



Glucate: Redefining Diabetes Management for a Healthier Tomorrow

Sarah Gedi | 2023-2024 | Science and Engineering Fair

Project Objectives

Rationale

In recent years, diabetes has emerged as one of the fastest-growing diseases globally, posing a significant public health challenge. The tendency of diabetes to cause various health problems that impact essential organs and systems is among the most concerning aspects of the disease. Some risks include: Heart disease, Strokes, Renal Failure, Blindness, Visual impairment, and Nerve damage. 38.4 million people have diabetes—that's 11.6% of the US population. 29.7 million people have been diagnosed with diabetes. 8.7 million people who have diabetes have not been diagnosed and do not know they have it. (Centers for Disease Control and Prevention National Diabetes Statistics Report)

Purpose

As of right now there is no cure for the disease causing more and more to affected with no cure. However there are ways to help people with diabetes to take charge and manage their sugars like apps but most apps are not easy to use nor are affordable causing people not to feel motivated to take charge of their health."many apps aren't being used – or are being used a few times and then dropped – because they're unreliable or ineffective."((Eric Wicklund Diabetes app market 'fragile' but improving). My main purpose is to collect first-hand accounts from people who deal with the complexities of diabetes daily. Then based on this information create a groundbreaking app for blood sugar stability based off of all the participants suggestions. My app will seek to improve diabetes management, help limit related health risks, and encourage a proactive attitude to personal well-being.

Survey

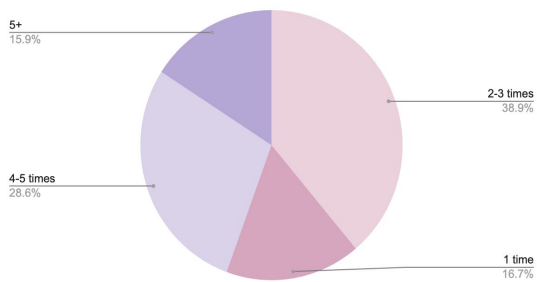
Despite the abundance of knowledge available online, I choose to use a more personalized strategy. I created and sent out a survey to people who have diabetes in an effort to learn more about their particular struggles and experiences. My intention with this survey is to get firsthand accounts from people who live with diabetes on a daily basis, in addition to the basic information that can be accessed online. The information acquired from this survey will be used as a basis for creating an app that can truly enhance the lives of those who are living with diabetes. The survey I conducted (To ensure that it was a complete random sample I sent it in random diabetes group chats and posted on social media.), with about 270 responses, aimed to learn about people's everyday practices in diabetes treatment. Questions focused on the frequency of blood sugar checks, the timing of glucose monitoring, and the usefulness of carbohydrate and calorie tracking. Beliefs regarding the significance of regulating these variables and weight on blood glucose levels were investigated. The survey also assessed the use of diabetic applications and interest in a simple, non-restrictive tool for blood glucose control before meals.

Survey Results & Engineering Goal

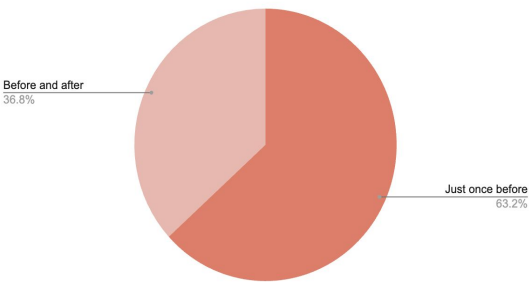
Engineering Goal

- A way to help diabetics track their blood sugar before every meal.
- A way to set a goal for the amount of carbohydrates and calories each diabetic should intake daily. could be recommended by a doctor.
- Letting the user be able to input the food they are eating every meal and then utilize something that is accurate to calculate the amount of carbs and calories and display them graphically so the user can keep track.
- Also, displaying the blood sugar levels before each meal graphically on a separate graph allows the user to be able to track that.
- Make sure that the app is very easy to use, effective, and not time-consuming for the user.
- My ultimate goal is to help progress diabetes management by offering a key tool that targets particular requirements while also improving the overall quality of life and limiting the chances of other health risks for all individuals affected.

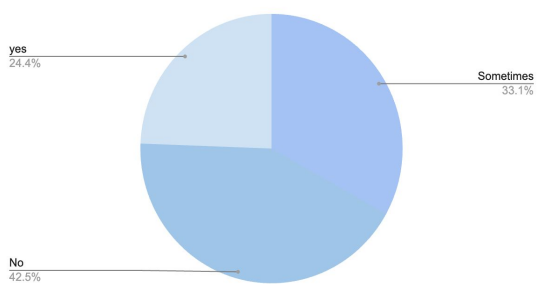
About how many times a day do you check your blood sugar levels?



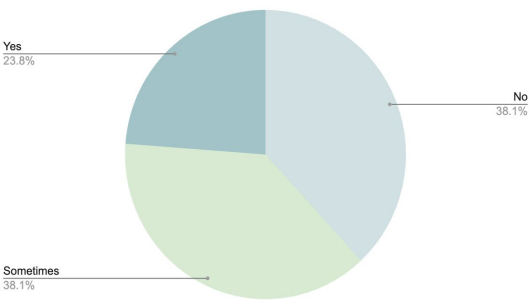
Count of Do you check your glucose levels before and after each meal or just once before?



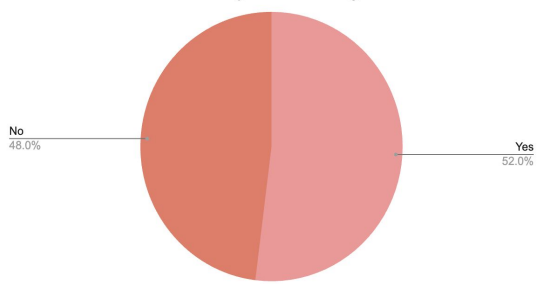
Count of Do you check your carbohydrates to manage your diabetes?



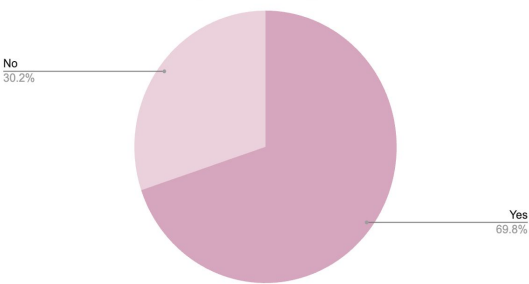
Count of Do you check your calories to manage diabetes?



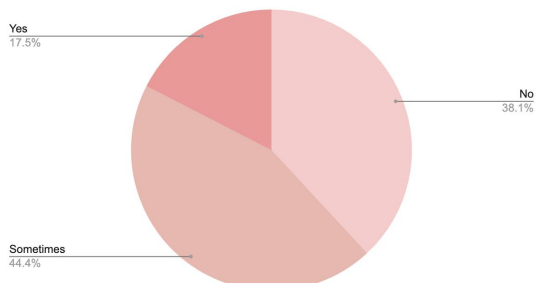
Count of Do you believe that managing your carbohydrate intake is vital to your blood sugar levels?



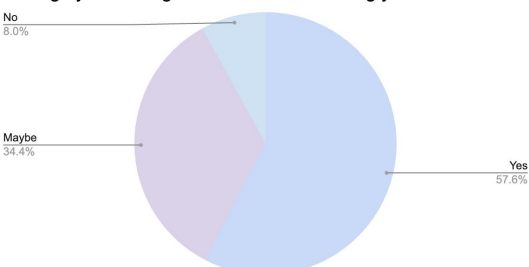
Count of Do you believe that managing your calorie intake is vital to your blood sugar levels?



Count of Do you utilize diabetes apps daily?



Count of Would you use an app that will better help you manage you blood glucose without restricting your meals but...



Methods & Project Design I

Methods

01

Simplify Food Tracking

Create a user-friendly platform for diabetics to quickly input their meal choices, simplifying nutritional tracking in under a minute.

02

Nutritional Breakdowns

Develop a platform that calculates and visually presents precise nutritional breakdowns, including carbs and calories, in a clear graphical format, aiding users in making informed dietary choices.

03

Graphical Representation

Enable users to input and monitor their pre-meal glucose levels over time, facilitating a deeper understanding of trends and patterns in their blood sugar levels.

04

Flexibility

Enhance diabetes management flexibility by enabling users to select meals within specific carbohydrate and calorie limits, offering a personalized and adaptable strategy for stabilizing blood sugar levels.

Calorie & Carb tracker

The next step is to find an easy to use and accurate calorie and carb tracker and I found two options That I wanted to further test and compare.

Calorie Ninjas	Nutritionix
Offers: Custom Portions	Offers: Custom Portions
Global Nutrition facts.	Can process food phrases, and tags.
Branded items	200,000 Restaurant items.
Data for 100,000 food items.	Branded items
	Data for one million food items.

From comparing the two API's we can clearly see that Nutritionix has a lot more to offer however I want research more by testing multiple food items on both API's.



CalorieNinjas

<https://calorieninjas.com/>

Vs.



nutritionix TRACK
a Syndigo Company

<https://www.nutritionix.com/>

Calorie & Carb tracker Accuracy

Despite recognizing Nutritionix extensive features over Calorie Ninja, I'm inclined to conduct a thorough accuracy test. I plan to analyze various foods in different serving sizes, comparing the results with a highly accurate calorie and carb dictionary. This approach aims to validate the precision of both platforms and provide insights into their reliability across a range of scenarios.

*means inaccurate	Control		CalorieNinja		Nutritionix	
	Cal:	Carb:	Cal:	Carb:	Cal:	Carb:
White Bread(1)	77	13.3g	*75	*12.3g	77	13.3g
Brown Bread(1)	75	13.0g	*79.7	*15.2g	75	13.0g
1 egg	74	0.38g	*70.2	*0.26g	74	0.38g
3 eggs	219	1.2g	*215	*0.9g	219	1.2g
1lb. of chicken breast	760	0g	*800	*0g	760	0g
1 cup of white rice	205	44.6	*208.5	*46.7g	205	44.6g
1 cup of brown rice	218	45.8g	*107.3	*22.5g	218	45.8g
1 cup of orange juice	110	27g	*115.6	*28.9	110	27g
1 cup of apple juice	114	28g	*110	*26g	114	28g
3 cherry tomatoes	9.4	2g	*9.0	*2g	*9.3	2g

From this chart we can conclude that Nutritionix is the most accurate option given that there was only one inaccurate calorie count and it was only by .1

Project Design II

- I started by creating a basic template React Native JavaScript application, which allows the app to be interactive and set up authentication using Google's Firebase. Users are able to login using a created username and password.
- Then, I set up the user's initial survey, where questions on their carbohydrate and calorie goals, as well as their blood sugar levels are recorded and saved to Google's Firebase, which is a secure database that stores user's health data.
- To estimate calorie and carbohydrate data from the user's self reported meals, I used an API called Nutritionix that estimates this data given a natural language description of the meal (ex. '3 eggs and a waffle').
- Finally, I visualized user's blood sugar, carbohydrate, and calorie data in line graphs utilizing react library that show the last week's readings of each. Users can edit the responses to the initial user survey as their needs change, and these changes are reflected in the graph.




- An example of how Nutritionix API works:
- Below is an example of the result of a breakfast example that consists of 3 eggs, Bacon, and cheese.:



for breakfast i ate 3 eggs, bacon and cheese

☐ Check for only one food per line
☐ Check to use raw foods

Calculate Foods QR Code

	Qty	Unit	Food	Calories	Weight	Food Group	
	3	large	eggs	214.5 kcal	150 g	Protein	i
	3	slices	bacon	161.46 kcal	34.5 g	Protein	i
	1	slice (1 oz)	cheese	113.12 kcal	28 g	Dairy	i

API response time: 152ms

1 Servings

Nutrition Facts

Amount Per Serving

Calories 489

% Daily Value*

Total Fat 36g **46%**

Saturated Fat 14g **70%**

Trans Fat 0.4g

Polysaturated Fat 5.4g

Monounsaturated Fat 13g

Cholesterol 620mg **207%**

Sodium 977mg **42%**

Total Carbohydrates 2.5g **1%**

Dietary Fiber 0g **0%**

Sugars 0.7g

Protein 37g

Vitamin D 3.3mcg **16%**

Calcium 287mg **22%**

Iron 3mg **17%**

Potassium 400.4mg **9%**

Caffeine 0mg

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2000 calories a day is used for general nutrition advice.

Micronutrients

Phosphorus, P 558.3 mg

Potassium, K 400.4 mg

Caffeine 0.00 mg

<https://www.nutritionix.com/>

App & Conclusion I

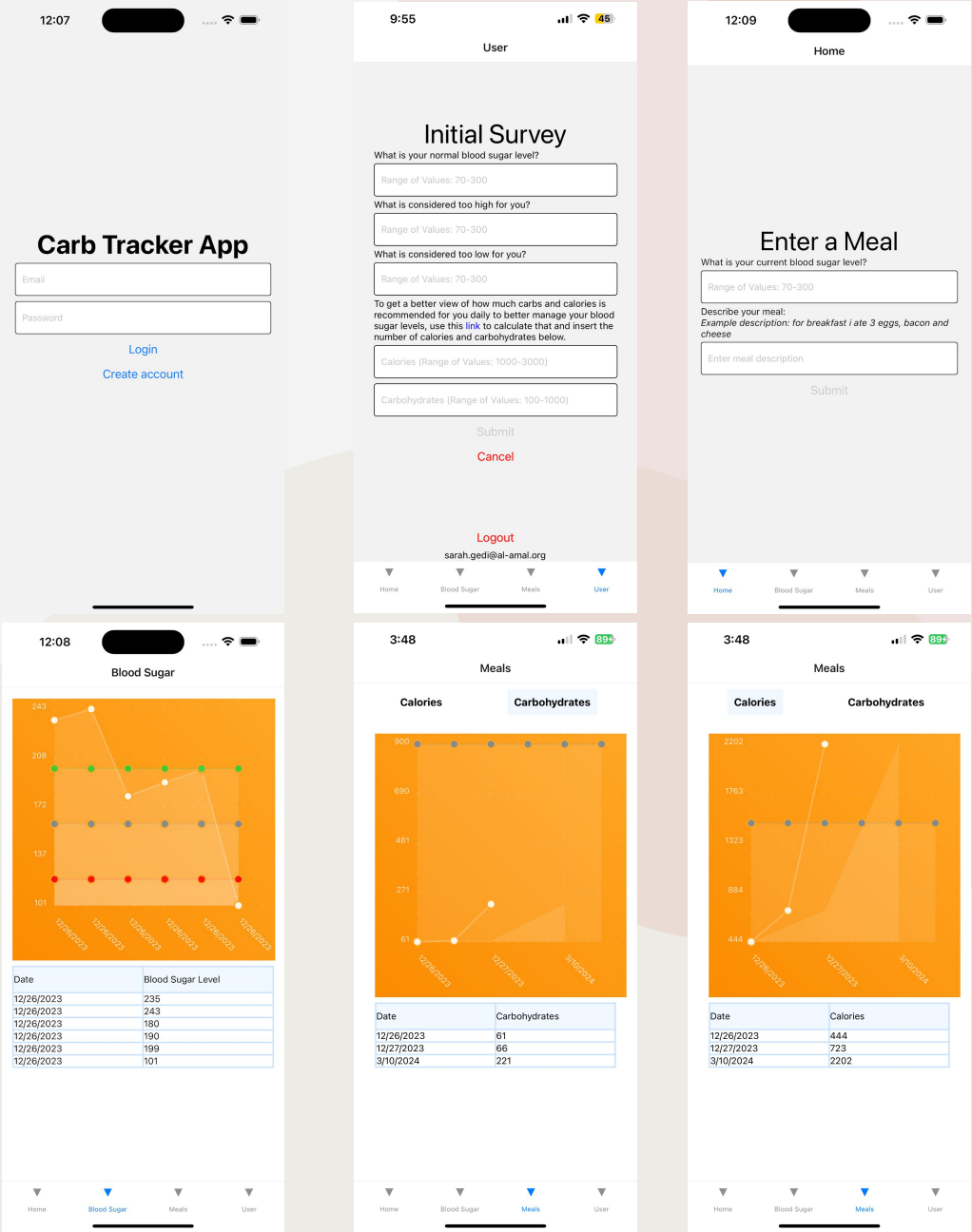
Log in or Create an account
Code

```
return (  
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    <Text style={{textAlign: 'center', fontSize: 40, fontWeight: 'bold'}}>Carb Tracker App</Text>  
    <KeyboardAvoidingView behavior="padding">  
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        style={styles.input}  
        placeholder="Email"  
        autoCapitalize="none"  
        onChangeText={({text}) => setEmail(text)}  
      ></TextInput>  
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        onChangeText={({text}) => setPassword(text)}  
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      ></TextInput>  
  
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      : <>  
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        <Button title="Create account" onPress={signUp}/>  
      </>  
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  </ScrollView>  
)
```

Conclusion

The developed software’s main goal was to allow users to take charge of their diabetics with a tool that not only is proven to be accurate but also easy to use for just about anyone and the app was able to make that happen. It prioritizes user comfort and empowerment, providing a tailored approach to health monitoring while lowering the chances of health risks associated to diabetes. This research is a huge step toward greater inclusion and efficacy for people with diabetes from various backgrounds.

App



Interpretation & Conclusion II

Discussion

No participants tested the app in this experiment since there were no health hazards, confirming its safety. Furthermore, the API's excellent accuracy and dependability (previously tested) support the app's safety and efficacy.

Further Experimentation

I will arrange a fundraiser to purchase the necessary API, which will allow me to expand the functionality of my software. Thanks to this assistance, patients can watch their development for longer periods of time, maybe weeks or even months. By enabling participants to test the app and investing in the API, we may properly test its functioning over a longer period of time with a wider user base.

Limitations

The app currently stores information for only one week, Monday through Sunday. This constraint is due to the app's prototype status, and we're using the free version of Nutritionix. While it does notify users if they have over their daily carb and calorie goals, it does not yet provide alternate alternatives.

Practical Application

This app is inclusive for everyone, regardless of whether they have diabetes or not. Even those simply interested in monitoring their carb and calorie intake can benefit from its features.