Diabetics Group

FINAL DESIGN REPORT

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About the Team

Iffat Memon (Team Lead): iffatm2@illinois.edu

Iffat Memon is currently a Junior majoring in Information Systems & Operations Management. Around campus, she is deeply involved, and is pursuing certificates in Leadership, Innovation and Business Analytics. Iffat is passionate about leadership and change management. Iffat intends on pursuing a career in consulting after college and to get her MBA in the future.

Ruthvik Reddy Kadiri

Ruthvik is a senior double majoring in Computer Engineering and ILEE (Innovation, Leadership, Engineering Entrepreneurship), graduating this Fall. He has interests and involvements in entrepreneurship, AI, robotics & business. Ruthvik has worked with multiple start ups in the past and is a part of the iVenture community. He is an avid drummer, soccer and F1 racing fan

Zezhi “Jimmy” Guo: (zezhig2@illinois.edu)

Zezhi Guo is a Junior Student majoring in Industrial Design and minoring in Informatics. He loves to design and bring good things to people. Around campus, he works as an interaction designer to work with his groupmates and create objective and positive design works.

Hamza Sohail (hsohail2@illinois.edu)

Hamza Sohail is a Senior majoring in economics and minoring in computer science. Around campus, he plays basketball and is part of founders. After college he intends to use his technical skills in data science career

Inquiry

Through secondary research, we learned that type 1 diabetes is caused when the body's immune system attacks and destroys the cells in the pancreas that make insulin, a hormone that helps carry glucose (sugar) into your cells to be used for energy. While type one diabetes is considered the 'genetic type' of diabetes, there are more factors than just genetics that cause this. Type 2 diabetes results when the body doesn't use insulin properly, a condition called insulin resistance. At first the pancreas makes more insulin to compensate, but in time, there isn't enough to keep blood glucose at normal levels. Type two diabetes is influenced by other health conditions in which it can be aggravated or increased in intensively by, such as obesity. This form of diabetes is developed over time. Family history still comes into play with diabetes related Pre-diabetes is a notch below Type 2 diabetes. It is a serious condition, where blood sugar levels are elevated, but not serious enough to be diagnosed as diabetes. From this, we really learned that diabetes is more of a spectrum in severity, rather than enforced by harsh cutoffs. Diabetes is a chronic condition, which means that it affects the body long term. Because diabetes affects multiple organ systems, it can cause other chronic conditions, including cardiovascular conditions, like high/low blood pressure, heart conditions, among others. Some stronger, irreversible issues that come with diabetes includes nerve damage, glaucoma. The effects of diabetes are widespread and point to a direction that diabetics are a key user group with different areas of solving problems.

We also learned about other forms of diabetes, such as Gestational diabetes, which is when a pregnant person develops a certain level of insulin resistance, which impacts the fetus. Different factors such as lifestyle, family history, environment, and genetics come into play. For our project, we knew we would have to design for the extremes and that would account for the middle, so we thought that we would make a mental note that those who are new to diabetes and need help managing their condition, or would encounter a more experienced individual merely need a centralized manner to manage their condition as an experienced diabetic

To hear more user stories and gather where we could enter as a product or service, we decided to launch a survey for distribution on various diabetic support groups or help communities on Reddit, Facebook, and reached out to individuals in our personal lives that have diabetes. Our survey was hosted on Qualtrics, which is a platform that is more professional and used for research conduction. Iffat lead the formative structure within the survey, allowing for branching logic if certain questions apply. All of the questions were optional, which allows for survey participants to only answer questions they're comfortable answering. Within the survey structure, Psychographics, demographics, and identifying information are used if the survey participants want to sign up with an interview later on. Certain characteristics of those who respond will told us more about the target market, such as what impacts their work environment may have to be able to explain. We did understand that this is limited based on the survey distribution locations, as this limits the scope and reach of eligible users from our user group. Questions regarding information such as cost of goods

and insurance coverage on a case by case basis allows for identifying if financial metrics are a suitable area for product/service creation, and gives an idea of how high/low in comparison to price the product we create. We also tried collecting information and feedback about how survey respondents report their diet and exercise and gives us context to how close or not close survey responders are to meeting their needs and expectations.

Part of Inquiry also explored different existing market solutions, and helped us see some insights on potential entrance areas:

1. Dexcom is a sensor that has both a transmitter and sensory device and allows you to continuously monitor your blood sugar. Dexcom has transmitters last 6 months and the sensor, which is the patch like device that sticks to your arm, lasts about 3 weeks before requiring the need to change it. Dexcom requires you to have doctor's authorization and requires insurance approval to use. The app that is used to monitor this is by Dexcom themselves and it also comes with a black portable device if you do not have a smartdevice to use the app on.
2. FreeStyle Libre is a similar sensor, which works as a continuous monitor with different requirements on where the sensor goes. Dexcom has more flexibility where the sensor goes, whereas freestyle libre restricts you to the arm.
3. One Drop tests more than just glucose: it helps to manage and monitor diabetes, blood pressure, heart health, and weight related metrics. One drop utilizes AI and coaching to help make progress.

4. App Alternatives Across the app stores of where you go, there are a myrad of applications that offer the ability for users to input their blood sugar testing results for traditional fingersticking methods, or offers the ability to log meals and provide a macro and micro view towards nutrient consumption.
5. Within the wearable market, there are certain companies, such as Apple, who are trying to be an innovative first mover, and add in special monitoring tools within the keyboard area of their MacBook according to recent patents, and has been doing research into adding diabetes tools for checking blood sugar and other sensors in its apple watch for a long time. Apple definitely has the technical and organizational feasibility to pursure research and progress for the benefit of diabetics and the daily user curious about affiliated metrics

We additionally utilized other surveys and data to analyze and make predictions about those who are diabetic.

Generally, we found that within the user group of people with diabetes, there exists:

- People repulsed of or inconvenienced by medicine usage
- People uninformed on the medicine instructions
- People who felt depressed by their diagnosis
- People who rejected their diagnosis and mismanaged diabetes due to lack of care
- People with extreme dietary habits: either too conservative or too extreme
- Some patients were not aware of the complications of diabetes.
- Some patients have incorrect cognitions about their medicines and injections.

- Most patients usually forget to take medicines/ do the monitor on time.
- Some people opt out of the continuous monitoring as they cite comfort for reasons.

This correlated with our survey findings that:

- Most products used are covered by insurance, but out of pocket costs still remain high per month for supplementary goods/products/services
- For most of those replying to the survey, insurance covered half or more of the costs
- Most people experienced additional pain points beyond diabetes, including:
- Other health condition/medicine interactions
- Drug to Drug interactions / side effects
- Financial Issues
- Medicine Management
- People with more active/hands on jobs, and jobs in healthcare, or are retired, say they have less time or energy to care for themselves, or avoid doing so, and are less likely to follow a meal or exercise plan compared to more sedentary individuals

Through our surveys and interviews, we additionally learned that:

- Most products used are covered by insurance, but out of pocket costs still remain high per month for supplementary goods/products/services
- For most of those replying to the survey, insurance covered half or more of the costs

- Most people experienced additional pain points beyond diabetes, including:
    - Other health condition/medicine interactions
    - Drug to Drug interactions / side effects
    - Financial Issues
    - Medicine Management
- People with more active/hands on jobs, and jobs in healthcare, or are retired, say they have less time or energy to care for themselves, or avoid doing so, and are less likely to follow a meal or exercise plan compared to more sedentary individuals

Insight

The second phase of the project was Insight. The main objective of this stage was to generate valuable insights from our surveys, interviews, and research that would inform the design phase that would follow ahead. As a group, for this phase of the project, we were supposed to use the approaches of people and systems, pattern and priorities and problem framing. During this process, we were able to learn more about our potential users and what are the problems they are facing.

Additionally, we were successful in finding gaps between what users want and the existing solutions, filling those gaps would ensure success for any future product. Some of the observations that we were able to make are that potential users are not fully aware of the complications of diabetes, most patients usually forget to take their medicine on time and fail to check their glucose levels on regular intervals, some users who knew about their disease struggle to keep a proper diet that is high in nutrients and low in glucose. Lastly, we learned that some patients have incorrect cognition about medicines and insulins.

There were three major directions for our project that we were able to see: health tech, dietary consultation, and financial aspects of Diabetes

Health Tech

We learned fairly quickly from this process that people want something that is intelligent and not binary. Continuous Glucose Monitoring (CGM) was a common theme in this phase. Existing products in the market are very bland and do not provide much value to users. Moreover, we learned that people are tired of plugging the device in the same area of their body (arm) again and again but we couldn't do much about this because of the technical shortcomings we had and relatively short time span. If we look at the market today, there are many apps on the market that allows users to connect their CGM device with the app and the users can look at their glucose levels on the app but users want much more than that, they want the app to tell them how does their blood glucose level differ when they eat a certain food and what are the kinds of food they should avoid in order to stay healthy.

Dietary Consultation

The second main theme from the insights phase was dietary consultation. We were able to learn that people lack the discipline to cook or eat food everyday that corresponds well with their existing diabetic condition. Moreover, people lack the sufficient knowledge to judge if the following food is good for their condition or potentially bad. One thing that really struck out during the interviews is that users find it too much of a hassle to manually dial in the food and food portion that they are eating, rather they desire something that is more intuitive like just simply scanning the food. There are some existing diet management application on the market but they fail to cater the needs for diabetic patients efficiently to the point where

there is mass adoption amongst users so this provides us with an opportunity to dive in and try to do something in this area so we can make a positive impact on the users.

Financial

The third theme from insights was the financial aspect of people dealing with diabetes. This includes their insurance premiums, their copays, and deductions. The aspect also included various day to day or monthly costs that are incurred due to diabetes. Lowering these costs represents an opportunity for us but we realized quickly that our time span of just one semester would not be enough for us to try to tackle this problem. Additionally, we did not have sufficient knowledge and expertise in this area so this was something we decided not to explore.

From the insights phase, we decided that we are going to ideate more on the health area and dietary management. These two verticals are going to be something we innovate on in the later phases of the design process.

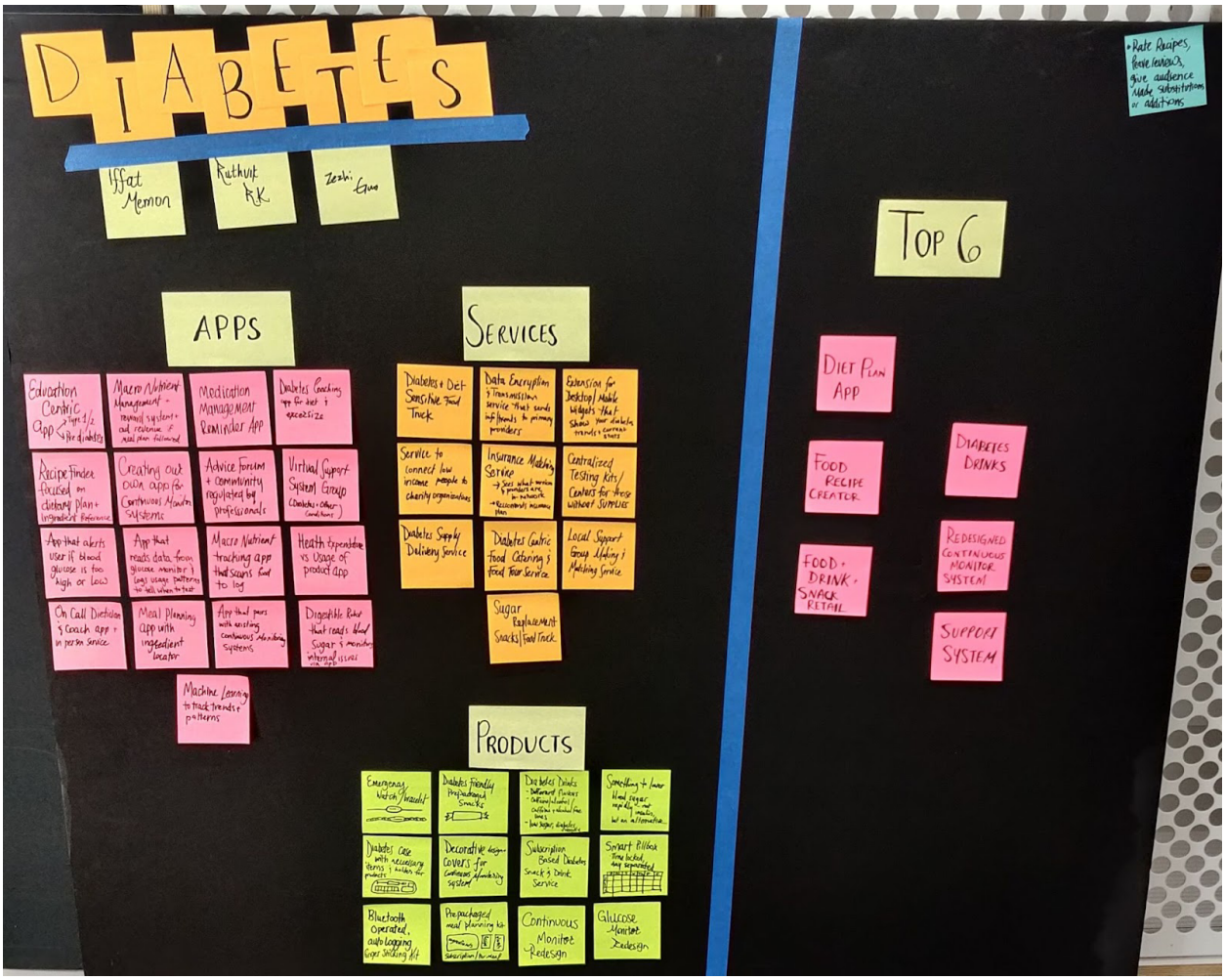
Ideation

From the first few weeks in class, after gathering insights from the multiple surveys that we put out on Facebook, Reddit, reaching out to personal connections with Diabetes, and talking to diabetic patients firsthand, we were confident in our understanding of the pain points that people with diabetes face in their daily life. Once we were able to lay out the characteristic activities of diabetic patients' daily lives, we hypothesized this as our customer archetype and started getting creative with addressing their pains or creating gains. The ideation process (third phase of the class) was a journey that adapted to new facts that we found and to new

insights that we received. We found a plethora of domains to ideate in but the most practical ideas were all mobile phone applications that enhanced lifestyle for diabetic patients in some way or the other. Health tech devices and pharmaceuticals products require FDA approvals and none of us wanted to waste time without any medical professionals on board. We also identified the demand for physical products such as food and drinks. Following is a breakdown of different attempts at solving specific problems that we were able to identify from our customer discovery and research.

Monitoring blood sugar levels and eating, exercising, and medicating appropriately is the most relevant and important habit that we were able to identify among those with diabetes. Although we did not want to create new devices, we certainly intend on creating a new way data is logged, analyzed, and made use of. These levels are affected by what we eat, exercise and medication. Our goal was to somehow bring about a tool that tracks glucose levels while accounting for these factors which makes one's body's responses more predictable and thus helps them behave accordingly.

Other ideas such as food and beverages for diabetics and support group services were some other ideas we were considering. Below is a list of our idea list which we sorted based on its deployment into mobile applications, physical products and services; out of which we picked our top 6 ideas and further narrowed it down and refined our idea based on further insight and feedback.



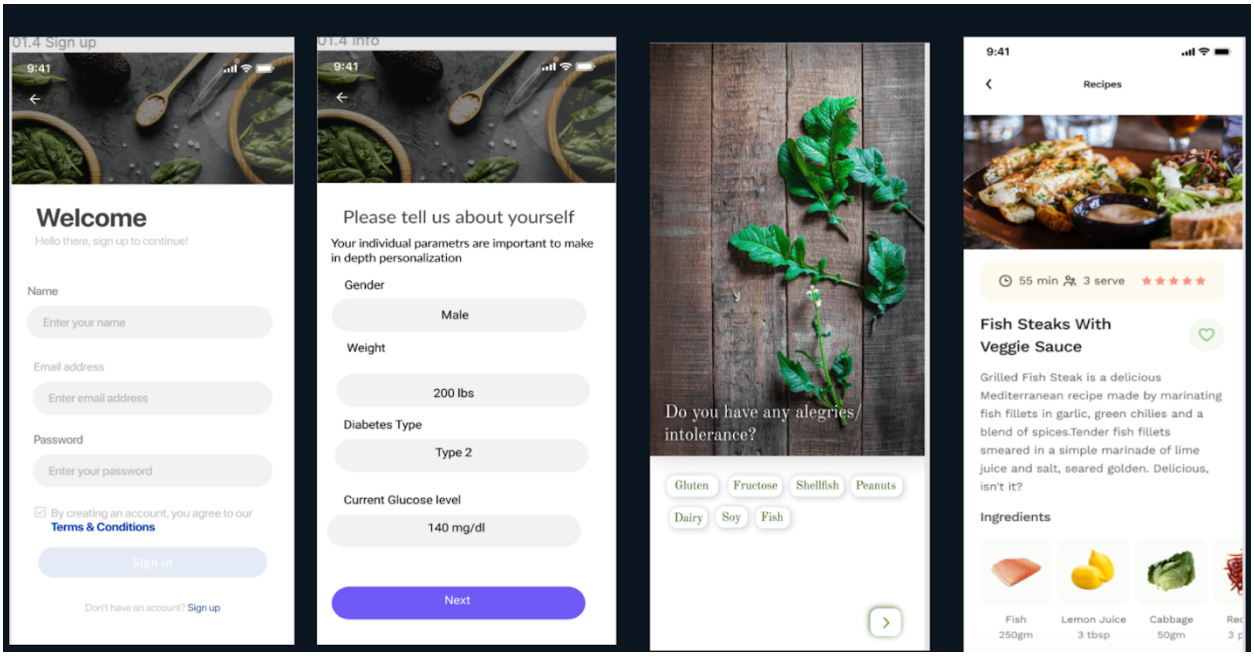
Involvement:

Involvement phase requires that we get our potential users involved in the design process and try to make products that serve their needs to the highest levels. At the start of this phase, we had concluded three major ideas that we would like to work on and shared them with our potential users. We shared the details and rough prototypes of our potential products to 100 plus survey responders and asked them their quantitative feedback.

<u>Recipe Maker and Ingredient Finder App:</u>

- Customized recipes and nutritional information

- Assists in making diet plans that correlates with a user's dietary requirements
- Video based instructions
- Log in food and medication
- Filtering of recipes by skill level and preparation time



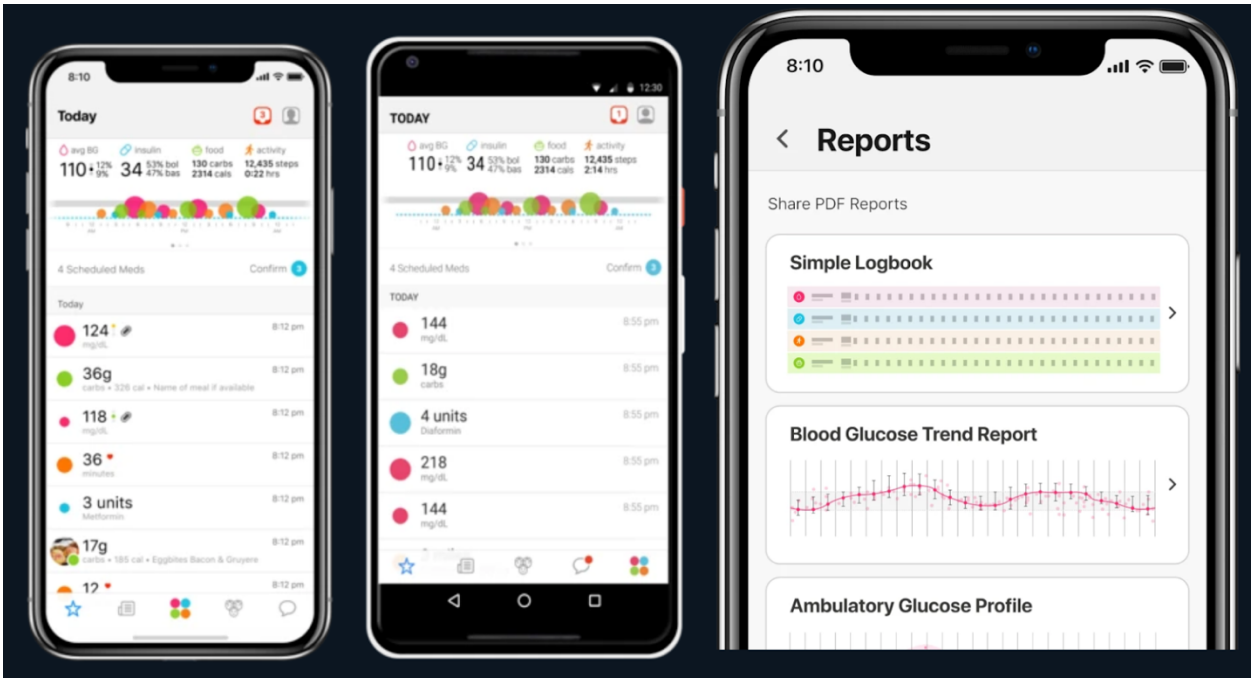
<u>Diabetes Drink</u>

- Canned and flavored drinks
- Non Alcoholic and Non Sugar
- Tastes good like regular drinks
- Comes in packets and solo


UNITED SODAS OF AMERICA
LEMON VERBENA
WHITE GRAPE
STRAW-BERRY BASIL
EXTRA PEACH
GINGERY ALE
SOUR BLUEBERRY
TOASTED COCONUT
PUREWOW100
95
100

Redesigned Continuous Glucose Monitoring Experience

- App that can be paired with existing CGM sensors and new ones also
- Provides real time feedback to users on their health and goals
- App provides educational insights based on user's behavior
- Uses Machine Learning to analyze users behaviors and past trends and recommend actions based on that
- Data can be seen on the app page or can be sent through text and email



Quantitative feedback from our users

There were more than 100 survey respondents. Out of them, 68.5% were prediabetic, 27.5% were Type-1 Diabetes patients, and 3.25% were Type-2 Diabetes patients. Out of these

patients, 52.5% chose redesigned continuous glucose monitor app as their top choice, 43.5% chose recipe maker and ingredient finder as their top choice, and diabetes drinks were the least favorite amongst the users sitting at about 5%.

Additionally we used machine learning to count the top keyword for product feedback and these are the results:

- Exercise Plans: 32 occurrences
- Mental Health Issue: 24 occurrences
- A Patient Based Community: 13 occurrences
- Address to Side Effects: 4 occurrences

From the survey we had a very good understanding of what our final product would look like. We decided that we are going to cut out diabetes drinks because they are not popular amongst our users and do not provide them with much value. We turned our focus on exercise plans, and patient-based community to substitute diabetes drinks. So for our final project, we came to the conclusion that a one stop shop for diabetes patients is something that is missing in the market and we should try to build that. In our final product, we would have elements of continuous monitor, recipe maker, community, and exercise all blend into one app seamlessly.

Informing

After several rounds of quantitative and qualitative research on target users, we are ready to make a basic low-fidelity model (wireframe). Before starting to make models with Figma, we first used Jesse James Garrett's five elements of user experience to think and analyze the structure, content, and display methods of the entire product to a certain extent. However,

due to the timing problems caused by the different majors of each person in the group, we did not have the opportunity to complete this step in more depth.

Strategic level:

Commercial level: Although the starting point of this course project does not include making the product have excellent commercial performance, in order to make the whole project closer to the real design scenario, we still hope to increase user stickiness by providing users with relatively high-quality services. Through the consumption items in the App to obtain from users at least the basic funds that can maintain the continuous operation of the App.

User level: We hope that the product can meet the needs of target users related to maintaining their own health in a variety of situations in their daily lives. Our product should not be limited to letting users simply know their own blood sugar situation from words and numbers; on the contrary, it should be a part of users' lives and provide users with a variety of user-friendly and highly customized services/ assistance and become users' best friends.

Scope level:

Through several rounds of qualitative and quantitative research on target users in the early stage, as well as insights and analysis of other similar products in the market, we have basically understood the basic needs of users (recording and analyzing the continuous monitoring of users' glucose & more convenient to understand and manage users' bodies' conditions) and some surprising, additional needs that most users expect the product to solve (management of daily diet and establish effective exercise plan/community. The next thing we need to do is to

brainstorm in the group to think about the content and functions that the product can have based on the research's participants' feedback. In order to achieve this goal, we spent two weeks getting more than 40 ideas for several different content directions. After that, we first gave up some of the ideas that most members (2 or more) thought they have problems with voting in the group, and then based on the possible limitations of various functions (existing technology/time/platform competitiveness) we once again excluded some ideas. Finally, we prioritized the remaining ideas and created a feature list by using NUF (New & Feasible & Useful).

Low-Fidelity Wireframe Application Design Features & Modeling

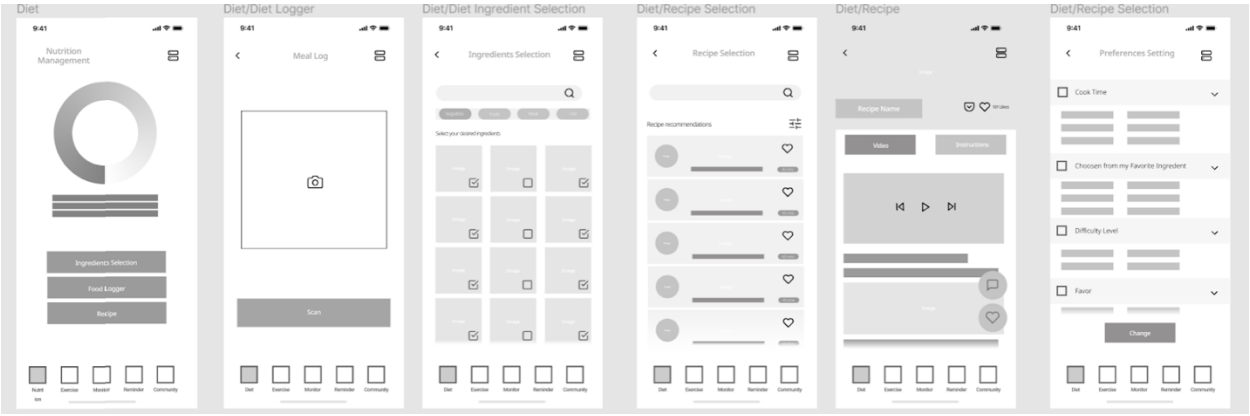
The five main functions we have identified are: Nutrition, Exercise, Monitor, Reminder, and Community. Each main function has at least 1-3 sub-functions and content sections.

Nutrition

Nutrition contains 4 modules: Ingredient Selection, food logger, Recipe, and record history.

- Ingredient Selection: Users can record their daily nutritional intake by selecting designated ingredients according to the conditions of all their ingredients and recording them in the logger record.
- Food Logger: Scan the barcode on the food package to obtain nutritional information and other App users' evaluations of this food.
- Recipe: Search for recipes that users are interested in by entering keywords or names of ingredients. Each recipe will display its nutritional information, text and video tutorials, and other user reviews. Users can also filter out a specific range of recipes (e.g.: hotness, time, difficulty) through the filtering function for different aspects.

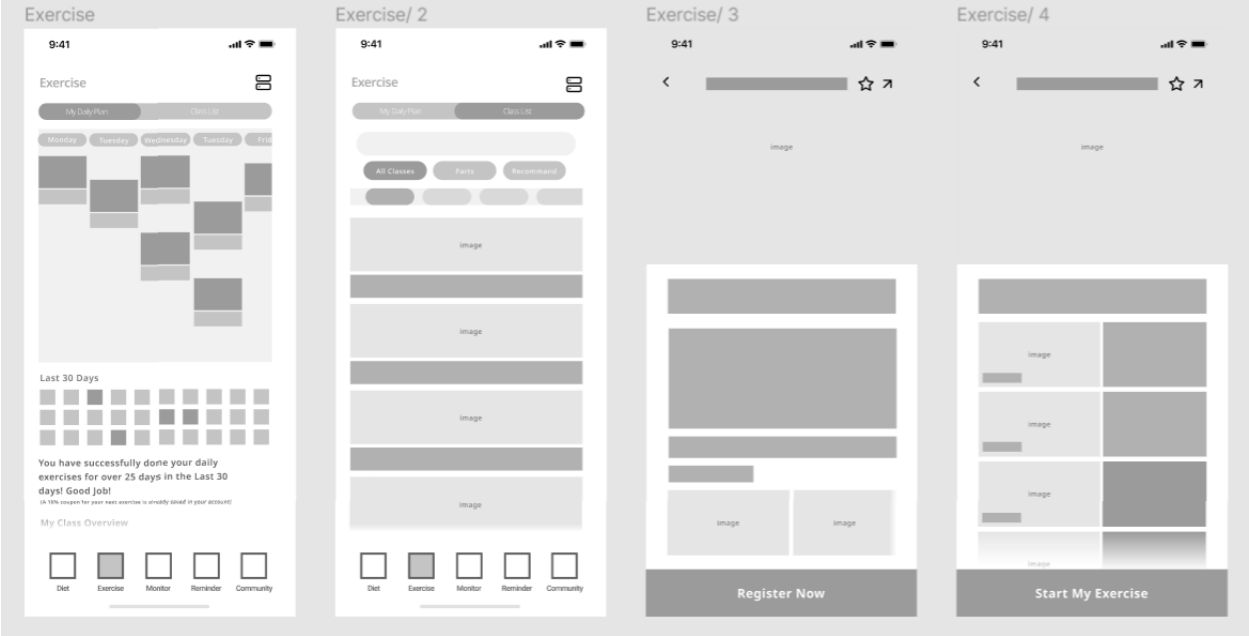
- Record History: Here, users can see their nutritional information in different time dimensions and get some basic feedback on their current status.



Exercise

Exercise contains two modules: personal exercise schedule and exercise item list.

- List of exercise items: This feature includes paid items, which is currently the only way to make money for our app. The list provides various exercise items for different aspects. Users can find a highly customized exercise program that suits them through their own conditions.
- Personal exercise schedule: After the user has selected the item he wants to perform, he can add this item to his personal schedule. The calendar will show all the exercise items that users need to perform at the moment. In order to encourage users to complete exercises on time and increase user stickiness, this feature will set up a reward mechanism. When the user insists on completing the exercise for a period of time, the user will have a corresponding discount for the next item selected.

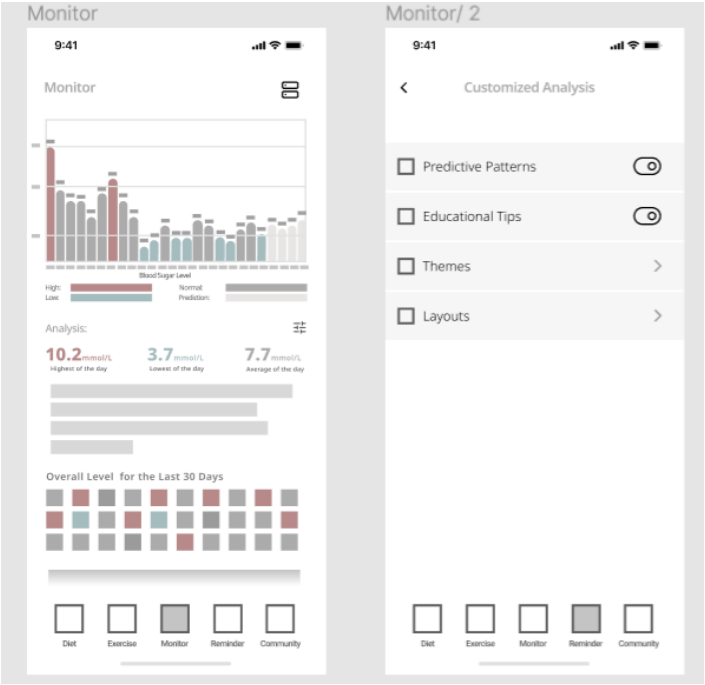


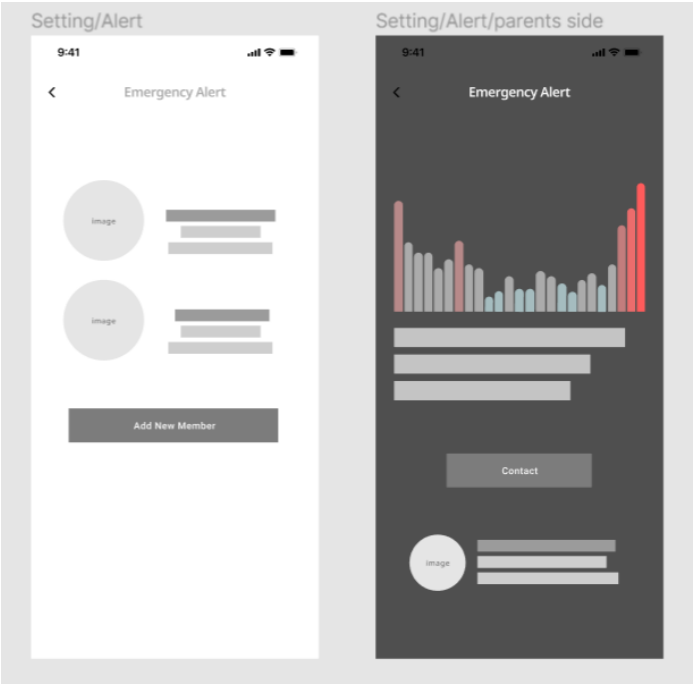
Monitor

Monitor contains 3 modules: continuous blood glucose monitoring, blood glucose status analysis and peer emergency reminder.

- Continuous blood glucose monitoring: This function will connect the portable blood glucose monitor carried by the user via Bluetooth and display the monitoring results in real-time, and will give the prediction results in the next 1 to 2 hours through the analysis of the current status. In addition, when the user's blood sugar is in a low or high state, relevant warnings will be displayed on the monitoring chart.
- Blood glucose status analysis: By analyzing the user's blood glucose status and trend in the previous day/period, we can provide users with humanized and easy-to-understand stage summaries and reminders. Different from the similar functions of other products on the market, the way this function is displayed will be warmer.

- Emergency Alert: When the user's blood sugar is too high or too low, the contacts that are set by the user in advance will be notified of the user's current status information.

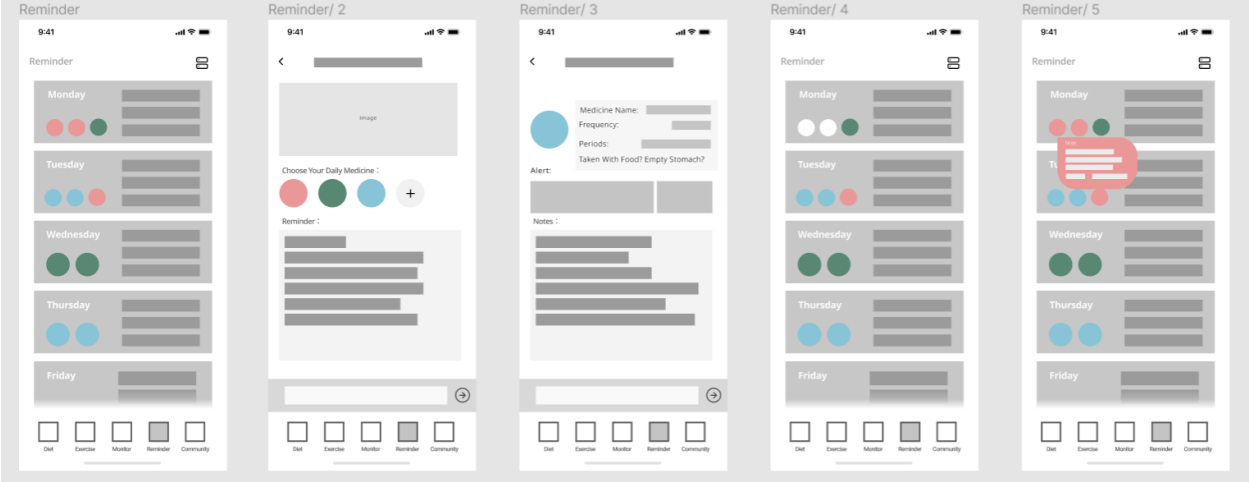




Reminder

Reminder contains a module: daily information reminder.

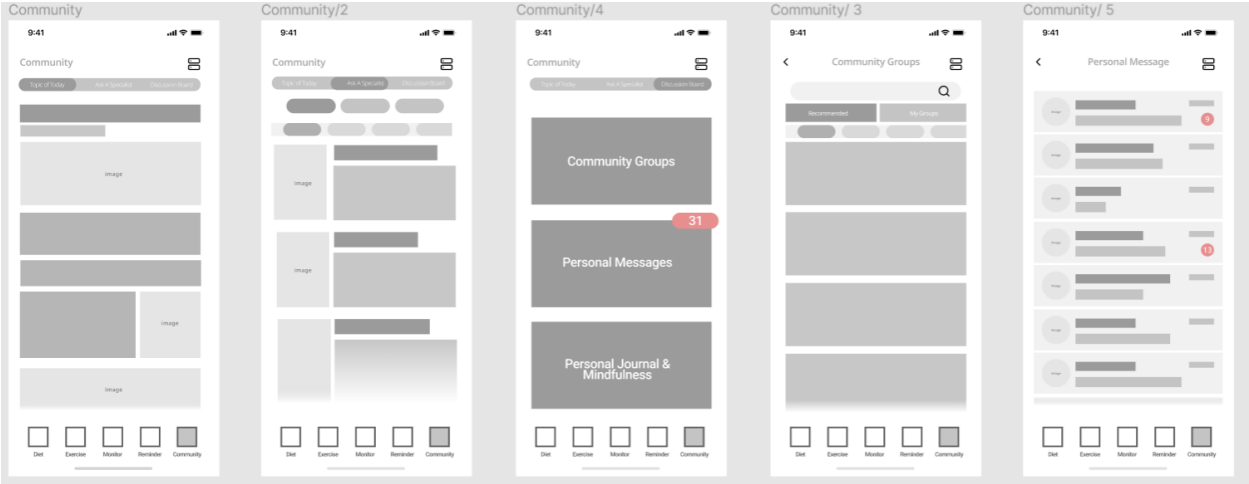
- Daily information reminder: In this function, users can enter their daily tasks/drugs/insulin injection time to remind themselves to complete tasks on time.



Community

Community contains three modules: Topic of Today, Ask a Specialist, and Discussion Board.

- Topic of Today: Users can learn about the daily news about diabetes or related knowledge popular science.
- Ask a Specialist: Users can ask experts in different fields about questions they don't understand and any confusion about their physical state.
- Discussion Board: This feature provides a platform for users to communicate and share with this App. Users can join topic groups they are interested in or add friends to chat here (1 to 1 & 1 to multiple).



Structure Level of Development

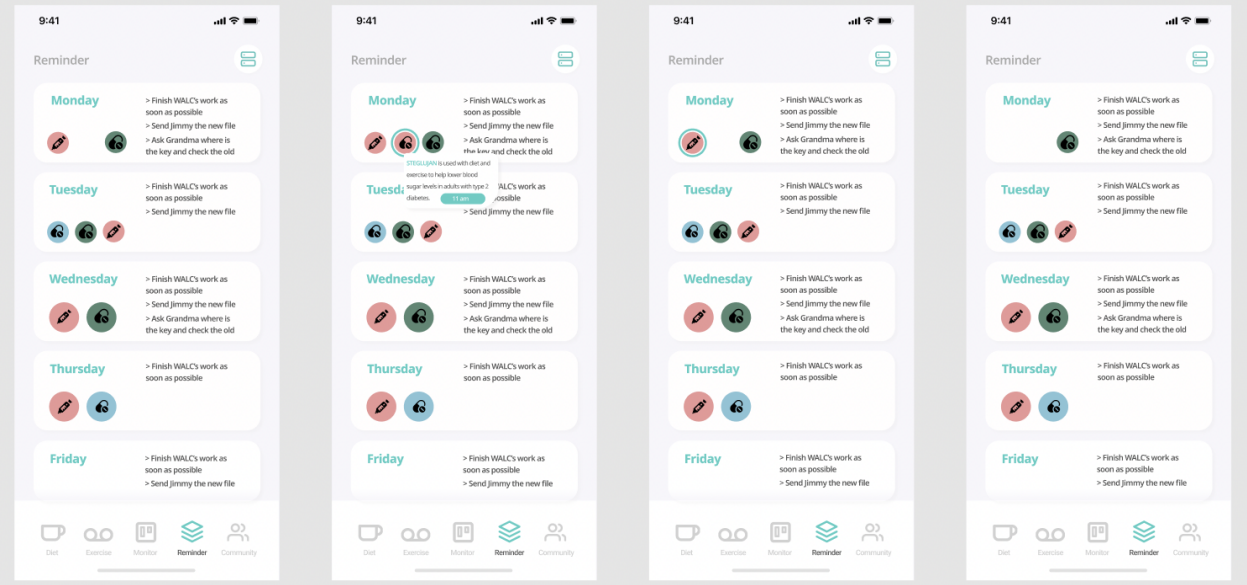
Because the number of our main functions and secondary functions is not very large, we chose the more traditional bottom navigation bar menu as the first-level navigation guidance system. The user can enter the area of this function by clicking the corresponding function (five) in the bottom navigation bar. There is only one Setting interface for the entire product, and it basically exists on every level 1 interface. Users can directly click its icon on most interfaces to quickly access various functions/interface settings information. In addition, most of the product's functions (nutrition/exercise...) that involve a large amount of information will provide a corresponding search bar and filtering system. Users can enter keywords or select their preferred category in the filtering system to find the information they want in a large amount of information.

In order to prevent any visual decorative elements from affecting the subsequent testing of low-fidelity models, we did not design for the frame layer and the visual layer at this stage.

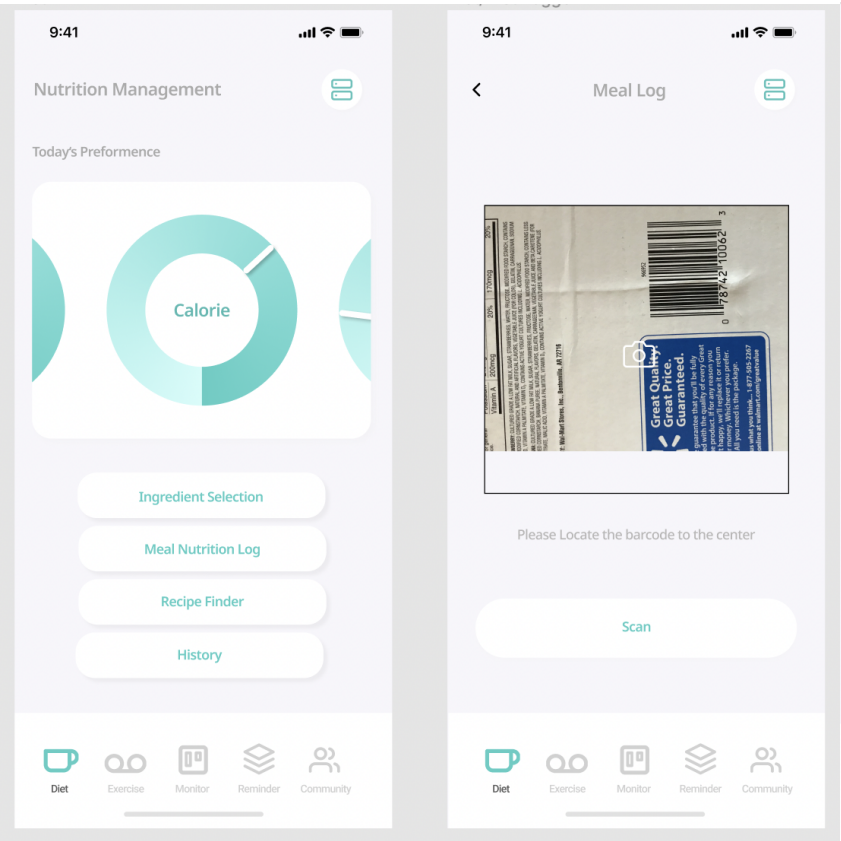
After we completed the low-fidelity model and invited several target users to test, we found some problems with the interaction details. We made some corresponding corrections and improvements to them and built the final model after adding visual decoration to the low-fidelity model. Because blue and green colors can give people feedback of peace of mind and comfort, we choose them as the main color of our final interface.

Medium-High Fidelity Prototype with Updated Design Interface

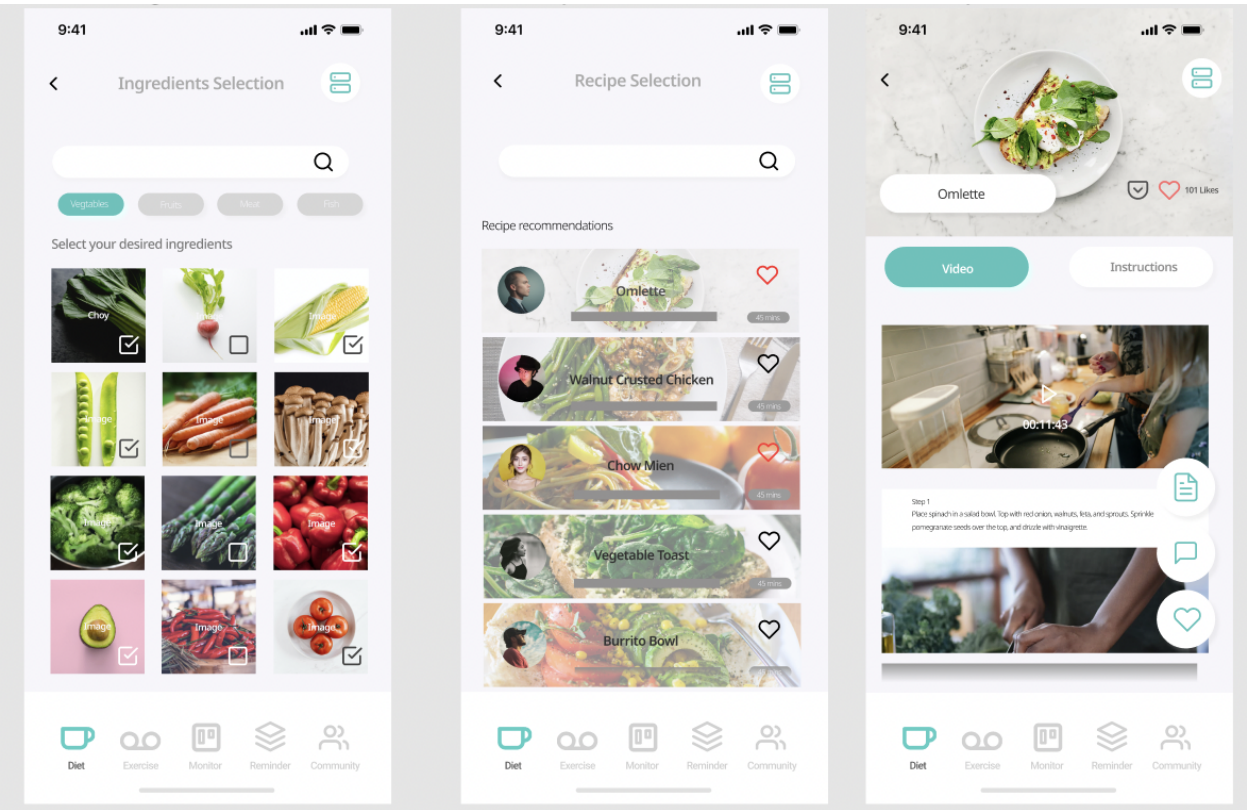
Reminder Screen



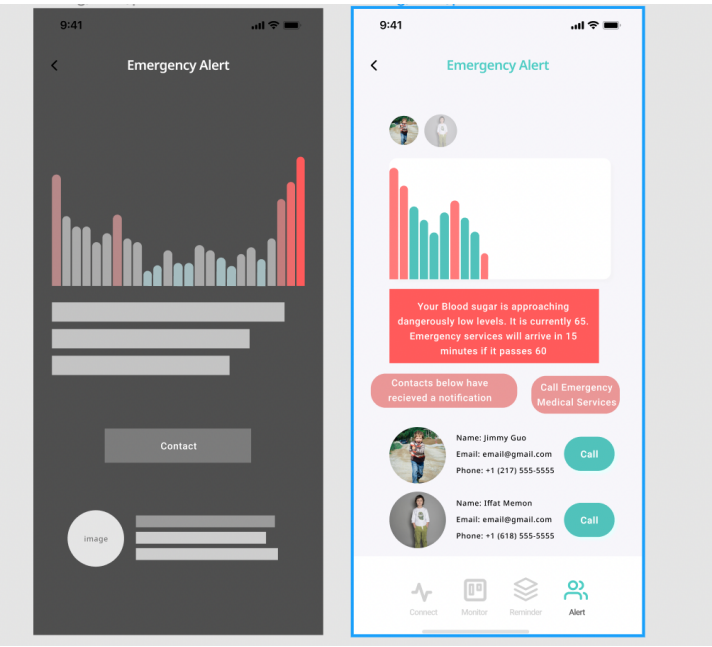
Food / Nutrition Logger Screens



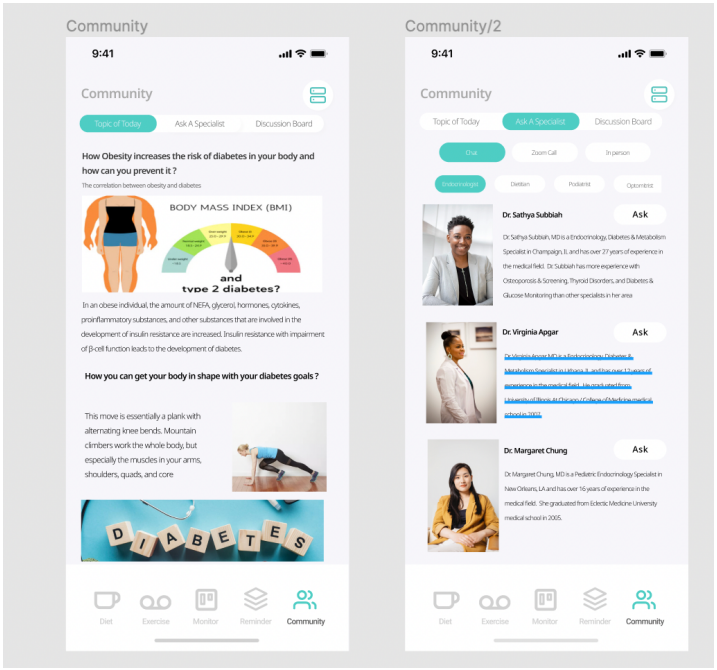
Recipe Finder



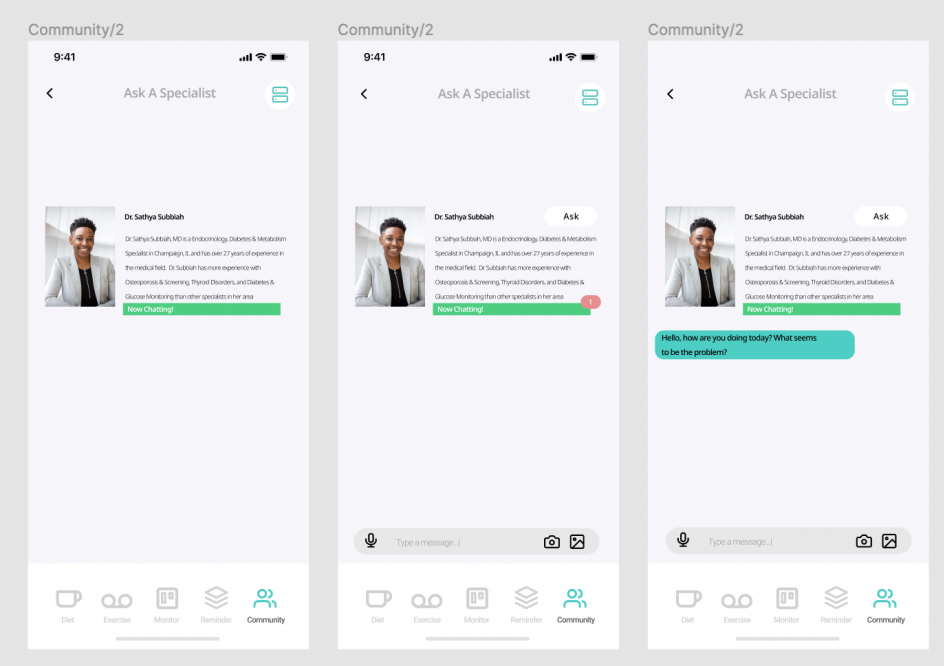
Emergency Alert Screen:



Community Screens:



Ask an Expert Screens:



Implementation

For the implementation for this application, it would need to be properly coded using Android Studio for Android users and XCode for iOS/MacOS/WatchOS/iPadOS users.

Due to the nature of the technology, the production of this application would need to be subcontracted out and have agile development with consistent communication. As a part of the planning and documentation required, each interaction, use case, and potential edge cases would need to be thought out to adjust for alterations in information infrastructure based on Alpha Beta testing and user centric needs.

As for identifying profitability opportunities once the application is created, there could be exploration on sponsored meal services such as HelloFresh on the recipe finder application, and a partnership with delivery services such as InstaCart to instantly shop for the ingredients. There could be ad-based revenue through showing ads on the application. For the trainers and specialists on the site, as well as any in-app purchases, a portion of the proceeds could come to the creators of the app.

Project Conclusions

Through this project and through this course, our team has learned the importance of refining solutions by going back to the user group identified and truly gathering thoughts and insights based on their needs, usage patterns, and psychedemographics. This course and project has also showed us the significance of trusting the process, and focusing on innovative design that identifies a problem or pain point of a user group; this reinforces the idea that this is about the process, not just the end goal of a 'solution', because solving a problem that doesn't exist or creates future problems is not a 'solution' at all. For all of our areas of study, these takeaways have been critical, not just to learn, but to also put into practice