Dedications

We dedicate this work to our families who have endowed us with a dignified education and who have not ceased to encourage and support us until the end.

ACKNOWLEDGEMENTS

It was nice to pay us a debt of gratitude to all those, whose contribution during this project, helped its outcome.

A special thanks to Mme Sinda El Ghoul for her countless hours of reading, encouraging, supporting and most of all patience throughout the entire process.

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Abbreviations List

OS: Operating system
IOS: iphone Operating system

T1D : Type 1 diabetes

T2D: Type 2 diabetes

RUP: Rational Unified Process

IBM: International Business Machines

SDK: Software Development Kit

AOT: for Ahead Of Time

JIT: Just-In-Time

SQL: Structured Query Language

GENERAL INTROUDUCTION:

Mobile technology is the actuality in many industries and it is not just a buzzword. Nowadays, the mobile phone is no longer only used to communicate but also to exchange messages, e-mails, web browsing, music, movies, etc. Thanks to the widespread use of wide-screen touch phones, as well as the development of software and networks, mobile applications are able to satisfy a wide range of needs, particularly in the health sector.

In the other hand, Diabetes is one of the most challenging health problems of the 21st century; it is the fourth leading cause of death in most developed countries. In fact, it is estimated that 415 million people are living with diabetes in the world, which is estimated to be 1 in 11 of the world's adult population.

46% of people with diabetes are undiagnosed. The figure is expected to rise to 642 million people living with diabetes worldwide by 2040.

With all the research on diabetes and advances in diabetes treatments, it is unfortunate to say that there is no cure. However, people can manage it with medicines and lifestyle change. Including simple things, they can do daily, that make a big difference.

Thus, in order to facilitate Diabetes' lives, we chose to create a mobile application which controls one's Diabetes and helps him manage his lifestyle to develop.

This work is structured in five chapters: we will begin by giving an overview of the project. Secondly, we will talk about some similar examples of our project. In the third chapter, we will demonstrate the theoretical study and we will specify the technical choices. In addition, the fourth chapter is a step to the functional and non-functional requirements in order to evaluate the application performance. Finally, the last chapter is about the realization and presentation of the environment in which we have built our application and then the different screens of our application in order to validate its functionality.

Chapter I: General Presentation

1. Introduction

In this chapter, we are going to present our project: the problem, the objectives of our application, and the methodology adopted to find solutions.

2. Problematic:

What is diabetes?

Diabetes [1] is one of the chronic diseases. It is a serious, long-term condition with a major impact on well-being of individuals, families, and societies worldwide. It is characterized by the insufficient quantities of insulin produced by the pancreas, which is a hormone responsible for the glucose transfer to the blood where it will be used by cells for energy. There are two types of diabetes: type 1 (T1D) and type 2-diabetes mellitus (T2D).

People with diabetes should take good care of their health and they should visit a doctor regularly. During the period between one control and another with an endocrinologist, there is a risk that the insulin value given following a blood glucose test may not be suitable on a regular basis following the change in blood sugar values. In addition, people with diabetes may forget to take their treatment, not take care of their diet and sports activities, which can cause serious consequences.

3. Objectives of the application:

- Allow the user to know the best dose to take daily approximately according to the glucose test.
- Remind the user to have their daily intakes.
- Find the suitable diet to have according to the type of the person's diabetes and his daily intake.
- Suggestions of sports activities to have a better and healthier glucose level.
- Visualize the progress of the glucose level during the use of the app.
- Have access to ask a doctor for more specific info regarding the user's condition.

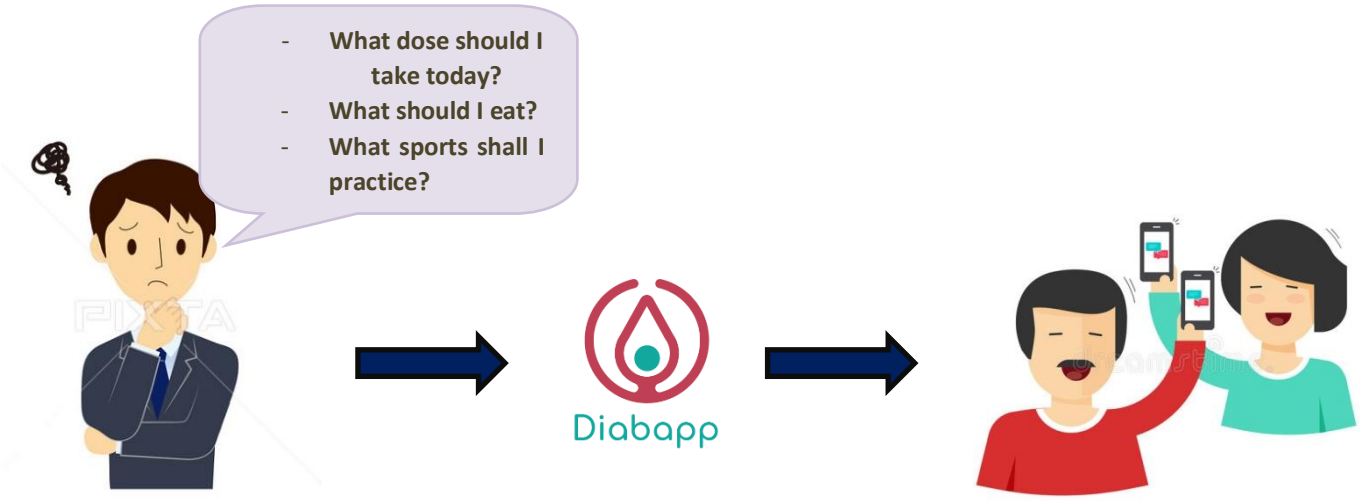

Figure1. Simplified version of our objectives

4. Followed approaches:

The project consists of two phases: The first is the research for a suitable solution to realize the application, and the second is the design and development phase.

- Research phase:

This stage includes the research for answers of two main general questions, which are:

- What happens in diabetes' system?

The insufficiency of insulin leads to excess of glucose in the blood which can damage the blood vessels and then to several complications like heart disease, kidney damage, nerve damage, eye damage and blindness ...when not controlled, diabetes may raise the propensity for infections .This may lead to an amputation if severe.

- How can we reduce this risk?

As we know, diabetes still does not have a real 'cure', although studies have shown that good control of blood sugar is the key to control the sugar levels in the blood.

Thus, in order to reduce complications, we have to keep it under control. Although medication is one aspect of diabetes cares, people with diabetes also should:

- Have daily tests of their blood sugar especially before meals and two hours afterwards.
- Maintain a healthy weight by eating healthy food, healthy diet and increase their physical activity.

- Take their medications as prescribed: In all type 1 diabetics and in severe uncontrolled type 2 diabetics some injections of insulin will be needed.

The amount of self-management you can achieve will affect the quality of life you lead and this is what we want to achieve with this app, help people know the best dose of insulin to take every day, what food would benefit their body the best and what sport they should practice.

- Design and development phase:

This is a step in which we specify the functional requirements and model the system to clarify the tasks to be carried out in the development part.

The end of this face includes the part of programming and validation tests.

5. Methodology:

The methodology is a process used to develop software systems in order to provide guidance to structure, plan and control.

In our project, we will be adapting the methodology of Agile: Rational Unified Process.

In fact, **The RUP** has four sequential phases: Inception, Elaboration, Construction, and Transition and we made this choice according to these characteristics:

- Iterative
- Focused on architecture
- Helps to deal with the unpredictable project development scenarios.
- Helps to assess how well the project is going throughout the project's lifecycle.

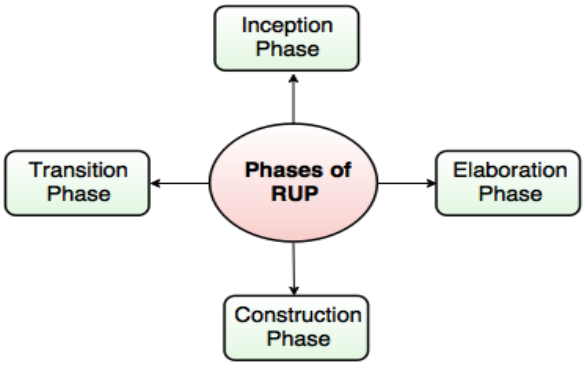

Fig. Phases of Rational Unified Process

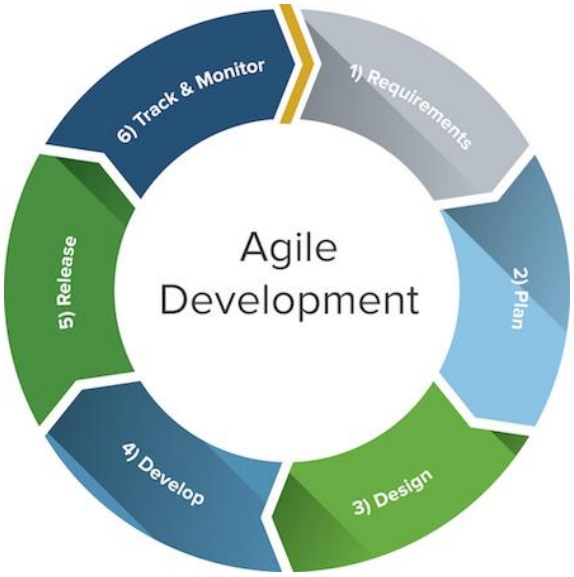

Figure3: Phases of the unified process

6. Conclusion:

In this chapter we gave an overview of the problematic, our app objectives, and a simplified version of how our app would help diabetic people, the followed approaches and the followed methodology, in the next chapter we'll discuss examples of existent applications on the market and what our application offers in addition.

Chapter II: The state of art

1. Introduction

This chapter presents examples of diabetes mobile applications in the market in order to describe them briefly and also show what's missing in these and the need for a more modern user-friendly app.

2. Examples of diabetes mobile applications available on the market:

2.1 MySugr:

The free app MySugr helps you to control blood glucose levels, monitor carbohydrates, track insulin and insulin intake and avoid hyper/hypo to manage better your diabetes. **: [2]**

a) Advantages:

- It's great at helping you keep track of the user's blood sugar
- Clear blood sugar level graphs.
- Daily, weekly and monthly medical analysis

b) Disadvantages:

- There is not where to add your daily calories intake so you cannot really know the carbs.
- You do not have food suggestions according to your diabetes type.
- Some users complain that it does not read your blood type correctly.

Figure 4: mySugr application

2.2 My Glycemia:

The application allows you to record all your daily and weekly blood glucose levels classified by event. An "event" is being a control before and/or after a meal. All these events can be exported by email to your doctor directly from the application.

a) Advantages:

- Alarm to prevent hypoglycemia
- Records rates before and after meals for three meals of the day

b) Disadvantages:

- The user interface looks old.
- The use of the app is not so easy.
- There are always problems when it comes to contacting doctors according to the users.

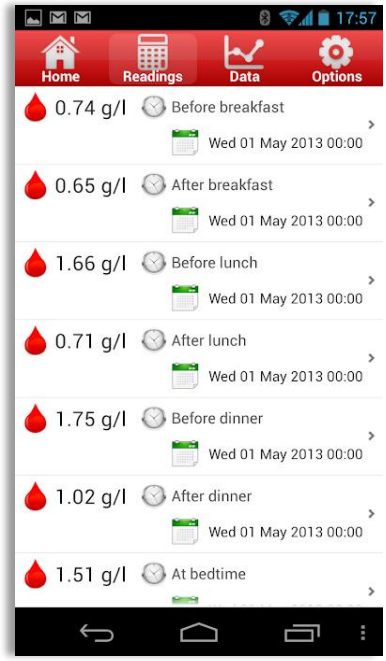

Figure5: MyGlycemia application

2. Criticism and advantages offered by our app:

Although these applications will allow the user to keep track of his diabetes, our application is a little different: on one hand not only it measures insulin in order to calculate the doses, but it also helps the user to control his meals and daily physical activities; it allows the user to keep on track his daily nutrient intake and suggests what's best for him according to his diabetes type, as well as alarms of mealtimes and insulin injection times which is used to better manage diabetes and on the other hand our application is totally free and valid on android and iOS.

3. Conclusion:

In this chapter we presented two examples of mobile applications on the market and what they're missing, we've also mentioned what our app will have in addition to those existents. In the next chapter, we will go through the most famous development frameworks and our adopted architecture.

Chapter III: Theoretical study and technical choices

1. Introduction:

In this section, we will be briefly defining the mobile application and its history, presenting each of the mobile operating systems; their advantages and disadvantages in order to get to know the leader in the Smartphone market and determine which system will best meet the needs of our application and finally we'll explain the adopted architecture for our app.

2. Development Frameworks:

2.1 Smartphone:

A Smartphone is a smart mobile or a small computer. It can be used for sending and receiving emails, text, photographs, web navigation, GPS and multimedia message... one of the most benefits of a Smartphone is the mobile application. [3]

2.2 Mobile application:

A mobile application is a stand-alone program or application software developed as a free or paid download to be installed on a mobile device, usually a mobile phone, Smartphone or tablet computer, used for information services, social media, games, etc., and executable by an operating system of the latter. The mobile application generally allows more efficient access to sites or services otherwise accessible in mobile or web versions.

They are adapted to the different technical environments of Smartphone and to the hardware possibilities incorporated in mobile terminals (camera, GPS, gyroscope, etc.).

Mobile applications can integrate specific and dedicated functionalities for users, thus allowing them to enrich their functional spectrum and imagine uses not covered until now by information systems such as geolocation, QR code scanning (Quick Response codes), augmented reality, m-commerce 1, etc.

It is thanks to the functionalities they offer that they are nowadays taking an increasingly important place in our daily lives.

2.2.1 History:

We start by looking at the history of mobile applications in general which is linked to the appearance of Smartphone: [4]

In 1992, the IBM company (International Business Machines) had invented the first Smartphone in history called "Simon" delivered with 10 basic applications and the autonomy of one hour.

"Dispatchit" was the only application developed by a third party for Simon, sold for $3,300 and the host had to be hosted on its own server to use it.

Now Apple, with its App Store launched in 2012, is allowing its users to define their relationship with their Smartphone themselves, hence the applications have become the tools and Smartphone their platforms.

Thus, the market has completely clarified the interest of mobile applications, two challenges have developed in parallel: to keep the amazement on the user side and the race for the app showcase on the business side.

When the stores opened, mobile apps were considered the new flagship innovation. Thus, the number of mobile applications rose from 500 in 2008 to 200,000 in mid-2010 (App store).

From 2015 onwards, the market for mobile apps is slowing down and the major applications have lost in notoriety, as shown by Sensor Tower in its study on downloads: in 2016 the 15 most popular applications lost 20% of downloads in 1 year.

Yet mobile applications are far from dead and much of their salvation is due to the long tail.

Thus, with companion apps, brands are deciding to approach the application in a new way by offering consumers alternative ways of engagement. The video game industry seems to have understood this issue best in a shooting game ("Call of duty companion app").

And then we enter the wonderful world of the Internet of Things: connected objects. The ever-increasing number of companies involved in digital transformation is developing their own tools in the form of mobile applications.

2.3 Operating system:

While Smartphone are developed day by day, there are many types of operating systems appearing by different companies.

As the figure 6 shows, the most popular mobile OS in 2019 are: [5]

- Android (85.23%)
- IOS (10.63 %)
- kaiOs (4.13%)
- Windows mobile (0.01%)

Figure 6: Percentage of the Operating system use

- In front of these various OS and their different characteristics, it's too difficult to choose the most appropriate **development environment** that's why we had to compare the most popular ones.

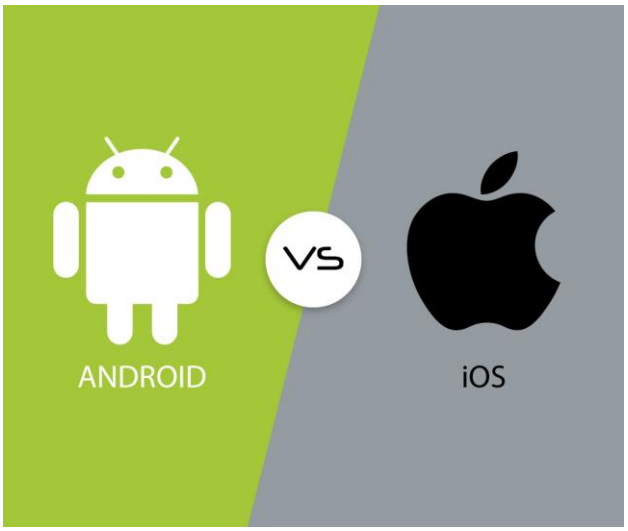

Figure 7 : Android vs iOS

2.3.1 Android:

Android is a mobile operating system created by Google that appeared on the market in 2008 based on the Linux kernel. It equips the majority of mobile phones at the moment: Smartphone, touch tablets, connected objects and computers such as televisions, cars, computers and smart watches. The name Android came from the eponymous startup that specializes in the development of mobile applications owned by Google in August 2005. **[6]**

Indeed, the name comes from "Android" which refers to a robot built in the image of a human being.

a) Advantages:

This operating system is totally Open source; anyone can download, install and modify its source code for free. The latest major version of the world's most widely used mobile operating system is the android 10, which launched on September 3, 2019 on Pixel Smartphone and is characterized by many new features: dark mode, support for foldable Smartphone.

b) Disadvantages:

This operating system has some weak points such as security, as we have noticed a vulnerability that allows us to take control of 95% of Smartphone.

The second vulnerability revealed by two security researchers during the "Black Hat Security Conference", concerned the fingerprint recognition system. [7]

Indeed, hackers had found a way to thwart the security of the readers by recovering the user's fingerprints on the traces left on the screen and it is because of the freedom of its platform.

2.3.2 iOS:

iOS is Apple's proprietary mobile operating system for the iPhone, iPod touch, and iPad. It is derived from Mac OSx, whose foundations it. iOS has four layers of abstraction, similar to those of Mac OSx: A Core OS layer, a Core Services layer, a Media layer and a Cocoa layer. **[8]**

a) Advantages:

It offers integrated search; in files, multimedia objects, applications and e-mails. It also offers integrated search in files, multimedia objects, applications and e-mails, as well as gesture recognition, Safari mobile browser, direct access to the Apple Store catalogue: applications, music, podcasts, TV shows and films, compatibility with iCloud, Apple's Cloud service. iOS 13.3, the latest version, has been updated on the iPhone and iPad since December 10, 2019.This system has a very intuitive interface and it is easy to classify applications. The Siri application, developed by Apple is also very funny, and sometimes even useful. Finally, the navigation is extremely fluid and pleasant

b) Disadvantages:

iOS is exclusive to Apple devices (unlike Android, which allows several manufacturers to integrate it), so you have to buy an iPhone, which is always more expensive than the equivalent on the market. Also, Apple users are more accustomed to paying for their applications, but free applications on Android are paid for on the App Store.

3. Technical choice:

3.1 Flutter:

In order to have applications suitable for the operating systems used by Smartphone and tablets (iOS, android, etc...) and when you need the same application for a service available on iOS and Android you have to develop a second identical application or you will have to run many tests to ensure the behavior on both platforms, hence the idea of using cross-platform frameworks that we see a good way to reduce development costs. That's why Google has developed Flutter as a framework, so that the engineers could observe the strengths and weaknesses of each existing tool and extract only the quintessence of it. Indeed, in December 2019, Google announced the version 1. 12 of Flutter at the Flutter Interact event in New York, its open source SDK for cross-platform application development that brings performance

improvements, more control over adding content to existing applications, and updates to the Material and Cupertino libraries. This is the fifth stable release since the arrival of version 1.0. Google wanted to make flutter a key part of "ambient computing".

With Flutter, the goal was to start developing the application without specifying the type of device targeted to create user experiences without compromising on any device or form factor.

One cannot talk about mobile application development without talking about the development languages that Google has created extensively but has opted for a specific language with flutter which is Dart.

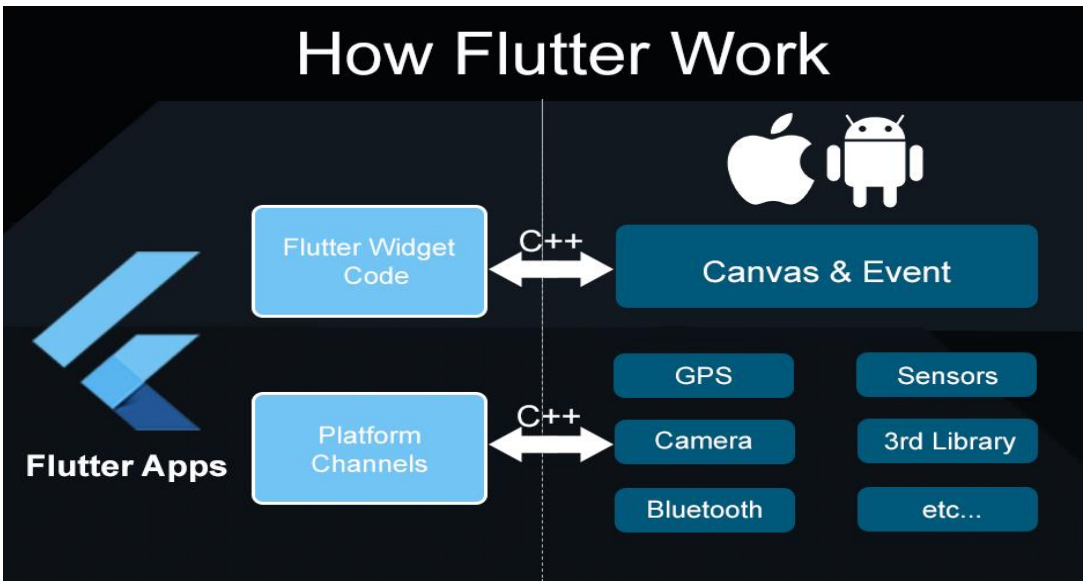

Figure 8: Flutter VS Android + java

4. Adopted architecture:

Figure 9 illustrates the adopted architecture used for our mobile application, we used **Firebase** as a mobile development platform and this project has three parts:

- The diabetic user part:

It consists in typing personal info, daily glucose level, interacting with the doctor in case of need, consulting statistics, and daily nutrient intake.

- The doctor part:

Consulting messages from the diabetic users and answering them.

- The server part:

It stores data coming from both the diabetic user and the doctor, it calculates the doses of the day and it starts alarms when it's time for the doses.

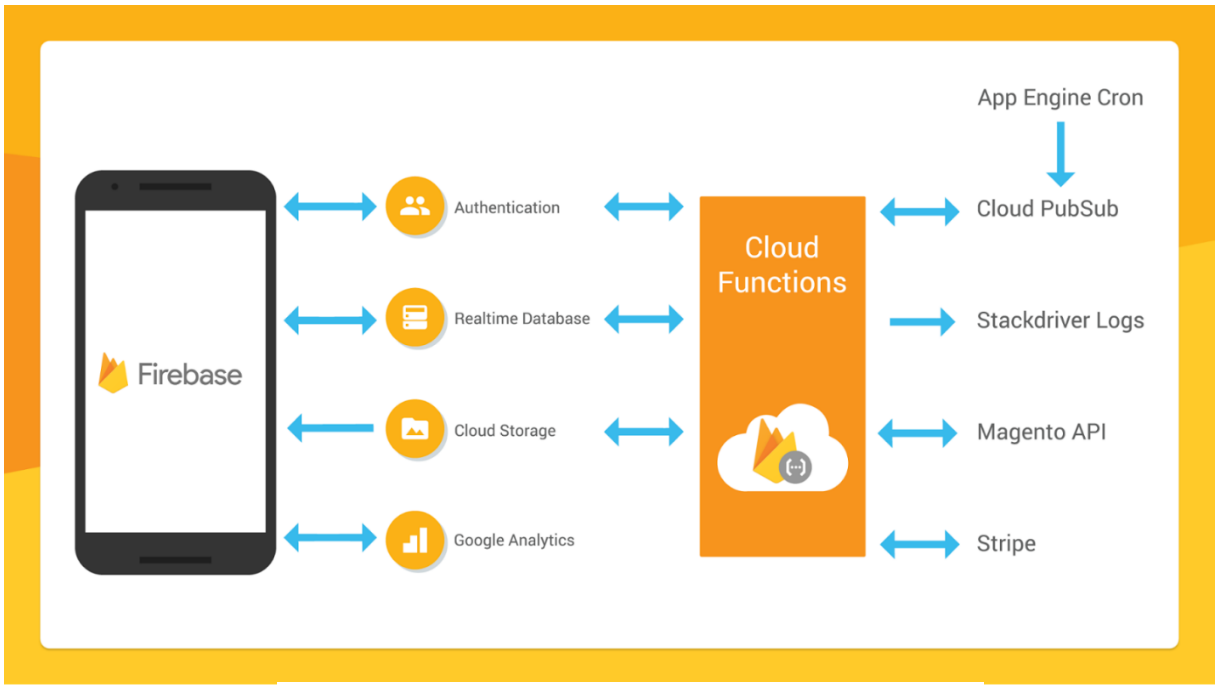

Figure 9: Adopted architecture for the app

5. Conclusion:

In this chapter, we went through the different operating systems and explained our choice concerning the use of Flutter for this app, and we illustrated our adopted structure.

After explaining our technical choice, we have to specify the different requirements of our application which we will go through in the next chapter.

Chapter 4: Specification of requirements

1. Introduction:

This chapter is a very important step to set the design, verification and maintenance of the project, and to ensure that the results obtained will be in conformity with the requirements established at the beginning.

This part will then be dedicated to the specification of the functional requirements and the non-functional requirements of the application.

2. Actors description:

- User :(Who's the person with diabetes)is a key actor in our application: He plays many essential roles in providing the necessary details about his diabetes.
- System: Is the major player in our application: It's responsible for the principal objectives of our project such as: the user reminder of insulin injection and the right insulin dose …
- Doctor: Can help the user to have more information about his illness and rescue those in a critical condition.

3. Specification of requirements:

3.1 Functional requirements:

The application is a tool for self-monitoring of diabetes. It should allow the user to:

- Control the state of diabetes on a regular basis.
- Analyze the state following the values and information entered according to the questions proposed by the application (age, weight, sports activities, diet, other diseases ...) and informs the user about his normal state, hyperglycemia, and hypoglycemia.
- Estimate insulin doses: The application proposes an estimation of insulin doses (for example: if there is a hyperglycemia with the dose of insulin prescribed by the doctor the app increases the dose in proportion to the blood sugar doses and according to other well determined factors).
- Propose suitable diets: suggest dishes and desserts with the carbohydrate intake according to the recorded glucose values.

- Propose sports activities according to age, glucose measurements ... etc.
- Remind the user for hours to take insulin doses: By recording the time, the application alarms the diabetic after a set number of hours to get the next dose of insulin, and can remind the user of regular sports activities and meal times.

The application can also remind the user of regular sports activities and meal times. Gradually acquire the knowledge and skills necessary to manage the disease by recording everything related to the patient condition through the history and statistics of the application, which can facilitate diagnosis by the doctor.

3.2 Non-Functional requirements:

Information systems must consider non-functional requirements as a matter of fact, it is a requirement not related to a functionality requested by the customer but associated with a primary need for the software to function or to be developed: Performance, Reliability, Usability and Maintainability.

As we have already indicated the system to be designed must be:

- Multiplatform (compatible with iOS and Android).
- Usable even if the user is not connected to the Internet.
- Portability: The application must be easy to download regardless of the type of Smartphone.
- Ease of use: Given the types of users targeted by this application, it must be intuitive and easy to use.
- The conservation and security of data according to the personal account (name, password etc...).
- The storage: the application must occupy the minimum memory space.
- Flexibility: such as ease of updates, ease of system development and implementation.
- Rapidity of operations: indeed, Cloud is efficient and effective in this respect.
- Ergonomics: it is the fact of opting for a solution that best meets the needs and objectives of users according to two points:
- Usefulness: it must be relevant and efficient and meet the needs, expectations and objectives of the target users.
- Usability: the ability of an application to be easily used to perform the specified tasks based on effectiveness, efficiency and user satisfaction.

4. Use case diagram:

The use case diagram is a model which describes the functionality of a system and the user interaction with this system using

- The actors: In fact, in our project the system is an actor, then the user and finally the doctor
- The use case: They are demonstrated in the diagram.

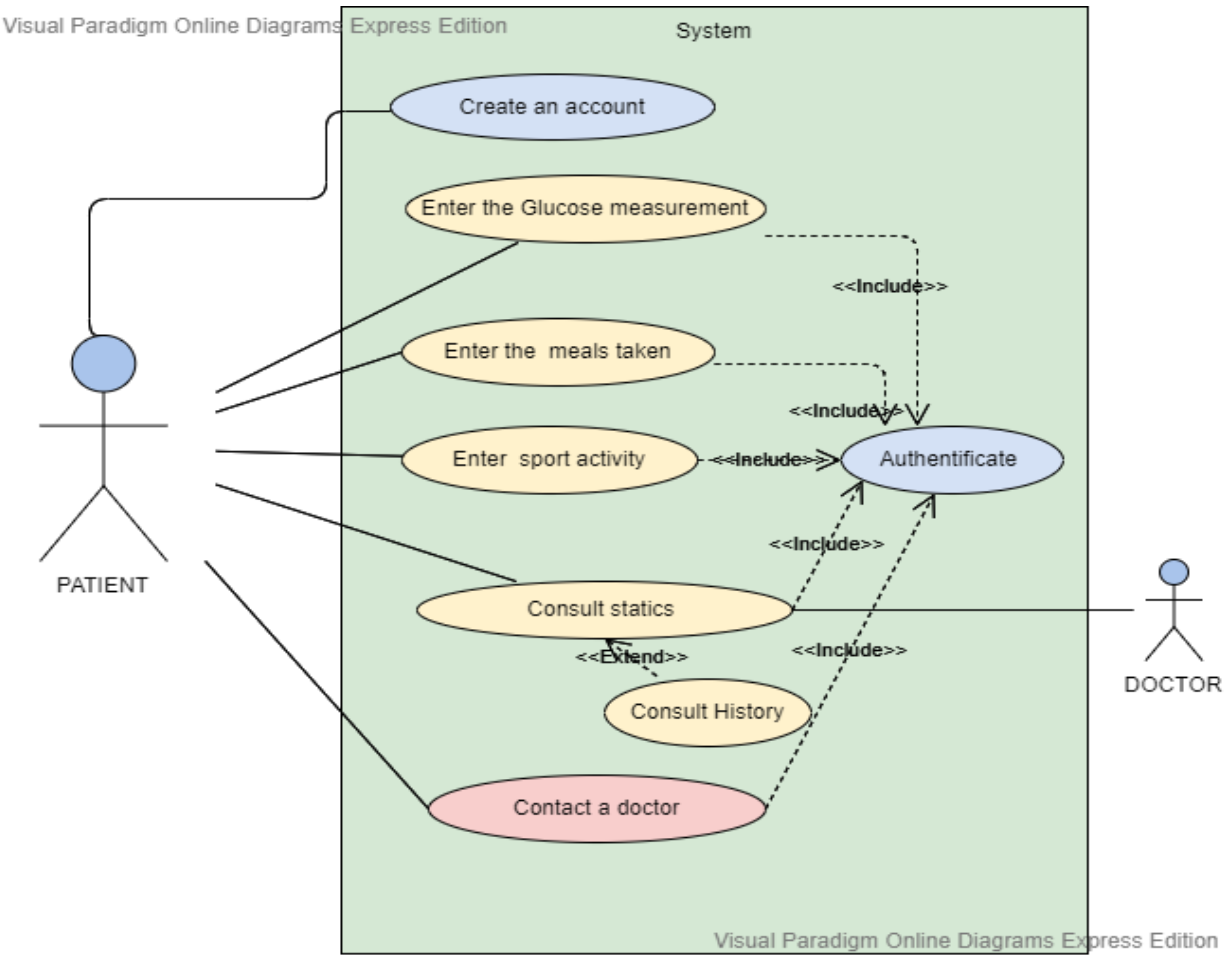

Figure 10: Use case Diagram

4.1 Use Case Description:

4.1.1

Table 1: The process of "Getting the alarm time insulin injection"

Use case	Get the alarm time insulin injection.
Actor	User
Pre-condition	Create an account and set the insulin injection time reminders.
Post-condition	
Main flow of event	-The user creates an account. -The user set the insulin injection time reminders. -The system registers insulin injection time. -The user gets the insulin injection reminder at the right time.

4.1.2

Table 2: The process of "Getting the insulin dose"

Use case	Get the insulin dose.
Actor	User
Pre-condition	System is working. Enter the glucose measurement.
Post-condition	
Main flow of event	-The user registers the necessary details (age, sex, weight...). -The user enters the glucose measurement. -The system esteems the right dose of insulin. -The user gets the right insulin dose.

4.1.3

Table 3: The process of "Getting the nutrient intake"

Use case	Get the nutrient intake.
Actor	User
Pre-condition	System is working. Enter the meals taken.
Post-condition	Get the meals suggestions.
Main flow of event	-The user enters the meals he had taken. -The system calculates the nutrient intake (glucose, crabs, vitamins, fibers). -The system gives meals suggestions.

4.1.4

Table 4: The process of "Getting the sport activities suggestions"

Use case	Get sport activities suggestions.
Actor	User
Pre-condition	System is working. Enter the sport activities practiced.
Post-condition	
Main flow of event	-The user enters the sport activities. -The system gives sport activities suggestions.

4.1.5

Table 5: The process of "Consulting statistics"

Use case	Consult statics
Actor	User
Pre-condition	The system is working. The user creates the account.
Post-condition	Consult history
Main flow of event	-The user creates the account. -The user enters the glucose measurement. -The system registers the glucose measurements. -The system set up statistics (mean, maximum, minimum). -The user consults statistics (the user can also show the statistics to the doctor). -The user consults history.

5. Application model:

In this part, we will be presenting the functionalities of our application and we will start by giving an overview of the main relations between screens.

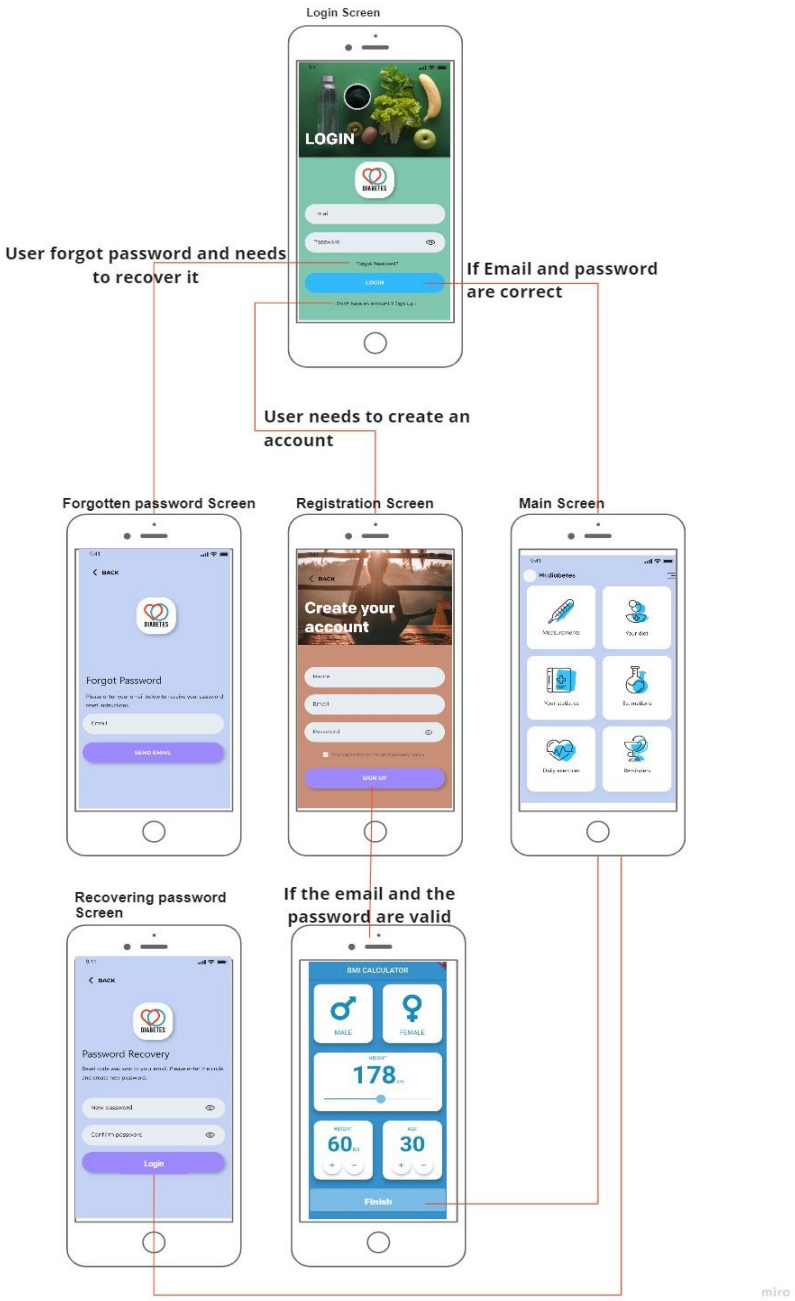

Figure 11: Creating account, Login and password restoration

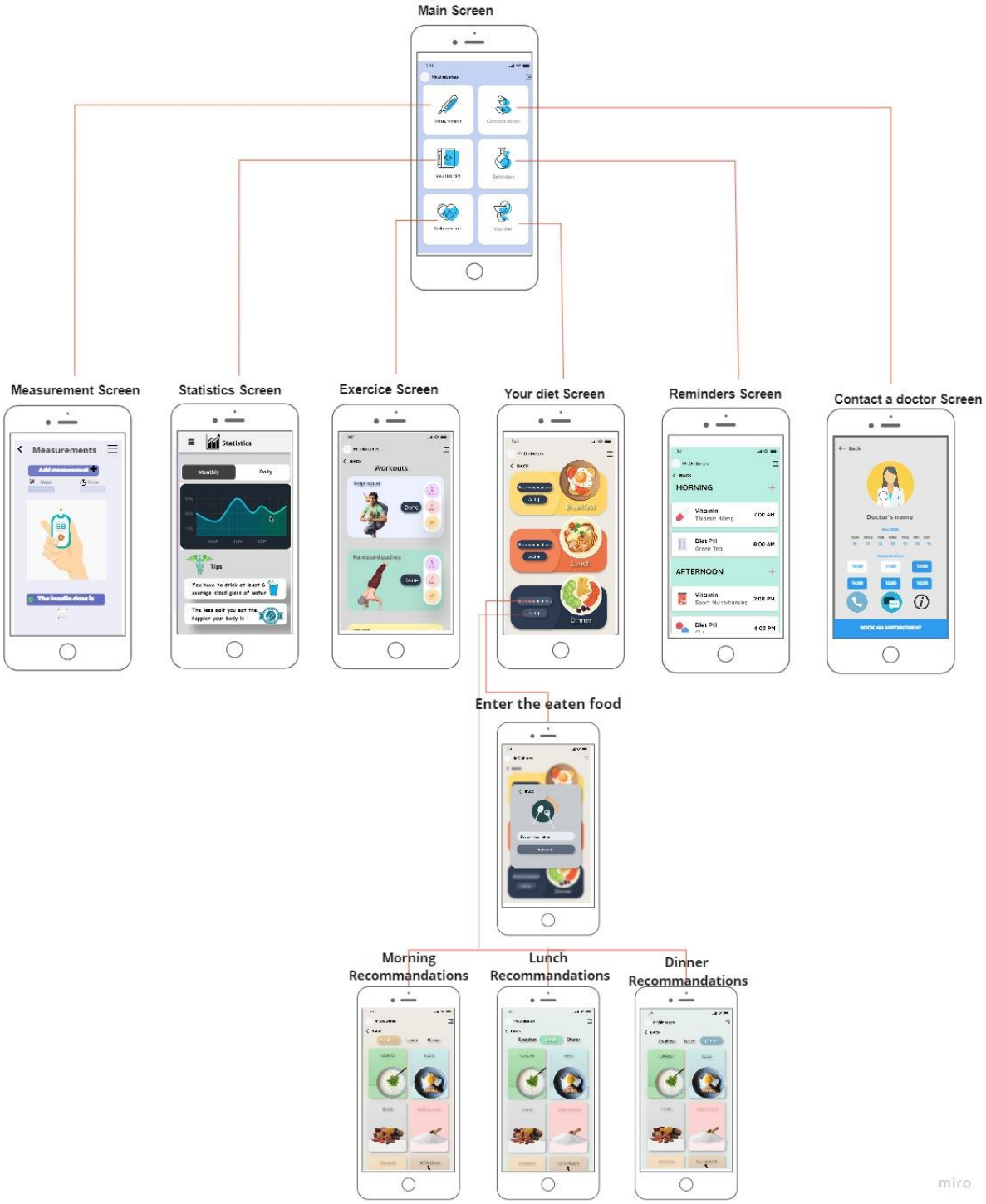

Figure 12: All interfaces and the relation between them

Chapter 5: Realization

1. Introduction:

After having developed the design of our application, we approach in this chapter the last part of this report, which aims to expose the implementation phase. The implementation phase is considered to be the final realization of the entire design method. We first carry out a technical study where we describe the software resources used in the development of our project. We first present our choice of work environment, where we specify the hardware and software environment that we used to make our application and then we detail the architecture, also we present some interfaces made to illustrate the operation of some system activities.

2. Hardware environment:

We used:

- A PC: to create and develop the mobile application.
- A Smartphone: used to run tests.

3. Software environment:

3.1 Android studio:

Android Studio is a development environment for developing Android mobile applications developed by Google and programmed by Java, Kotlin, C++. It is based on IntelliJ IDEA. This software can be downloaded under Windows, macOS, Chrome OS and Linux Operating systems.

The android studio latest version is: 3.6.1 which was in February 28, 2020 while the first version was in December 1, 2014 and the advanced version 4.0 Beta was developed in February 25, 2020 and 4.1 Canary 1 in February 27, 2020.

WHAT is IntelliJ IDEA?

IntelliJ IDEA also called "IntelliJ", "ID"or "IDJ" is an integrated development environment of Java technology intended for the development of computer software. Its latest version is 3.6.1 in February 28, 2020 and its first version is in December 1, 2014.It can be downloaded in GNU/Linux, macOS and Microsoft Windows.

Figure13: android studio logo

3.2 Flutter:

Flutter is an open source software development kit created by Google IT; it is a responsive multiplatform mobile development framework using the Dart language. It could work on any device with an intelligent screen. It, therefore allows building applications that can be deployed at once for different platforms (android/iOS) and even the web and desktop.

Since our application aims to be accessible to everyone who suffers from diabetes, and provides its services to all categories of people, we chose to use flutter as a development framework: It combines the ease of development with native performance while maintaining visual consistency across platforms.

One of the most benefits of this cross-platform framework is allowing to share both the UI code the UI itself besides Flutter.

3.2.1 Dart:

This programming language was beginning to be forgotten and since the emergence of Flutter, it started to revive and went through a version 2.0.

Why did flutter improve the evolution of Dart? Indeed, Google chose Dart because it offers two modes of operation;

AOT (for Ahead Of Time), which allows you to generate a native application for each platform which strengthened Flutter in front of its competitors.

JIT (Just-In-Time) and offers the functionality of Hot Reload during development which is used to reduce the time required between each build which makes the development of its application is much faster.

In addition Dart also allows to manage the allocation and efficient in the "garbage collector".

Note that Flutter works on all Android 888 / d terminals from version 4.1, t. And on iOS, iPhone and iPad are compatible since version 8.0 on 32 and 64 bit models.

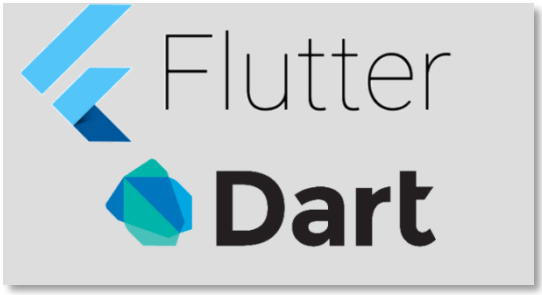

Figure 14: Flutter and Dart logos

3.3 Firebase:

3.3.1 What is firebase?

Firebase is Google's mobile application development platform that helps you build high-quality apps, improve, and grow your user base. It has been created in September 11, founded by: James Tamplin, Andrew Lee. It's built so that you're able to easily pull in Google Cloud Platform (GCP) products as your team or infrastructure needs grow. It is essentially a real time database. It allows real time changes to occur on the connected user side. In fact, building cross-platform apps using iOS, Android, allows the user to get all the data that was updated.

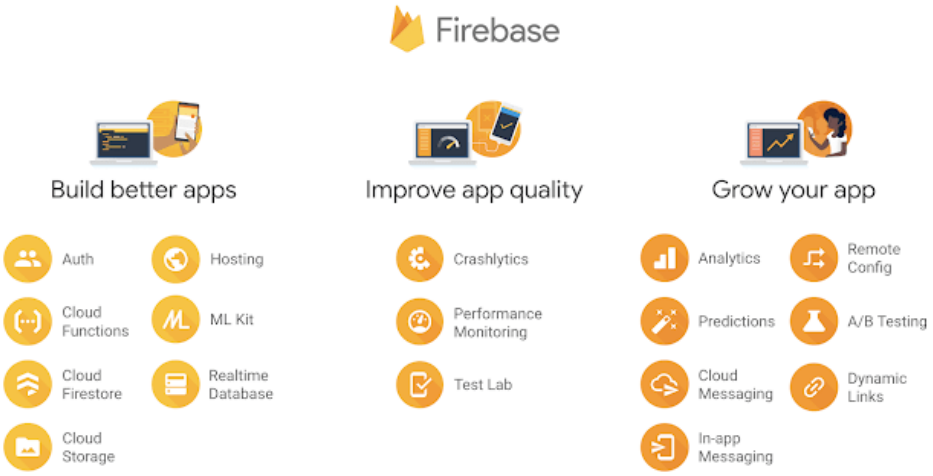

Figure15: Firebase Features

3.3.2 Cloud firestore:

Cloud Firestore is Firebase's newest database for mobile app development. It's is a NOSQL database. You store data in documents, which are organized into collections. It appears as combination of key/value pairs there's no schema for the database, no tables, and no columns which is different from SQL. Cloud Firestore supports a variety of data types for values: Boolean, number, string, geo point, binary blob, and timestamp. You can also use arrays or nested objects, called maps, to structure data within a document. Its operations can also be faster than the relational database. The Cloud Firestore also offers seamless integration with other Firebase and Google Cloud Platform products, including Cloud Functions.

We had chosen the firebase as an efficient solution for our mobile application since it has required synced states across user in real-time.

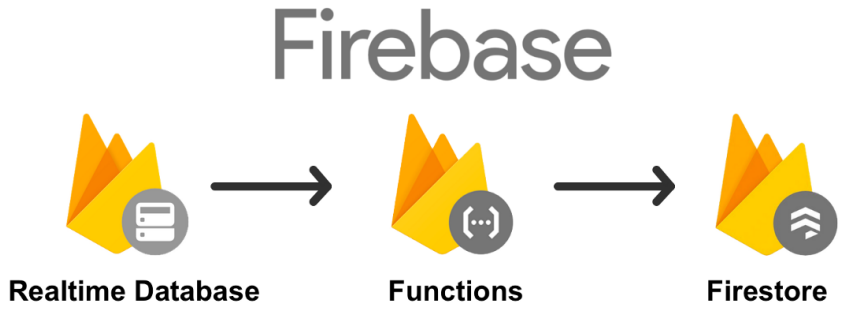

Figure 16: Cloud Functions and Firestore

4. Screens and functionalities:

4.1. Patient/Doctor Screen:

Once the user opens the app for the first time, he has to choose if he is a patient or a doctor in order to have the needed functionalities.

Figure 17: Patient/Doctor Screen

4.2. Login Screen:

This is the first screen the user will encounter, he will be asked to enter his email and password in order to connect him to his account. If the user does not have an account or if he forgot his password, he can also chose to sign up or recover his password.

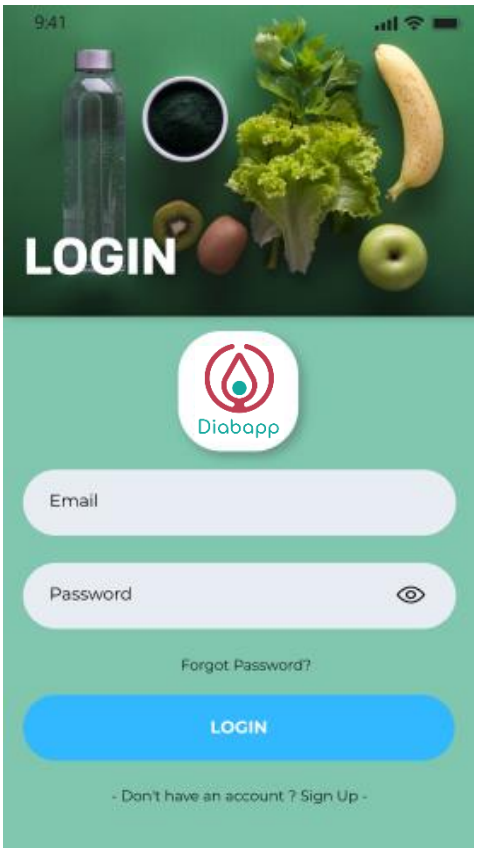

Figure 18: Login screen

4.3. Recover password Screens:

If the user has forgotten his password and he wishes to recover it, he can enter his email, get a recovery link that will lead him to the password-resting page, he can enter his new password and then he will be able to login to his old account with this new password.

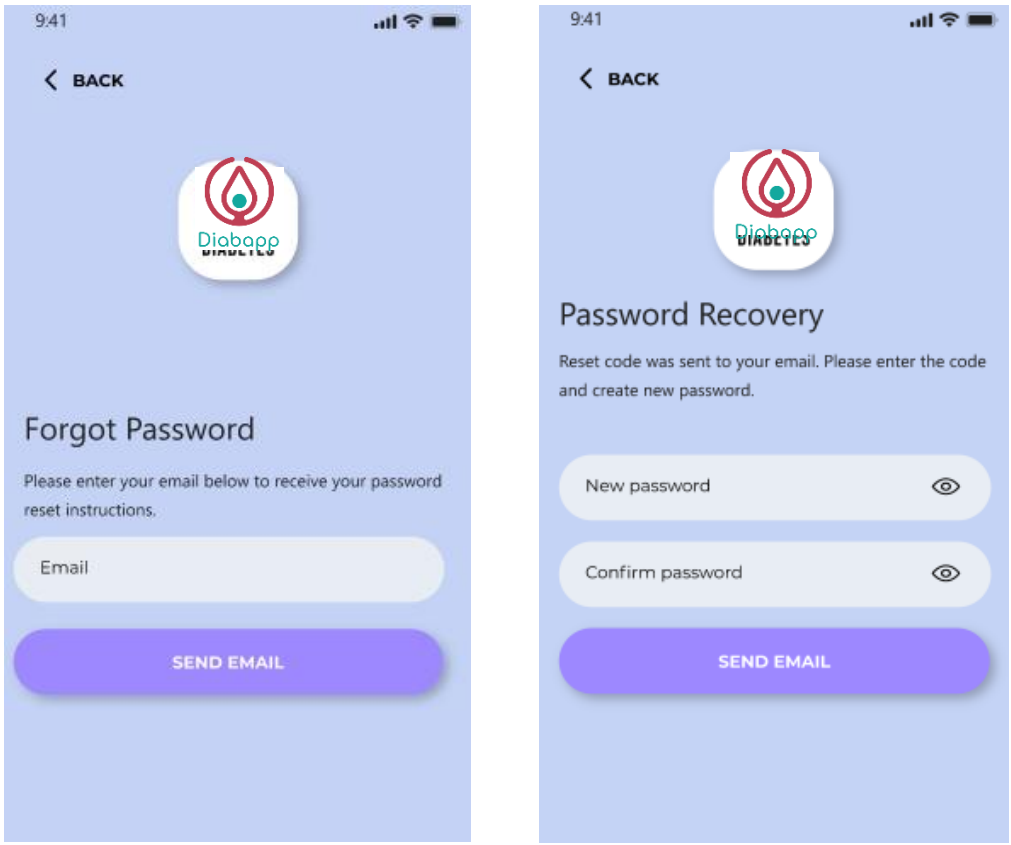

Figure 19: Recover password Screens

4.4. Create an account Screen:

If the user does not have an account, he can sign up and create one, he has to enter his name, email and password in order to be added in the system.

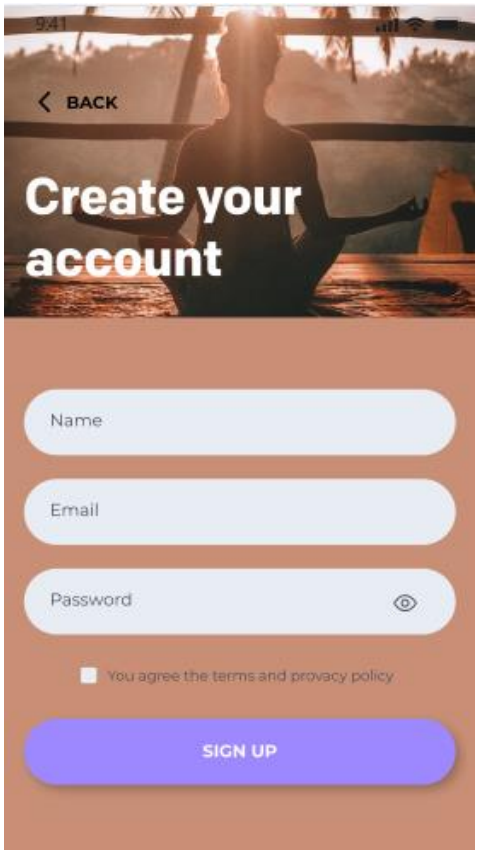

Figure 20: Create an account Screen

4.5. Information setting Screen:

After creating an account, the patient should fill some information like his gender, height, weight and age in order to provide him the most suitable services for his need.

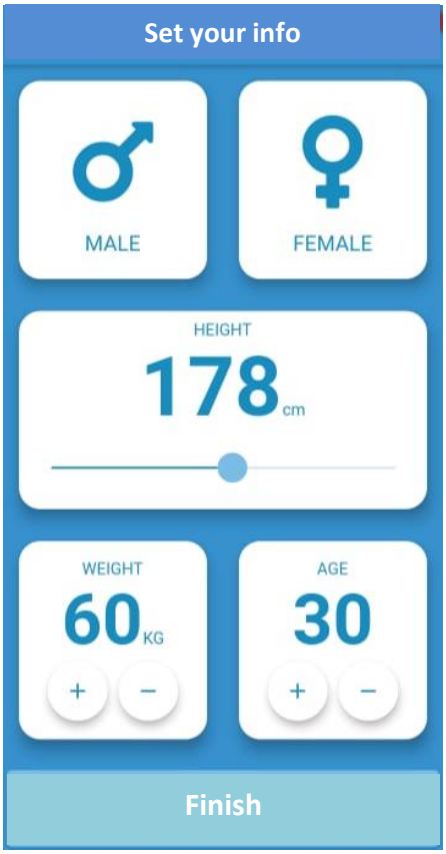

Figure 21: Create an account Screen

4.6. Menu screen:

In this screen, the patient will find what the application offers and can access any option he likes just by typing on it.

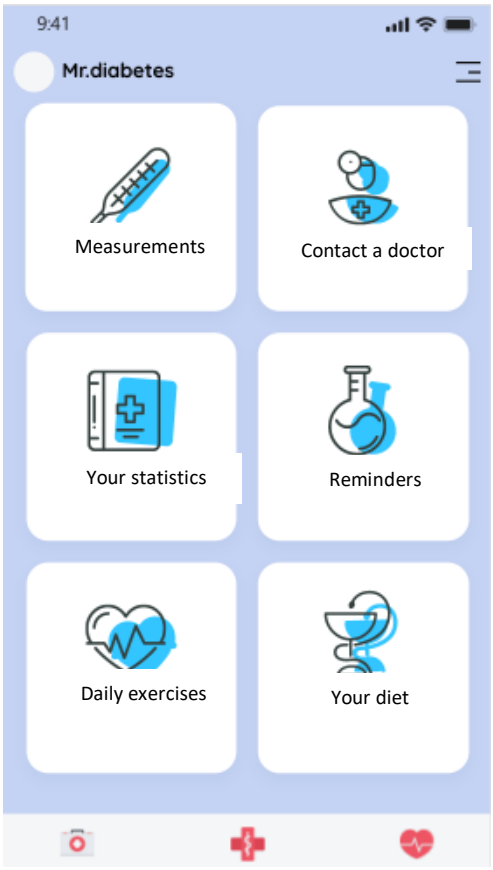

Figure 22: Menu Screen

4.7. Measurements screen:

This screen will allow the patient to enter his blood glucose test measurement, in order for the system to calculate the next dose accurately.

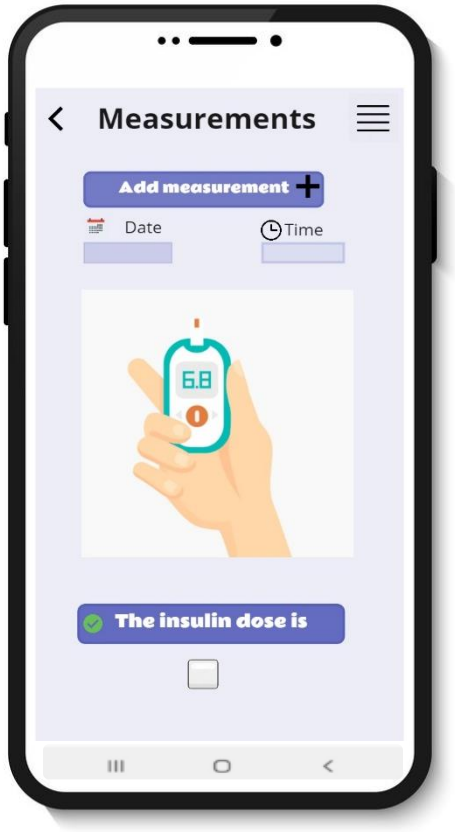

Figure 23: Measurement Screen

4.8. Statistics screen:

In this screen, the patient can consult his monthly and daily statistics, tips are suggested and if the results require a doctor's intervention, the system will send an alarm to the patient doctors and alert the patient.

Figure 24: StatisticsScreen

4.9. Exercise screen:

In this screen, we suggest to the user some physical activities according to his personal needs and history analysis.

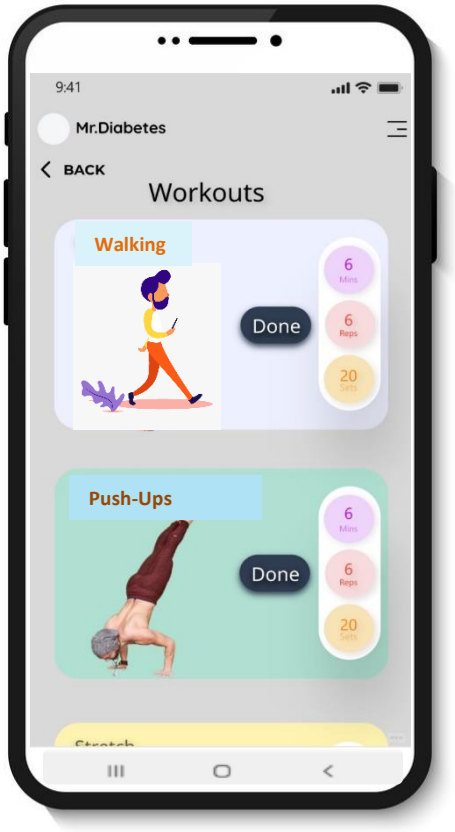

Figure 25: ExerciseScreen

4.10. Your diet screen:

In this screen, the patient can enter what he has eaten during the three meals of the day and he will have suggestions of what is best for him to eat as well.

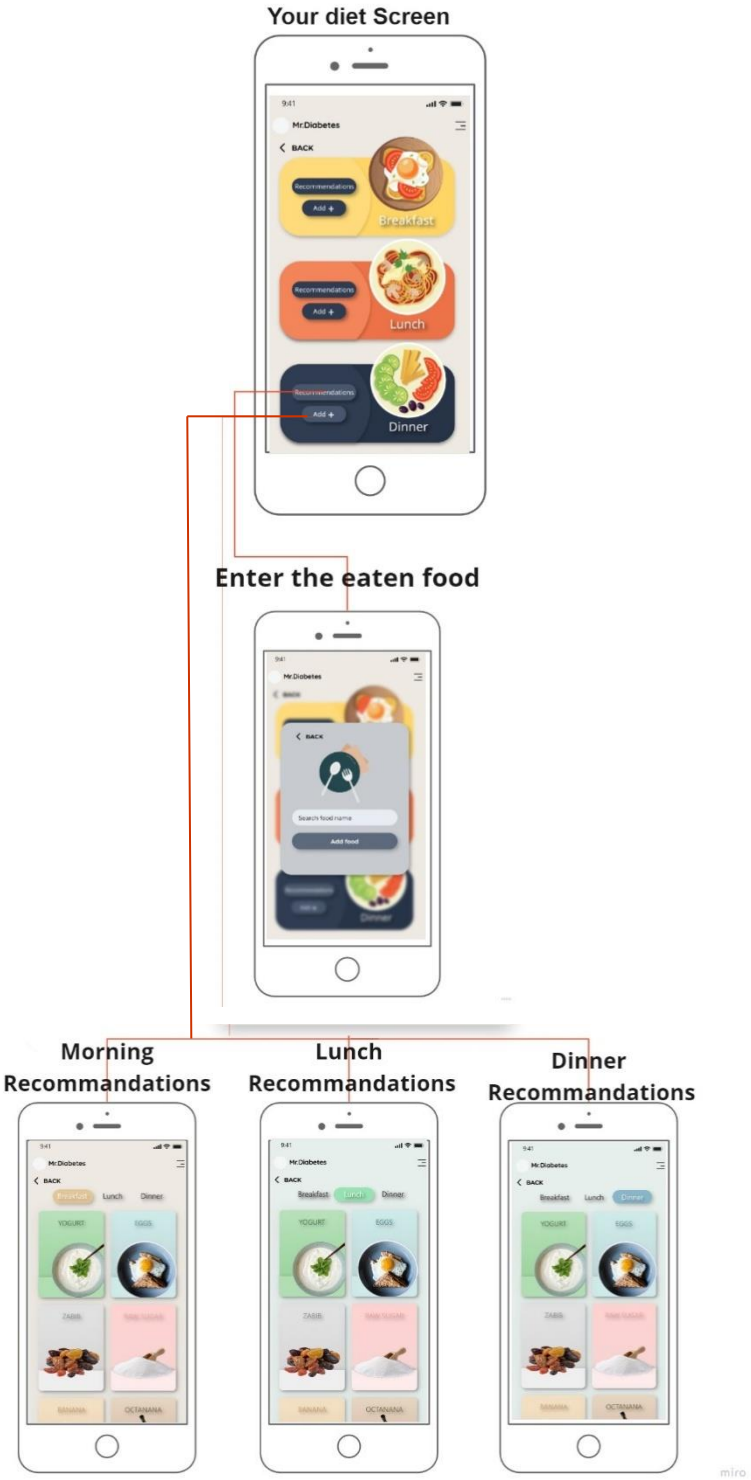

Figure 26: Your diet Screens

4.11. Reminders screen:

This screen contains the medications other the insulin intakes that the patient should have at specific time during the day.

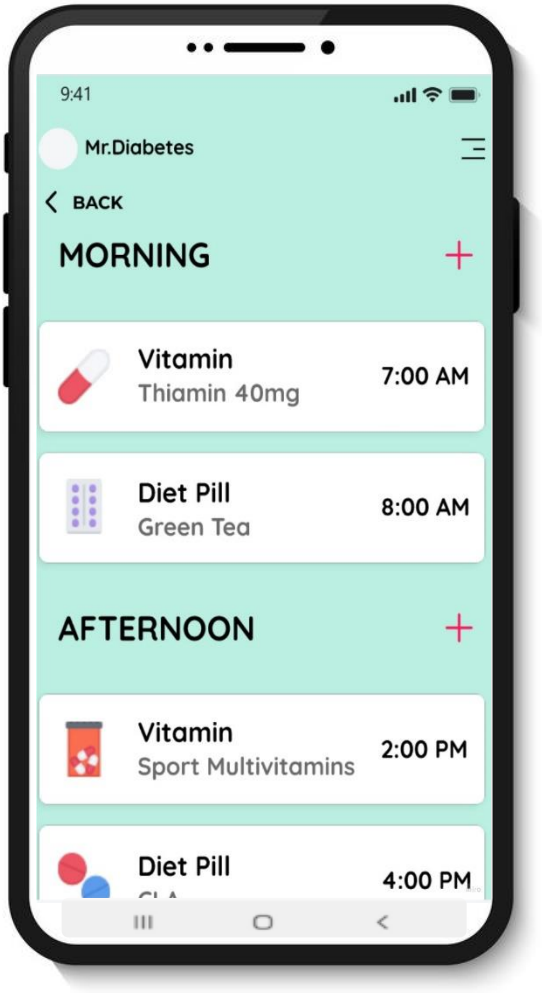

Figure 27: Medication reminderScreen

4.12. Contact a doctor screen:

In this screen, the patient can find when his doctor is available so they can book an appointment or he can contact his doctor as well if he is suspicious about something.

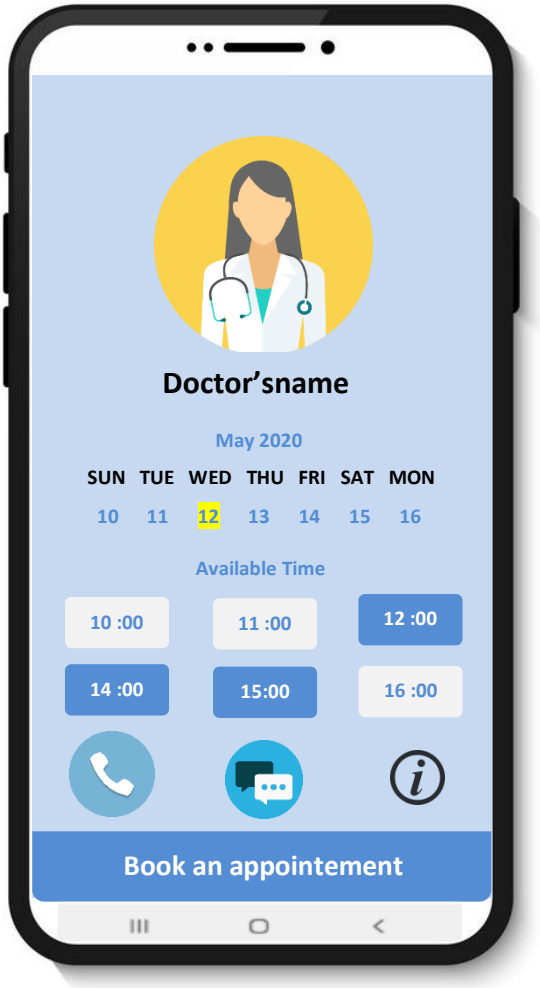

Figure 28: Contact a doctorScreen

4.12. Patients screen:

This is the screen that the doctor sees when he logs in. It has a list of his patients and he can tap on any patient's name to go to the statistics page where he can consult the progress of his patient, this screen will also show alerts if there is any.

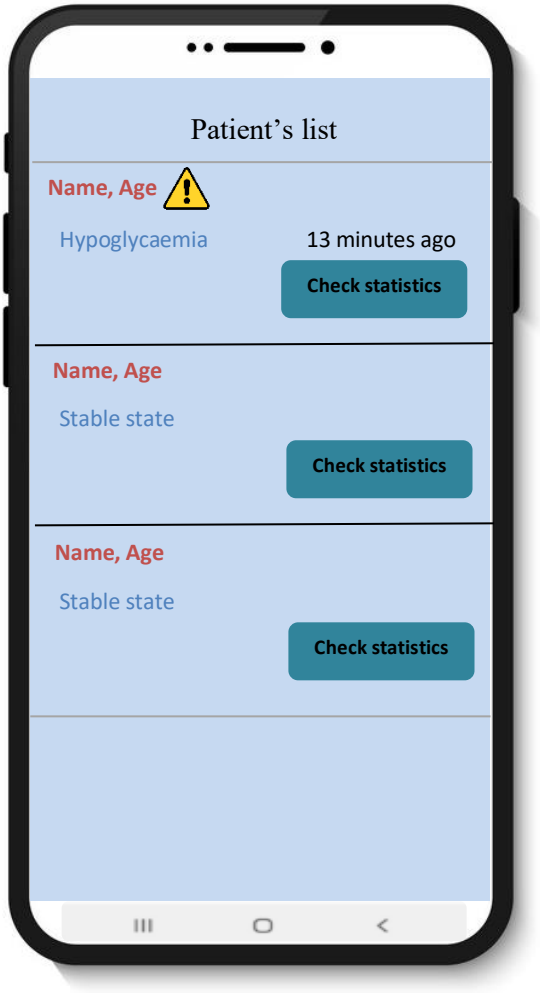

Figure 29: PatientsScreen

5. Conclusion:

In this chapter, we went through the tools we used realize this application, the software and hardware environment, and we presented the different application screens and what they offer.

GENERAL CONCLUSION

No one can deny the importance of mobile applications in the health sector. Mobile devices and applications allow patients to become more active in looking after their health. This fosters a better communication with the healthcare professionals and increases their awareness of their health in general. Hence, the aim of our project was to create a mobile application that can help people with diabetes to control and manage their illness.

In order to develop a powerful and useful application in accordance with the functional and non-functional requirements, one must first master the appropriate programming language and then should know how to adapt this code with the needs of the user.

When we started this project, we had in mind only a few basics concepts acquired during school's training. While working on this project, we had a complete overview on the methods of research, design, realization and testing .One of the main challenges encountered during this project consisted in handling the computer modules using: Flutter as a new framework, Dart, Firebase and Android studio.

However, this project pushed us to take initiatives to meet deadlines and to work as a team, an essential skill for an engineer.

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