System and Software Architecture Description (SSAD)

Diabetes Health Platform
Team #6

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Version History

Date	Author	Version	Changes made	Rationale
10/08/17	MN	1.0	Chapters 1,2,5	Draft
10/15/17	VV	1.1	Chapters 3,4	Finalize
11/29/17	MN	1.2	Chapter 3	Add Robustness Diagram

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1. Introduction

1.1 Purpose of the SSAD

The SSAD describes the whole picture of our project, which describes how the user can interact with the application and use all the features available.

This report contains the diagrams that are demonstrate the details of each of the feature that is available in the app. It also specifies the architectures of the project, with the focus on the software.

1.2 Status of the SSAD

At this time, we have included the use case diagram, system context diagram.

2. System Analysis

2.1 System Analysis Overview

The foremost objective of Diabetes Health Platform is to allow the users to enter their blood level into the app. The app is built in android. When the users firstly login, there are a few survey pages that the users can enter their personal info. After that, the users can use the app regularly and enter their diet and blood info into the app.

2.1.1 System Context

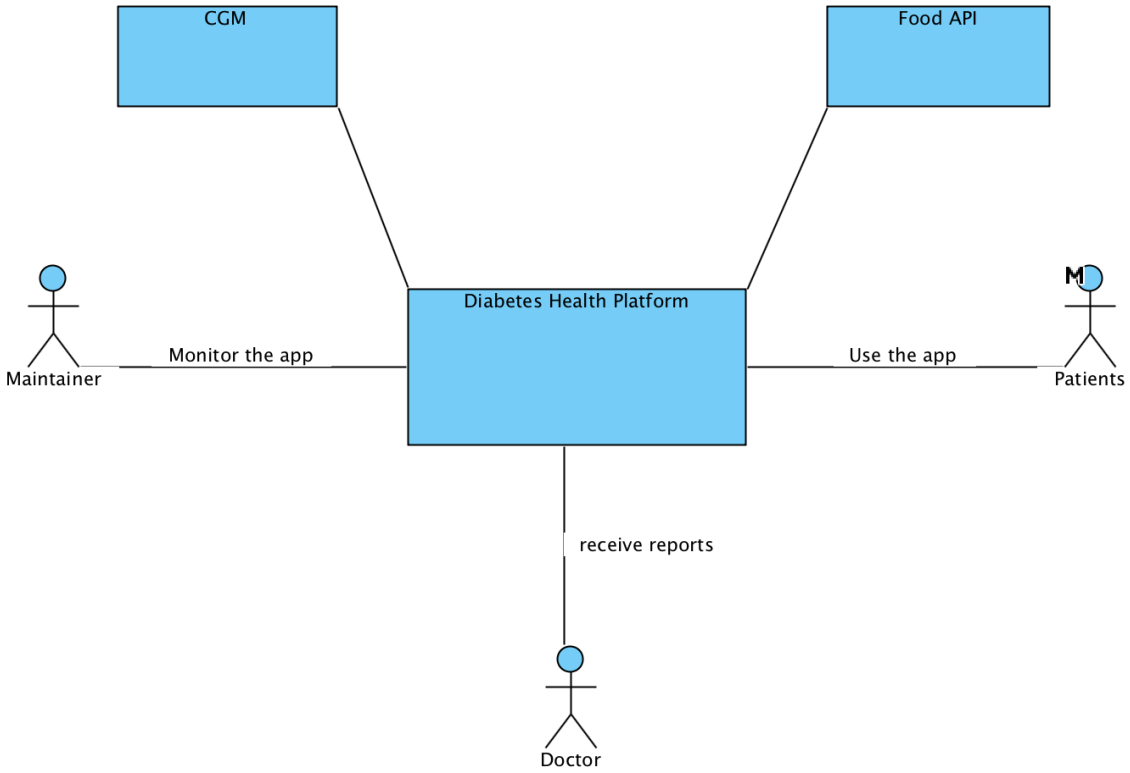
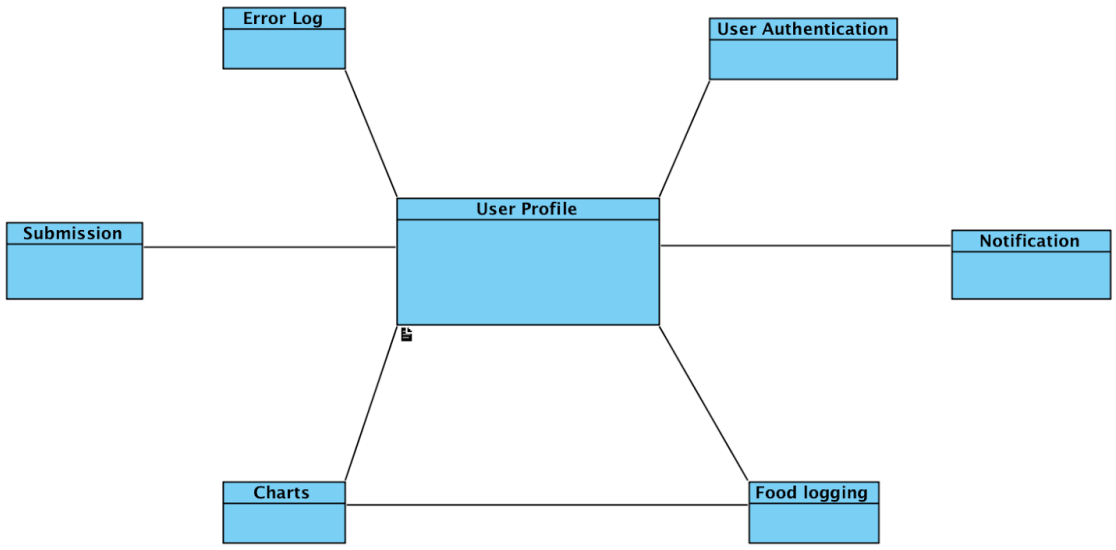


Figure 1: System Context Diagram

Table 1: Actors Summary

Actor	Description	Responsibilities
Patient	The user who uses the app	1. Enter the authentication 2. Update their profile 3. Record info
Maintainer	The person to monitor the app after it is operational	Fix bugs and administrate the database
Doctor	The professional who provide assistance to patients	Receive reports from patient
Food API	The API provided by USDA	Providing all the detailed food info
CGM	The machine that detect the health info of patients	Check the health status of the patient and provide data to the app

2.1.2 Artifacts & Information



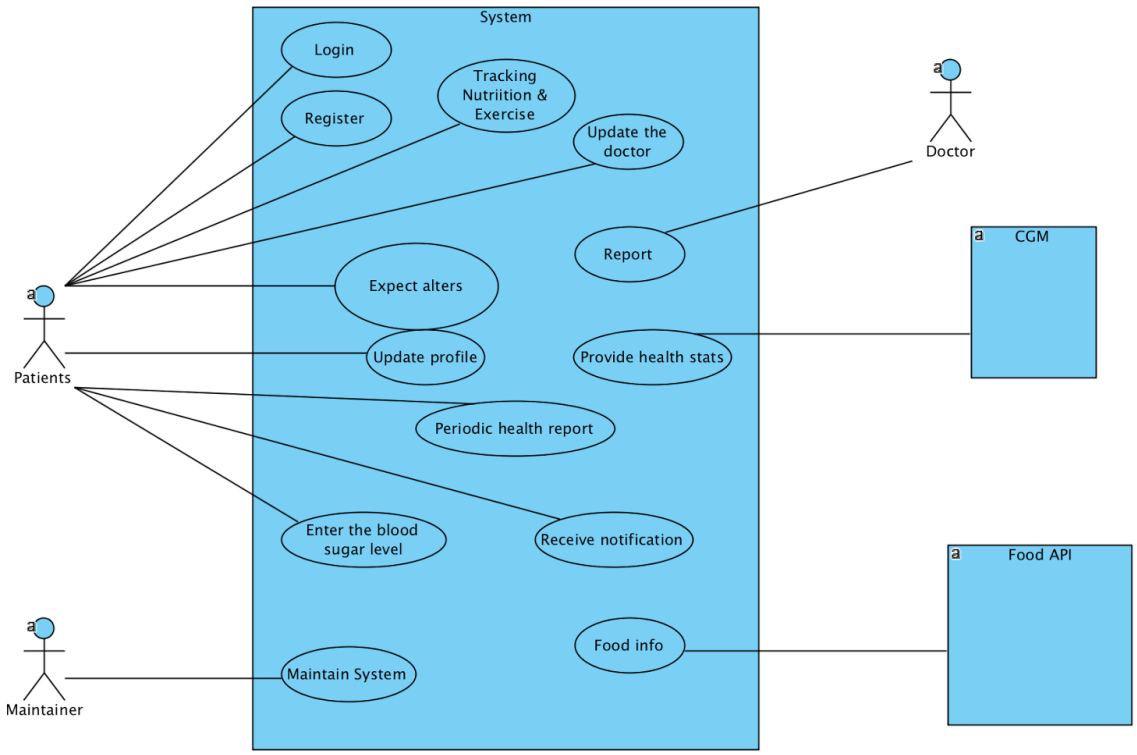
<<Artifacts and Information Diagram>>

Figure 2: Artifacts and Information Diagram

Table 2: Artifacts and Information Summary

Artifact	Purpose
User Authentication	Provide the form so the user can login or register the app
User Profile	User’s info such as name age, number
User error log	All the error messages that are recorded in the client side
Submission	User submit to the doctor
Notification	User receives when blood sugar threshold reaches
charts	The insulin diagram that is generated
food logging (each diet)	User enters for info for each meal

2.1.3 Behavior



<<Use-Case Diagram>>

Figure 3: Process Diagram

2.1.3.1 Capability Diabetes Health Platform

2.1.3.1.1 Process Diabetes Health Platform

1. User can login

Identifier	UC01 - User can login
Purpose	The user login and use the app
Requirements	Authentication
Development Risks	None
Pre-conditions	User has connection to internet, the database works properly
Post-conditions	If user is authorized, give the appropriate role for the user to access system; otherwise, user is denied access to the system.

Typical Course of Action

Seq#	Actor's Action	System's Response
1	Enter username and password	
2	Click login	
…		Send the form to Authentication backend to check its valid
n		Login

Alternate Course of Action: Failure

Seq#	Actor's Action	System's Response
1	The user enters the data	
2		Display error message to users like invalid username or password
…	Click OK	
n		Redirect to login page

2. User can enter the food

Identifier	UC02 - User can enter the food info
Purpose	The user can clicks the menu to enter the food info
Requirements	Touch screen android phone
Development Risks	The senior people don’t know how to use touch screen smartphone.
Pre-conditions	The user is logined and finishes the preference
Post-conditions	The diet info is entered into the the app

Typical Course of Action

Seq#	Actor’s Action	System’s Response
1	The user enters the info	
2	The user clicks the submit button	
…		The app checks the entered contents, verify the restrictions of wording.
n		The system store the contents into database, and shows the user success message.

Alternate Course of Action

Seq#	Actor’s Action	System’s Response
1	The user enters the info	
2	The user clicks the submit button	
…		The entered info is not compatible with the requirements
n		The app prompts error message and requires the user to re-enter

Exceptional Course of Action

Seq#	Actor's Action	System's Response
1	The user enters the info	
2	The user clicks the submit button	
…		The app experiences critical error and crashes.
n		

3. User can enter Survey preferences

Identifier	UC03 - User can enter survey preferences
Purpose	The user can clicks the personalized button to personalize
Requirements	Touch screen android phone
Development Risks	The users have not made final decisions on the preferences
Pre-conditions	The user is registering for the 1st time
Post-conditions	The user's preferences are set and cannot be changed

Typical Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the save & next	
…		The app process the user's selections and send to the backend program.
n		The user's preferences are saved, once finished the user can use the app normally

Alternate Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the save & next	
…		The entered info is not part of the survey selections
n		The app prompts error message and requires the user to re-enter

Exceptional Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the save & next	
…		The app experiences critical error and crashes.
n		

4. User can personalize health recommendation

Identifier	UC04 - User can personalize health recommendation
Purpose	The user can clicks the personalized button to personalize
Requirements	Touch screen android phone
Development Risks	The users have limited health knowledge
Pre-conditions	The user is logined and finishes the preference
Post-conditions	The dashboard is personalized

Typical Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the submit button	
…		The app process the user's selections and send to the backend program.
n		The user's preferences are saved, the UI is refreshed after relaunching the app.

Alternate Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the submit button	
…		The entered info is not compatible with the requirements
n		The app prompts error message and requires the user to re-enter

Exceptional Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the submit button	
…		The app experiences critical error and crashes.
n		

5. User can use the Nutrition & Exercise feature

Identifier	UC05 - User can monitor diet intake & exercise

Purpose	The user can track his diet and exercise balance
Requirements	Touch screen android phone
Development Risks	The users have limited health knowledge
Pre-conditions	The user is logined and finishes the preference
Post-conditions	The data is entered into the database

Typical Course of Action

Seq#	Actor's Action	System's Response
1	The user enter the data	
2	The user clicks the submit button	
…		The app process the user's selections and send to the backend program.
n		The user's preferences are saved, the app will analyses user's data and update user's health status

Alternate Course of Action

Seq#	Actor's Action	System's Response
1	The user selects preferences	
2	The user clicks the submit button	
…		The entered info is not rational.
n		The app prompts error message and requires the user to re-enter

Exceptional Course of Action

Seq#	Actor's Action	System's Response

1	The user selects preferences	
2	The user clicks the submit button	
…		The app experiences critical error and crashes.
n		

2.1.4 Modes of Operation

The system only has one mode, no description on this section.

2.2 System Analysis Rationale

The app targets the groups of people who has need to measure and monitor their blood level. The stakeholders are the users. These users will become the members of the members of the system.

3. Technology-Independent Model

3.1 Design Overview

3.1.1 System Structure

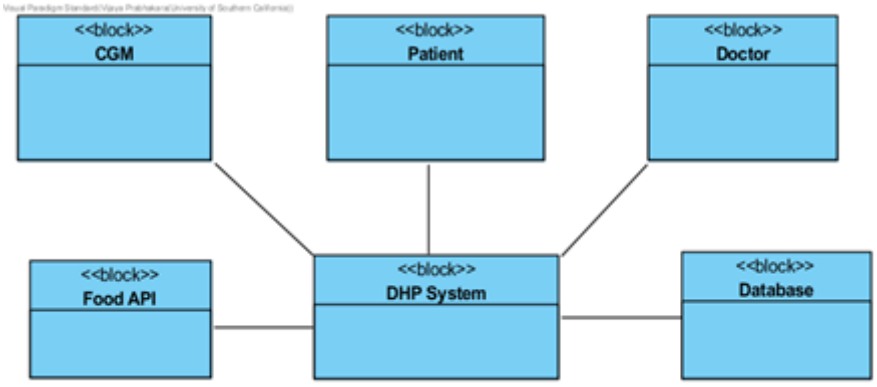


Figure 4: Conceptual Domain Model

The Project is developed using client suggested web templates and CGM API's. We are omitting this section to avoid redundancy with Technology specific system design in section-4

3.1.3 Process Realization

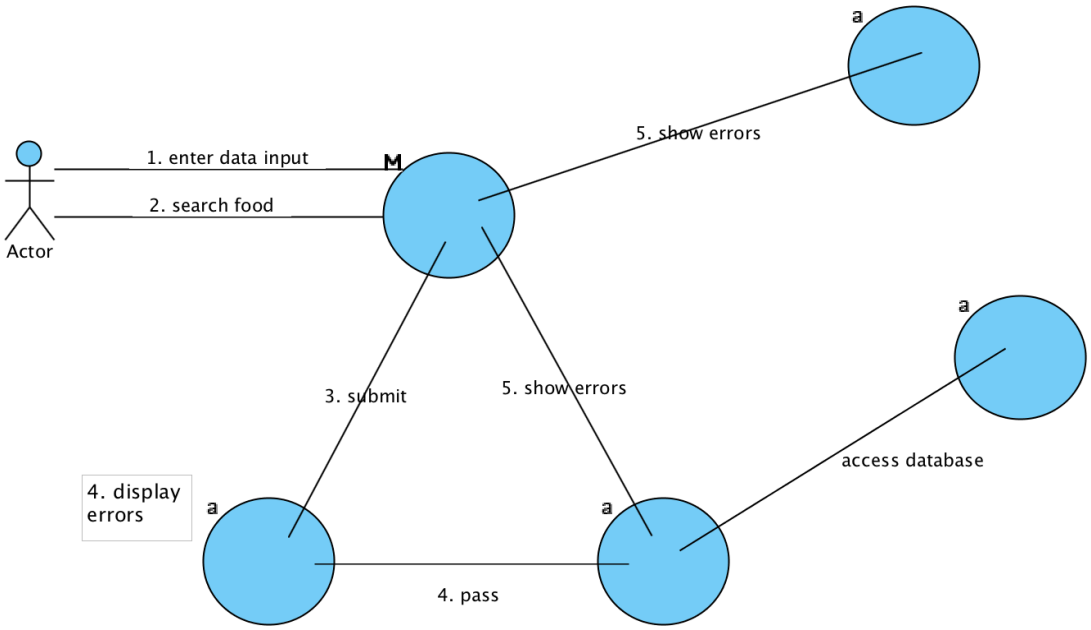


Figure 9: Robustness Diagram

4. Technology-Specific System Design

4.1 Design Overview

4.1.1 System Structure

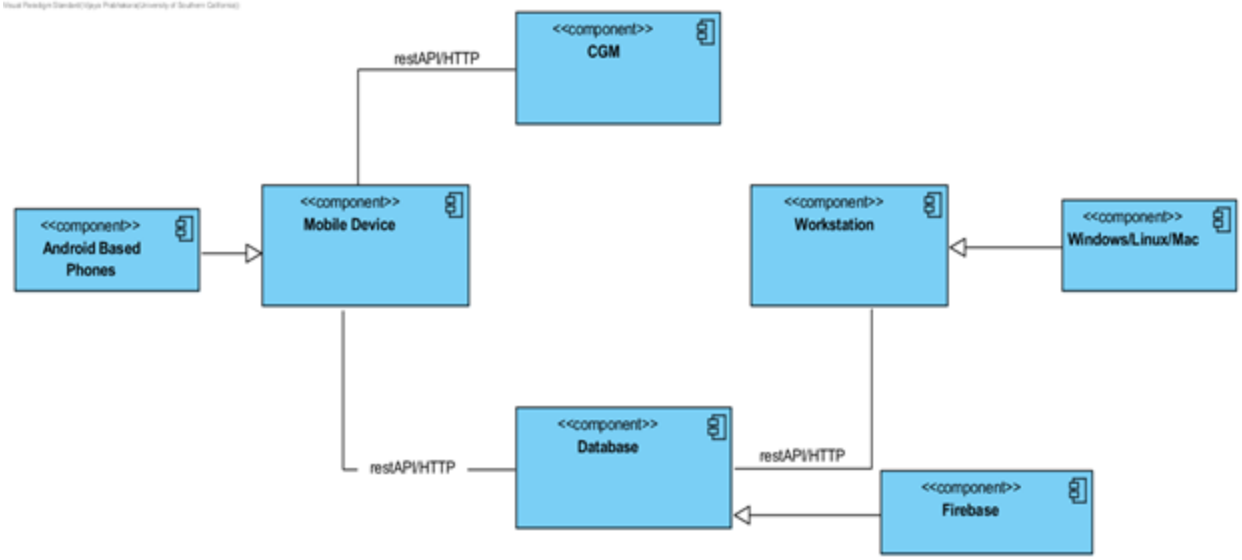


Figure 12: Hardware Component Class Diagram

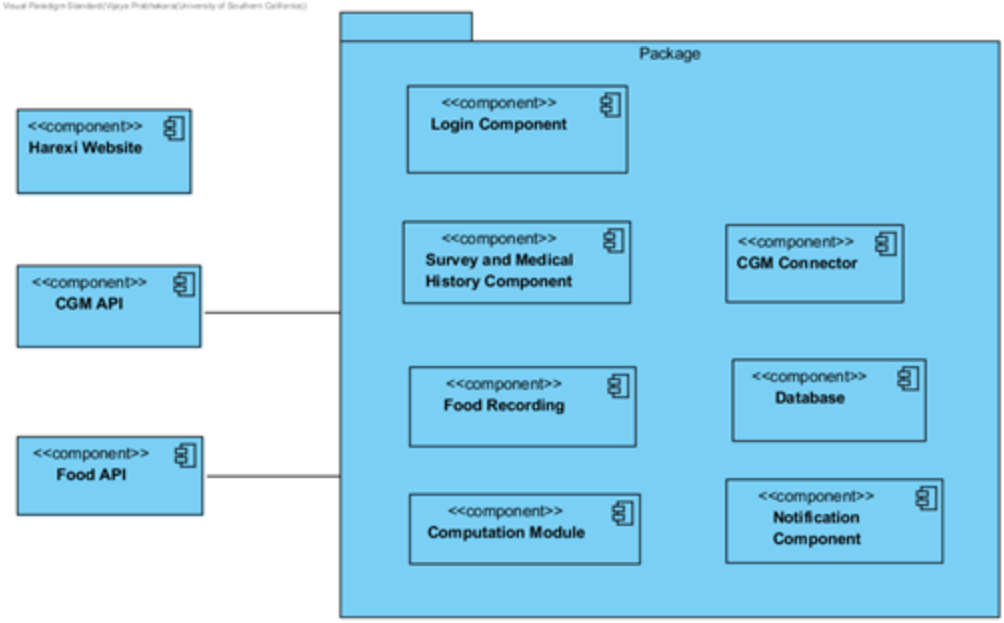


Figure 13: Software Component Class Diagram

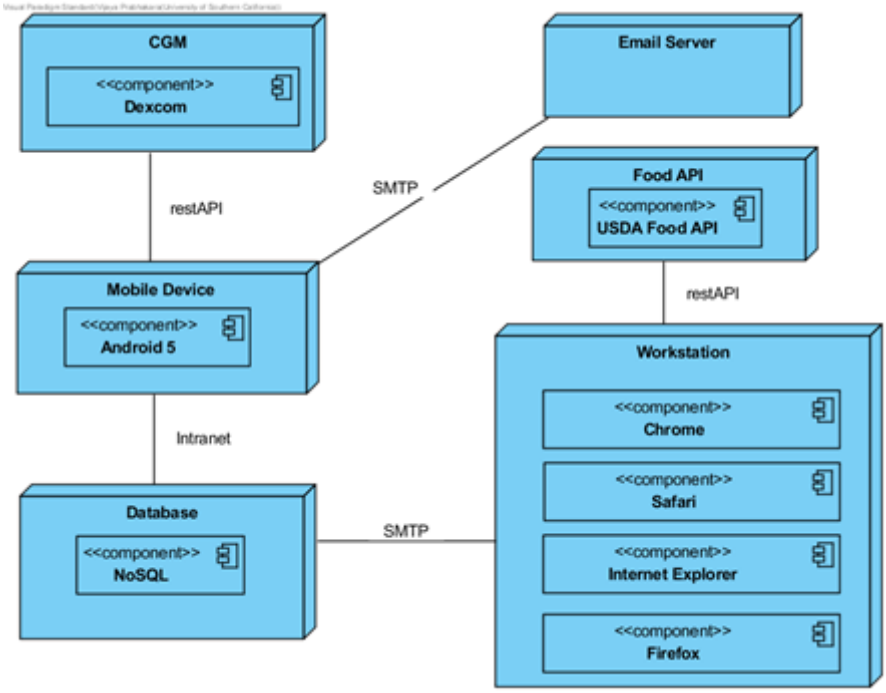


Figure 14: Deployment Diagram

Table 11: Hardware Component Description

Hardware Component	Description
Android Based Mobile Device	Android version 5 and above is supported for user access.
Continuous Glucose Monitor(CGM)	Dexcom CGM will be supported and integrated with the application
Workstation	Website can be accessed from the desktop workstation. Windows, MAC and Linux latest versions will be supported
Firebase Database	Firebase database is used to store all the user specific data for up to 3 months

Table 12: Software Component Description

Software Component	Description
Harexi Website	Static website to provide user information on diabetes and latest technical developments related to diabetes

Login Component	Login page to allow user to login or create a new profile
Survey and Medical History Component	Series of screens to get complete health background information on the user to personalize the application
Food Recording	Page to allow user to enter the food eaten into database. This calls food API to retrieve data from USDA
Computation Module	Module to calculate the required insulin dosage based on all the input data
CGM Connector	Module to connect to the CGM and retrieve patient's information. This calls CGM API
Database	Database stored on mobile to store and retrieve patient data
Notification Component	Component to send notification to patient and the doctor
CGM API	CGM API made available by the CGM service provider. This is integrated with in-house CGM function
Food API	Food API made available by the USDA restAPI functionality. This integrated with local foodSearch function.

4.1.2 Design Classes

4.1.2.1

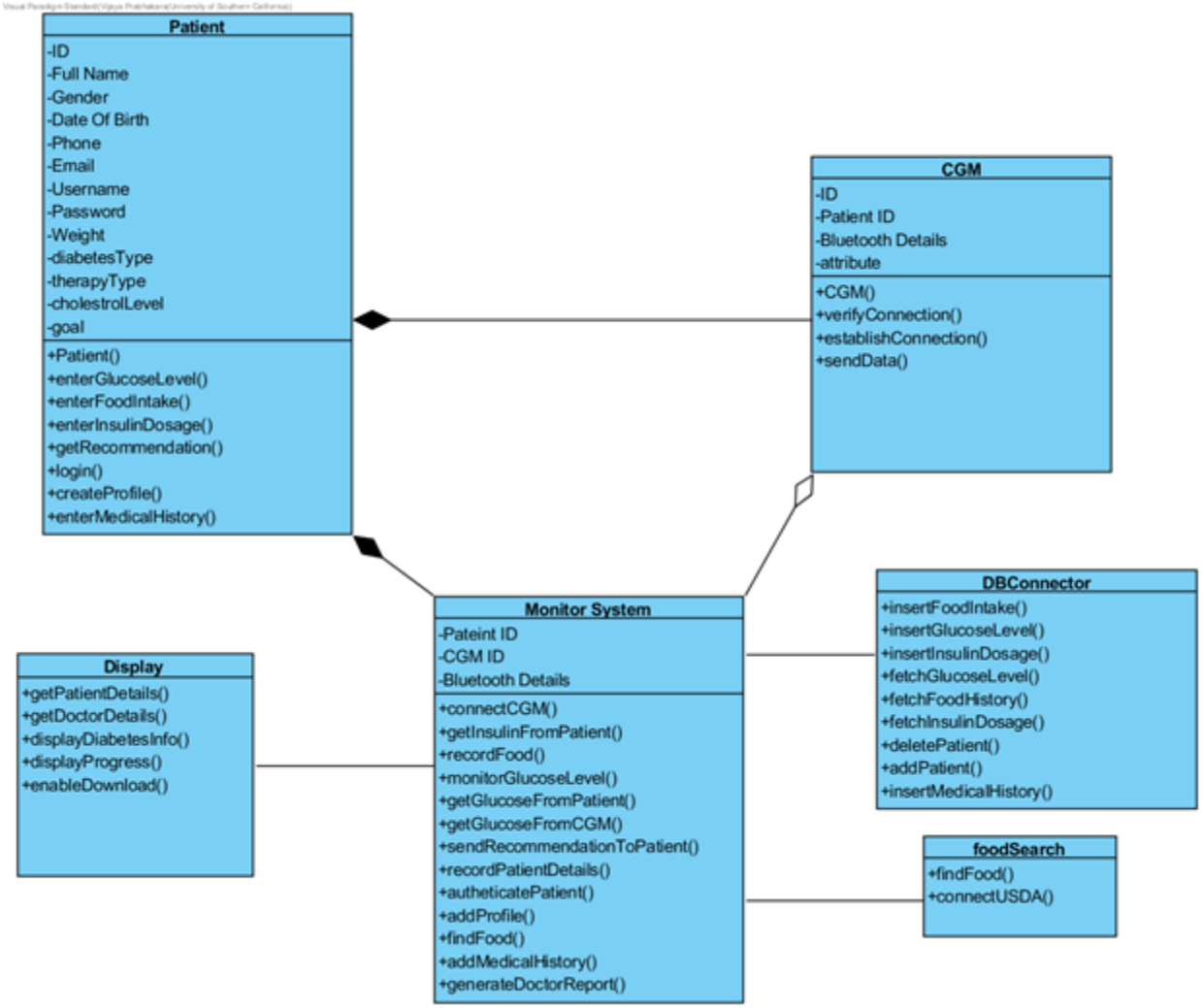


Figure 16: Design Class Diagram

Table 14: Design Class Description

Class	Type	Description
Patient	Entity	Patient with Type-2 diabetes. All the Patient details are recorded in this section
CGM	Component	Patient with CGM enabled. The class enables connection between the application and external CGM API
DBConnector	Component	Connects to local database to store and retrieve patient data
FoodAPI	Component	Connects to external food API to retrieve the nutritional value of the food consumed by the patient

Monitor	Component	This section computes the required insulin dosage
Display	Component	Sends various notifications to patient and doctors either periodically or based on threshold settings

4.1.3 Process Realization

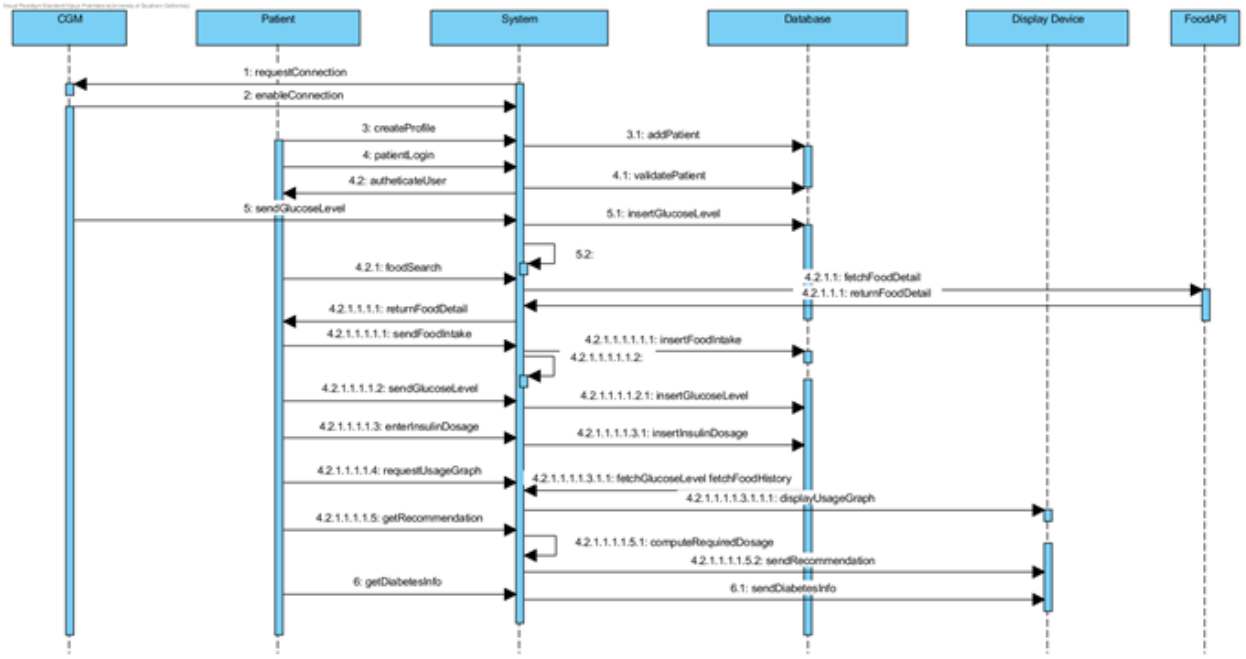


Figure 18:Sequence Diagram

4.2 Design Rationale

Harexi App will be used by patients suffering from Type-2 diabetes. The App is designed to collect the blood glucose level from patients through either CGM or manual entry. CGM model Dexcom was suggested by the client. We choose to use firebase database as it provides database on mobile platform with rich functionality set and easy integration. We also decided to use USDA API's to get food nutritional values. The app will be developed using Java due to in-house experience and easy integration with external components.

The App can be categorized into following components:

1. User Personalization: Set of pages to collect data in the front end and store in the database.
    a. Android device screens
    b. JSON documents.
2. Food Entry: Page to collect the food entry, communicate with foodAPI. Once selected, store it in database.
    a. Android device screens
    b. restAPI and HTTP
    c. JSON

3. CGM Connectivity: Connect to CGM database to retrive data.
    a. restAPI and HTTP
4. Notification: Generate report or alerts using data from database
    a. SMTP to send emails to patient and doctor

5. Architectural Styles, Patterns and Frameworks

Table 15: Architectural Styles, Patterns, and Frameworks

Name	Description	Benefits, Costs, and Limitations
3-tier architecture	The presentation layer is the Android UI, the logic layer is the Java code, and the data is in the Firebase.	- The user is supposed to have a Android device.
MVC	Models, Views and Controllers	- If the application is complex, the model layer will be very complicated. - MVC has separate layers for each specific layers