A Project Proposal on

DiaCare: An Intelligent Diabetes Management Application with an Integrated LLM-Augmented Chatbot and Machine Learning-Driven Risk Prediction for Personalized Health Optimization

Group Information

Group-01 CSE299 (Section-17)

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Brief About the Project

- **Target Group:** 21+ year-old male/female patients in Bangladesh diagnosed or at risk of Type-2 diabetes.
- **Dataset:** Bangladeshi male and female patients dataset from Mendeley Data and the Pima Indian Diabetes dataset for predictive modeling.
- **Platform:** Cross-platform mobile app built with Flutter, compatible with both iOS and Android.
- **UI Design Reference:** Inspired by Apple Health's design approach, developed in Figma.
- **Integration of AI/ML:**
  - Machine learning algorithms for diabetes prediction.
  - LLM-based chatbot for personalized guidance trained on the diabetes-related textbooks.
- **Timeline:** Six weeks.

Proposed Application UI (Figma)

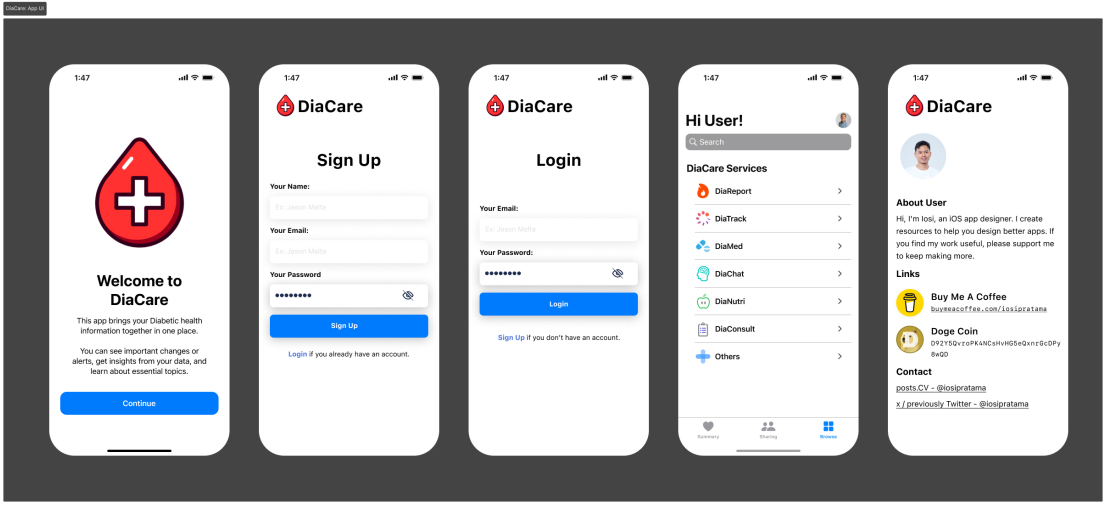


Figure: App Welcome Module (DiaCare UI)

Proposed Application UI (Figma)

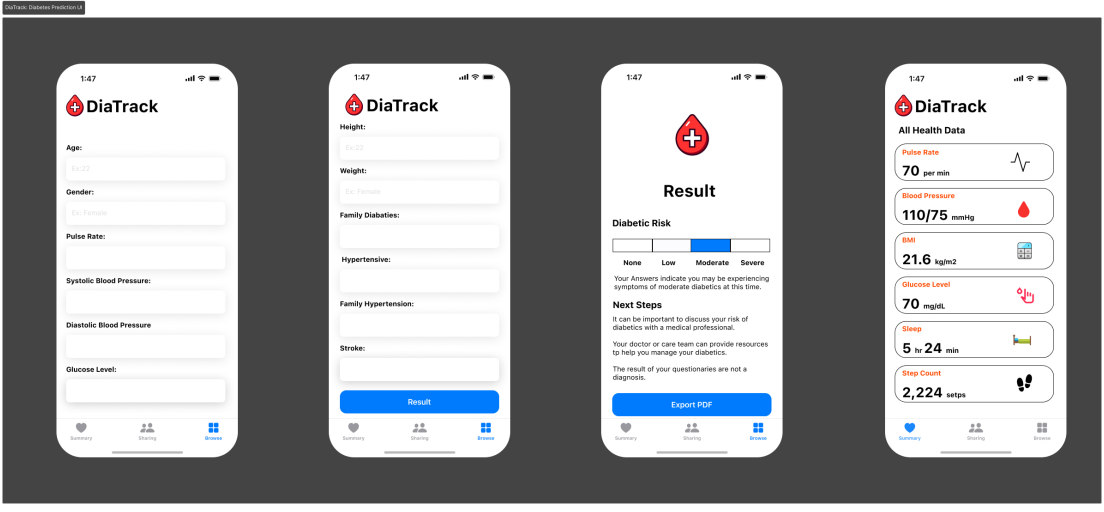


Figure: Diabetes Prediction & Track Dashboard (DiaTrack UI)

Proposed Application UI (Figma)

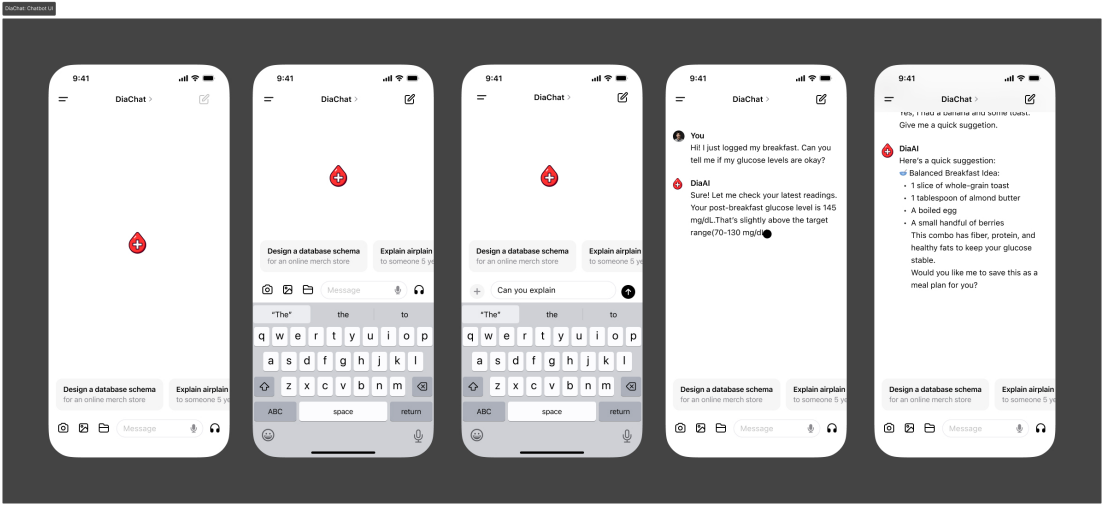


Figure: Conversation with DiaAI (DiaAI Chatbot UI)

Problem Statement & Solution

- **Key Issue:**
  - Diabetes is a prevalent chronic condition, and Type-2 Diabetes disproportionately affects women in Bangladesh due to a mix of genetic, lifestyle, and socioeconomic factors. Access to personalized diabetes management tools tailored to this demographic is limited.
- **Proposed Solution:**
  - Develop a cross-platform, AI-driven app tailored to Bangladeshi women with Type-2 Diabetes that:
  - Predicts diabetes risk and diagnoses with precision using ML models.
  - Provides actionable insights, health tracking, and diet plans through an intuitive interface.
  - Ensures data privacy and security while enabling collaboration with healthcare providers.

Expected Outcomes

- **Improved Diabetes Management:** Users achieve better control of blood glucose levels through personalized insights and real-time feedback.
- **Early Risk Detection:** Machine learning models enable early identification of diabetes risk, allowing for preventive measures.
- **Enhanced User Engagement:** AI-powered chatbot and interactive reports keep users motivated and engaged in their health journey.
- **Reduced Healthcare Costs:** Proactive management reduces the need for frequent hospital visits and emergency interventions.
- **Data-Driven Research:** Aggregated, anonymized user data contributes to diabetes research and improved treatment strategies.
- **Global Accessibility:** Cross-platform support and offline functionality make diabetes management accessible to users worldwide, including remote areas.

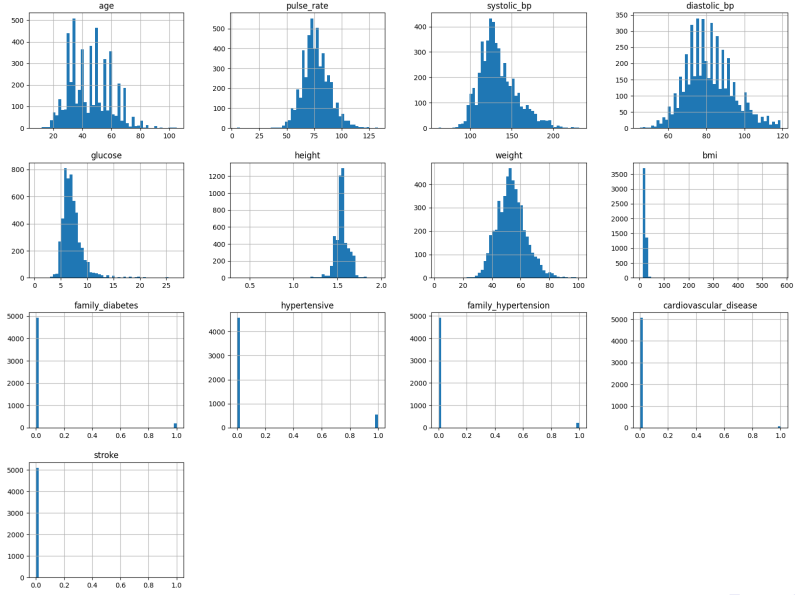
Target Audience

- **Demographics**
  - Age: 21+ years old.
  - Gender: Male and female.
  - Location: Bangladesh.
  - Language: Bangla (Primary), English (Secondary).
- **Psychographics**
  - Health-conscious individuals.
  - People at risk of or living with diabetes.
  - Those seeking reliable, accessible, and affordable healthcare solutions.
  - Users who prefer mobile-based solutions for health management.

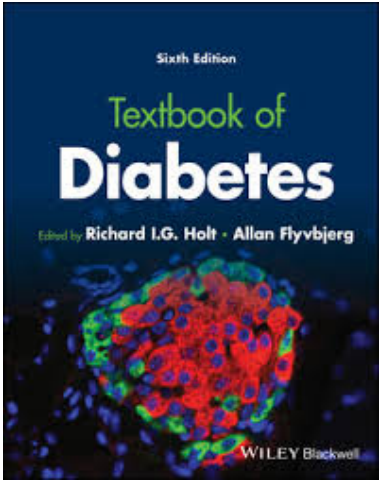
Dataset Details

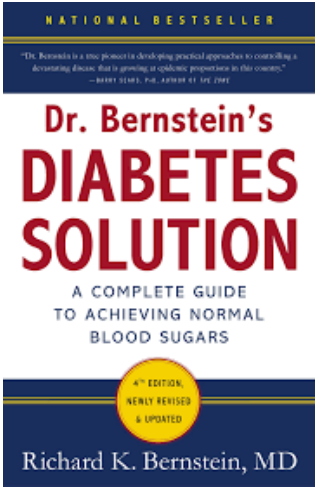
- **Source:** CMED Health Ltd. and PKSF, Bangladesh. (Mendeley Data)
- **Instances:** 5,437 patient samples (ages 21–80, both males and females).
- **Features:** 14 attributes (Demographics, Clinical, History).
- **Feature Types:** Real, Categorical, Integer.
- **Dataset Type:** Tabular.
- **Purpose:** Early detection and prevention of Type 2 Diabetes.
- **Key Attributes:** Pulse Rate, Systolic BP, Diastolic BP, Glucose, Body Mass Index (BMI), Stroke, Cardiovascular Disease (CVD)

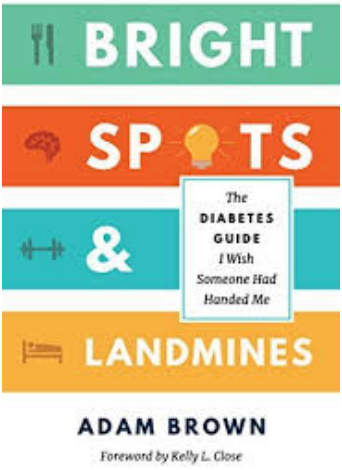
Dataset Attribute Histogram



Dataset Textbook







App Feature List

1. **Diabetes Prediction Module:** Predict diabetes from Bangladeshi Dataset using ML and display probabilities and risk levels.
2. **Prediction Report Exporting & Sharing:** Export reports as PDF.
3. **Personalized LLM Chatbot:** AI-powered guidance from diabetes textbook with diet, lifestyle, and medication advice.
4. **User Profile & Health Tracking:** Store health details securely and track glucose, medication, and exercise.
5. **Diet Management Module:** Meal suggestions, calorie tracking, and recipes.
6. **Medication Management Module:** Medicine suggestions based on age.

Technology Stack

Frontend:

- Framework: Flutter (Dart).
- UI Design: Figma.

Backend:

- Backend Framework: Django.
- Database: MongoDB.

API and Integration:

- API Gateway: FastAPI.
- Third-Party API: Firebase.

Cloud Services:

- Hosting: AWS.
- Storage: AWS S3/Firebase.

Machine Learning:

- Tools: TensorFlow, Scikit-Learn, NumPy, Pandas, Seaborn/Matplotlib.

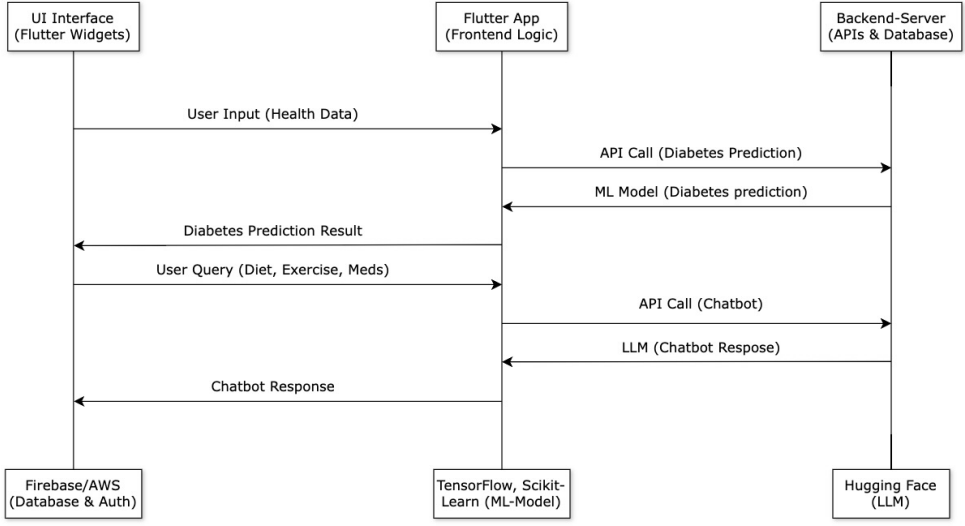
Chatbot Integration:

- Language Model: LLM (HuggingFace/Llama 3/Gemma 2).
- Frameworks: LangChain, LangSmith, LangGraph (RAG Pipeline).

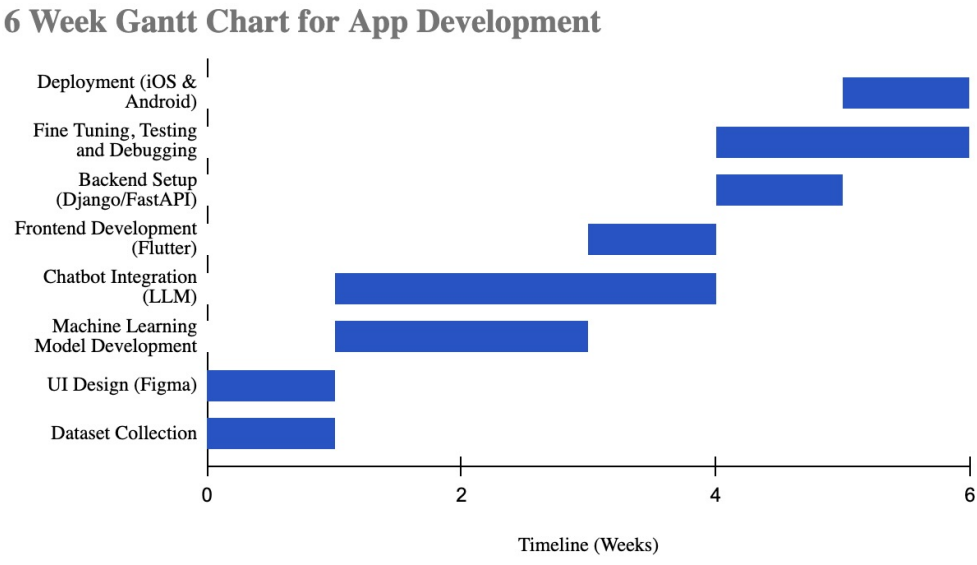
DevOps:

- Version Control: GitHub.
- CI/CD: GitHub Actions/Jenkins.

Project Diagram



Gantt Chart


6 Week Gantt Chart for App Development
Deployment (iOS & Android)
Fine Tuning, Testing and Debugging
Backend Setup (Django/FastAPI)
Frontend Development (Flutter)
Chatbot Integration (LLM)
Machine Learning Model Development
UI Design (Figma)
Dataset Collection
0
2
4
6
Timeline (Weeks)

Work Distribution

- **Saif Mohammed - 2121913042**
  - ML Model Development
  - LLM Chatbot Integration
  - App Deployment (iOS/ Android)
- **Nazibul Islam Nabil - 2222456642**
  - LLM Chatbot Integration
  - Chatbot Fine Tuning
  - BackEnd Development
- **Humayra Rahman Nipa - 2121128042**
  - UI Design
  - FrontEnd Development
  - ML Algorithms
- **Umme Suraia Haque Setu - 2031278642**
  - Dataset Preparation
  - ML Algorithms

References

1. National Institute of Diabetes and Digestive and Kidney Diseases. (1990). *Pima Indians Diabetes Database*. [Online]. Available: `https://www.kaggle.com/uciml/pima-indians-diabetes-database`

2. United International University. (n.d.). *UIU Diabetes Dataset*. [Online]. Available: `https://data.uiu.ac.bd/dataset/iriic/1`

3. R. Holt, C. Cockram, A. Flyvbjerg, and B. Goldstein, Eds., *Textbook of Diabetes*, 6th ed. Hoboken, NJ, USA: Wiley-Blackwell, 2020.

4. R. K. Bernstein, *Dr. Bernstein's Diabetes Solution: The Complete Guide to Achieving Normal Blood Sugars*, 5th ed. New York, NY, USA: Little, Brown and Company, 2011.

5. A. P. Runyon, *Bright Spots & Landmines: The Diabetes Guide I Wish Someone Had Handed Me*. [Online]. Available: `https://brightspotsandlandmines.org`