Journal of Information Systems Engineering and Management
2025, 10(17s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

Revolutionary Diabetes Artificial Intelligence Mobile Application for Managing Diabetes Patient

Messaouda Bouneb[1], Mehdi Boudouka[1], Abedeldjouad Attar[1] and Sara Zouad[1]

[1]Department of mathematics and computer science, university El Arbi Ben Mhidi Oum El Bouaghi, Algeria
messaouda.bouneb@univ-oeb.dz ; hmblmahdi@gmail.com ; attarabdeljdouad@gmail.com; sarazed03@yahoo.fr

ARTICLE INFO

Received: 05 Dec 2024

Revised: 28 Jan 2025

Accepted: 09 Feb 2025

ABSTRACT

Diabetes is a complex disease with serious complications, which can damage many organs in the body. Proper medication and blood sugar control are crucial for maintaining health. However, as diabetes is a delicate and complicated disease in addition to medical treatment, diabetics need electronic tools to help them manage their disease.

The purpose of this paper is introducing a revolutionary multi-platform, multi-screen mobile application designed to diabetes management. This application able to recommend suitable meals for better and more precise control blood sugar level. Furthermore, it offers a virtual doctor all the time for answering patient questions and providing guidance. Additionally, it allows users to record and analyze their blood sugar levels, generating statistics on their average levels over time.

This application is developed using react native as framework and JavatScript as programming language. These new technologies are mixing with artificial intelligence.

The result of this work is a revolutionary intelligent diabetes multi- platform multi-screen mobile application named Diabetes.Ai, which works correctly. When we say multi-platform that means that works for different platforms like android, iOS, windows . . . etc. In the same, way when we say multi-screen that mean that works for the different size of screens like mobile, tablet, or wristwatch...etc.

In conclusion, Diabetes.Ai is a new approach for the diabetes management application, which ensures efficient management of blood sugar levels through the prediction of the glycemic index in meals before eating all using Artificial intelligence.

Keywords: Diabetes, Revolutionary, Multi-platform, Multi-screen, , Artificial Intelligence .

I. INTRODUCTION

Sugar, or glucose, comes from food is essential for the proper functioning of the body. Glucose needs to be metabolized using a hormone produced by the pancreas named insulin, in order to be used as an energy source. The diabetes is a chronic illness, indeed Diabetes is a disease that occurs when the pancreas does not produce enough insulin or the body does not properly use the insulin it produces. Insulin is a hormone that regulates blood sugar concentration [1]. The accumulation of glucose in the blood can leads to several long-term problems, such as stroke, heart disease, kidney failure, vision problems and wound healing problems.

In fact, there is two types of diabetes: “Type 1” diabetes, defined by the absence of insulin secretion by the pancreas. “Type 2” diabetes, the most common (almost 90% of cases), which develops gradually over many years and is due to poor use of insulin by the body [2][3][4].

In France, more than 4 million people had diabetes in 2021. The prevalence of this chronic disease has continued to increase, going from 5.6% in 2015 to 6.07% in 2021. Type 2 diabetes represents 92% of cases and type 1 diabetes represents 6% of cases. These two types of diabetes are predominant. Other types of diabetes concern rarer forms and represent the remaining 2% [5]. In the worldwide statistics say, that diabetes kills: 1.5 million people [6].

The rise in diabetes cases highlights a significant issue, making diabetes management a major socio-economic and public health challenge. While lifestyle factors are central to this concern, family history also plays a crucial role in the development of diabetes.

Prompt detection and management of diabetes is essential to reduce the risk [7] of complications, including heart disease [8], diabetic ketoacidosis, foot ulcers and lower limb amputations, as well as damage to the eyes, kidneys and nerves. People living with diabetes also have an increased risk of developing more serious outcomes from infectious respiratory illnesses, such as influenza and coronavirus disease (COVID-19) [9].

Diabetes management is treating by making lifestyle changes and/or taking medications (oral or injectable such as insulin). As diabetes is a delicate disease in addition to medical treatment, diabetics need electronic tools to help them manage their disease [10]. In recent years, several mobile applications have been developed and published on the web for download, which allow diabetes management. Among the notable applications in this domain are MySugr, Glucose Buddy, and BlueLoop. These applications provide various functionalities such as blood sugar recording, and medication tracking, offering some statistics contributing significantly to the daily management of diabetes. However, there remains a need for more comprehensive and intelligent solutions that can offer real-time insights and personalized recommendations. In response to this need, we present Diabetes.Ai. In this work, we propose Diabetes.AI, a hybrid mobile application compatible with multiple platforms (Android, iOS, Windows) and devices (phones, tablets, smartwatches). It enables users to regularly record blood sugar levels, view profiles with statistical curves, interact with a virtual doctor for personalized guidance, and scan meals to check their glycemic index with dietary recommendations.

II. DIABETES

Diabetes is a chronic disease marked by high blood sugar levels, leading to potential organ damage. Symptoms include thirst, weight loss, fatigue, frequent urination, and blurred vision. The condition arises when glucose can't enter cells, causing fatigue and frequent urination. High glucose levels also damage blood vessels, slowing wound healing and infection clearance. Diagnosis is confirming through blood and urine tests [11]. The diabetic must know that the real medicament is a balanced meal. A balanced diet prevents chronic diseases like diabetes and obesity by providing essential nutrients [12]. Meal planning is crucial for effective diabetes management. Figure 1 illustrates blood sugar variations after different meals.

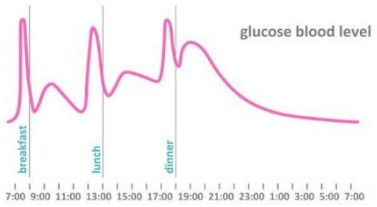

Fig.1. Example of variation of level blood sugar in day.

A diabetic must live daily with his disease in a way that adapts to it. Living with diabetes requires following a healthy diet and committing to daily physical activity. Figure 2 illustrates how physical activities can help reduce blood sugar levels.

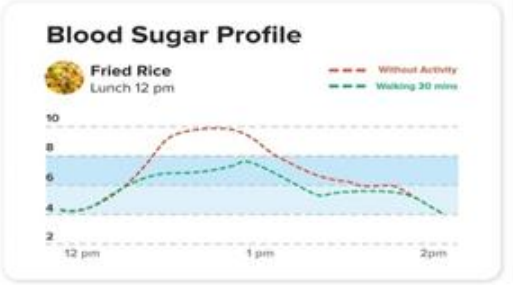

Fig.2. Example of blood sugar profile

Medication and insulin are essential for managing diabetes and lowering blood sugar levels. However, they don't

change eating habits, so patients should consult their doctor about adjusting carbohydrate intake [13]. Understanding the role of medication and insulin improves treatment adherence [14]. Figure 3 shows how insulin works.

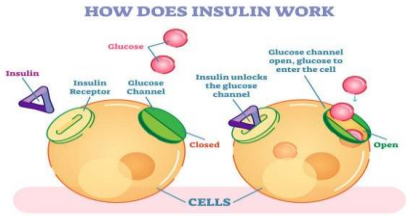

Fig.3. How does insulin work.

Glycemic control is crucial for preventing complications like neuropathy, retinopathy, and nephropathy in diabetic patients. Effective management involves understanding the impact of blood glucose levels on well-being and how diet, exercise, and insulin affect glucose levels [15]. Patients should select foods based on their glycemic index (see Figure 4) and adjust insulin for optimal control [16].

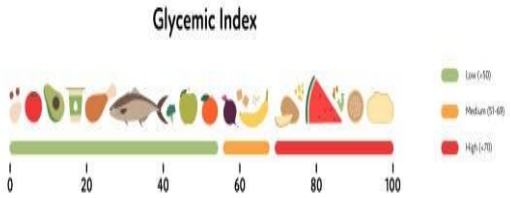

Fig.4. Foods and glycemic index

III. MOBILE APPLICATIONS

Mobile apps offer like functionality PC and are downloading from app stores. Development practices focus on user behavior, cross-device responsiveness, a unified code base with platform-specific APIs, and cloud-based data services [17].

A. Smartphone industry

Android and Apple have been the main players in the smartphone industry for years. Google acquired Android in 2005, while Apple's iOS was developing from MacOS. Other operating systems, such as Windows Phone,...etc also exist. Figure 5 displays the usage percentages of these systems over time.

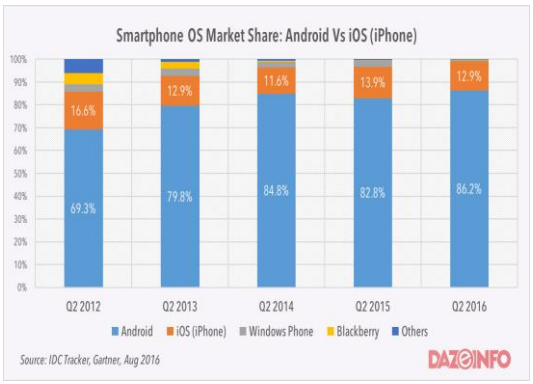

Fig.5. Smartphone OS Market Share

B. Mobile Application Frameworks

Flutter and React-Native are the most popular cross-platform mobile framework used by global developers. Beside these platforms, there is others. Figure 6 summary the statistics about the use of the different platforms.

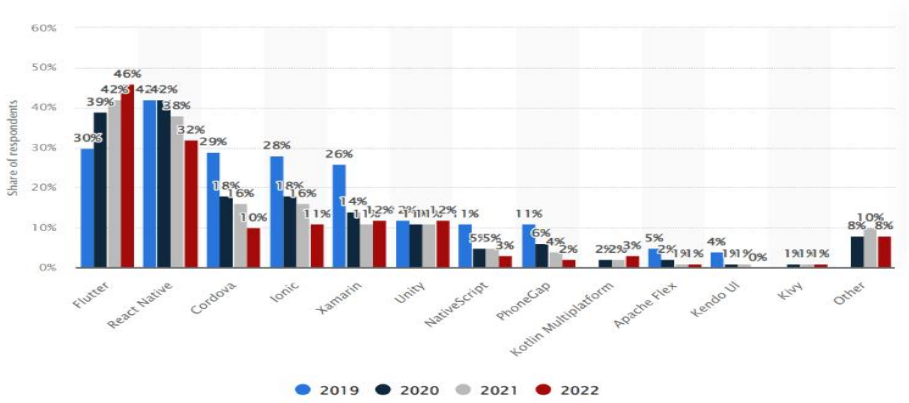

Fig.6. Cross-platform mobile frameworks used by developers worldwide 2019-2022.

IV. USED TOOLS

In this work, we have used react native as cross platform and JavaScript as programming language. Figure7 explains how React Native is multi-platform and how we can use the same code to generate an application for the Android platform and even generate an application for the iOS platform.

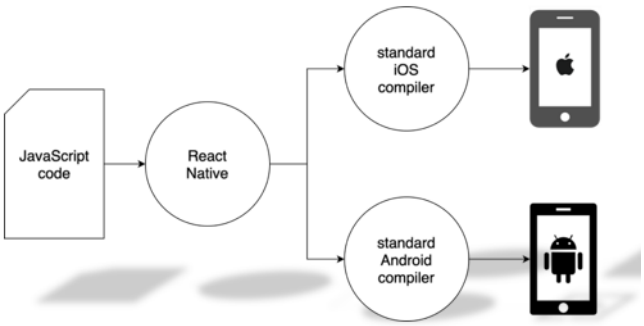

Fig.7. React Native application compilation

The app uses two APIs: Clarifai for analyzing food photos to determine the glycemic index, and Dialogflow for a chatbot that provides virtual doctor support, answering diabetes-related questions and offering quick interventions.

V. REVOLUTIONARY INTELLIGENT DIABETES MOBILE APPLICATION (DIABETE.AI)

A. Application Development

In our App, the evolutionary model was using. Figure 8 outlines the development's flow.

- Stage 0: The planning phase includes creating diagrams to offer an overview and documentation for development.
- Stage 1: Analysis and design phases.
- Stages 2 and onward: Implementation and testing phases, where features were developed and tested iteratively until satisfactory.
- Final Phase: The final product was completed.

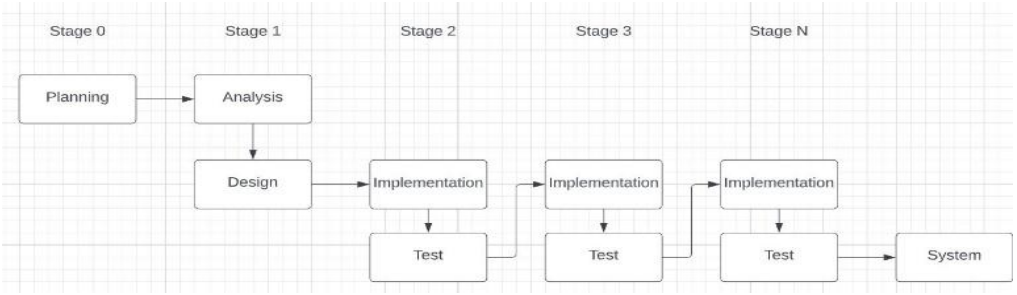

Fig.8. Diagram of an evolutionary model for development

B. Application plans

- *Mind map:* A mind map is suitable for visualizing the app's features, components, technologies, and future enhancements. Figure 9 is the mind map for the general use case of the Diabete.Ai.

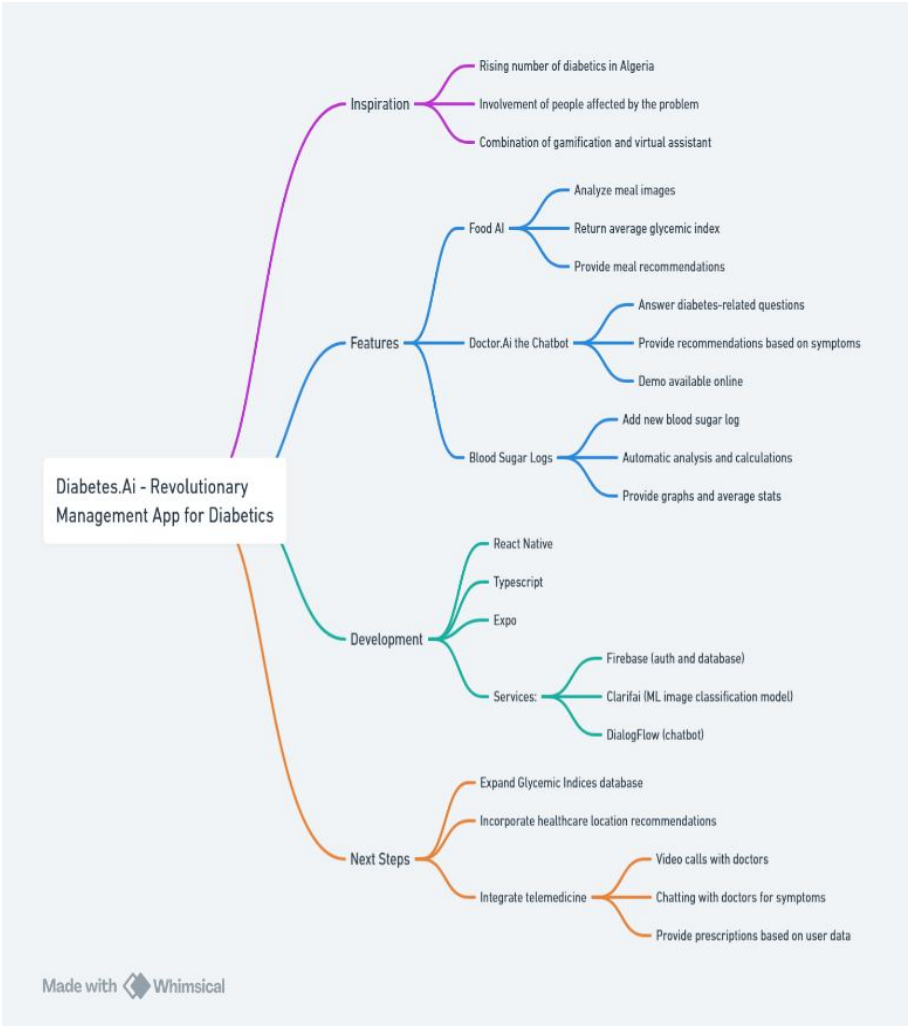

Fig.9. Mind map for the general use case of Diabetes.Ai

- *System Flowchart*

The system flowchart for Diabetes.AI will visualize key processes and interactions among components, including Food AI, Doctor.AI the Chatbot, Blood Sugar Logs, and interactions with external services like Firebase, Clarifai, and Dialogflow.

Figure 10 shows the global flow chart of the application. while figure 11 represents the general plan of Use Case Diagram.

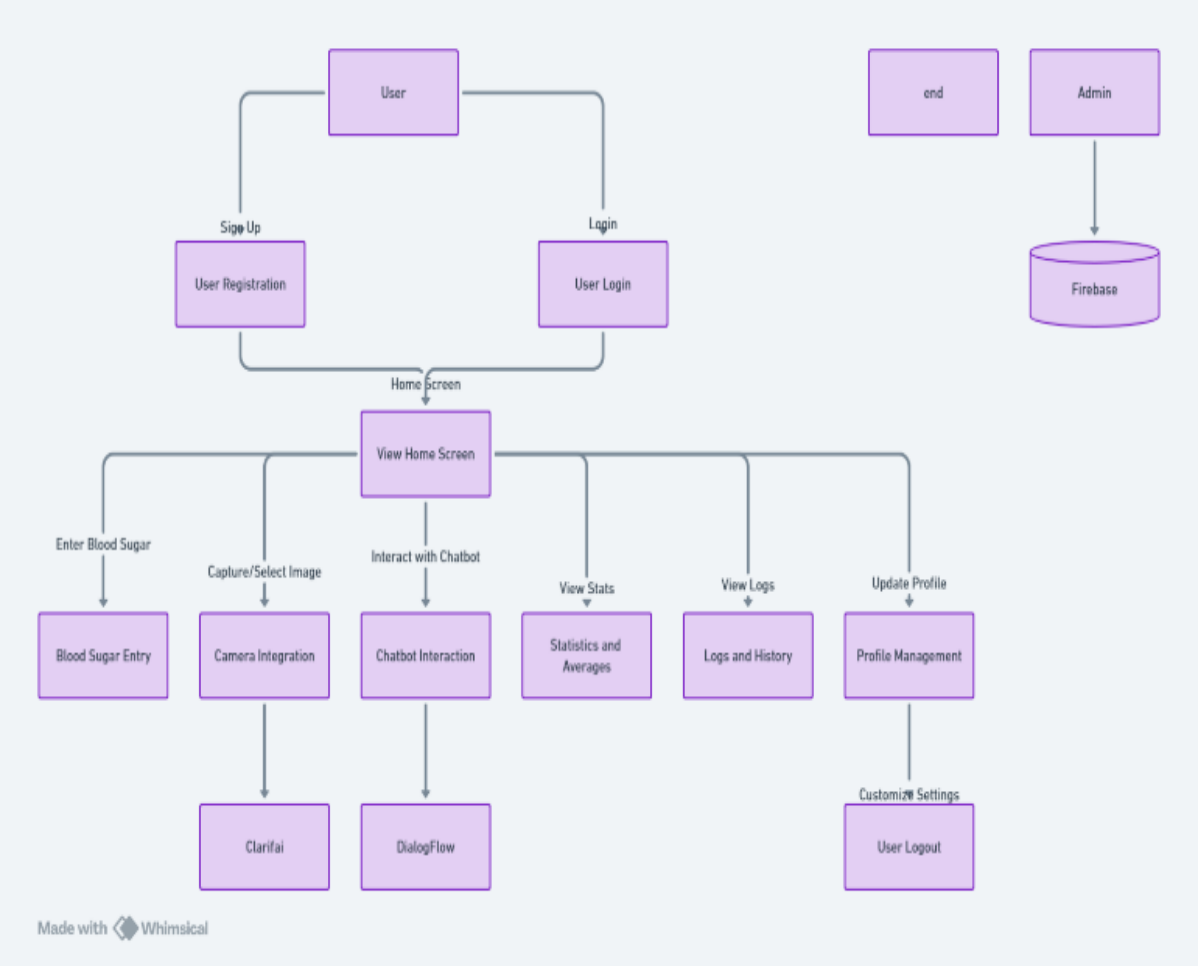

Fig.10. Diabetes.Ai flow chart

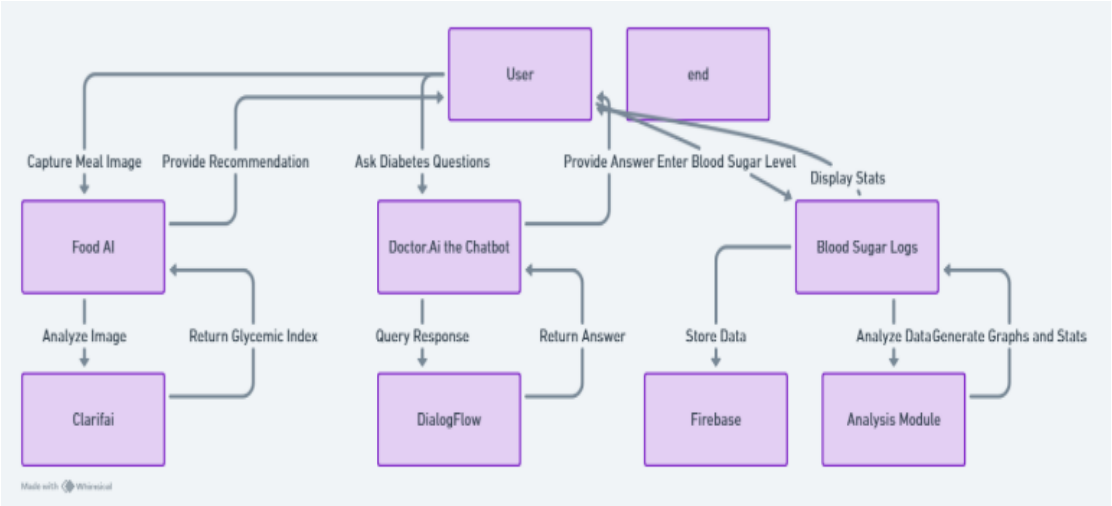

Fig.11. general plan of Use Case diagram

- *Use case diagrams:* The use case diagram for Diabete.Ai will show user interactions with the app and its functionalities. Figure 12 shows an example of use case diagram.

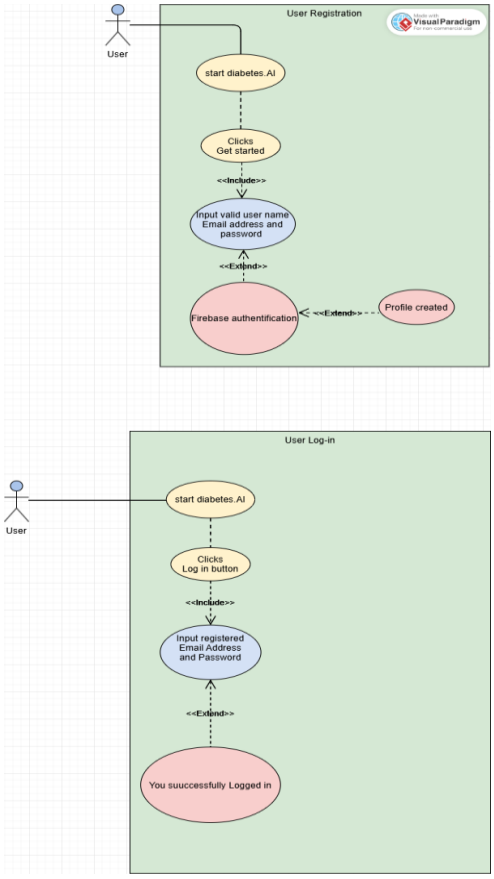

Fig.12. login/register use case diagram.

- Sequence diagram: A sequence diagram shows how different components of the Diabetes.Ai system interact over time. Figure 13 illustrates this with key interactions including user registration, image analysis, chatbot interaction, and blood sugar entry.

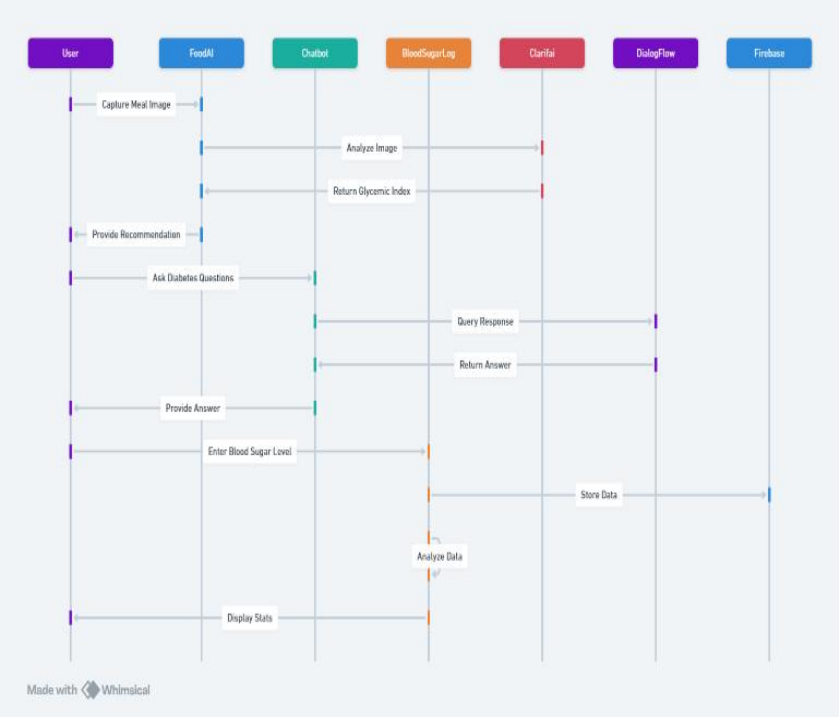

Fig.13. sequence diagram for the Diabetes.Ai

C. Design

- User interface design

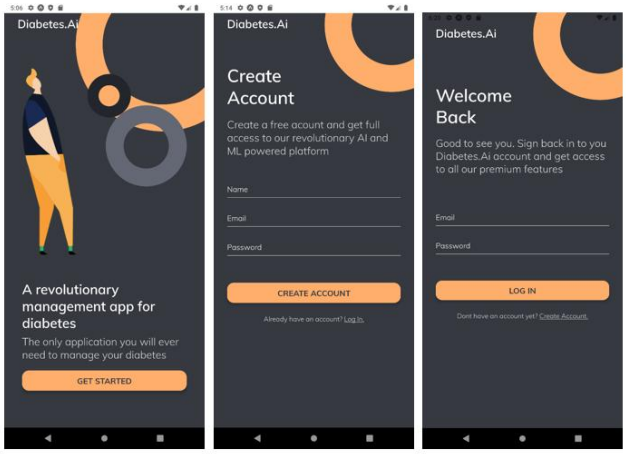

Fig.14. Log in

Figure 14.(a) shows the application Splash Screen, which serves as an introductory screen for the mobile app.

Figure 14.(b) shows the Signup screen, where users create an account by entering their name, email, and password. It uses Firebase for account management and navigates users to other screens based on their actions.

Figure 14.(c) shows the Login Page, where users enter their email and password to access the main page. It includes a "Create Account" option for new users and uses Firebase for authentication, navigating users to other screens as needed.

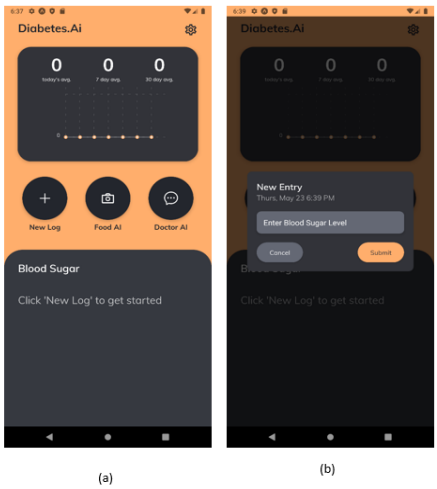

Fig.15. Enter new value blood sugar

Overall, Figure 15.(a) displays the Home Page, where users can add blood sugar logs, view average levels, access Food AI and Doctor AI, and manage data through Firebase.

In Figure 15.(b) The screenshot shows the Blood Sugar Entry pop-up screen for adding new blood sugar logs and managing data through Firebase.

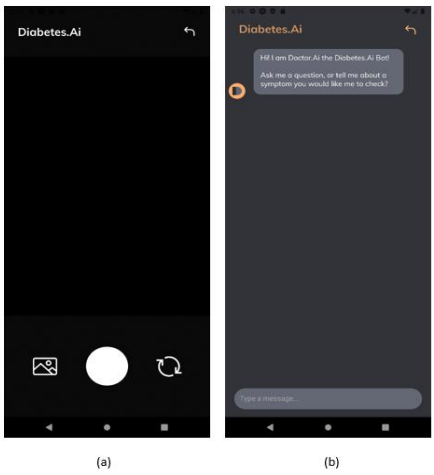

Fig.16. Food AI and Doctor AI

Figure 16.(a) The screen uses camera functionality and image recognition to identify food items and provide their glycemic index, helping in diabetes management.

Figure 16.(b) The screen provides a chat interface for interacting with Doctor.AI, a chatbot using Dialogflow for natural language processing.

- Unit Testing: To evaluate this application, unit testing will be used. Below are parts have been evaluated:

Unit testing 1: Sign up as a new user (see figure 17)

Testing Objective: Guarantee that a new user is creating and verifying successfully.

The different unit testing 1 scenarios are summarized in table I.

Fig.17. Unit testing 1.

TABLE I

UNIT TESTING 1

No	Description	Expected Result	Final Result
1	Users fill all the information blank on Register Page to create a new user.	Taking user directly to the home screen .	Successful
2	Users don't fill in any information or miss some blanks on Register Page.	Showing a message below the missing blank to notify the user to fill in.	Successful
3	In the Password blank, users fill in the wrong password format.	Showing a message below the Password blank to notify the user it must be 8 or more characters.	Successful
4	In the Email blank, users fill in the wrong email format.	Showing a message to notify users that their email is invalid.	Successful
5	In the Email blank, users fill in used email.	Showing a message to notify users that their email is already in use.	Successful

Unit testing 2: Login as a user (see figure 18). The different unit testing 2 scenarios are summarized in table II.

Testing Objective : Users can log in using their information and enter the Main Page successfully.

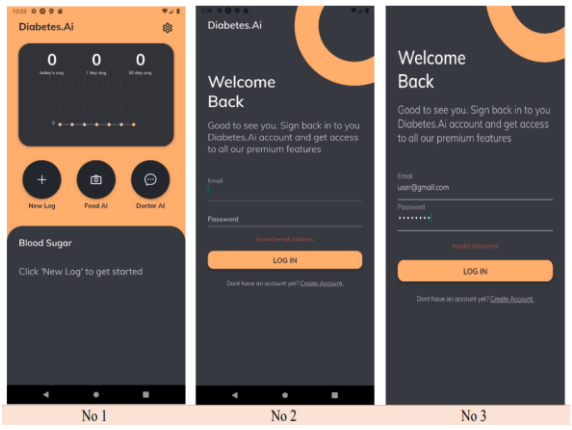

Figure 18: Unit testing 2

TABLE II

UNIT TESTING 2

No	Description	Expected Result	Final Result
1	Users fill all the information blank on Login Page to enter the system	Showing a message that the login is successful	Successful
2	Users don't fill in any information or miss some blanks on the Login Page	Showing a message below the missing blank to notify the user to fill in	Successful

3	Users log in but use the wrong information.	Showing a message to notify users that their information was wrong	Successful

Fig.19. Unit testing 3

Unit testing 3: Viewing Averages and Logs (see figure 19). The different unit testing 3 options are summarized in table III.

Testing Objective: Users can see their average blood sugar levels for today, the past week, and the past month (Statistics)

TABLE III

UNIT TESTING 3

No	Description	Expected Result	Final Result
1	Users see Statistics Display.	A view shows the average blood sugar levels for today, the past week, and the past month.	Successful
1	Users can see Line Chart.	A line chart displays the blood sugar levels for the past seven days. The chart is configured with custom colors and styles.	Successful
1	Users can see Log List.	A scrollable view lists all the blood sugar logs. Each log entry shows: • An icon representing day or night (based on the time of the log). • The date and time of the log. • The blood sugar level, color-coded based on its value (normal, low, or high).	Successful

Unit testing 4: Adding a New Log (see figure 20). The different steps of execution are summarized in table IV.

Testing Objective: The "Adding a New Log" feature allows users to record their blood sugar levels.

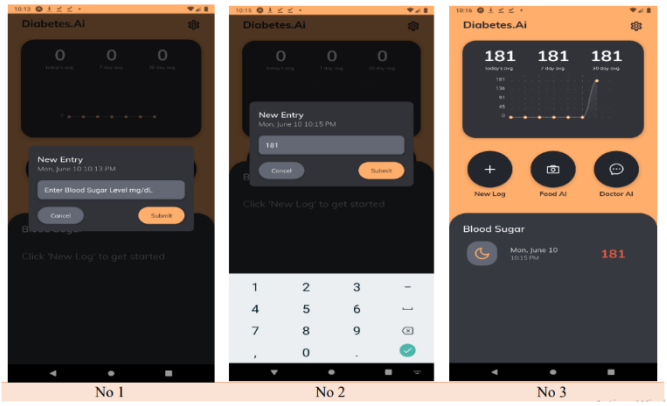

Fig.20. Unit testing 4

TABLE IV

UNIT TESTING 4

No	Description	Expected Result	Final Result
1	Users Opening the Modal.	The user initiates the process by tapping the "New Log" button, which opens the modal.	Successful
2	Users can Enter Data.	The user enters their blood sugar level into the provided input field.	Successful
3	Users Submitting Data.	Upon pressing "Submit", the modal closes, the data is saved both locally and in Firestore, and the displayed averages are updated.	Successful

Unit testing 5: Food.Ai (see figure 21). The different steps of execution are summarized in table V.

Testing Objective: Food.Ai is a user-friendly app that utilizes camera functionality and image recognition technology to help users make informed dietary choices based on the glycemic index of their meals.

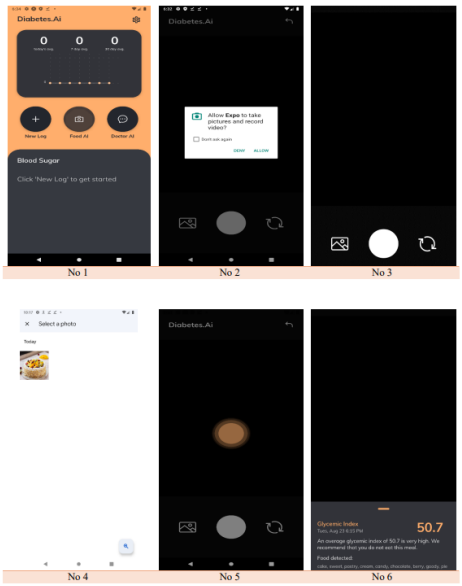

Fig.21. Unit testing 5

TABLE V

UNIT TESTING 5

No	Description	Expected Result	Final Result
1	Users can Navigate to the Food.Ai feature.	Users navigate to the Camera Page from the main interface, ready to take a photo of their meal.	Successful
2	Granting Permissions.	Users are prompted to grant camera access permissions, enhancing the security and privacy of the app.	Successful
3	Taking a Photo.	The interface is intuitive with a clear camera button to capture images.	Successful
4	Upload a photo from device gallery.	Users can also select images from their gallery, offering flexibility.	Successful
5	Processing.	The processing overlay with an activity indicator shows the progress, ensuring users are aware of ongoing operations.	Successful
6	Displaying Results.	Once processed, a bottom sheet provides the glycemic index information and detected food items, offering clear and actionable insights.	Successful

Unit testing 6: Doctor.Ai (see figure 22). The different steps of execution are summarized in table VI.

Testing Objective : The Chatbot Page in the Diabetes.Ai app offers a responsive and helpful interaction experience. This intuitive interface allows users to easily ask questions and receive valuable diabetes management information.

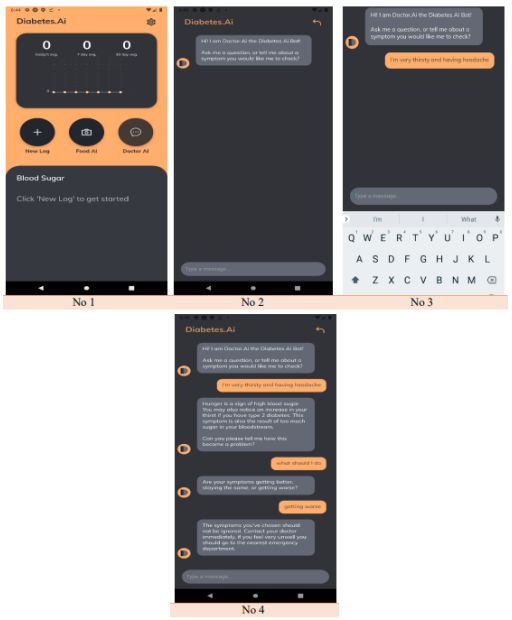

Fig.22. Unit testing 6.

TABLE VI

UNIT TESTING 6

No	Description	Expected Result	Final Result
1	Navigating to the Doctor.Ai screen.	Users access the Chatbot Page from the home page by click on the Doctor.Ai, expect to receive help related to diabetes.	Successful
2	Initial Interaction.	Doctor.Ai greets the user and provides a prompt to start the conversation, reducing any hesitation the user might have about what to ask.	Successful
3	Sending Messages.	Users type their questions or symptoms into the input field, styled to be easily readable and accessible. The send button is clearly visible and easy to tap.	Successful
4	Receiving Responses.	The Chatbot's responses are displayed in the chat window, with clear and text colors to ensure readability. Responses are timely keeping users engaged and informed.	Successful

Unit testing 7: Users Logout (see figure 23). This task is summarized in table VII.

Testing Objective: Users can log out of the system.

Fig.23. Unit testing 7

Table VII
Unit testing 7

No	Description	Expected Result	Final Result
1	User can navigate to the app settings to see profile and log out button.	Users click on setting icon on the top right of the application.	Successful
2	Users can log out of the system whenever they want.	Users click on the sign-out icon on the top right of the application, and a	Successful

		message shows that users log out successfully and taking him immediately to the splash screen.	

VI. CONCLUSION

Diabetes.Ai is a mobile application designed to assist in diabetes management through artificial intelligence and virtual assistance. It features:

- Food.Ai: Analyzes meal photos to provide glycemic index assessments and dietary recommendations.
- Doctor.Ai the Chatbot: Offers personalized responses to diabetes-related questions and advice.
- Blood Sugar Logs: Allows users to record and analyze blood sugar levels, generating graphs and statistics for data-driven decisions.

In conclusion, Diabetes.Ai is a game-changer in the diabetes management application. It introduces artificial intelligence into the mix with new technologies and empowers users in ways that were never realized before.

REFERENCES

[1] Diabetes. Pan American health organization?world health organization, America region
[2] Pinchevsky, Y., Butkow, N., Raal, F.J., Chirwa, T., al.: Demographic and clinical factors associated with development of type 2 diabetes: a review of the literature. International Journal of General Medicine (2020)
[3] Holman, N., Wild, S.H., Khunti, K., Knighton, P., al: Incidence and characteristics of remission of type 2 diabetes in england: a cohort study using the national diabetes audit. Diabetes journal (2022)
[4] Eizirik, L., Pasquali, L., Cnop, M.: Pancreatic -cells in type 1 and type 2 diabetes mellitus: different pathways to failure,. Nature Reviews Endocrinolog (2020)
[5] The numbers of diabetics in france. French Federation of Diabetics.
[6] In france, diabetes kills each year 10 times more than road accidents...silently. French Federation of Diabetics
[7] Wallace, A.S., Wang, D., Shin, J.I., Selvin, E.: Screening and diagnosis of prediabetes and diabetes in us children and adolescents. Pediatrics (2020)
[8] Pop-Busui, R., Januzzi, J.L., Bruemmer, D., al.: Heart failure: an underappreciated complication of diabetes. a consensus report of the american diabetes association. diabetes care (2022)
[9] Overview of diabetes in canada. Public Health Agency of Canada (2023)
[10] Peng, Z., Xie, X., Tan, Q., Kang, H., Cui, J.: Blood glucose sensors and recent advances: A review. Biomedical and Optical Health Informatics (2022) 25
[11] Evans, M., Morgan, A.R., Patel, D., Dhatariya, K., al: Risk prediction of the diabetes missing million: identifying individuals at high risk of diabetes and related complications. Diabetes Therapy, Springer 2021 (2021)
[12] Wagemakers, J.J.M.F., Prynne, C.J., Stephen, A.M., Wadsworth, M.E.J.: Consumption of red orprocessed meat does not predict risk factors for coronaryheart disease; results from a cohort of british adults in 1989 and 1999. European Journal of Clinica (2009)
[13] Mukhtar, Y., Galalain, A., Yunusa, U.: A modern overview on diabetes mellitus: a chronic endocrine disorder. European Journal of Biology (2020)
[14] Nathan, D.M.: Realising the long-term promise of insulin therapy: the dcct/edic study. Diabetologia (2021)
[15] Crecil Dias, C., Kamath, S., Vidyasagar, S.: Blood glucose regulation and control of insulin and glucagon infusion using single model predictive control for type 1 diabetes mellitus. IET Systems Biology (2020)
[16] Whicher, C.A., O'neill, S., Holt, R.I.G.: Diabetes in the uk: 2019. Diabetic Medicine (2020)
[17] Brown, A., Jones, B.: Exploring the potential of web applications in mobile computing. International Journal of Mobile Technology 5(1), 18–35 (2020)

Messaouda Bouneb was born in Algeria, she obtained her BEng degree from University of Mentouri Constantine, Algeria (2005). In February 2009, she obtained her M.Sc. degree in computer science. 2016 she obtained her doctorate degree. Her research domain is formal specification and verification of real-time systems, Medicine, Artificial intelligence, mobile application.

Mehdi Boudouka was born in 1999/01/22. He obtained his bachelor's diploma in 2021, specializing in computer systems. In 2024, he graduated at the University of Larbi Ben M'Hidi-Oum El Bouaghi with a master's degree in the field of "Distributed Architectures," focusing on "Mobile Application Development for Diabetics Assistance."

Attar Abdeldjouad was born in 2000/12/04. He obtained his bachelor's diploma in 2021 , specializing in computer systems. In 2024, he graduated at the University of Larbi Ben M'Hidi-Oum El Bouaghi with a master's degree in the field of "Distributed Architectures," focusing on "Mobile Application Development for Diabetics Assistance.

Sara zouad was born in algeria, she obtained her license's diploma in 2004. In 2007 she obtained Master's degree in computer science. Her domain of research is Computing in Mathematics, Natural Science, Engineering and Medicine, Information Systems (Business Informatics), Artificial Intelligence.