder, to maintain their balance in life”*

Insights:

*“The participant talked about motivation”*

*“The participant concluded the user have to keep a track for the low blood sugar and get the alerts they needs to stop action recognised from triggers.”*

*“The participant was happy with the activity and the mode of engagement such as Facebook and Spotify as the therapy”*

Interviewer Name: Kiran Khan

Interview Duration: 34:30 sec

Comments: *"I am happy to see such product integration, and the propose is also a defined with the actions, but needs  a high fedility to make user friendly "*

Insights:

*"the application needs a better typography and needs more breathing spaces"*

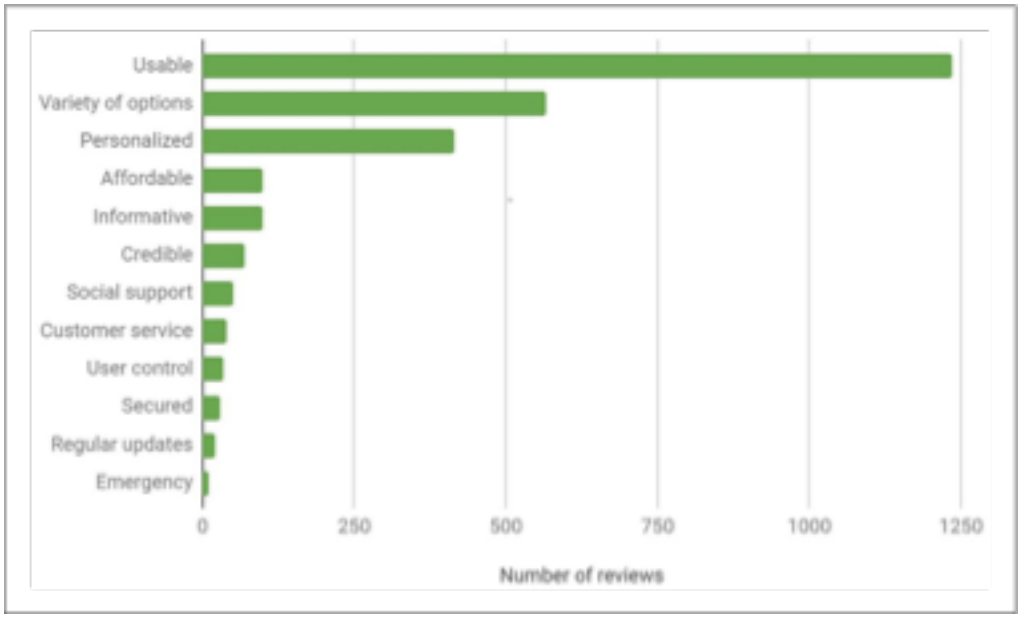
*"the application needs bit tailoring with the gridding and icon placement"*

*"making the right choice to make the design elements more universal  than making it more concept design"*

### 4.3 Analytics:


Strategies/theoretical background of mental health apps.*(Alqahtani and Orji, 2020)*

The analytics for the competitor market is really open with 43 free apps and 11 fee-based applications which makes a lots of application as constrains those make the application bit boring and lifeless for interactions. But standard and basic gridding give the application universal access apart from being appealing to the user.(Alqahtani and Orji, 2020)




Qualities that users liked.

Discussion were made to include certain feature according to the review discussions:

*“Would be awesome if you could track physical symptoms of depression/anxi- ety, too”*

*Moreover, users would like more emoticons and emojis to choose from “more variety in the daily mood rating. I don’t feel like three mood levels is enough”*

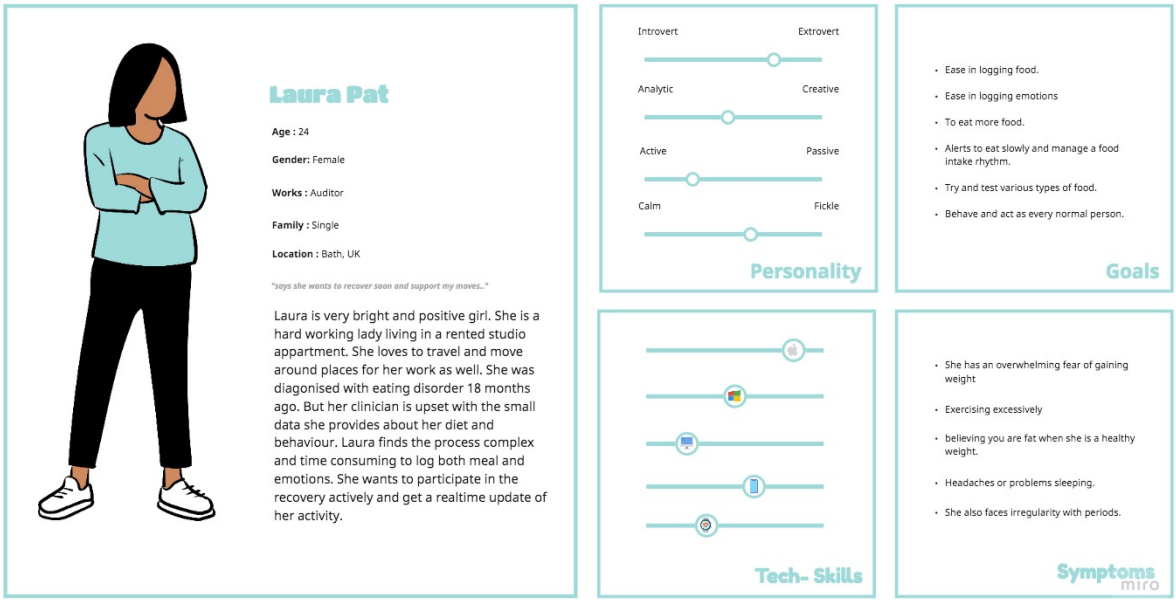
*“I hope adding a way to personali[z]e the app according to each user with different modes or methods that can really help them throughout their fight with depression”*

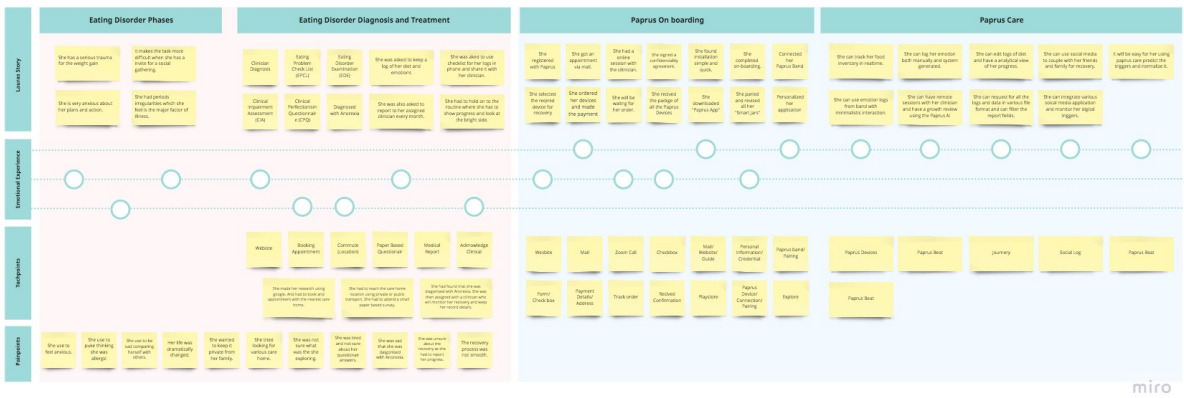
These are certain quotes and insights collected from the paper that suggested the features and needs of the user in today’s era. Those can be segmented as UI to be simplistic, Variable option to input data and personalize the application with social support for interaction. .(Alqahtani and Orji, 2020)

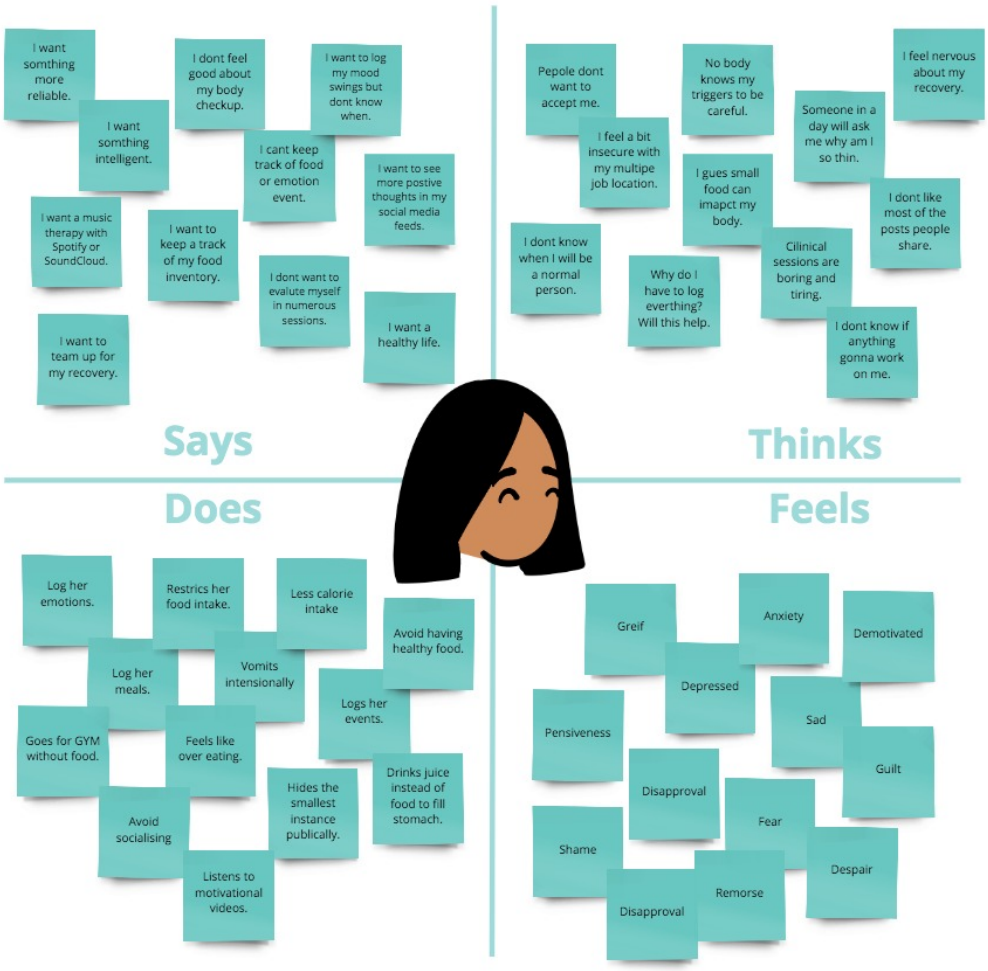
# 5. Chapter 4

## 5.1 Persona:

### 5.5.1Eating Disorder (Attribute of Anorexia & BED)



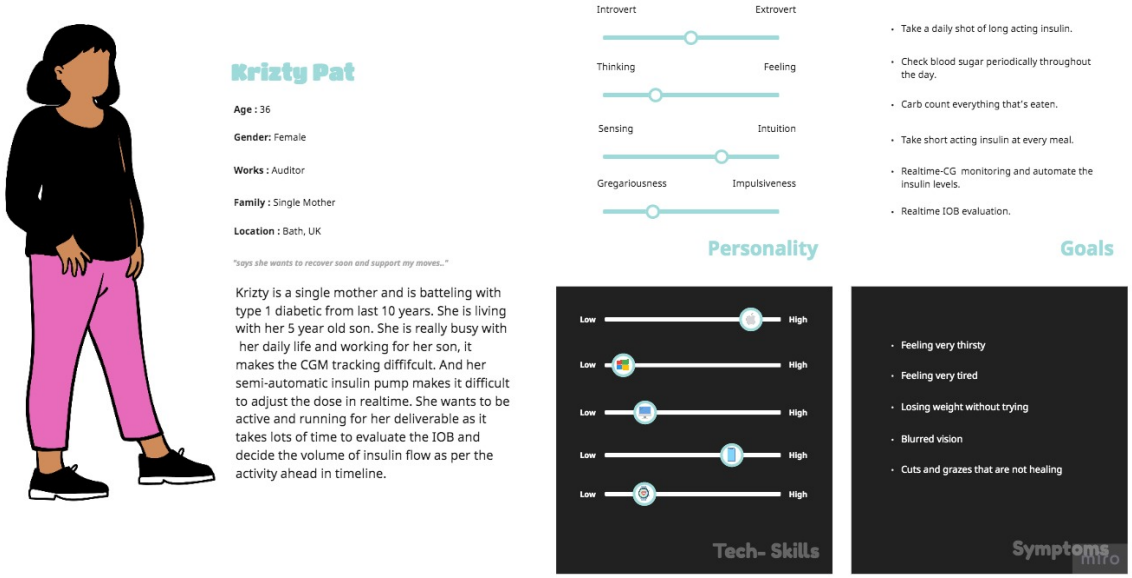



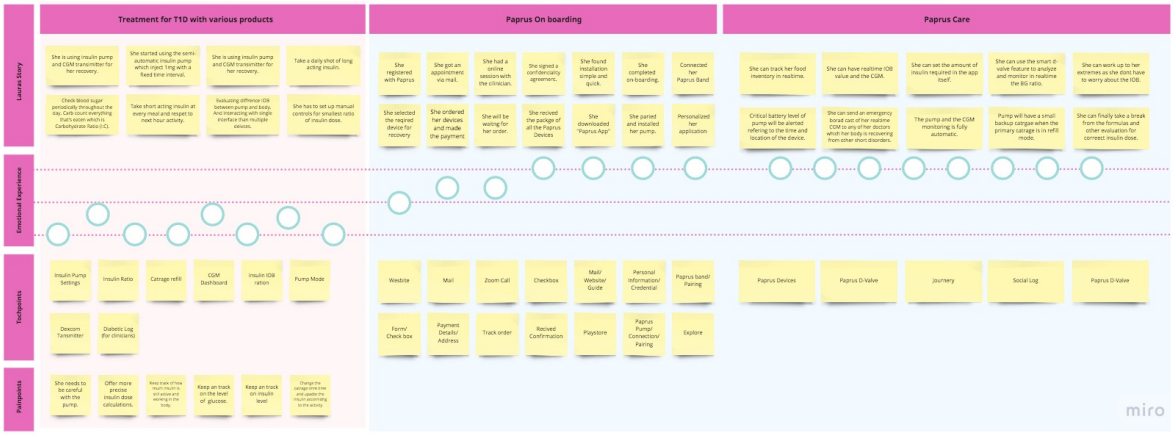



**Persona Discussion:**

The unique biological parameters of an individual is primarily suggestive of any potential health issues waiting inception at any point in life. Attributes pertaining to calorific consumption and metabolism are prime indicators of the majority health ailments suffered by humans in this age of physical ease. Human body somatotype, age, stress-susceptibility and genetic makeup are predetermined by hormonal patterns that in turn control the likelihood of developing cardiac/glycemic unbalance; which is the key focus of the product.

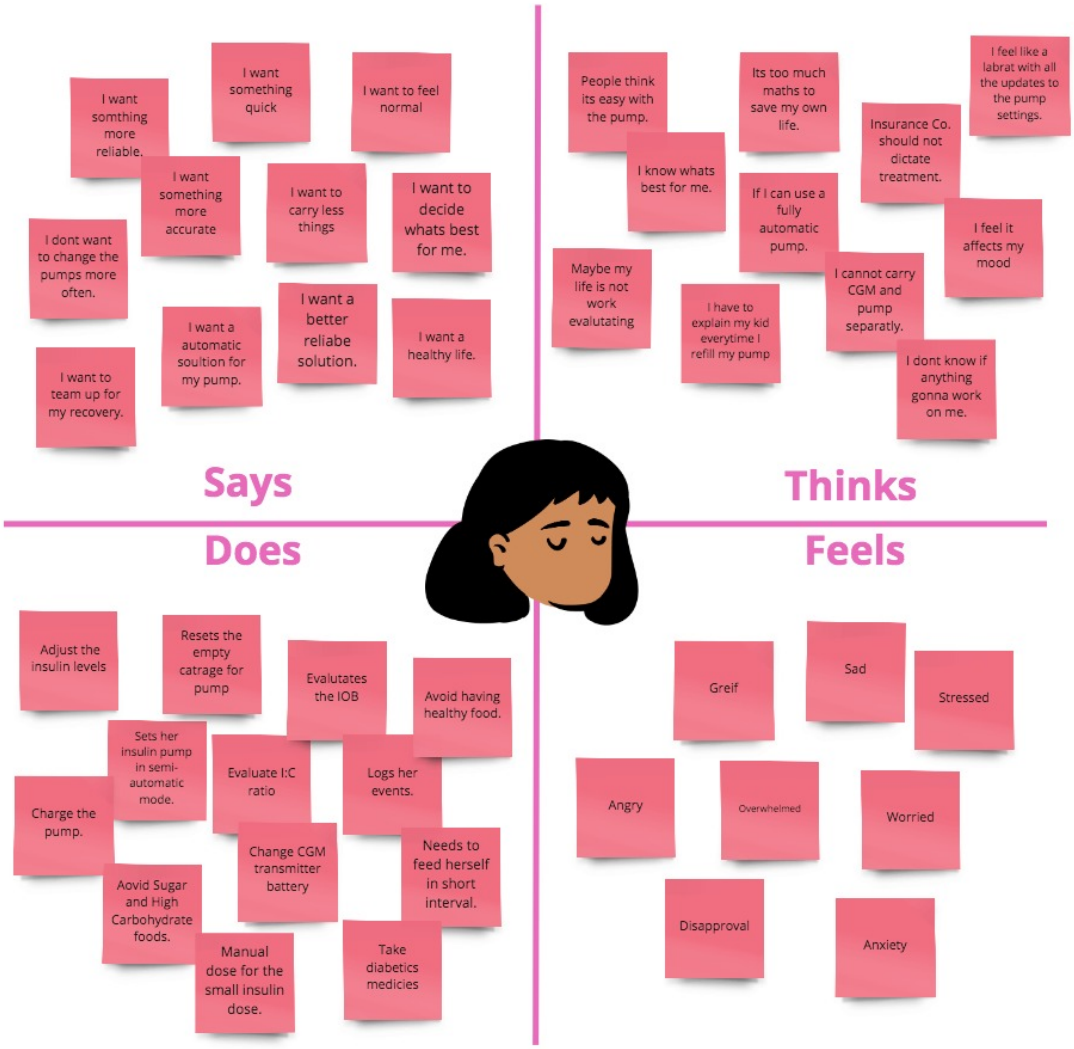
## 5.5.2 Diabetics (Type 1 & Type 2)




### 5.5.2.1User Journey Discussion:

User's acclimatization to the product framework is achieved through a pathway of phases, each of which consists of unique user inputs designed to provide an uncluttered environment for the assessment of targeted ailments and the subsequently needed aid.

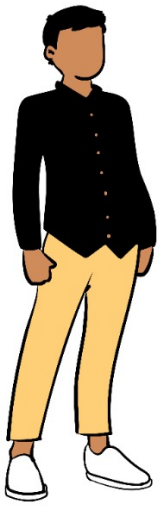



Common hindrance in the conventional mode of diagnostic is the absence of any real time monitoring. Needed clinical support is present only at certain intervals of medical appointments and for the majority of time user is left with uncertain advices that are hard to carry out with professional precision.

Real time monitoring provided by the product may prove critical to the improvement  of targeted issues; determining factor in a situation of life and death etc. Hence user guidance provided by the interface on a continuous basis alludes to better sucess rates for chronic diseases.

Diabetes and cardiac issues are lifestyle dependant diseases that require constant attention and professional guidance promptly provided by the product through implementation of Internet of Medical Things (IoMT).

### 5.5.3 Cardiovascular Disorder (Angina)



**Joe Paul**

**Age :** 18

**Gender:** Male

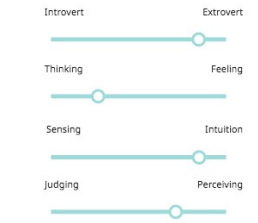
**Works :** Student/Part-time

**Family :** Single

**Location :** London, UK

*"says he will manage to follow a strict fitness schedule by heart.."*

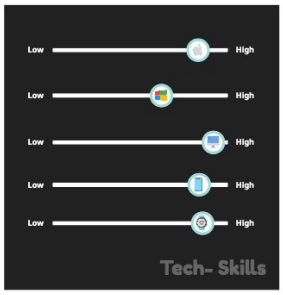
Joe is a bright students and a hardworking boy. He is pursuing graduation in mass communication and wants to be a travel writer. He was diagonised with in his early teenage. He is really good keeping a pace with all his daily life activities. But needs to know his activity triggers and alert himself for each threshold and try to normalise. He also is a bit picky with food and his habits of eating food.



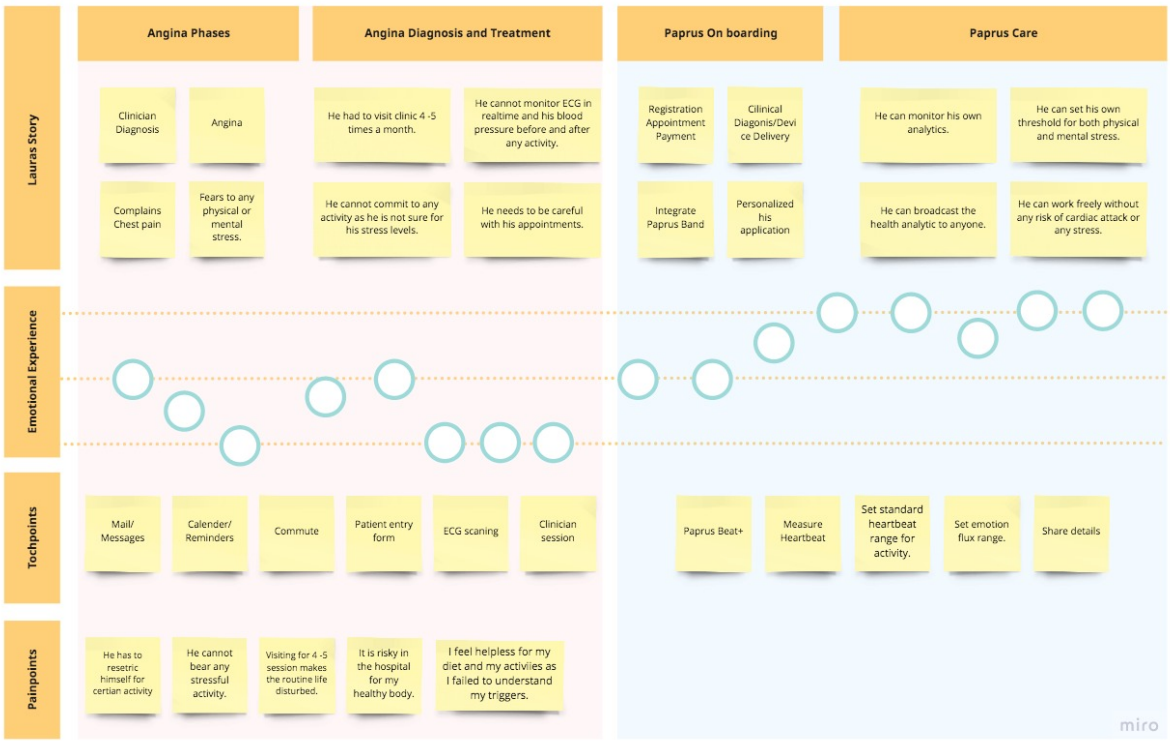

**Personality**

- Live and lead a healthy life.
- Alert for ciritical heart papitation.
- Trigger based ECG and stress monitoring
- Monitor and manage ECG logs to share with the local GP.
- Measure oxygen in relatime.

**Goals**

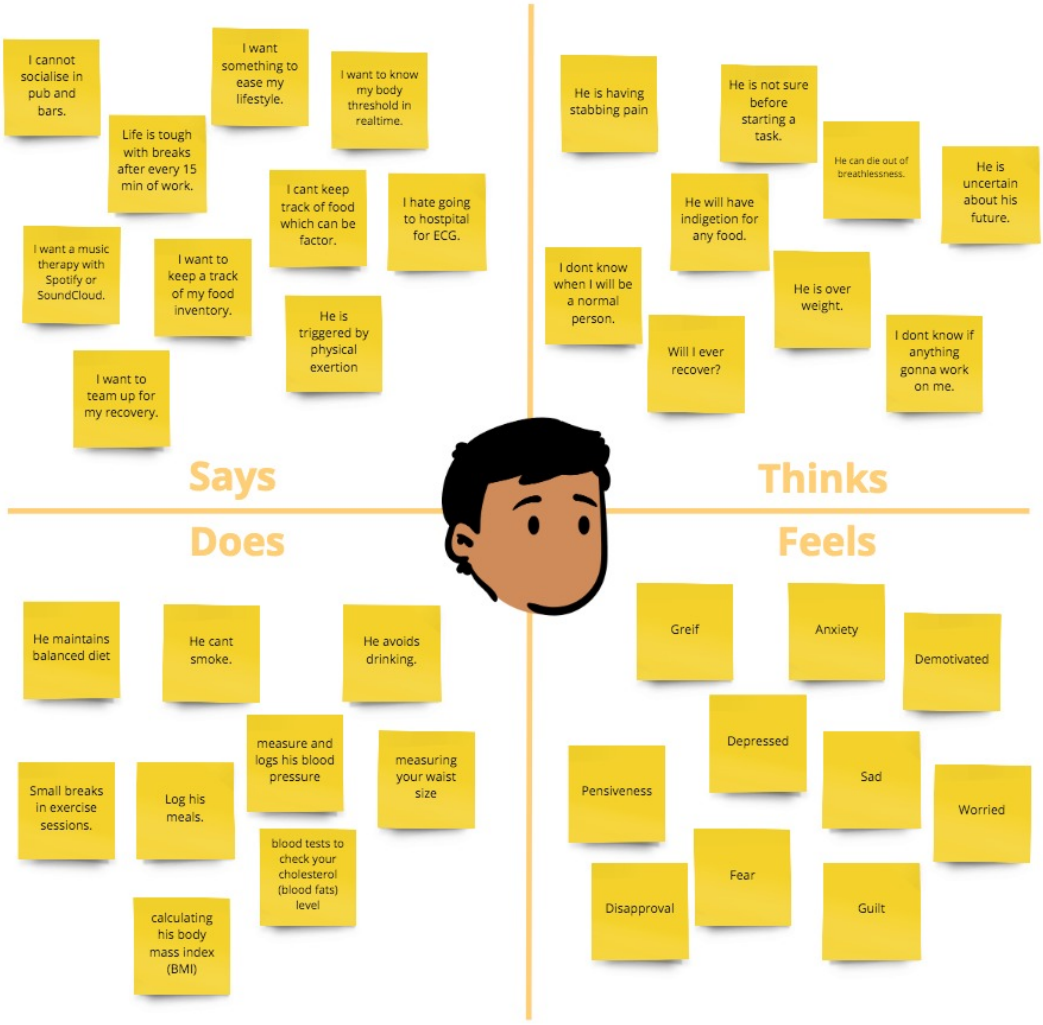






### 5.5.2.1 Empathy Map Discussion:

Studies in the recent times indicate a disproportionate calorific consumption by the human brain in terms of oragan to energy ratio. 20-25% for an organ that is barely 1/60th of the average weight for an healthy adult, is a critical factor in




determining the importance of our thoughts on the overall health of the individual. The "feelings" as we know them play the most important role in deciding the metabolic process for the body.

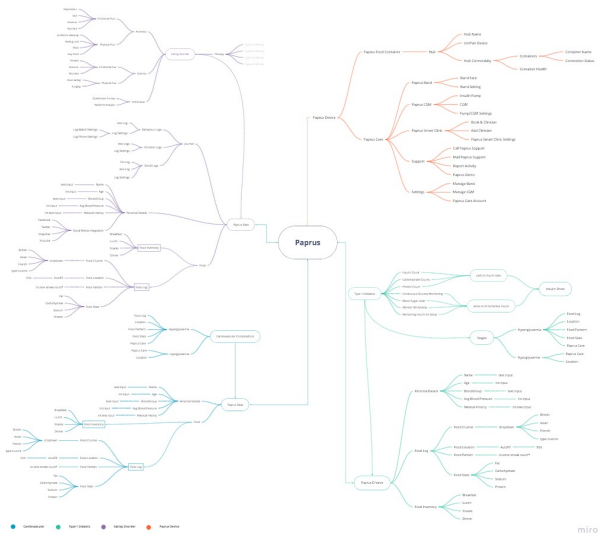
Stress hormones: cortisols; diminish insulin tolerance in predibetics to full blown diabetics, proving to be the single major contributor in sustained glycemic prevalence and subsequent organ damage.

People susceptible to anxiety attacks have a higher risk of cardiac arrest at ages above 40 which falls acutely within the target group of the device.

Real time pulse monitoring: the commonest indicator of people's emotions is a critical input for continuous diagnosis of health and hence is the basic source of data for the product.

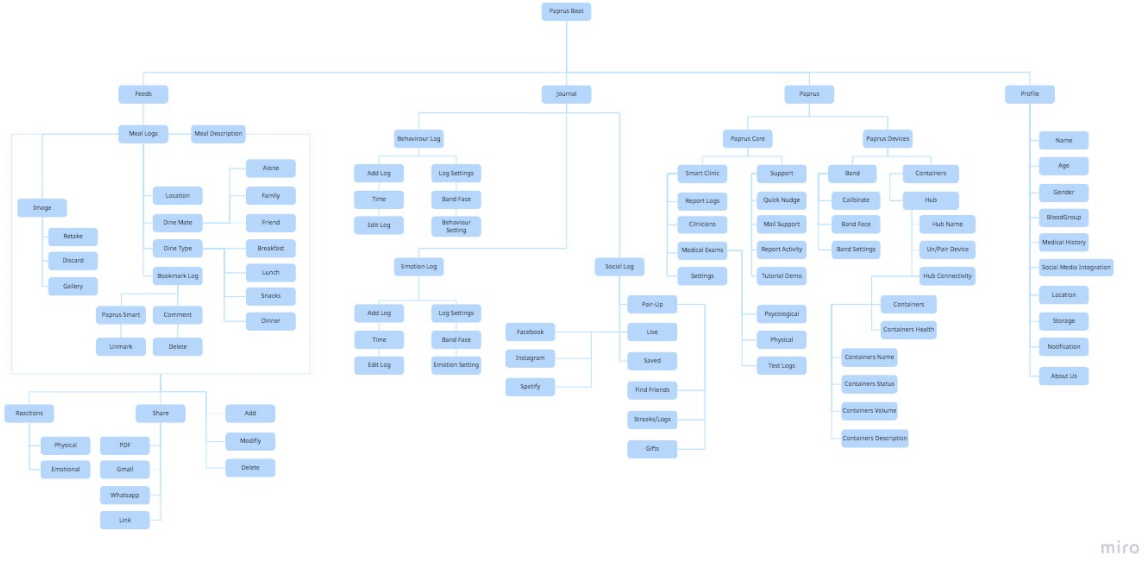
# 6. Chapter 5

## 6.1 Brain Writing & Mind Map

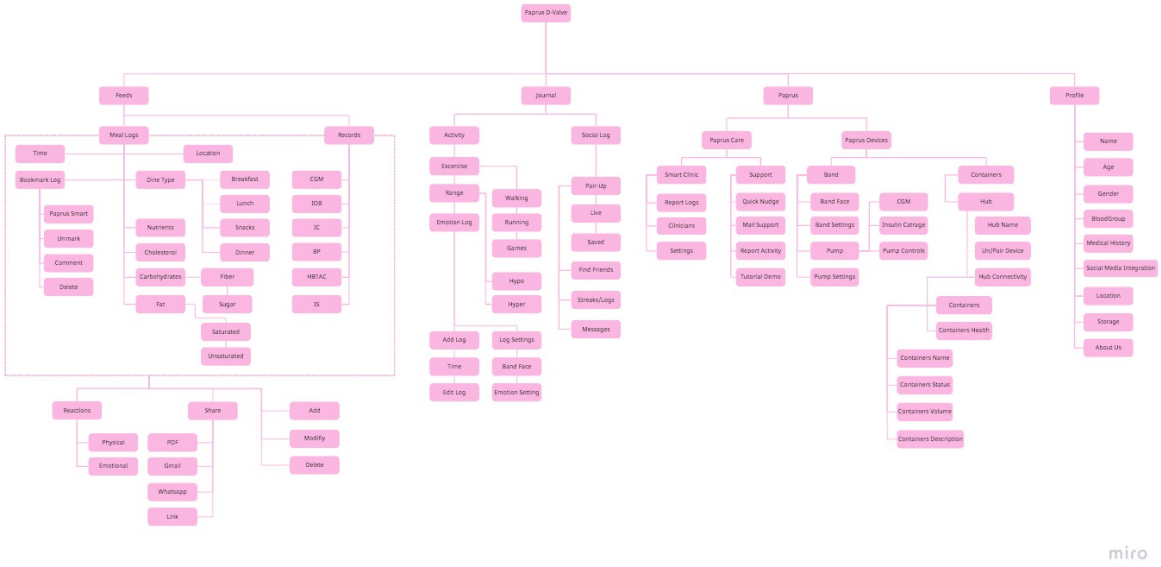




## 6.2 Information Architectures

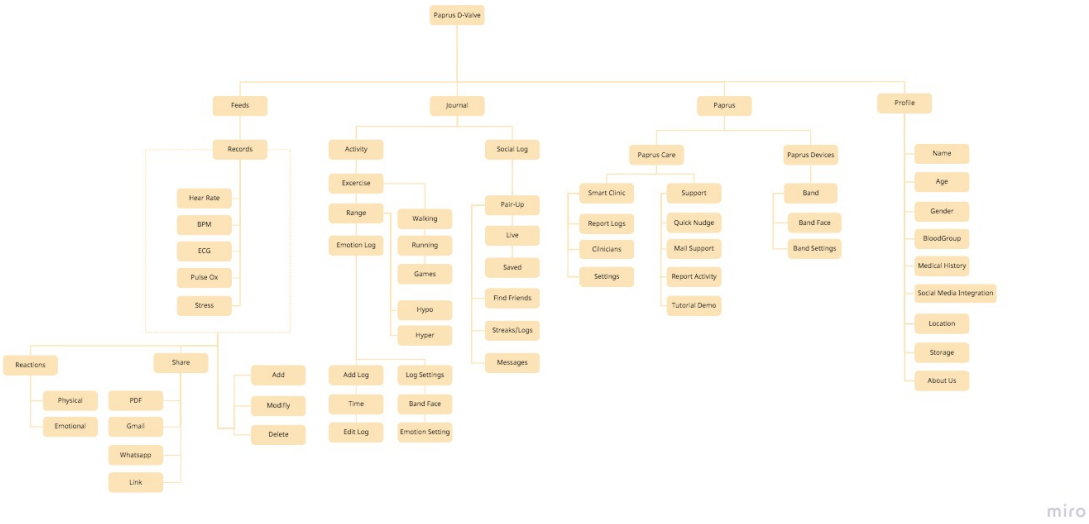
Flow of data from the point of inception to the point of analysis always follows a structured algorithm that governs various critical factors of a product like: Efficiency, Design Clutter, Data Quality and Reliabiliity.




## Eating Disorder (Information Architecture)

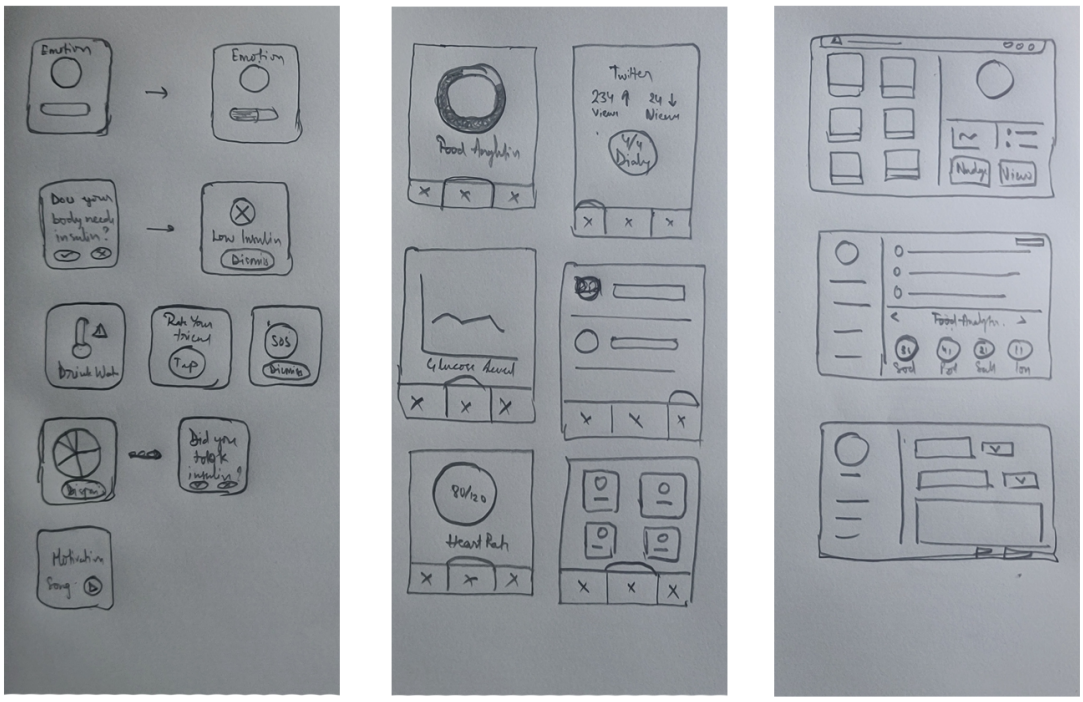



## Type 1 Diabetics (Information Architecture)




**Angina (Information Architecture)**

## 6.3 Sketch Prototyping



**(Rough Sketching for all applications)**

# 7 Chapter 5

## 7.1 Style Guide:

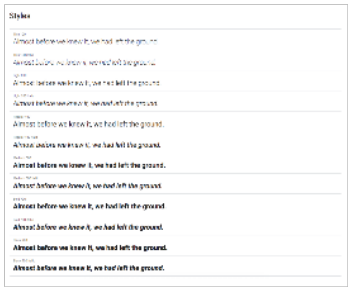
### UI Style Guide

Colours

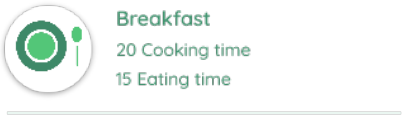

Typography

Quicksand:

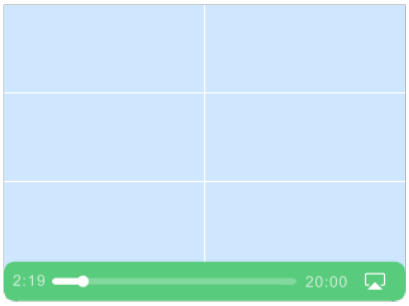

Roboto



UI Elements

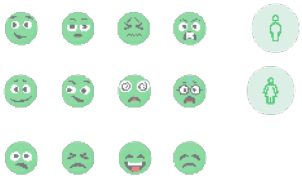







Buttons:


Iconography



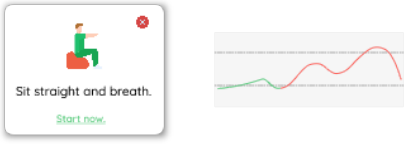
Input Feilds




### Wearbale Style Guide

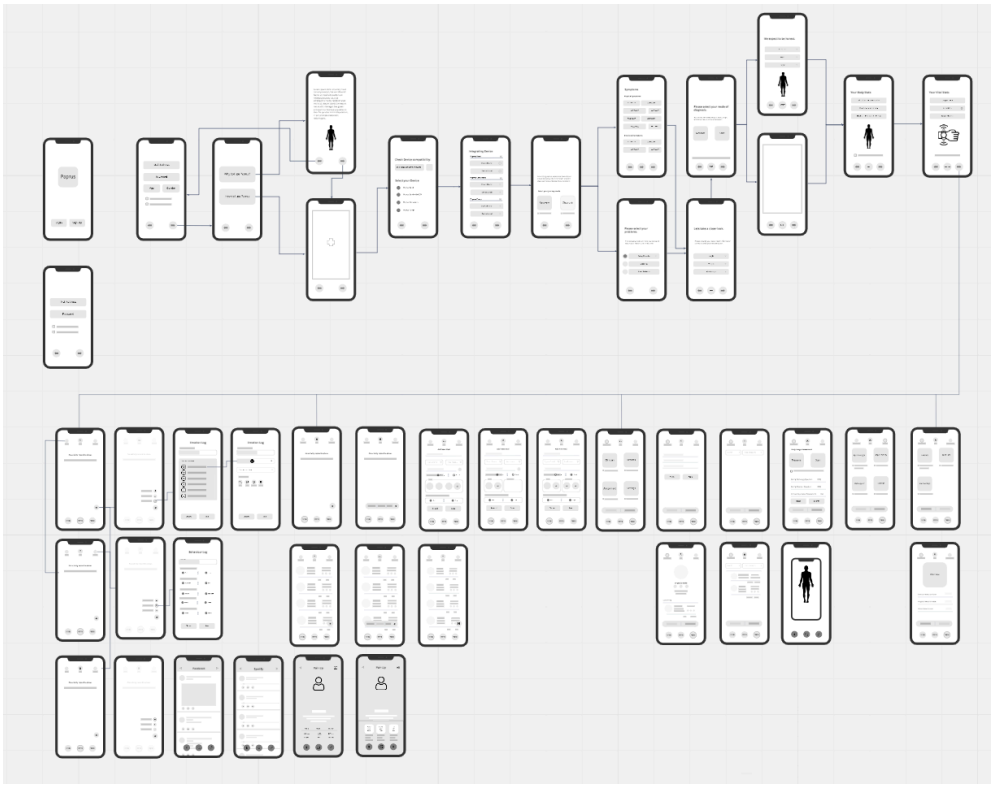
Visualisation & Input


Cards

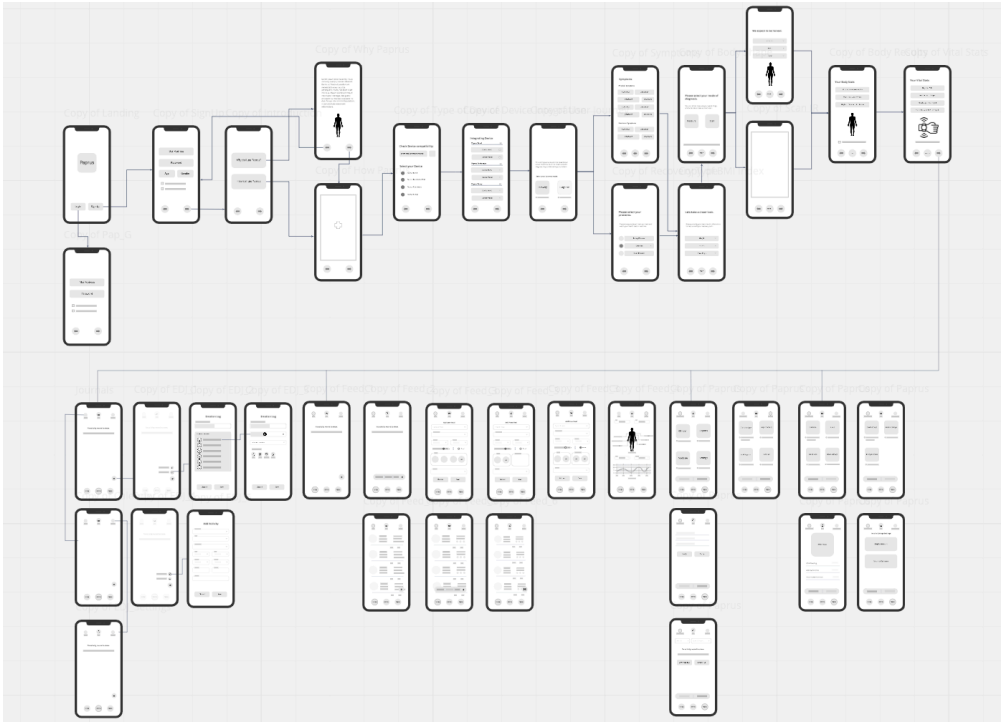



Iconography

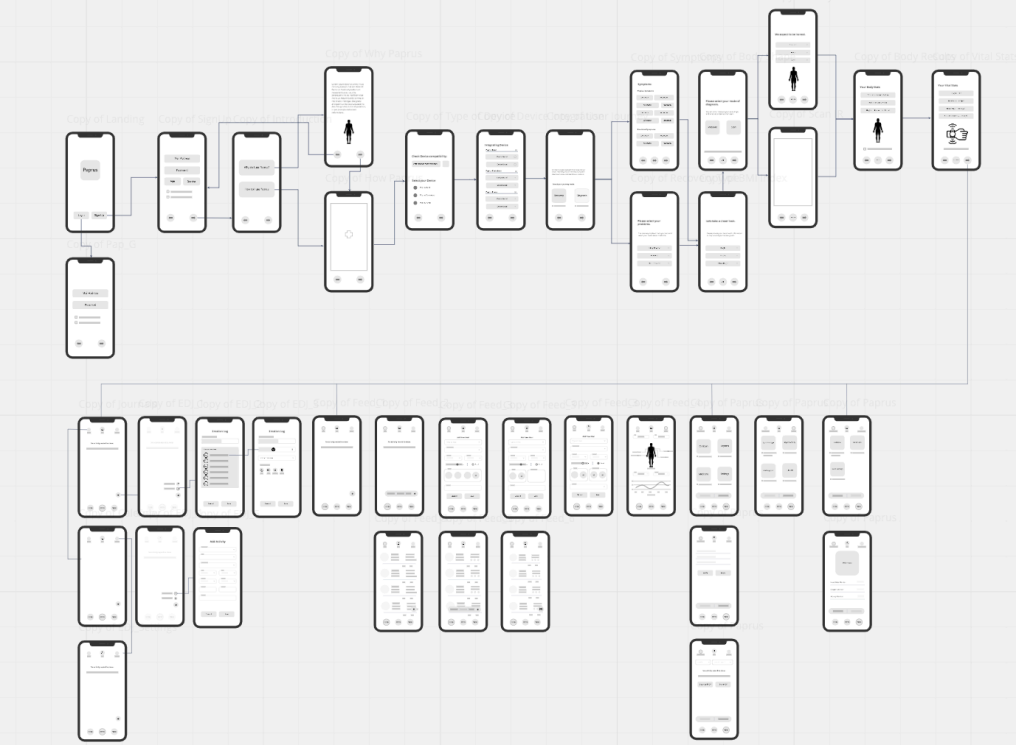
## 7.2 Low-Fidelity Design:



**Eating Disorder**



**Diabetics**



**Angina**

### 7.3 Usability Testing:

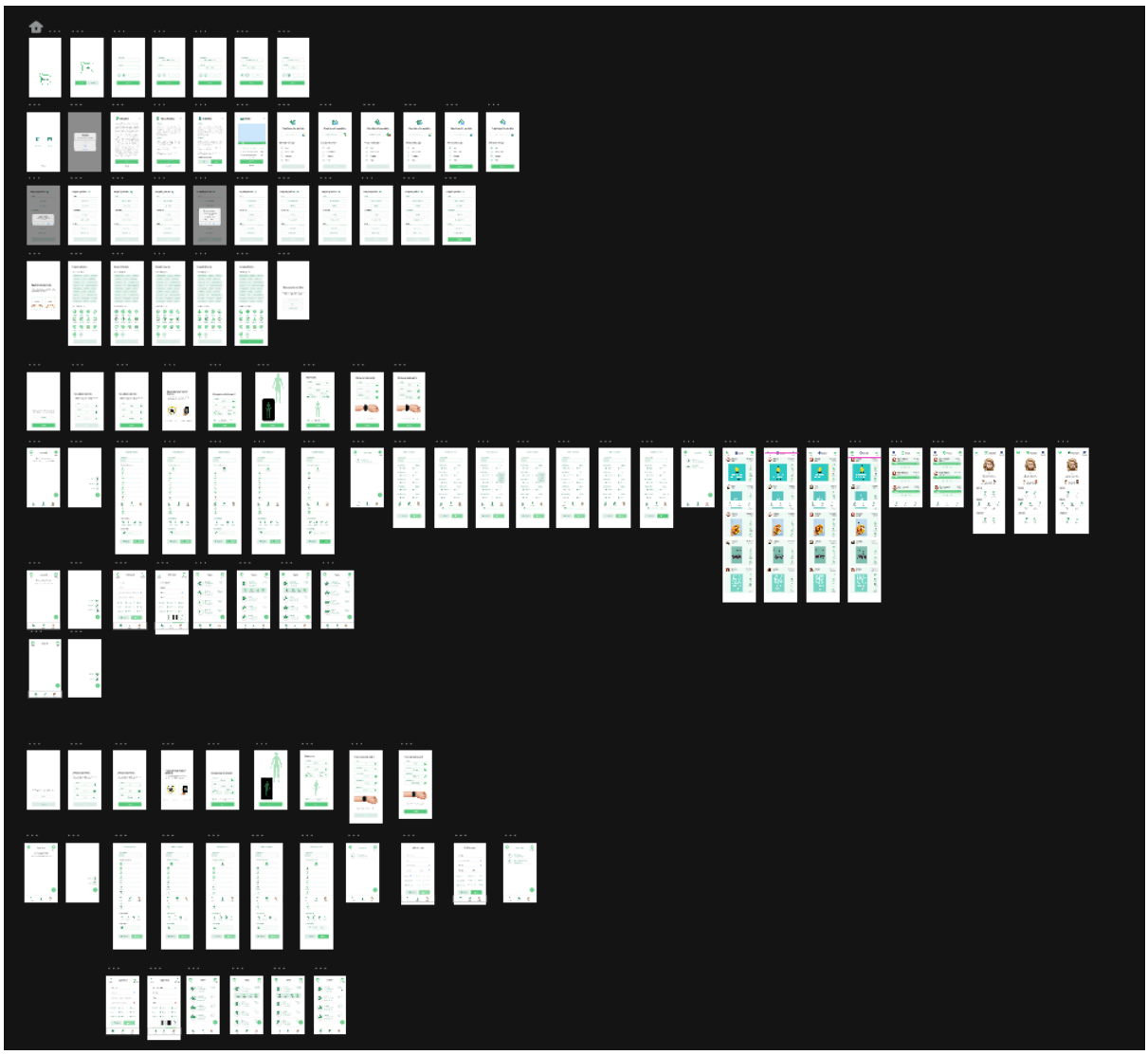
The low-fidelity model for mobile application was only tested on a free run by the participants to explore and comment on any element of design, aesthetic and usability action elements.

The usability for eating disorder and diabetics application had issue with the food logging, where the input elements such as text input box and radio button for multiple choice option were replaced as per principle and participants insights and suggestion.

The usability for the social media application with eating disorder was confusing while browsing. Which the participant complained about the placement of 3 CTA in single page.

# 8 Chapter 6

## 8.1 High Fidelity Design:



**Discussion:**

- The design screens for the application had user issue with the participants while browsing the eating disorder application.
- The participant was happy with the simplistic effect of interaction approach and smooth on boarding.
- While user was little dissatisfied with the text side for micro information.

**Discussion & Outcomes:**

The application has lots of potential to put together as a research work which needs bit tailoring.

The watch wearable are the primary user input and also can act as secondary depending upon scenario. The application used most minimalistic design and makes it simpler for any sort of user and visualise data in much cleaner way. The CMI (Continuous Monitoring Index) value helps the user validate the data faster than the traditional way of monitoring.

As the testing couldn't find a person with actual disorder each conclusion draw is based on previous research or existing application work which are certified to do day-to-day business. But the paper by *(Alqahtani and Orji, 2020)* really gave a clear idea of what the users are looking in the new interactive IoMT or healthcare application as the users interests in variation to process the validation.

The mobile application was is the primary device to integrate the device's irrespective of use and purpose. It makes the integration easy and helps the device connect quickly and automatically.

Future work include a scope of making the application interactive with target goals of the user to create an engagement factor in the Papripin application interface.

## Artefacts:

## High-Fidelity Design (Mobile Application) :

https://projects.invisionapp.com/prototype/ckfwybahx003nsg01lcic6hkf/play

## High-Fidelity Design (Watch Application) :

https://projects.invisionapp.com/prototype/ckfy6l46e001y0701vzg6w4sw/play

## Project Dependencies:

https://kingston.app.box.com/f/540eba8a93e342c6b879962c488f6dd1

## Bibliography:


Appelboom, G., Camacho, E., Abraham, M., Bruce, S., Dumont, E., Zacharia, B., D'Amico, R., Slomian, J., Reginster, J., Bruyère, O. and Connolly, E., 2014. Smart wearable body sensors for patient self-assessment and monitoring. *Archives of Public Health*, 72(1).

Alqahtani, F. and Orji, R., 2020. Insights from user reviews to improve mental health apps. *Health Informatics Journal*, 26(3), pp.2042-2066.

www.heart.org. 2020. *Angina (Chest Pain)*. [online] Available at: <https://www.heart.org/en/health-topics/heart-attack/angina-chest-pain#:~:text=Angina%20is%20chest%20pain%20or,angina%20is%20not%20a%20disease.> [Accessed 8 October 2020].

New Mobile App and Talk Therapies for Binge Eating Disorder

https://clutch.co/web-designers/resources/how-to-design-for-users-struggling-with-mental-health

https://positivepsychology.com/emotion-wheel/

https://www.uxbooth.com/articles/guidelines-to-designing-apps-for-mental-health/

https://medium.com/@emonterrubio/sweetspot-mobile-be848d8babcd

https://www.nakedlabs.com/

https://www.producthunt.com/r/5d62d2d4278657