

Pre-Diabetes Management App Using ML Based On Lifestyle Features

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Abstract- This project presents a smart healthcare application designed to predict the risk of pre-diabetes using machine learning techniques based on simple lifestyle-related features. In today's fast-paced lifestyle, factors such as irregular sleep patterns, poor diet, lack of physical activity, and increased stress levels have become major contributors to the early development of diabetes. Detecting this risk at an early stage can help individuals take preventive measures before the condition progresses into Type 2 diabetes. The proposed system uses important daily lifestyle parameters such as sleeping hours, sleep quality, activity level, stress, diet quality, BMI, age, and family history to analyze the user's health condition. The prediction model is built using the XGBoost algorithm, which is known for its high accuracy and efficiency in handling structured healthcare data. Based on the user's input, the model classifies the risk into low, moderate, or high-risk groups and provides personalized health recommendations.

keywords Pre-Diabetes Prediction, Machine Learning, XGBoost, Lifestyle Features, Risk Assessment, Flutter Application, Supabase Backend, Healthcare Monitoring, Preventive Healthcare, Mobile Health Application, Sleep Analysis, Stress Monitoring.

I. INTRODUCTION

Diabetes has become one of the most common and rapidly growing health problems in today's world. Due to changing food habits, reduced physical activity, stress, and irregular sleep patterns, the number of people affected by diabetes is increasing every year. Before a person is diagnosed with Type 2 diabetes, they often go through an early stage known as pre-diabetes. In this stage, the blood sugar level is higher than normal but not high enough to be classified as diabetes. Many people are not aware that they are in the pre-diabetic stage because the symptoms are usually mild and often go unnoticed. If this condition is identified at an early stage, it can be controlled through proper diet, regular exercise, stress management, and improved daily habits. Therefore, early prediction plays an important role in preventing the progression of the disease.

The main aim of this project is to develop a smart healthcare application that can predict the risk of pre-diabetes using machine learning techniques. The system uses user inputs such as sleeping hours, sleep quality, physical activity, stress level, diet quality, BMI, age, and family history to estimate the risk level.

For prediction, the XGBoost algorithm is used because it provides good accuracy and works efficiently with structured healthcare data. The frontend of the application is developed using Flutter, which provides a simple and user-friendly mobile interface, while Supabase is used as the backend for authentication and data storage.

II. LITERATURE SURVEY

Many researchers have worked on diabetes prediction using machine learning techniques. Different algorithms such as Logistic Regression, Decision Tree, Random Forest, Support Vector Machine, and XGBoost have been widely used for healthcare prediction systems.

Previous studies show that health-related factors like BMI, age, sleep quality, physical activity, and family history play an important role in identifying diabetes risk. Among the available machine learning techniques, XGBoost has shown strong performance because of its ability to handle structured data efficiently and improve prediction accuracy.

Based on the findings from earlier research work, this project uses the XGBoost algorithm for predicting pre-diabetes risk and generating personalized health recommendations.

III. PROBLEM STATEMENT

Many users are unaware of their health risk until symptoms become severe. This project aims to provide early prediction through an easy-to-use mobile app. Many users are unaware of their health risk until symptoms become severe. This project aims to provide early prediction through an easy-to-use mobile app.

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IV. OBJECTIVES

To predict pre-diabetes risk, provide personalized recommendations, and increase health awareness through a Flutter mobile application. To predict pre-diabetes risk, provide personalized recommendations, and increase health awareness through a Flutter mobile application.

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V. SYSTEM ARCHITECTURE

The app follows a client-server architecture where Flutter acts as frontend, Supabase handles backend services, and XGBoost performs prediction. The app follows a client-server architecture where Flutter acts as frontend, Supabase handles backend services, and XGBoost performs prediction.

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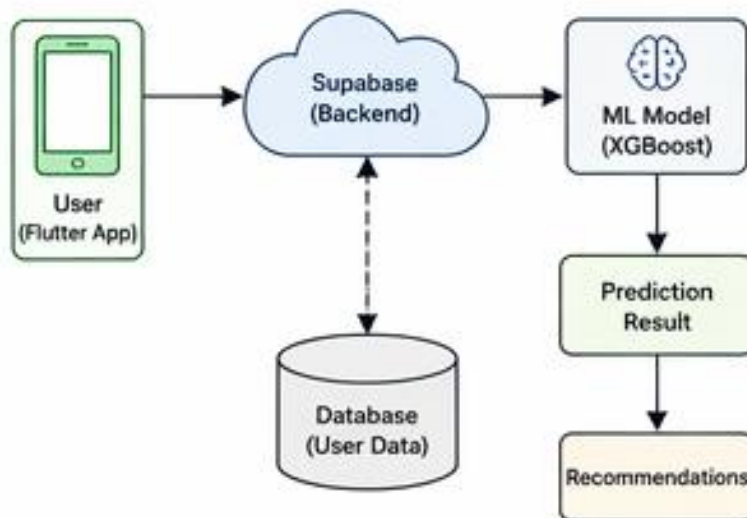
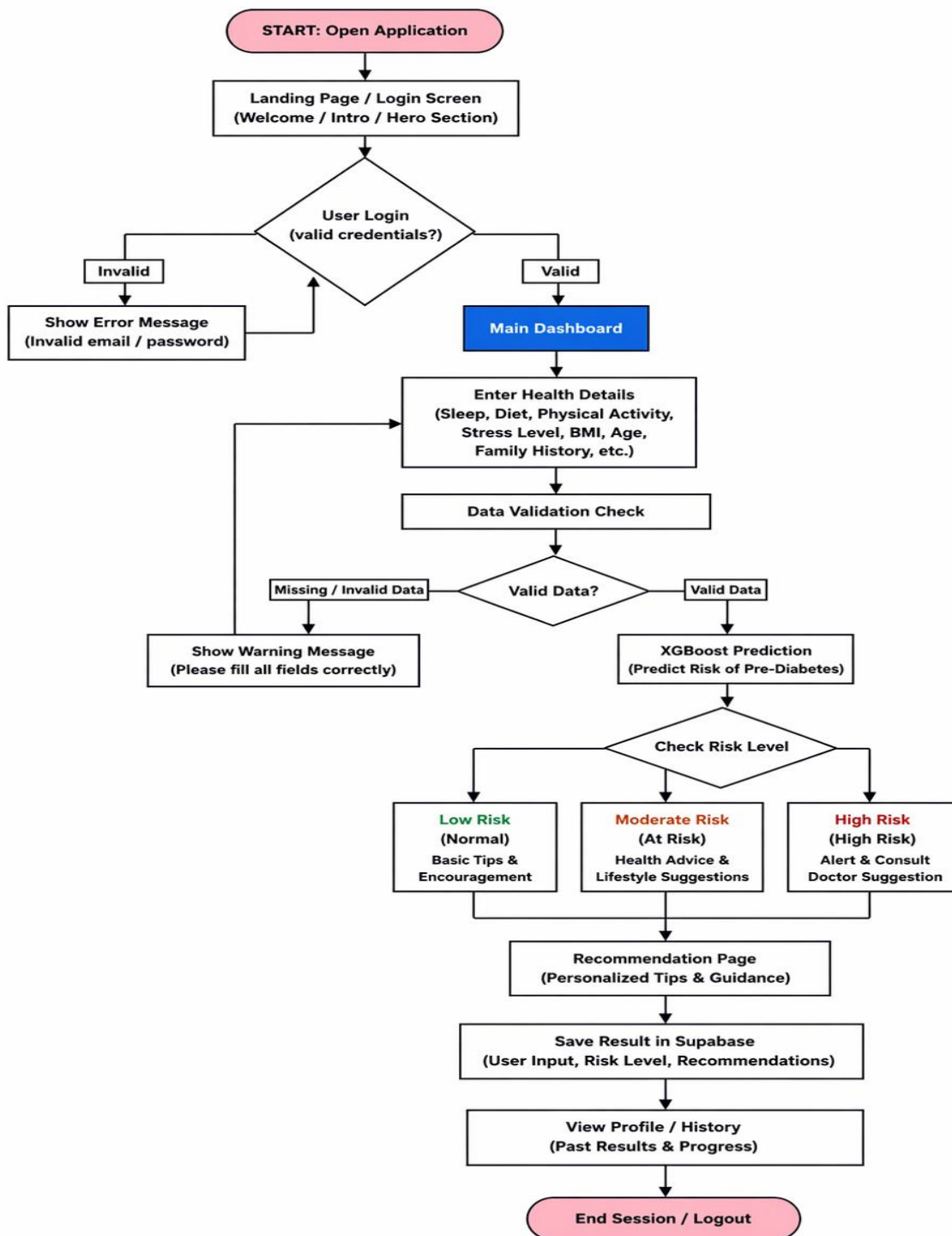


Fig. 1 System Architecture Diagram

VI. DATASET AND FEATURES

Features include sleeping hours, sleep quality, activity level, stress, diet quality, BMI, age, and family history. Features include sleeping hours, sleep quality, activity level, stress, diet quality, BMI, age, and family history.

User Journey Flowchart (The Learning Path):



VII. MACHINE LEARNING MODEL (XGBOOST)

XGBoost is used because it handles nonlinear patterns and feature interactions efficiently. The model achieved strong predictive accuracy on the test set. XGBoost is used because it handles nonlinear patterns and feature interactions efficiently. The model achieved strong predictive accuracy on the test set.

Model Performance (XGBoost)

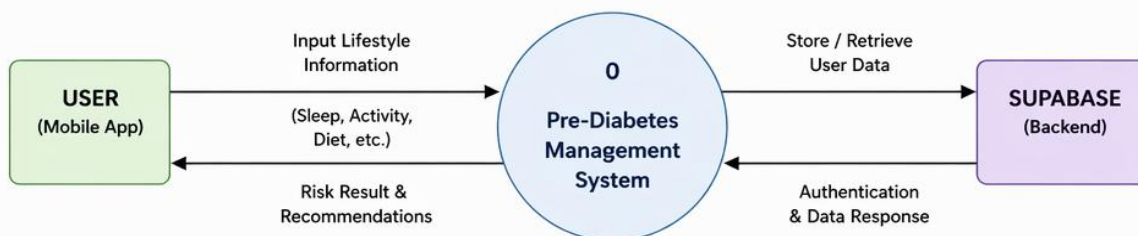
Metric	Value
Accuracy	84.74%
Precision	0.80
Recall	0.85
F1-Score	0.80

VIII. LEARNING MODULE STRUCTURE

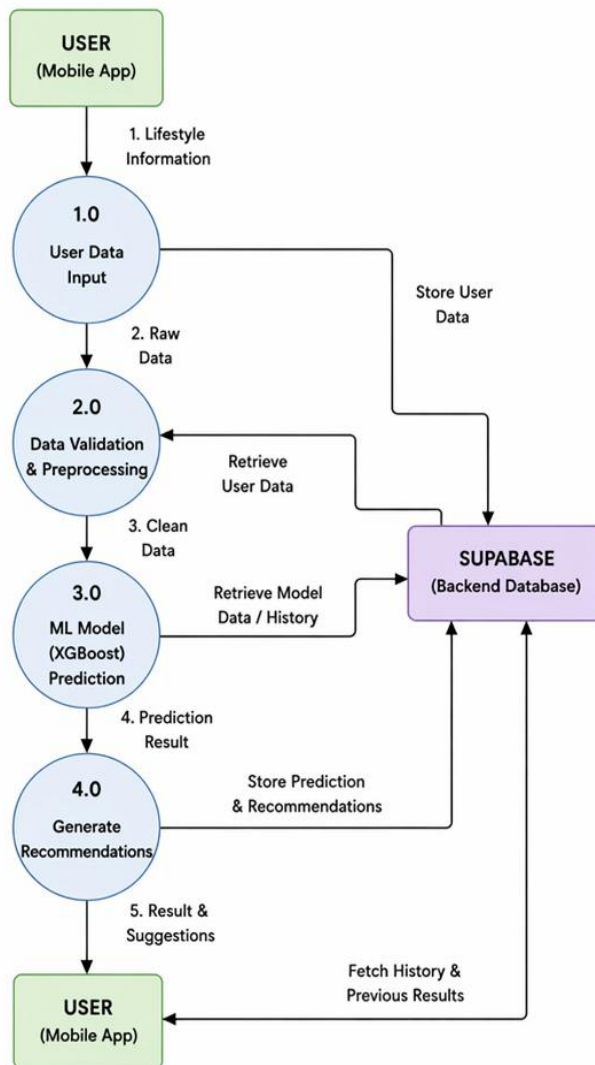
The data flow of the proposed application is organized into different levels to clearly explain how information moves through the system. The initial level focuses on the overall interaction between the user, the mobile application, and the backend database. At this stage, the user enters basic lifestyle details such as sleeping hours, sleep quality, physical activity, stress level, diet quality, BMI, age, and family history. The system then processes this information and returns the predicted risk level along with suitable health recommendations.

As the flow progresses, the intermediate level explains the major internal processes of the application, including data input, validation, preprocessing, and risk prediction using the XGBoost model. The user data is first checked and converted into a suitable format before being sent to the trained model for analysis. Once the prediction is completed, the system generates the result and displays personalized suggestions to help the user improve their lifestyle habits. This structured representation helps in understanding the complete working of the application step by step, from user input to final prediction and recommendation.

.DFD Level 0: Context Diagram:



DFD Level 1: Context Diagram:



IX. RESULTS AND DISCUSSION

The model successfully predicts pre-diabetes risk levels and provides meaningful lifestyle suggestions. The model successfully predicts pre-diabetes risk levels and provides meaningful lifestyle suggestions.

X. FUTURE SCOPE

The proposed system can be further enhanced in the future by adding more advanced healthcare and user-friendly features. At present, the application predicts the risk of pre-diabetes based on selected user inputs, but it can be improved to provide more personalized and real-time health support. With the growth of wearable devices and smart health technologies, the application can be extended to offer continuous monitoring and better prediction accuracy.

Some future improvements may include:

- integration with **smartwatches and fitness bands**
- real-time health and activity tracking

- daily reminders for diet, sleep, and exercise
- doctor consultation or appointment booking feature
- chatbot for instant health guidance
- personalized diet and workout plans

These enhancements can make the system more effective and useful for long-term health monitoring and prevention.

XI. CONCLUSION

This project successfully presents a Pre-Diabetes Management Application that helps in the early prediction of pre-diabetes risk using machine learning. By analyzing important user inputs such as sleeping hours, sleep quality, physical activity, stress level, diet quality, BMI, age, and family history, the system is able to classify the risk level effectively. The use of the XGBoost algorithm has improved the prediction accuracy and helped in generating reliable results. The application not only predicts the risk but also provides useful health recommendations, which can help users improve their daily habits and take preventive actions at the right time. Overall, the project contributes to preventive healthcare by creating awareness and helping users monitor their health condition in an easy and accessible way through a mobile application.

XII. REFERENCES

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