Project Deliverable C:
Conceptual Design and Project Plan

GNG 2101D
Team D1
Due Date: Jan 31, 2021
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List of Acronyms:

ADD- Attention deficit disorder

WiFi- Wireless Fidelity

Abstract:

This deliverable entails the team's conceptual designs, project plan, and feasibility study. First the functional decomposition process occurred in which each of our mealtime insulin tracker application's specifications were broken down into smaller sub-tasks, to allow for a more greater understanding into the key features that our app will have. Then came the convergence stage where each team member was tasked with creating 3 global concepts for the application. Each team member's concepts were benchmarked with each other using a selection matrix that entailed a numerical ranking process. After this, the divergence stage began in which the best conceptual design was selected, and using attributes from other comprehensive concepts, a final design concept was generated. Finally, each target specification was compared with how well it fits with the final design concept's features, as well as the benefits and drawbacks that entail with this comprehensive application. The final design concept that will be created is an application that allows the user to input various foods, their carbohydrates, and then calculates the hidden sugars, blood sugar levels, and insulin dosages required after every meal. Lastly, a feasibility study was conducted which displays that our project plan is realistic and all tasks will be completed to the highest degree of excellence. All in all, our device will help regulate the user's diabetic condition and improve their well-being, one dose at a time.

Introduction:

The primary goal of this deliverable is to utilise the customer needs and perform functional decomposition as well as the ideation process in order to create a final design idea, and then compare it with a set of target specifications. The function decomposition process consists of clarifying core functionality and breaking down required product functions into smaller basic sub-functions. Then each team member will provide 3 concepts which will all be analyzed and evaluated based on our set of target specifications. Then a final group design concept will be created that will be an integration of almost all of the concepts generated within the ideation stage. Afterwards, the final concept will be compared to the set of aforementioned target specifications, and a feasibility study will be conducted that will entail how realistic our project plan is. Finally there will be a Wrike project plan attached with the feasibility study that displays all tasks, task dependencies, milestones, and much more. This will show the evolution of our final product and what is to come.

1. Core Concept Breakdown:

Mealtime insulin tracker

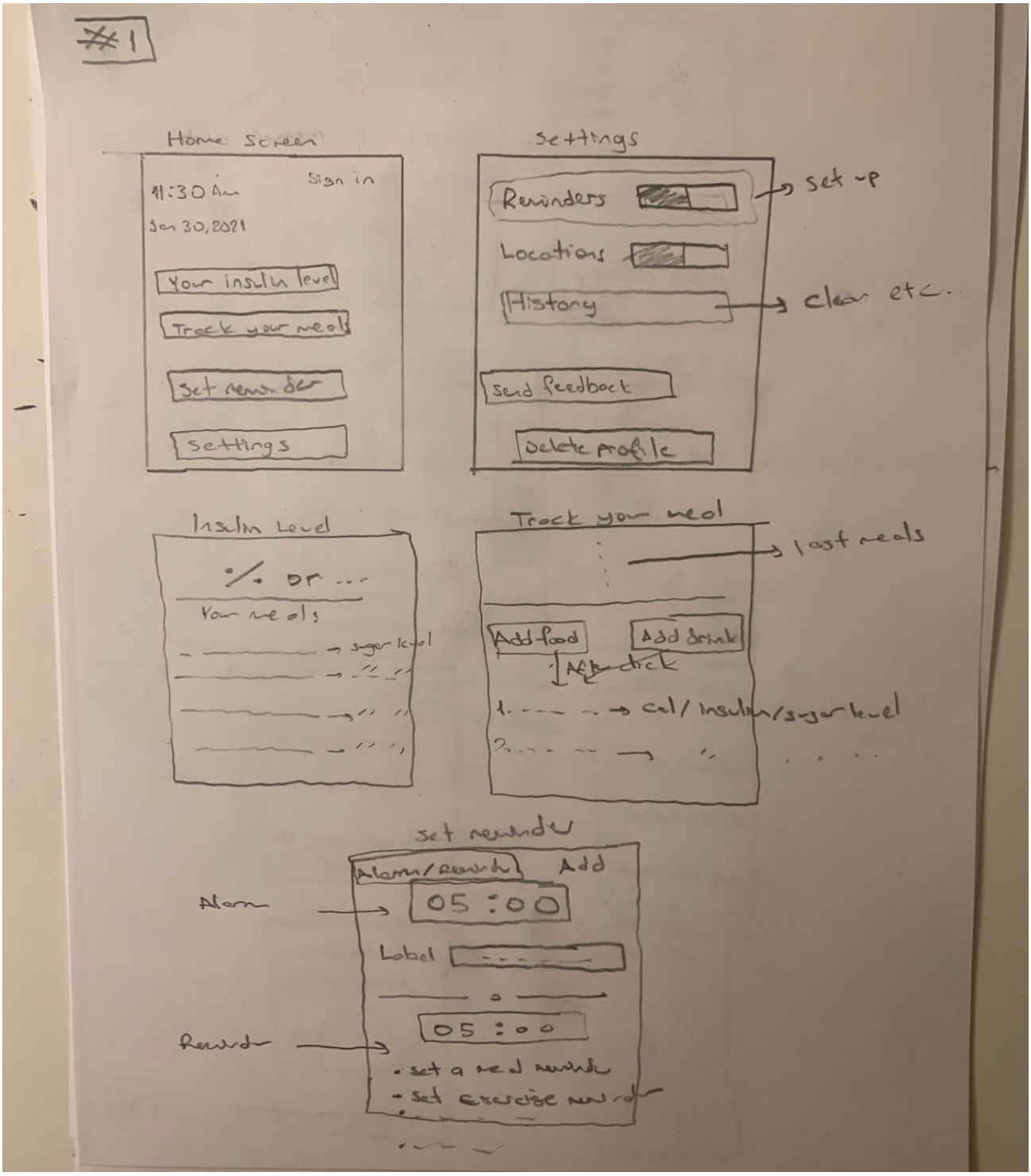
a. **Must estimate exact amount of carbohydrates in certain foods**
    i. Must find carbs, sugars, fiber etc, as well as any insulin spiking compounds
    ii. Find hidden sugar levels of the patient
b. **Must be simple**
    i. Must have simple interface
    ii. Must be minimalist
    iii. Must not require a large amount of user input
    iv. Must be visually pleasing and professional
c. **Must store data**
    i. Must keep track of data throughout time for reference
    ii. Must have visual representation of data vs time
d. **Must provide pop-up notifications**
    i. Reminders to track any extra food not entered by user
    ii. Notify user if levels are too high
e. **Must use live insulin levels**
    i. Must be able to input insulin levels from blood glucose reader
    ii. Must keep track of insulin levels and adjust depending on food inputs throughout the day to provide the best estimated blood insulin levels
f. **Cost**
    i. Must be free

When observing this functional decomposition list, our team has systematically broken down the key attributes of our application into smaller characteristics. For example when looking at the first attribute, the tracker must estimate the exact amount of carbohydrates in specific foods but that is not specific enough. Carbohydrates consist of fibers, carbs and sugar and we also need to account for any other compounds that may spike the user's insulin levels. Then we must focus on finding the hidden sugar levels and this cannot be done before because we first want a general sense of what

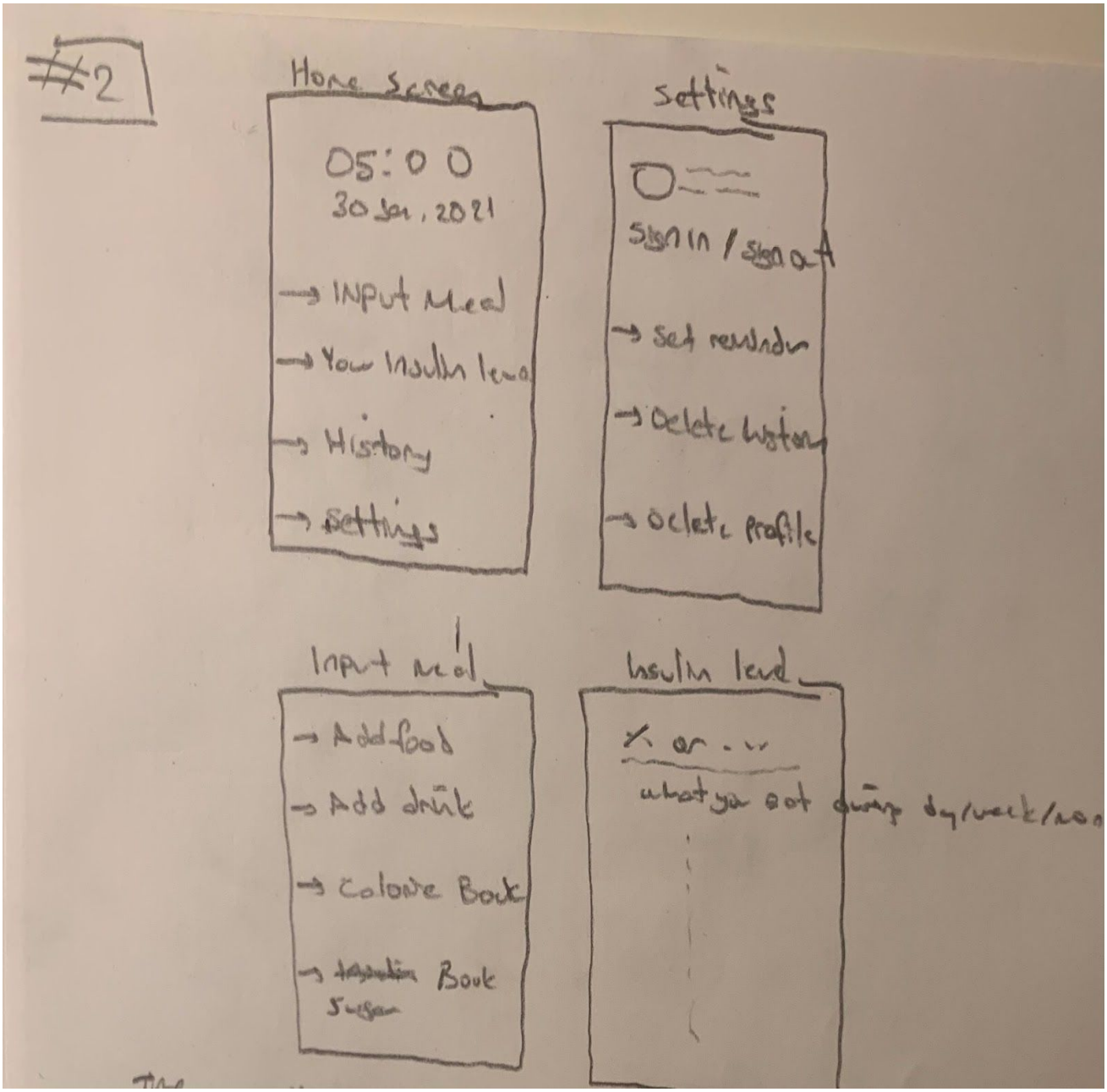
compounds make up the carbohydrates, and then narrow our selection. There is more emphasis placed on finding the hidden sugars within various foods because that is one of the client's prioritized needs.

2.Conceptual Ideas:

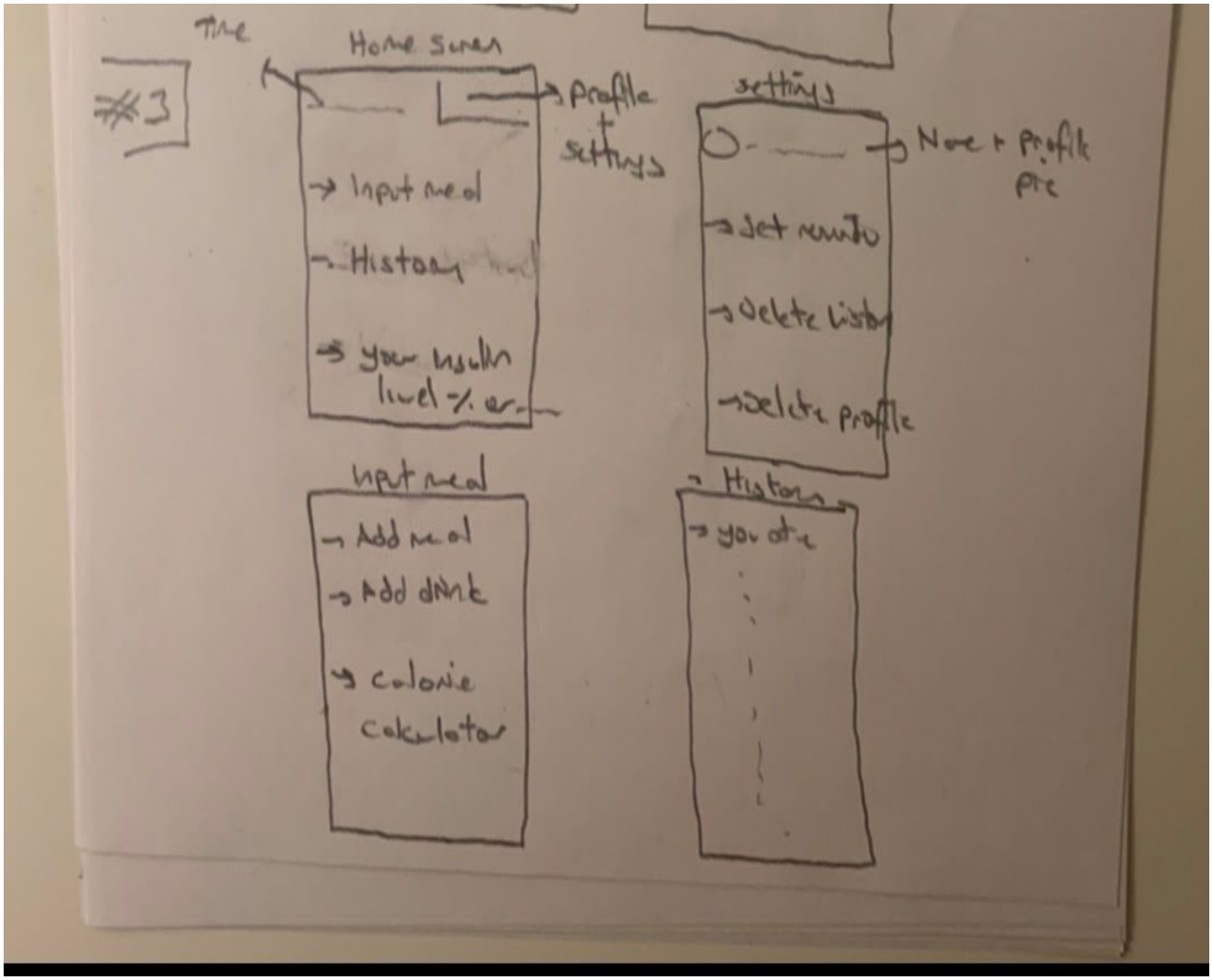
(Fig.2.1)- Bora - Comprehensive Concept #1:



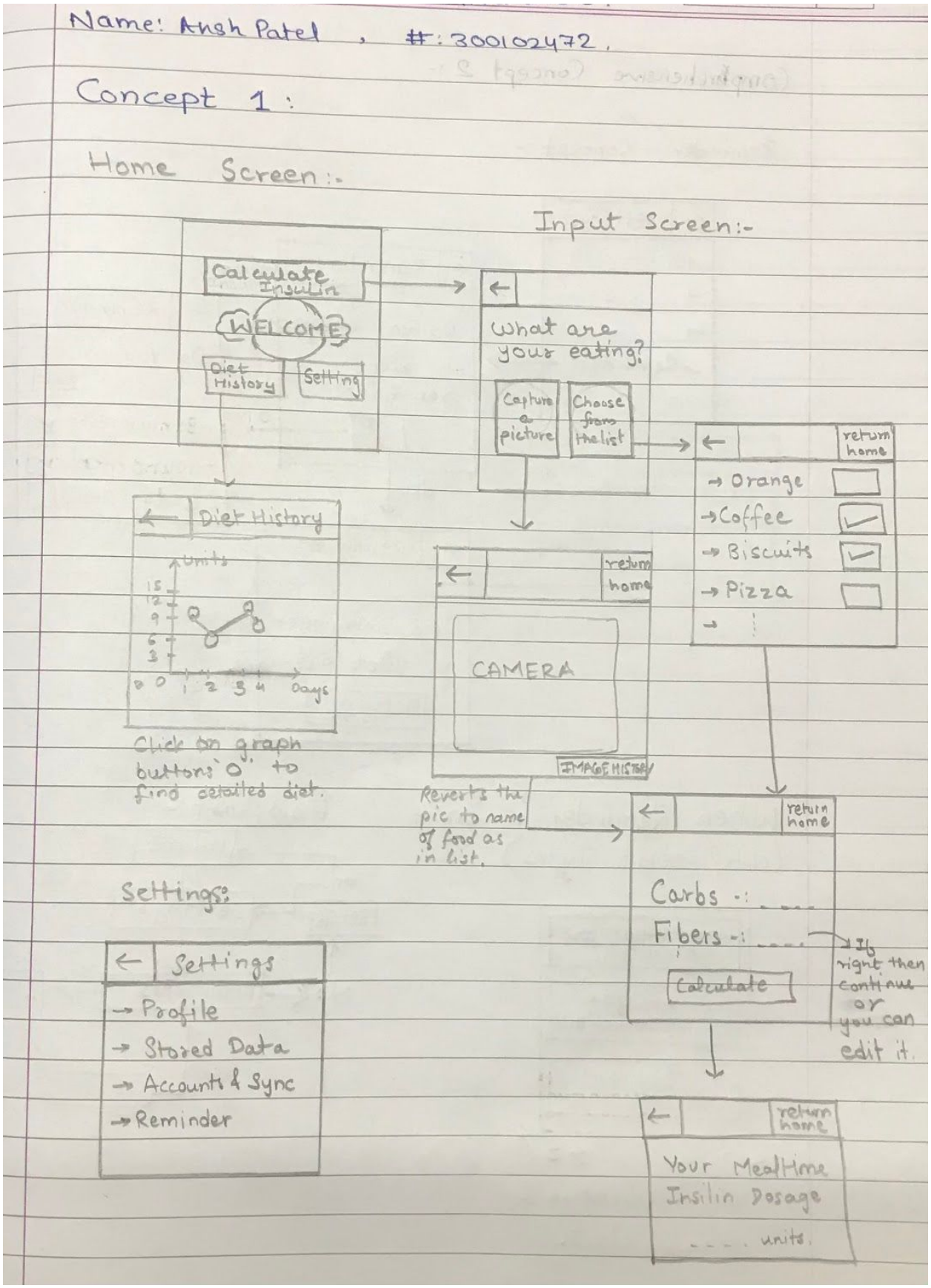
(Fig.2.2)- Bora - Comprehensive Concept #2:



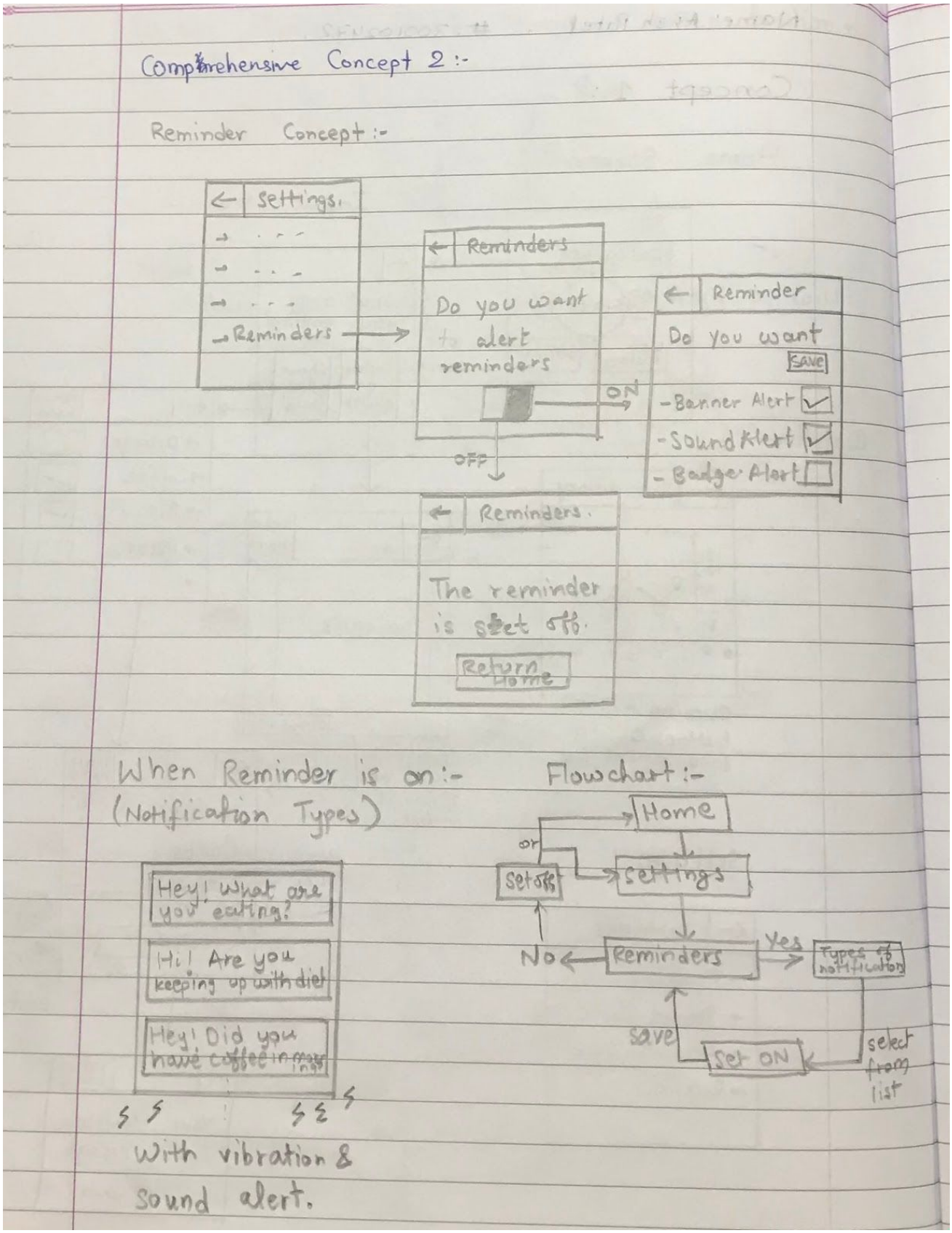
(Fig.2.3)-Bora - Comprehensive Concept #3 :



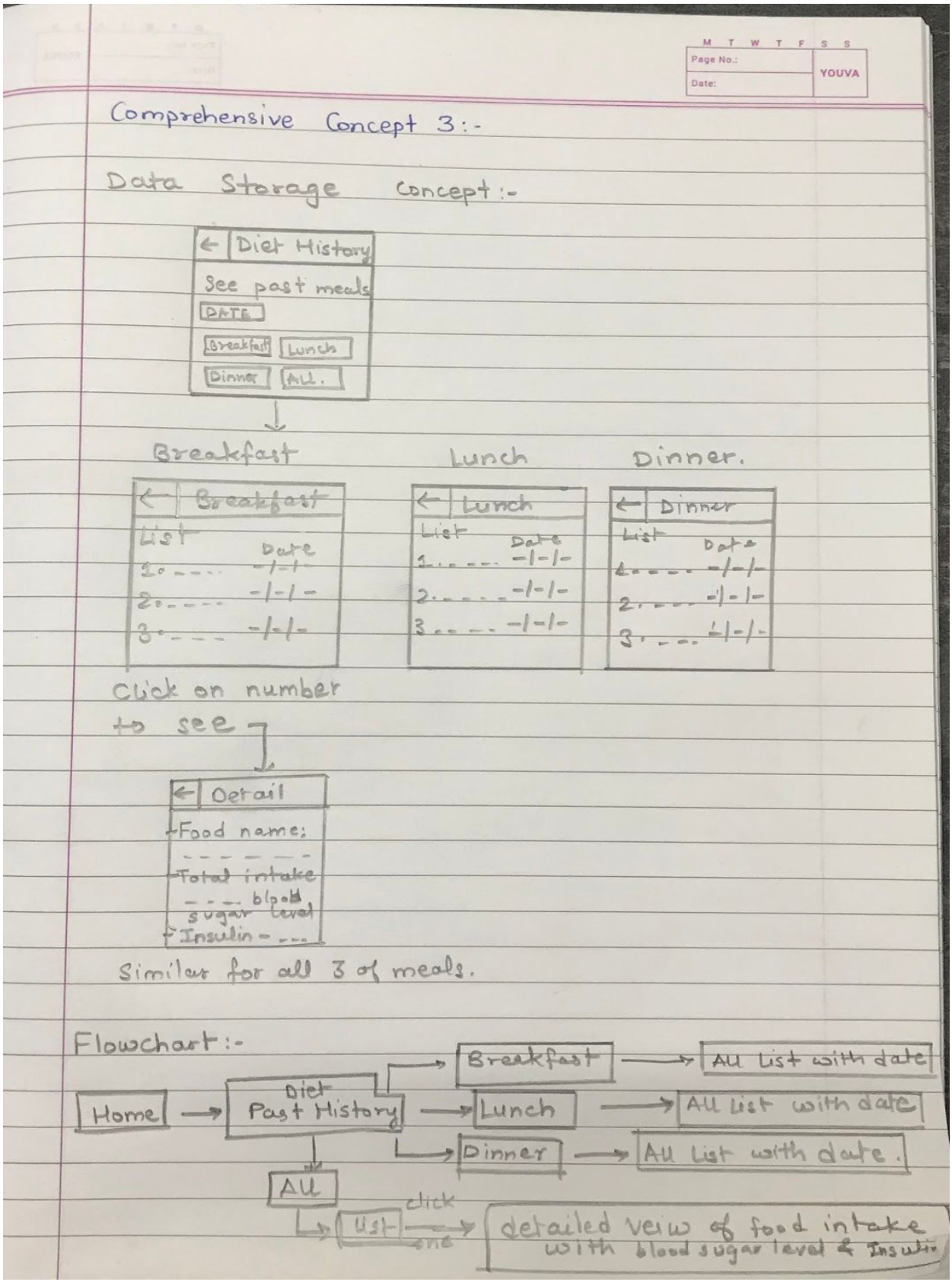
(Fig.2.4)-Ansh - Comprehensive Concept #1



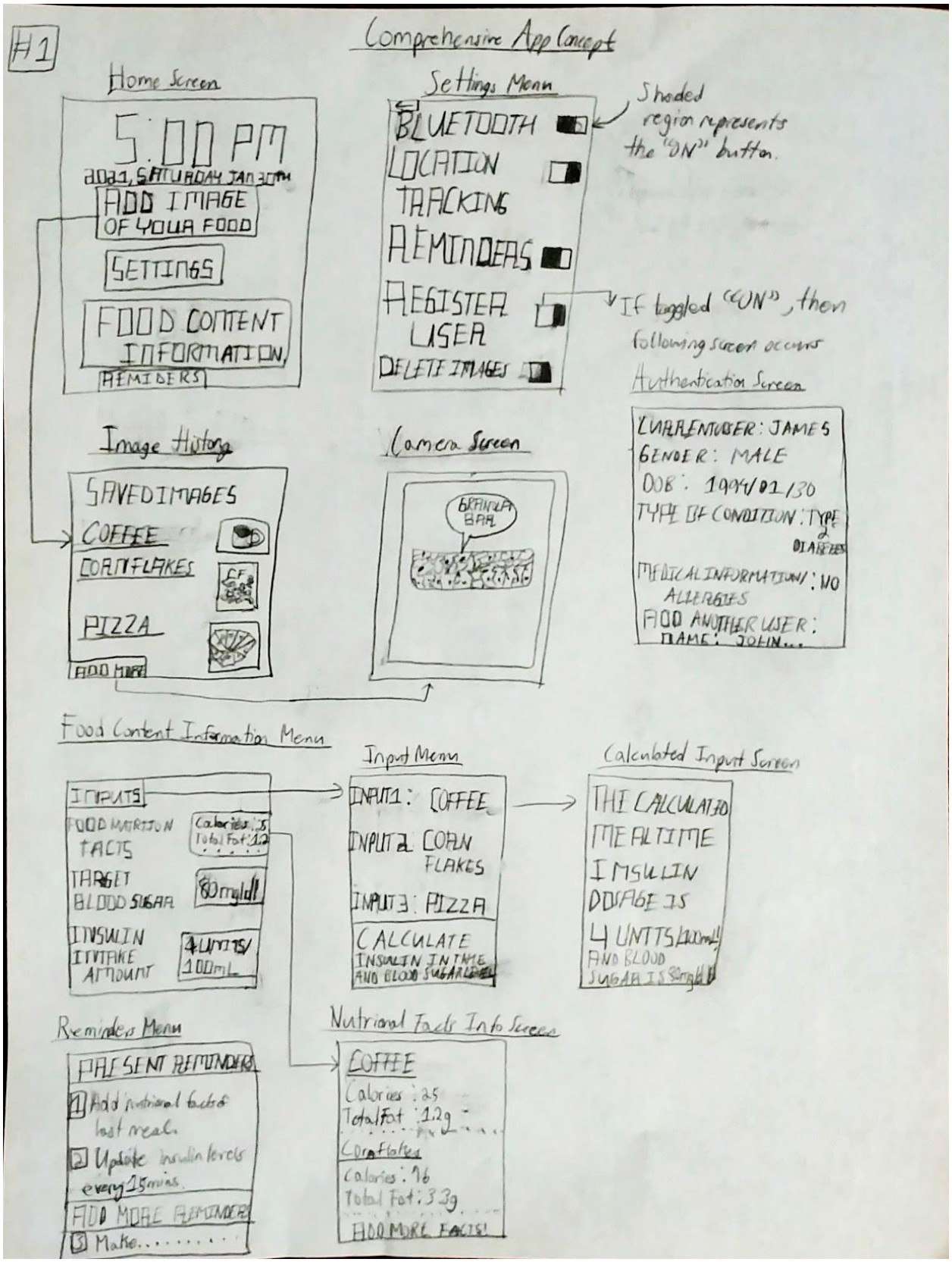
(Fig.2.5)-Ansh - Comprehensive Concept #2



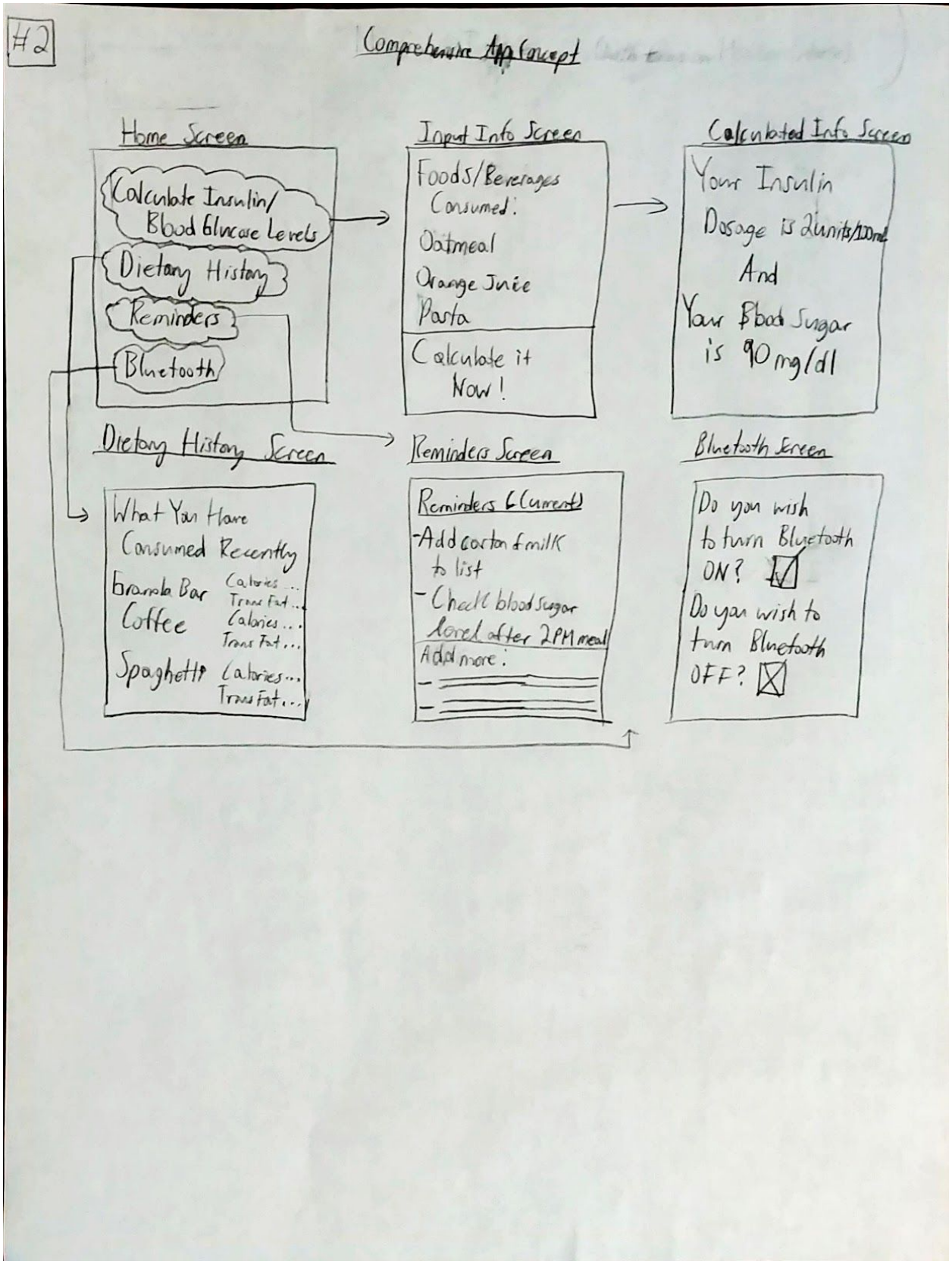
(Fig.2.6)-Ansh - Comprehensive Concept #3



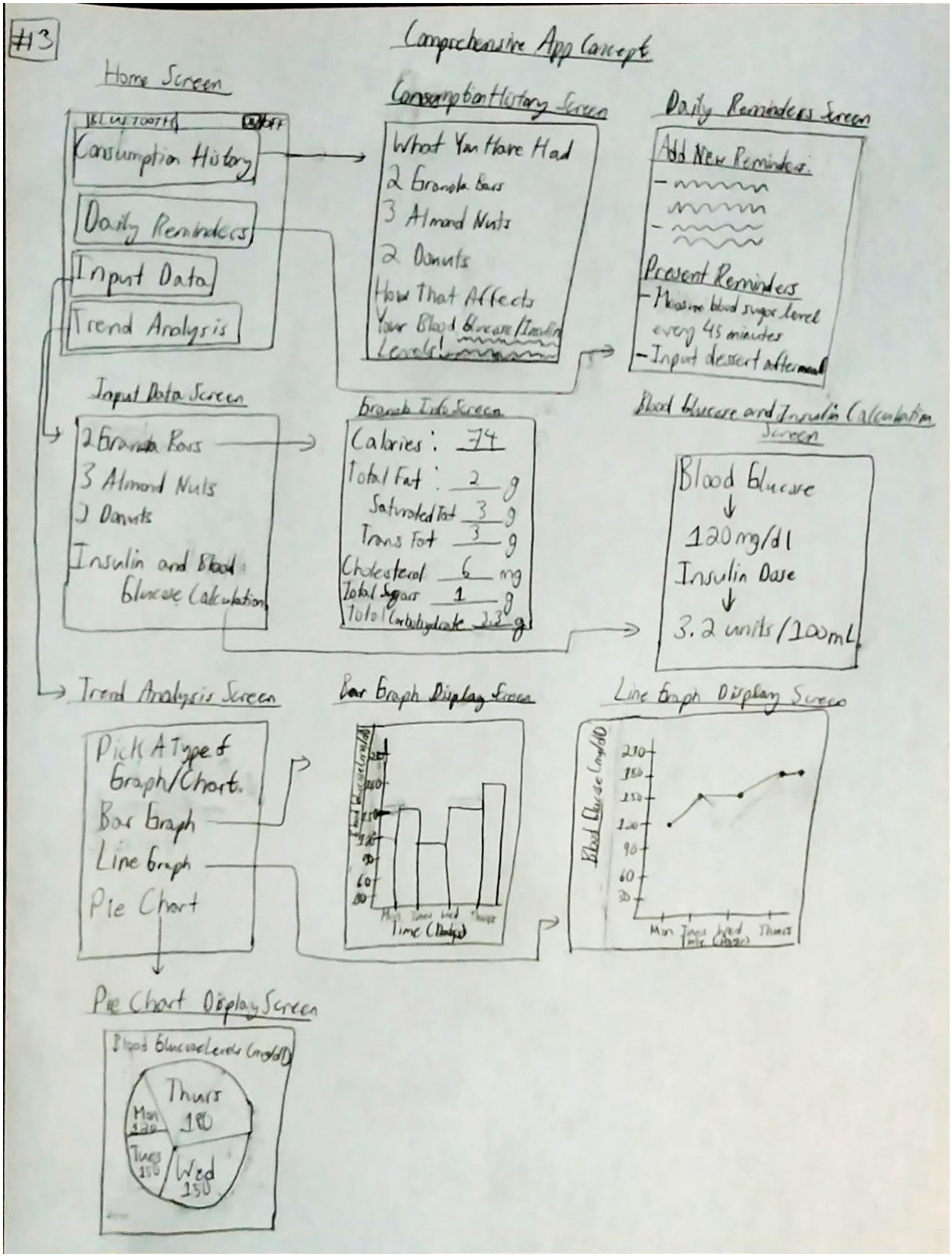
(Fig.2.7)-Abdel - Comprehensive Concept #1



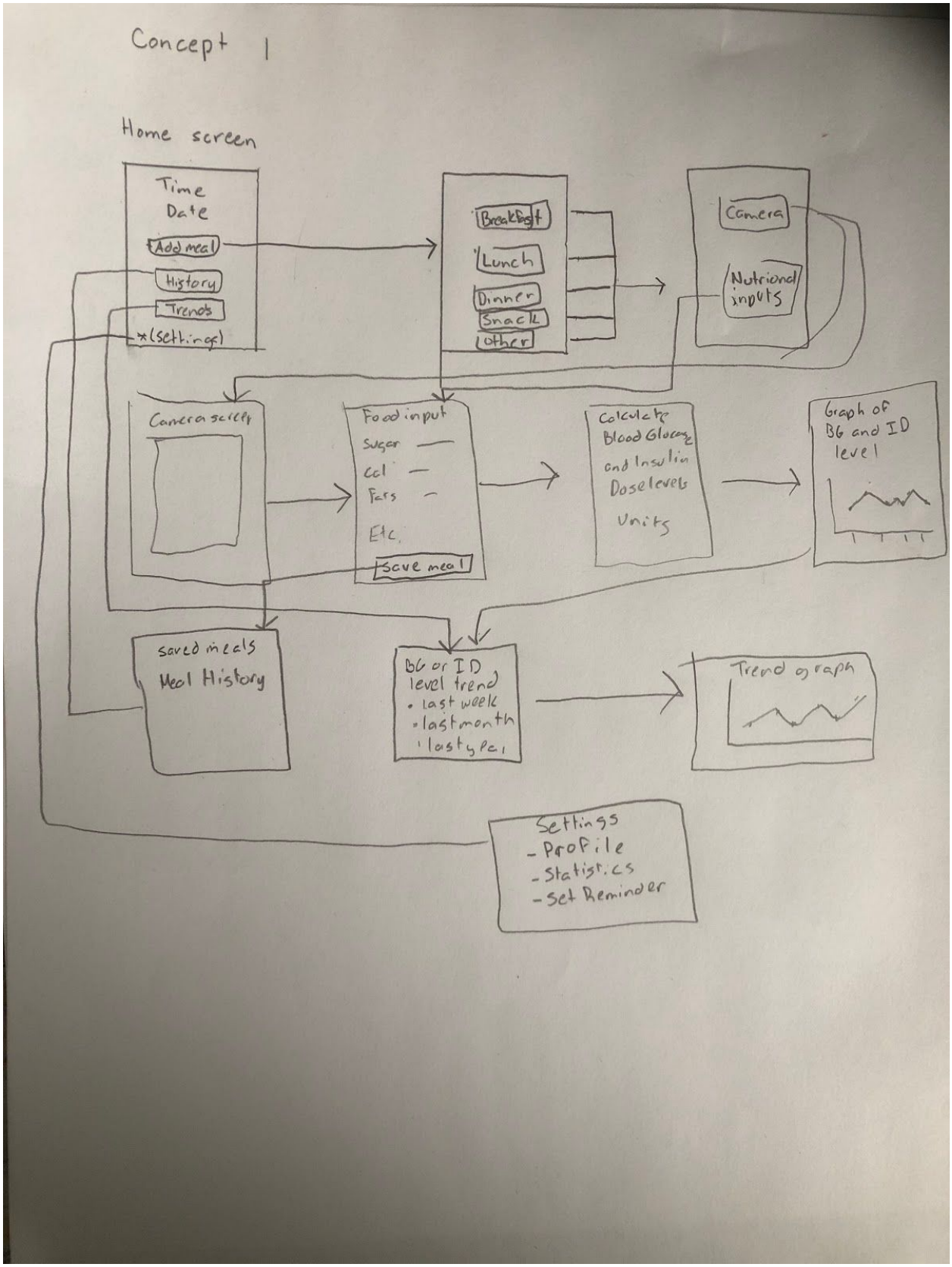
(Fig.2.8)-Abdel - Comprehensive Concept #2



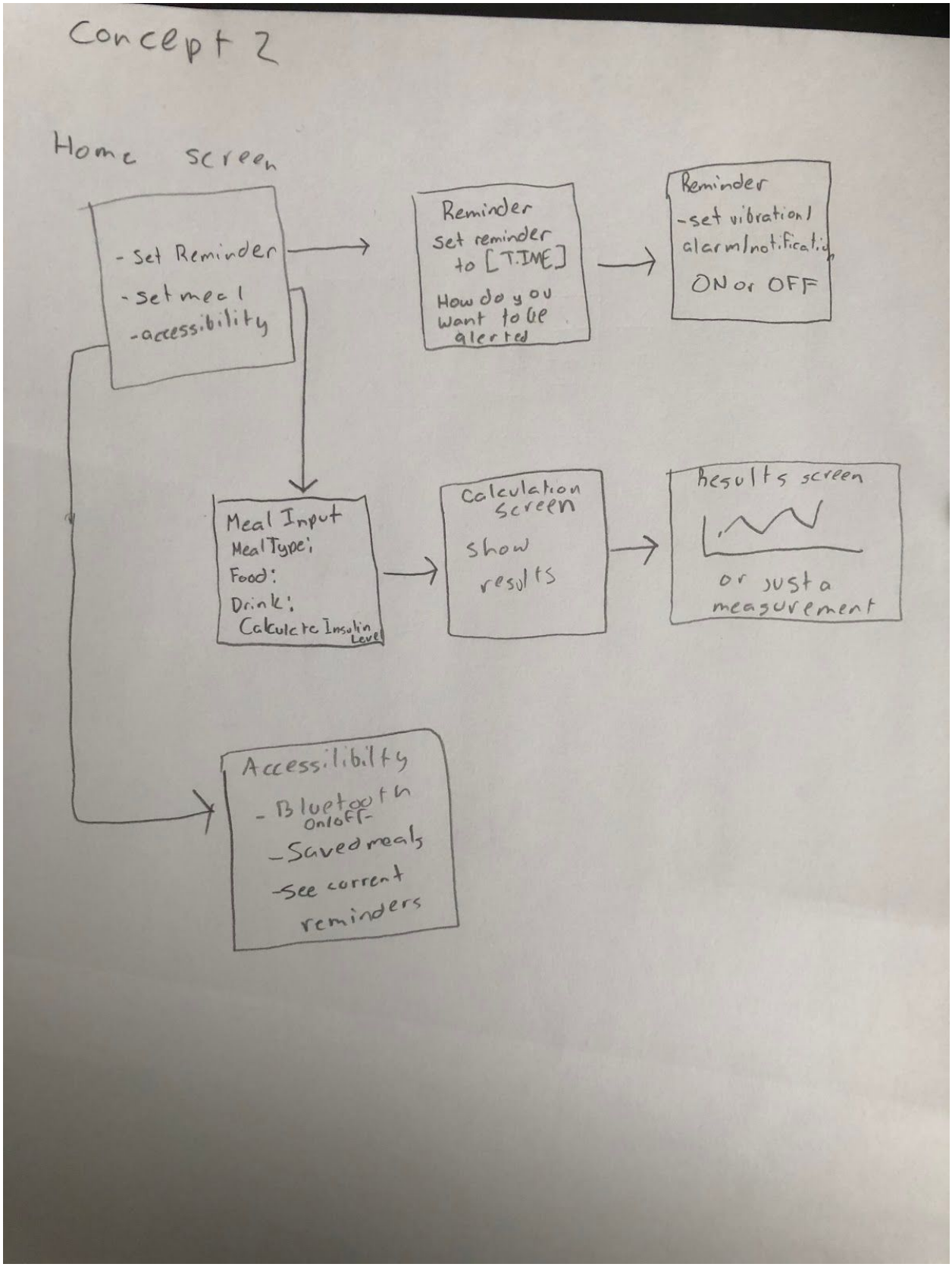
(Fig.2.9)-Abdel - Comprehensive Concept #3



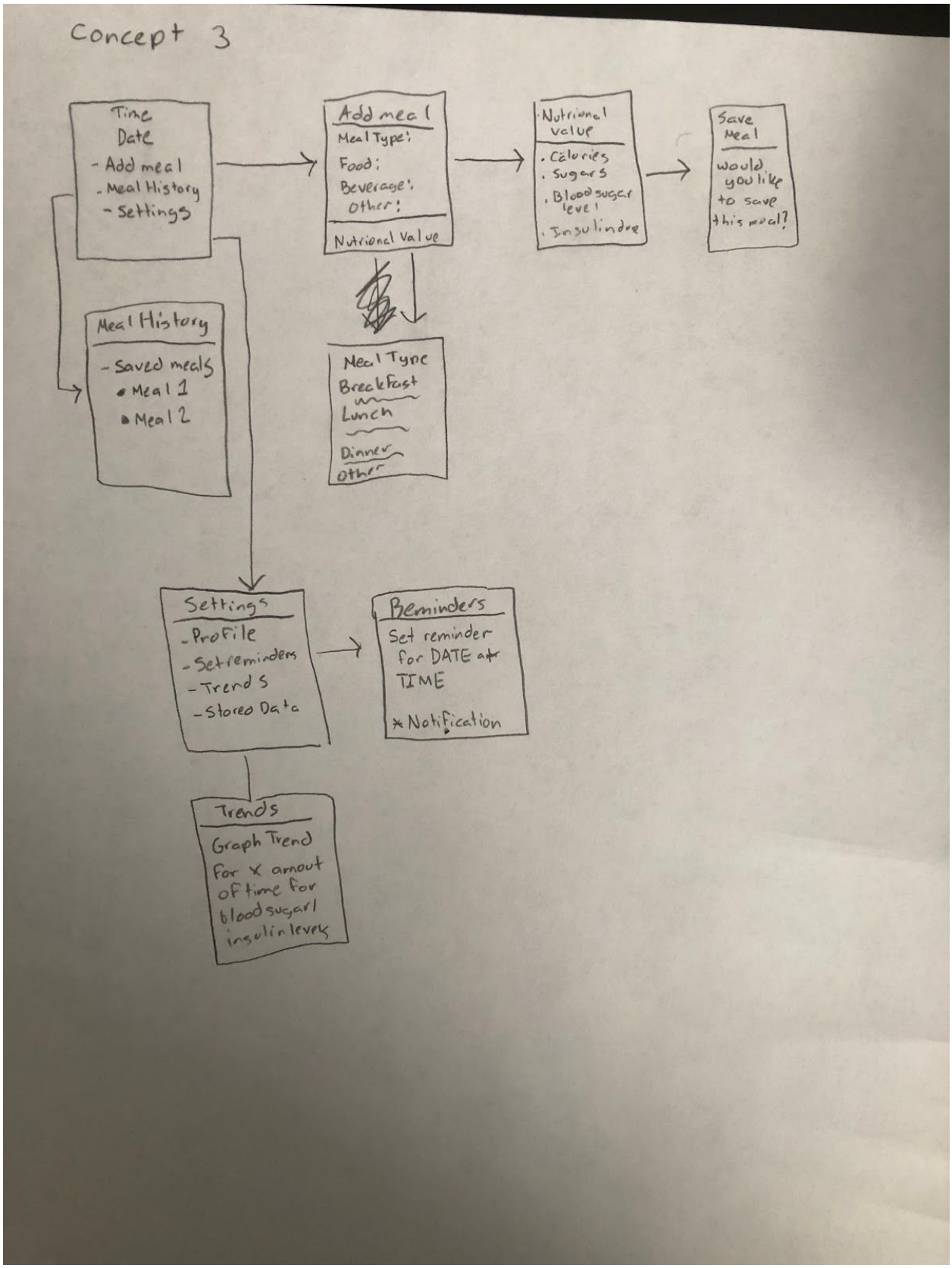
(Fig.2.10)-Ben- Comprehensive Concept #1



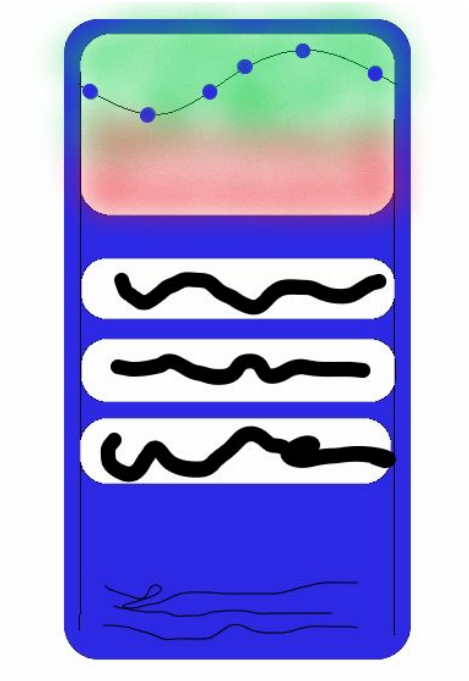
(Fig.2.11)- Ben- Comprehensive Concept #2



(Fig.2.12)-Ben- Comprehensive Concept #3

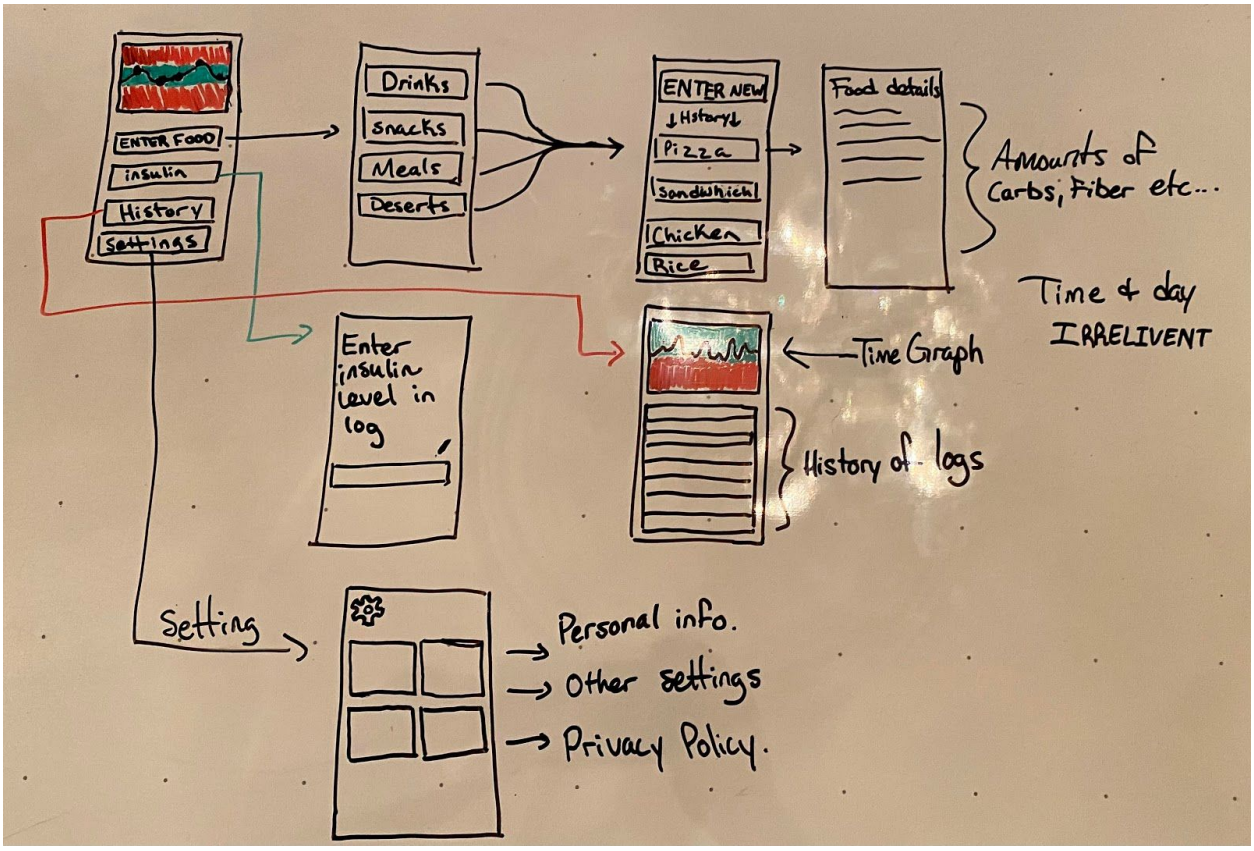


(Fig.2.13)-Dylan Comprehensive Concept #1:

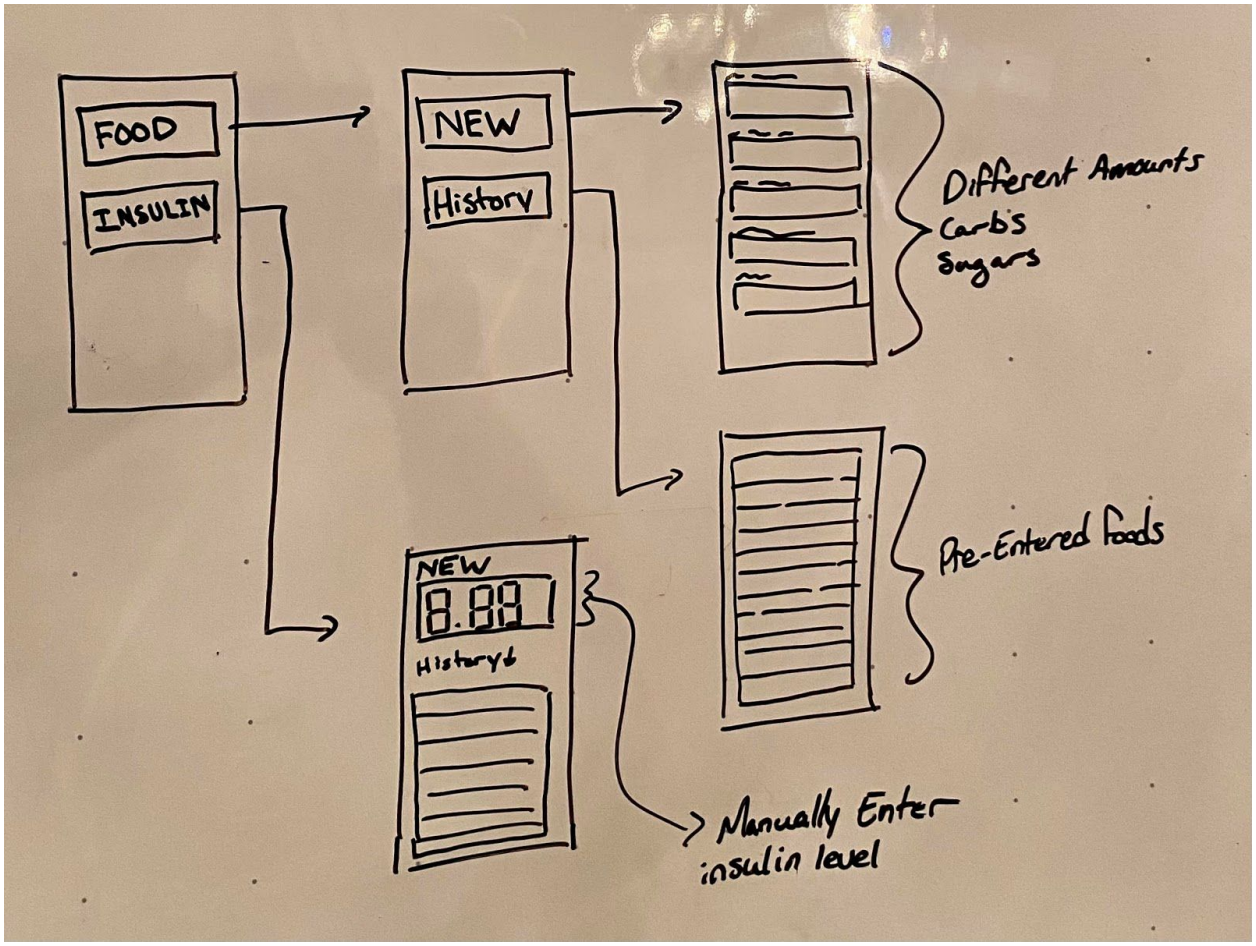


This graph of insulin level vs time shows insulin levels either entered by the user or calculated by the app depending on the food entered with a specific amount of carbohydrates, fiber, sugars etc…
When the graph in the green means insulin levels are within healthy range. When in the red, levels are within dangerous range either too low or too high. Alerts will then be transmitted to the user if the trend is heading towards these red areas.

(Fig.2.14)-Dylan Comprehensive Concept #2:



(Fig.2.15)-Dylan Comprehensive concept #3:



3. Analyze Concept Ideas:

The tables below consist of a numerical ranking system with a scale of 1 - 5, one being the least matched to the target specification, and 5 being the closest match. For every team member's concepts, all three of their conceptual ideas are benchmarked with each other in order to determine the best conceptual idea, which will then be compared to every other member's best concept.

Abdel's Conceptual Idea:

Table 3.1:Analysing Abdel's Conceptual Ideas

#	Specifications	Concept 1	Concept 2	Concept 3
1	Accuracy of insulin needed per meal	Tracks insulin dose after each meal by clicking on the calculation button so the user can analytically determine the insulin amount needed for the next meal (5)	Tracks insulin dose after each meal by clicking on the calculation button so the user can analytically determine the insulin amount needed for the next meal (4)	Tracks insulin dose after each meal by clicking on the calculation button so the user can analytically determine the insulin amount needed for the next meal (4)
2	User Feedback	None (1)	None (1)	None (1)
3	Ease-of-use	A bit complicated to start, but still relatively easy-to-use (4)	Very easy-to-use, and very few nested menus (5)	Mostly easy-to-use, not that many nested menus (3)
4	Software application testing	The client will download the app onto his phone and use	The client will download the app onto his phone and	The client will download the app onto his phone and use it for a

		it for a certain number of days (5)	use it for a certain amount of days (5)	certain amount of days (5)
5	Cost	Free to use (5)	Free to use (5)	Free to use (5)
6	Wifi dependence	No, Bluetooth is a secondary option (5)	No, Bluetooth is a secondary option (5)	No, Bluetooth is a secondary option (5)
7	Product quality	Focuses on productivity and aesthetics, with many nested menus (5)	Medium, emphasis on productivity (3)	High, focuses on data analysis and productivity (4)
8	ADD friendly	Somewhat, may be a complicated at the beginning, but the user will slowly ease into using the app (4)	Minimum use of radio buttons (only 4), so not complicated to use (5)	More visually appealing due to graphical representations so it is more easy-to-use (5)
9	Data Storage	User is able to view past meal history, as well as the nutritional facts and insulin dosage/blood glucose levels for each inputted food/beverage (5)	Only viewable to developers, not users (1)	Only viewable to developers, not users (1)
	Total	39	34	33

Ansh's Conceptual Idea:

Table 3.2: Analysing Ansh's Conceptual Ideas

#	Specifications	Concept 1	Concept 2	Concept 3
1	Accuracy of insulin needed per meal	Yes, calculates the required insulin dosage. (5)	Yes (2)	Yes (2)
2	User feedback	Yes, the option is built to give users the opportunity to enter their feedback.(5)	Yes (2)	Yes (2)
3	Ease-of-use	Simple Interface, Very comfortable and easy to access. (5)	Yes, focused on the reminder concept of the project. Helps the user to keep up with his diet. (4)	Yes, This concept focuses on the data storage facility the app will provide. Very simple and friendly interface.(4)
4	Software application testing	We as well as the client can download and run it. (4)	Yes(3)	Yes(3)
5	Cost	Free (5)	Free (5)	Free(5)
6	WiFi dependency	No (5)	No (5)	No (5)
7	Product quality	Focused on aesthetics, nested menus, and radio buttons.(5)	Used to remind the daibetic patients to eat as well as put in their notification type.(4)	Helps patients to log in the meals if they are repeating, also great way for them to access the details of past meals.(4)
8	ADD friendly	Simple interface, easy	Simple interface,	User-friendly simple interface.

		to understand texts (4)	easy to understand texts (4)	(4)
9	Data storage	Yes (3)	Yes (3)	Yes, very important feature that helps the dabetic patient to keep up with their meals and also get a summary of their past meals (5)
	Total	41	32	34

Bora's Conceptual Idea:

Table 3.3: Analysing Bora's Conceptual Ideas

#	Specifications	Concept 1	Concept 2	Concept 3
1	Accuracy of insulin needed per meal	Tracks Insulin level after each meal by manual input of foods, drinks, etc…(4)	Tracks Insulin level after each meal by manual input of foods, drinks, etc…(4)	Tracks Insulin level after each meal by manual input of foods, drinks, etc…(5)
2	User feedback	Needs WiFi(4)	Needs WiFi (4)	Needs WiFi (4)
3	Ease-of-use	Simplicity (4)	More Complicated (2)	Simple interface (5)
4	Software application testing	Client will use the application for couple days and give feedback (5)	Client will use the application for couple days and give feedback (5)	Client will use the application for couple days and give feedback (5)

5	Cost	Free to use (5)	Free to use (5)	Free to use (5)
6	WiFi dependence	No (5)	No (5)	No (5)
7	Product quality	Nice interface, maybe even dark mode. Not simple or complicated (3)	More buttons, more detailed (2)	Much simple interface, less buttons on home screen (4)
8	ADD friendly	Simple interface, dark mode (4)	More complicated, minimal buttons (3)	White and clean interface, bigger buttons (5)
9	Data storage	Hard drive (3)	Hard drive (3)	Hard drive (3)
	Total	37	33	41

Ben's Conceptual Idea:

Table 3.4: Analysing Ben's Conceptual Ideas

#	Specifications	Concept 1	Concept 2	Concept 3
1	Accuracy of insulin needed per meal	Track insulin after meals to determine the amount needed for next meal (after a certain amount of time) (5)	Keep insulin levels within a certain range (ideally) (4)	Calculates blood sugar levels and insulin levels after consuming a meal (5)
2	User feedback	Allows for online user feedback to compare to and see other potential feedback (4)	Allows for user feedback from within the application (4)	Allows for user feedback when connected to WiFi (4)
3	Ease-of-use	Focus on	Focus on	Focus on a

		simplicity (5)	accessibility (4)	combination of simplicity and accessibility (5)
4	Software application testing	The client can download the application it and test it out (5)	The client can download the application and test it out (5)	The client can download the application it and test it out (5)
5	Cost	Free to use (5)	Free to use (5)	Free to use (5)
6	WiFi dependence	Does not rely on WiFi connection (could be used on the road) (5)	WiFi connection for some services (but key services would still be online) (3)	WiFi connection for nutritional facts of foods (2)
7	Product quality	A functional, pleasing, product. Emphasis on functionality (4)	A good quality product Emphasis on accessibility (3)	Apply a combination of functionality and accessibility
8	ADD friendly	Simplistic interface (4)	Simplistic interface, not too many buttons (4)	Minimalistic design (3)
9	Data storage	Information stored on device's hard drive (3)	Information stored on device's hard drive (3)	Information stored on device's hard drive (3)
	Total	40	38	32

Dylan’s Conceptual Idea:

Table 3.5: Analysing Dylan’s Conceptual Ideas

#	Specifications	Concept 1	Concept 2	Concept 3
1	Accuracy of insulin needed per meal	The client must insulin with what he eats (4)	Adjusted metrics to display how each person is affected (5)	Adjusted metrics will be altered by input of insulin by user and calculated result with food logging which will combine both aspects (5)
2	User feedback	Rating system has to be connected to WiFi (4)	Contact information with developers’ emails (4)	Contact email (3)
3	Ease-of-use	Simplicity (4)	Simple with different functions (5)	Extreme simplicity is the goal (5)
4	Software application testing	We can test it (5)	We can test it (5)	We can test it(5)
5	Cost	Free to use (5)	Free to use (5)	Free but with ad. space but will distract ADD clients (2)
6	WiFi dependency	Pre-integrated formulations and functions (4)	Pre-entered meals that the client has on a regular basis (4)	WiFi should not be required (4)
7	Product quality	Functionality, it has to do what we want it to do (4)	Pleasing appearance, rounded buttons (5)	Cannot be over complicated(3)
8	ADD (Attention deficit	Simple, Apple	Minimal	White and blue

	disorder) friendly	like interface (4)	buttons, not complicated (4)	interface (4)
9	Data Storage	Store data on hard drive (4)	Stored data which can be viewed by users and developers (5)	Simple data storage in form of history log (4)
	Total	38	42	35

From the above benchmarking of the conceptual ideas of each team member we analysed thoroughly what is the requirement and need of our project and came out with the best conceptual ideas and combined them together into creating the final conceptual design.

From Abdel's conceptual benchmarking, the team found that the concept had a very good interface and different ways to calculate the insulin dosage as well as the blood sugar level. Hence, the team used a major part of his conceptual ideas in the input screen and also the settings menu.

From Ansh's conceptual benchmarking, the team found that the overall working of the app looks simple and easy to understand. The team also used the home screen idea from his concepts. Other concepts were also added in the few parts of the final sketch.

From Bora's conceptual benchmarking, the team was inspired by his track your meal idea which would let the user view his past meals as well as the current meals he had with a detailed view of the insulin dosage requirement and blood sugar levels.

From Ben's conceptual benchmarking, it was seen that the diet history was analysed through the use of a graph. This idea was very creative and was considered in the final concept as the user needed visual images and an ADD friendly app.

From Dylan's conceptual benchmarking, it was found that his interface was very color friendly and the food history input screen was unique. This will help the user to freely enter the meal that he had and could use the same meal if he is repeating it instead of writing the inputs again, thereby removing any tedious work for the user.

4. Chosen Concepts :

After analyzing each specific concept through and through using the benchmarking design matrix, Ansh's Comprehensive Concept #1 was considered to be the best solution to our client's problem. Although his concept does not cover all the details and attributes that must be integrated within our final concept. This is why we must integrate other aspects of different team member's concepts in order to yield the best possible result. The aesthetic design of Ansh's Comprehensive Concept #1 will be the starting point for which all new concepts will be derived from.

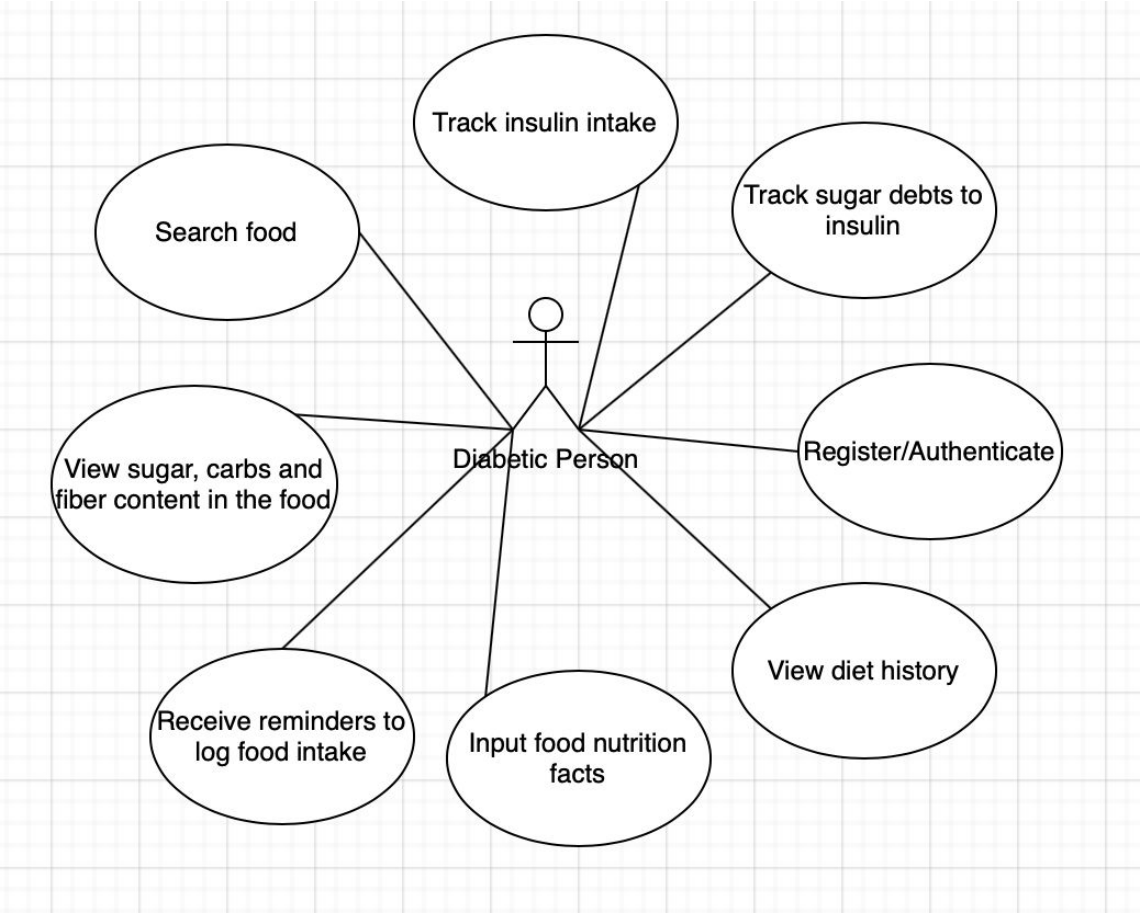
In order to proceed with further developing Comprehensive Concept #1, we have decided to implement various attributes from different concepts that will strengthen the final design concept that is to be made. This was accomplished through benchmarking each individual member's three conceptual ideas, and then determining the best one from the selection. These various concepts are the following:

- Ansh's Comprehensive Concept #1 (Overall Aesthetic Design)
- Bora's Comprehensive Concept #3 (Track Your Meal Screen)
- Dylan's Comprehensive Concept #2 (Input Food History Screen)
- Benjamin's Comprehensive Concept #1 (Graph Trend Screen)
- Abdel's Comprehensive Concept #1 (Input Data Screen and Settings Menu)

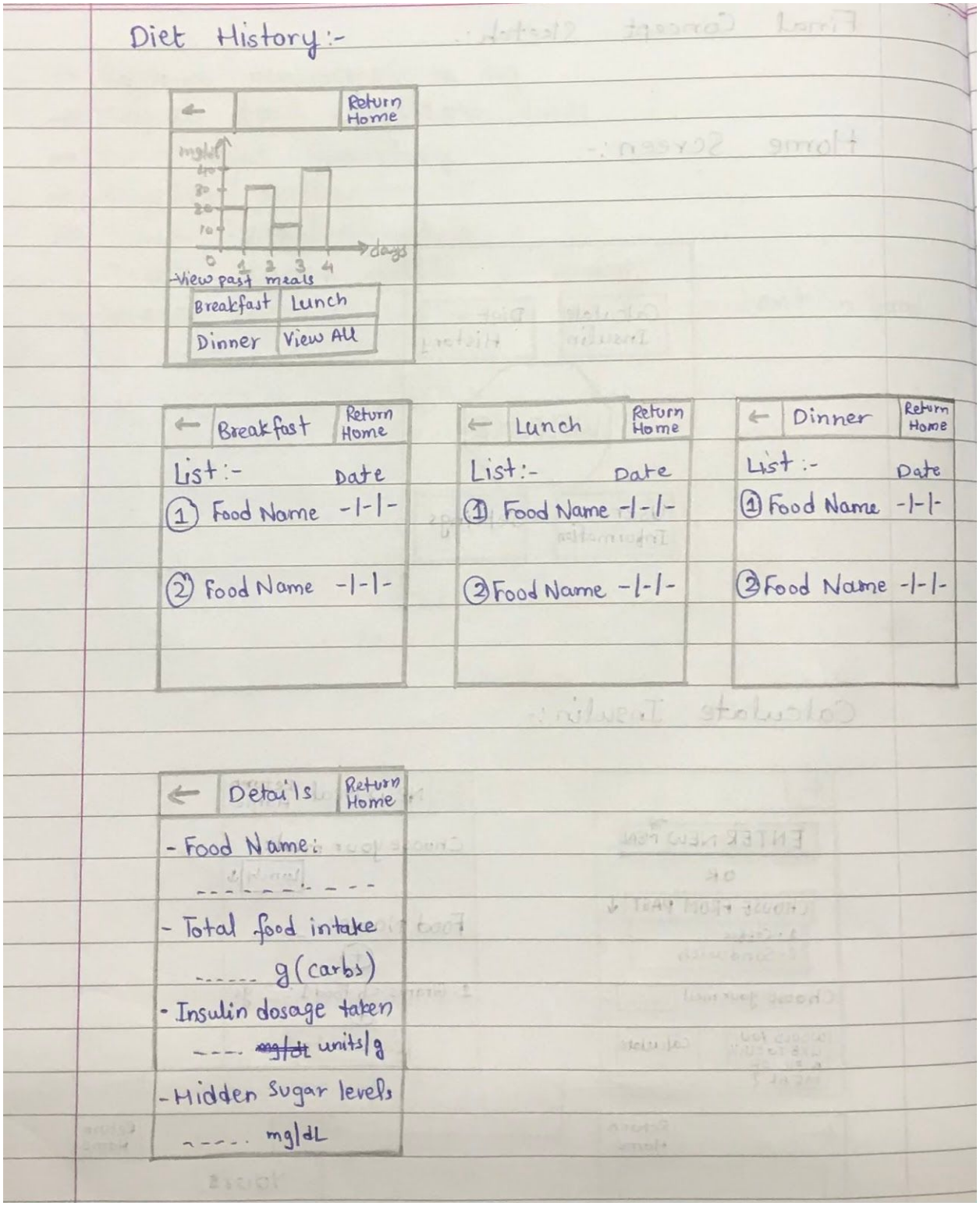
Utilising the decision matrices allowed our team to settle on which overall design would be most effective for the mobile application. This was Ansh's Comprehensive Concept #1 because it best matched our set of prioritized design criteria. Instead of creating matrices for specific kinds of screens entailed within each concept, such as the track your meal, input food history, input data and graph trend screens and settings menu were decided through majority vote because these options are secondary to the overall design of the application.

5. Group Design Concept & Final Concept Sketch:

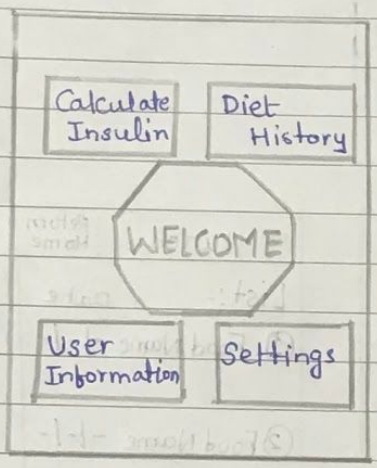
(Fig 5.1) Use Case Diagram:



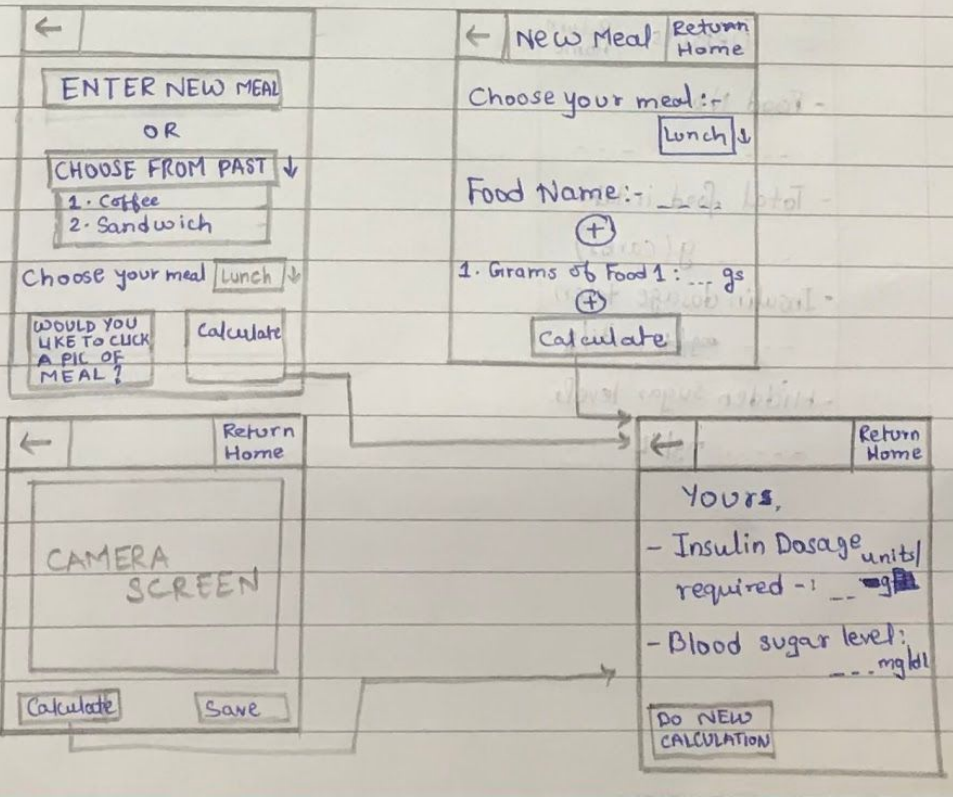
(Fig 5.2) Final Concept Sketch:



Home Screen :-

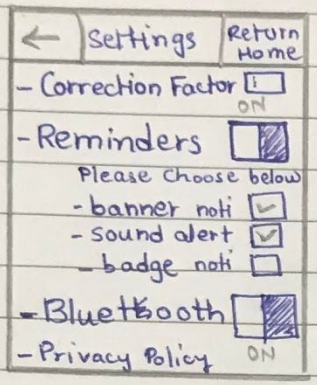


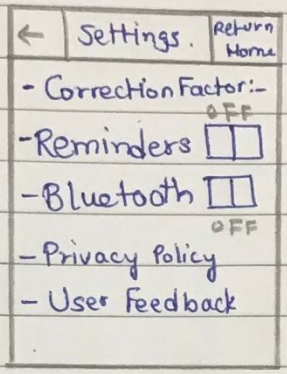
Calculate Insulin :-



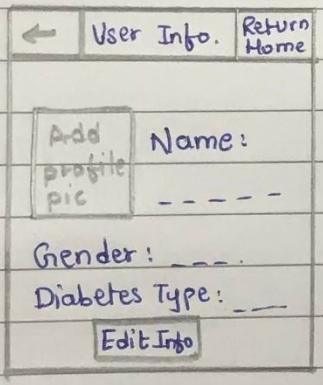
Date:

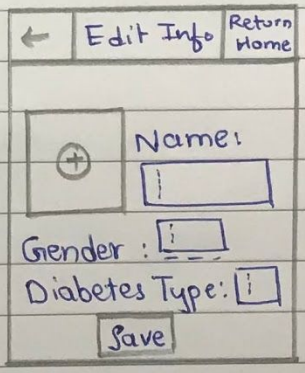
Settings :-





User Information :-





As can be seen above, the final design concept for our mealtime insulin tracking application is displayed. Starting with the home screen, it displays a welcome button centered on the page, with four buttons each within their respective corners of the screen. These are the following; Calculate Insulin, Diet History, User Information, and Settings. When the Calculate Insulin button is clicked, this leads to a page that has a couple of different options. The first option prompts the user to enter a meal and the second one asks the user to choose from a list of pre-existing meals. This allows for nested menus which make it much more ADD friendly. Then there are two buttons on the bottom with one asking if the user wants to take a picture, and the other asks to calculate the insulin dosage (units/mL) and blood sugar level (g/dl). When the calculate button is clicked, the aforementioned values pop up on the screen. If the former option is chosen, this leads the app to open the user's camera and take a picture of the food they are eating or have eaten, and then click save, so the image will be stored in the application. Then the user can press the calculate button which will also lead to the insulin dosage and blood sugar levels to pop up. If a user wants to enter a specific meal on the home screen, then they will be redirected to a page that asks for the food's name, and a calculate button also appears which redirects to the calculated insulin dosage and blood sugar level value.

When the Diet History button is clicked, this takes the user to a page that displays a bar graph of the blood sugar level on the y-axis versus the time (in days) on the x-axis. This allows for the user to make a visual observation, thereby increasing the overall aesthetic of the app. Then at the bottom of this page, there are four buttons; Breakfast, Lunch, Dinner, View All. When any of these buttons are clicked, there is a list that displays all the food names. If one wishes to know more, they can click on a certain food, and view details about it, including the total food intake, insulin dosage taken, and hidden sugar levels.

When the User Information button is clicked, this shows a page that displays the user's profile picture, name, gender and type of diabetes that they are diagnosed with. In the bottom center there is a button that says Edit Info, which allows the user to edit this aforementioned data and then save the information to the application.

Lastly, when the Settings button is clicked, this displays a couple of attributes, namely the corrective factor, reminders, Bluetooth and privacy policy. The corrective factor is a measurement that lists how much 1 unit of insulin will lower one's blood glucose level between 2 to 4 hours before the consumption of a meal. The 1 unit amount is an approximate value and varies depending on the diabetic patient, which is why when the user first installs the application, they must enter their specific value, which The reminders and Bluetooth buttons may be toggled ON/OFF based on the user's preference, thereby displaying that the app is not WiFi dependent. The privacy policy redirects the user to a page that states the terms and conditions as well as the fact that all the user's private information is secure and not in dangerous hands. Lastly

the user feedback option allows the user to fill in a form which is stored on the application and sends all information directly to our team, the developers of the app. This ensures that constant communication between our team and the client takes place, thus allowing us to truly understand and gain an insight into the life of the client.

6. Concept's Relationship to the Target Specifications, Benefits and Drawbacks.

Table 6.1: Concept's Relationship to the Target Specification

#	Target Specifications	Final Design Concept
1	Accuracy of insulin needed per meal	The important concept of our team's project is fulfilled because of our key feature of calculating the insulin dosage, the hidden sugar levels and the blood sugar levels. Very accurate through the implementation of various calculations from the user's inputs thereby providing an appropriate result for the diabetic patient.
2	User feedback	It has an inbuilt user feedback button that would help the customer to give their reviews on the Google Playstore platform or is sent to the developers.
3	Ease-of-use	Concept uses a simple interface with nested menus. It also consists of other features such as radio buttons and camera use. This makes the app very comfortable to the patient.
4	Software application testing	The client will test the app over the course of a few days.

5	Cost	The app is free, with a price of $0 because there are no paid resources used to build the app.
6	WiFi dependency	The app is not WiFi dependent because there is a built-in Bluetooth feature in the settings menu that can be turned on/off.
7	Product quality	The product is made in such a way that it is easily available to the user through Google Playstore. Also, the app consists of reminders that helps the user be on track with his daily insulin and blood sugar levels.
8	ADD friendly	Very ADD friendly, as our client suffers from this condition so we have made this app compatible to ADD patients with diabetes. It has options where the user can choose meals he has already had and save time, thereby making it more efficient. To add on, it has a color friendly interface that makes it more visually appealing to the user.
9	Data storage	This specification helps the diabetic patient to keep track of their meals and also get a summary for all meals. In short, the details of the past diet can be seen with an instant click. This feature makes the

		user also check his past insulin levels and blood sugar levels through a bar graph. The data storage is updated daily, when then updates the bar graph continuously.

There are many benefits to the final concept our team chose. For the first target specification which states the goal of accuracy of insulin needed per meal, our final concept has a precise method of calculating the insulin dosage and blood sugar levels of the user, through the use of inputting various foods alongside their carbohydrates contents that he has consumed on a daily basis. This ensures that our application is extremely accurate because it provides automatic and efficient results to the user. However there is one drawback which is that the user has to consistently remember to input all of the correct foods, and even though there are reminders, he still needs to input the names of the foods alongside the carbohydrate amounts if he wishes to yield the most accurate results.

7. Feasibility Study:

As it can be observed by our project plan on Wrike and from the information provided in this document, our project aims to be detailed in attaining all of our clients needs and seems ambitious in its goals. The constricted time frame given to accomplish this project caused us to question the feasibility of our project. With a limit of twelve weeks and the constrictions imposed by lockdowns and a global pandemic, restrictions are imposed. Being a software orientated project, this gave us the ease of having no costs or needing to purchase any tools or supplies. This in mind the feasibility of this project could be put in question uniquely by the tight time constraints and not by a lack of ability. Being able to provide a simple interface with simple and rapid user input by the app user which will provide estimated insulin blood levels dependent on the foods consumed is feasible, the extra features of graphing, notifications and camera features will be the less feasible options when comparing our case diagram. We must ensure that all essential features for the client needs are met and prioritized first and foremost and the addition of extra features will come second to that. As past projects had gone in a simpler direction such as the E-12 group with their Mealtime Insulin Calculator app, which has a minimalist design which could pass for unfinished meaning their project was not feasible in the amount of time given. This was confirmed by the client as he has proven frustration and disappointment towards past iterations of the project. Learning from their mistakes, we know where to be more efficient for our application.

8. Conclusion:

In Deliverable C, the team has developed a basic concept of a mealtime insulin calculator app that will be able to calculate an insulin dosage from the user input. The team has arrived at a decision with designing an attractive and simple user Interface to initialize our project. The processes of function decomposition, rapid concept generation and decision matrices were used to develop various concepts.

First, functional decomposition was used to breakdown the customer's needs and plot our requirements for creating an app. Then, each team member was given the responsibility to generate their own conceptual ideas and share it with the rest of the team. This generated many interesting concepts and these concepts were further analysed and evaluated with respect to target specifications. After using decision matrices and majority voting, the final concept for the application was made.

The best ideas were put forward in the meeting and discussed amongst all members. Without teamwork, dedication and creativity the team would have been unavailable to provide such great results. The work that has been done for this deliverable is the foundation for the team's first prototype and a stepping stone to reach our goal of developing a mealtime insulin calculator app.