# I HEALTH RECOMMENDATION SYSTEM

Disease prediction

# Our Team

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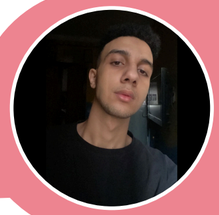

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## Dr. Samar Hesham Eng. Al-Mohannad Alaa El-din

# Agenda

1. General
2. Problem statement
3. Related work
4. Proposed approach
5. implementation
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7. results
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# • Introduction

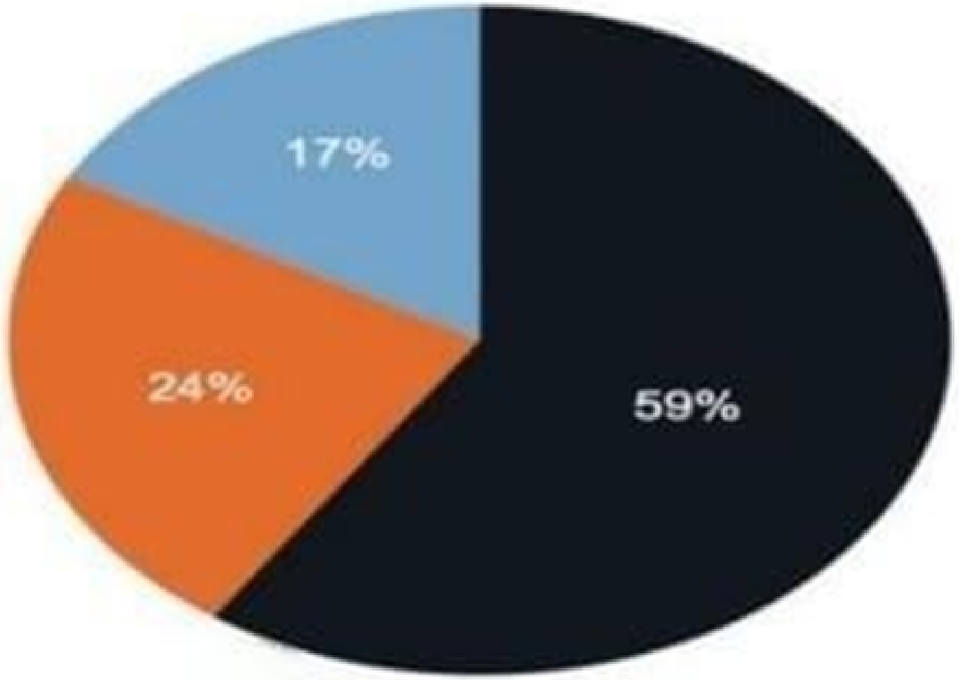
This project focuses on developing an intelligent healthcare chatbot. By leveraging artificial intelligence and natural language processing, the chatbot interacts with users to analyze their reported symptoms and identify possible diseases.is.

It provides instant medical guidance and tailored advice, especially useful in areas with limited healthcare services or outside regular clinic hours. The chatbot serves as an accessible and efficient tool to enhance health awareness, support early diagnosis, and improve overall public health.

# Background and Motivation

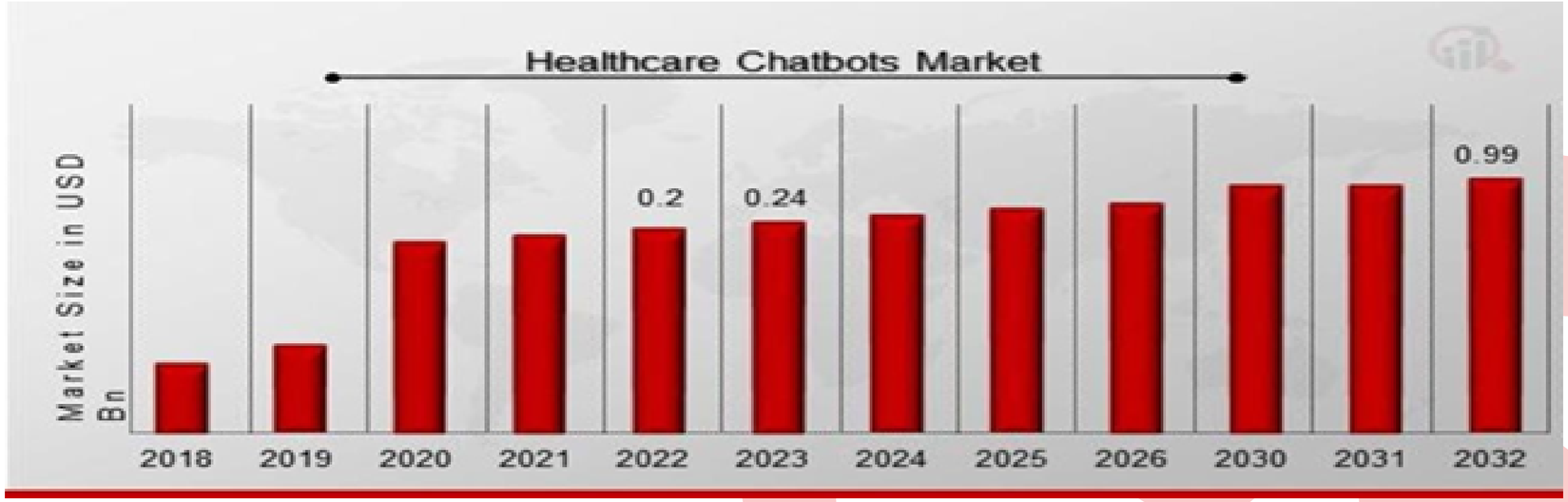
Over the past decade, global healthcare systems have faced growing challenges due to increasing patient loads, limited resources, and unequal access to medical services—especially in remote areas where timely consultations are often unavailable. Advances in artificial intelligence, particularly in machine learning and natural language processing (NLP), have made it possible to analyze medical data and simulate diagnostic reasoning. These developments inspired our team to explore how AI can serve as a reliable, automated first point of contact to bridge the healthcare accessibility gap.

Our motivation stems from the rising trust in AI tools and the urgent digital health solutions—an area still largely underserved. Key goals include providing 24/7 access to healthcare advice, empowering users with health education, promoting early detection through symptom monitoring, and supporting healthcare professionals by managing simple inquiries digitally. Notably, the healthcare chatbot market was valued at USD 0.2 billion in 2022, highlighting the growing relevance of this technology.




The chart indicates that 59% of the population supportsAI's role in human assistance, while 24% lack knowledge about AI's functions and 17% are clueless.

# Statistics



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# Problem Statement

If the patient delays finding out about the disease he has, regardless of the reasons for his delay, and does not take the necessary precautions as soon as possible, his health condition will worsen before he is able to go to the doctor.

01 The user enters linguistic words that do not affect the understanding of symptoms, which leads to an incorrect classification of the disease.

02 Possible inaccurate classification of diseases and this may put the patient's life at risk.

03 Patients want a Suitable and Interactive GUI to easily deal with chatbot.

04 The patient does not have enough knowledge of the necessary precautions and which hospitals are closest to the patient’s location.

# OBJECTIVE

To develop an AI-powered healthcare chatbot that analyzes user-reported symptoms, provides instant medical guidance, and improves accessibility to basic healthcare servicesespecially in underserved or remote areas—while supporting early detection and empowering users with health awareness.

# solve problem

1- In order to understand the description of the patient's symptoms,

2- In order to correctly diagnose the disease and achieve the best possible accuracy from the ML model, we applied hyperparameter tuning using Grid Search method on Different ML models.

3- Comprehensive Medical Dictionary: The chatbot includes a built-in medical dictionary that not only provides the predicted disease but also offers relevant information such as treatment options and recommended lifestyle habits.

4- Provide patients with some precautions and a Google Map to guide them to the closest hospitals to their location.

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# limitations

**Low accessibility** in remote or underserved areas where medical consultation is limited.

**Limited adaptability**: Many current chatbots are rule-based and do not incorporate advanced ML models for disease classification.

Difficulty in understanding which treatment steps to follow based on their symptoms

**Limited access to immediate medical advice.**

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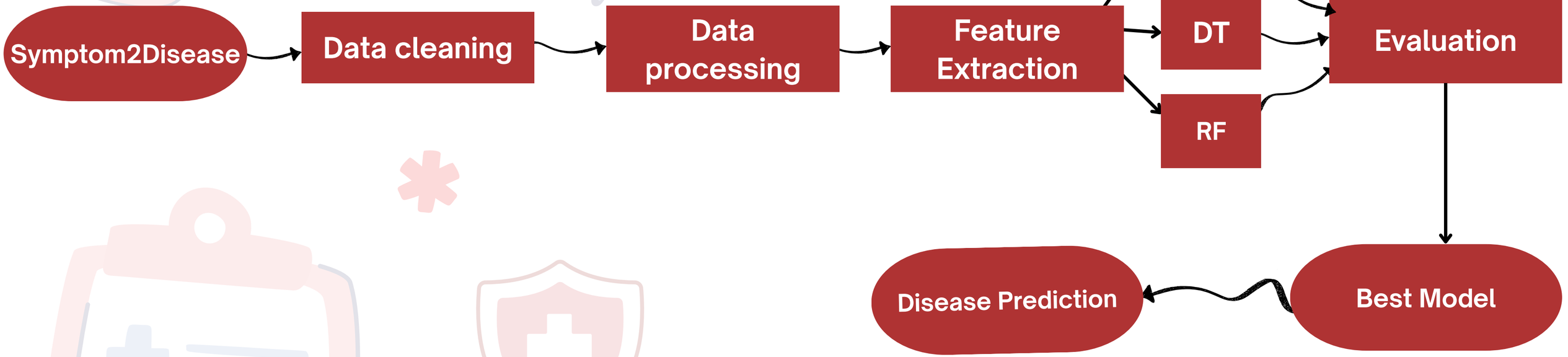
Symptom2Disease
Data cleaning
Data processing
Feature Extraction
SVM
DT
RF
Evaluation
Best Model
Disease Prediction

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# METHODOLOGY

## Symptom2Disease

### DESCRIPTION

THE SYMPTOM2DISEASE DATASET IS A COLLECTION OF DISEASES AND EACH DISEASE HAS DIFFERENT SYMPTOMS.

| | |
|---|---|
| Disease | 24 |
| Sympotoms | 1153 |

### DATASET SIZE

- ROWS : **1200**
- COLUMNS : **2**

### CONTAINS TWO COLUMNS :

- LABLE
- TEXT

| lable | Text |
|---|---|
| Common Cold | My eyes are usually red and runny and my nose is always stuffy. |
| Acne | My skin has developed a terrible rash It has a lot of blackheads and pus-filled pimples. |
| GERD | I often vomit whatever I eat and I have a nagging pain in my upper abdomen |

# PROPOSED APPROACH

**Our healthcare chatbot development followed a systematic approach that combined data preparation, machine learning model development, back-end API building, and mobile app integration. The steps were as follows:**

## DATA PREPARATION

- USED THE SYMPTOM2DISEASE DATASET (INITIALLY **1,200** ENTRIES) AND EXPANDED IT TO **3,600** USING DATA AUGMENTATION (QUILLBOT PARAPHRASING).
- APPLIED DATA CLEANING, DUPLICATE REMOVAL, AND ENSURED SEMANTIC CONSISTENCY.

## NLP PREPROCESSING

- APPLIED LOWERCASING, PUNCTUATION/STOPWORD REMOVAL, TOKENIZATION (NLTK), AND LEMMATIZATION.
- CONVERTED TEXT INTO TF-IDF VECTORS USING TFIDFVECTORIZER.

## MODEL TRAINING & EVALUATION

- TRAINED 3 MODELS: DECISION TREE, RANDOM FOREST, SVM (BEST: 97%), .
- USED GRIDSEARCHCV FOR HYPERPARAMETER TUNING.
- EVALUATED USING ACCURACY, CONFUSION MATRIX, AND CLASSIFICATION REPORT.

# PROPOSED APPROACH

## MODEL DEPLOYMENT (FLASK API)

- DEVELOPED /PREDICT ENDPOINT.
- RETURNED DISEASE PREDICTION AND CONFIDENCE SCORE.

## MOBILE APP (FLUTTER)

- BUILT WITH SUPPORT FOR ENGLISH, TEXT/VOICE INPUT, DISEASE DISPLAY,LIFESTYLE,RECOMMENDED SPECIALIST AND MEDICATIONS.
- IT ALSO INCLUDES A MEDICAL DICTIONARY SHOWING:DESCRIPTION, SYMPTOMS, CAUSES, DIAGNOSIS, MEDICATIONS, TREATMENT DURATION, PREVENTION, COMPLICATIONS, AND IMAGE REFERENCES.
- INTEGRATED GOOGLE MAPS FOR HOSPITAL AND PHARMACY LOCATIONS .

# Tools and Technologies

PYTHON

FLUTTER

**DART**

FLASK

Git, GitHub

# Machine Learning

**SUPPORT VECTOR MACHINE(SVM)**

**RANDOM FOREST (RF)**

**DECISION TREE**

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# Best Model

# Model Evaluation

Support Vector Machine (SVM) with 97% accuracy

Precision: Accuracy of positive predictions 98%

Recall : Coverage of actual positives 98%

F1-score: Harmonic mean of precision and recal 98%

# TESTING

## Unit Testing

Each function (e.g., text preprocessing, TF-IDF vectorization, prediction) was tested individually, including handling of edge cases like empty or invalid inputs.

## Integration Testing

The communication between the Flutter app and Flask backend was tested to ensure proper API interaction.

## User Testing

Real users tested the mobile app by submitting symptoms via text/voice, switching languages, and viewing predictions and hospital, pharmacy locations. Feedback was used to enhance user experience.

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# Results

## Symptom2Disease

| | SVM | DT | RF |
|---|---|---|---|
| Accuracy | 97% | 76% | 95% |
| Precision | 98% | 82% | 96% |
| Recall | 98% | 76% | 96% |
| F1-score | 98% | 77% | 96% |

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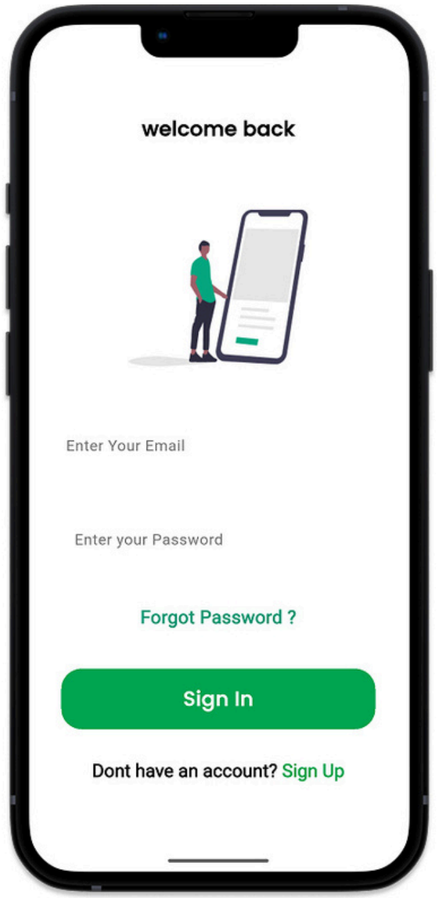
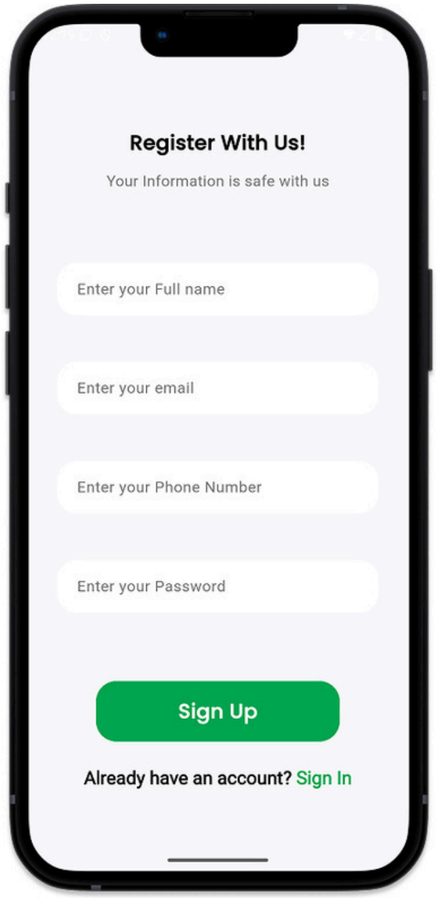
# Application

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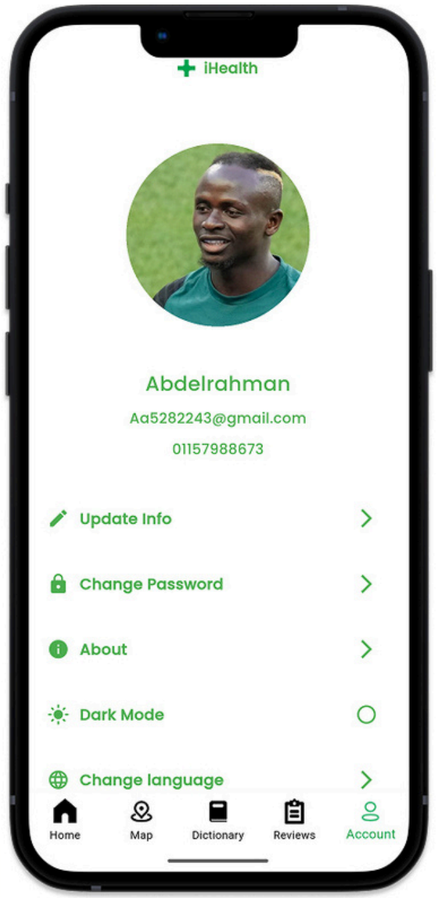


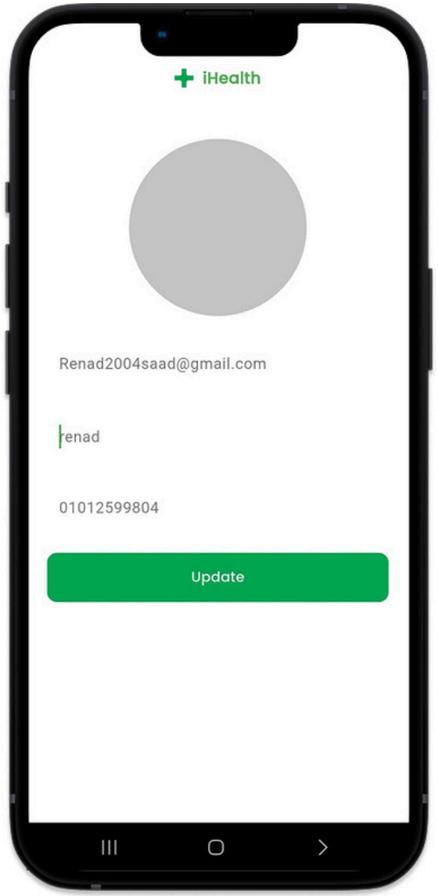


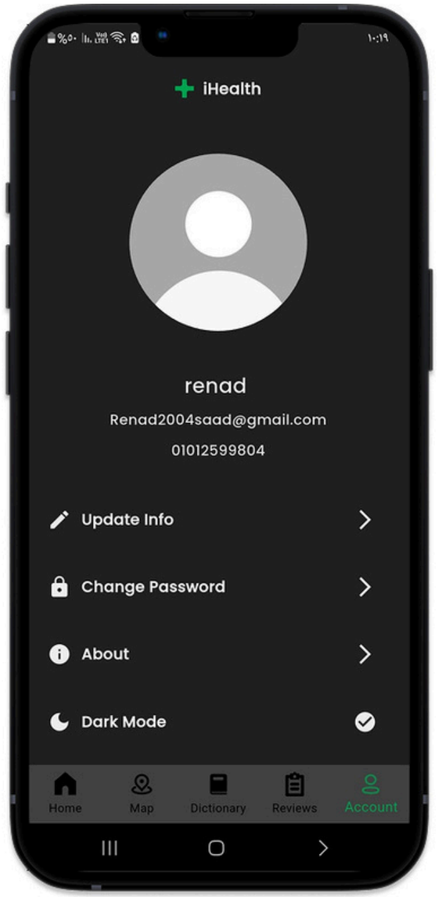


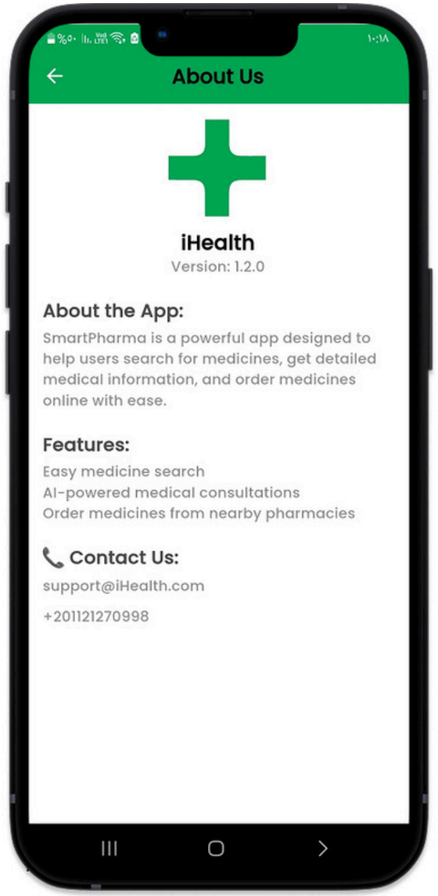


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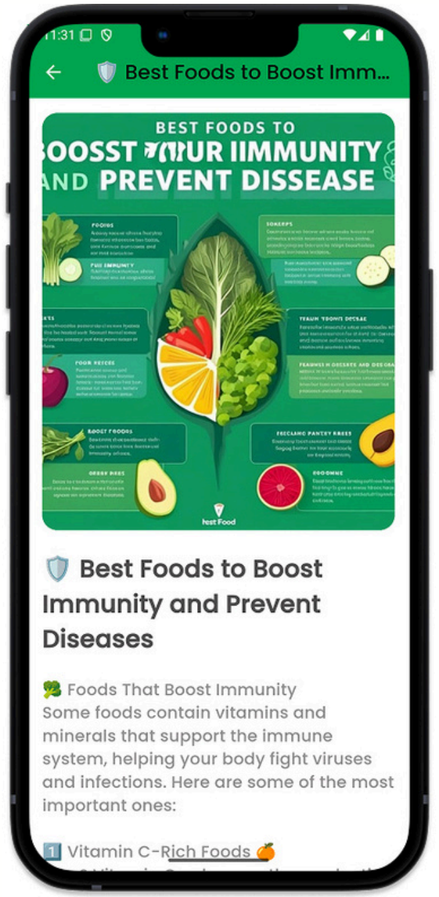
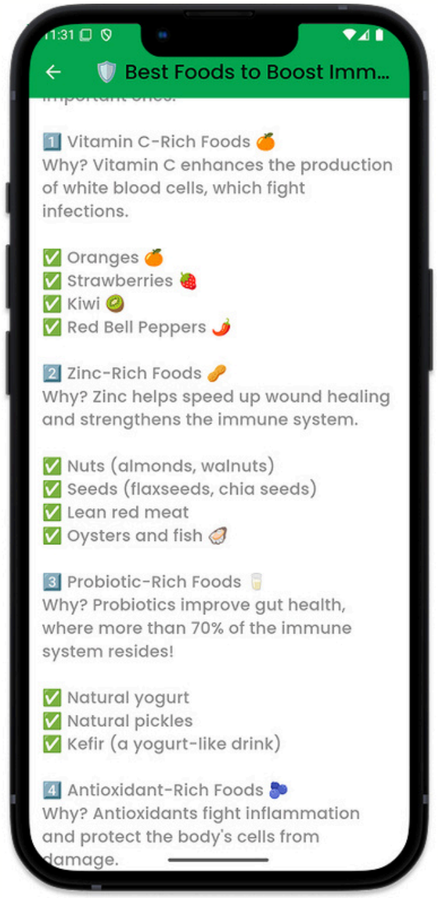
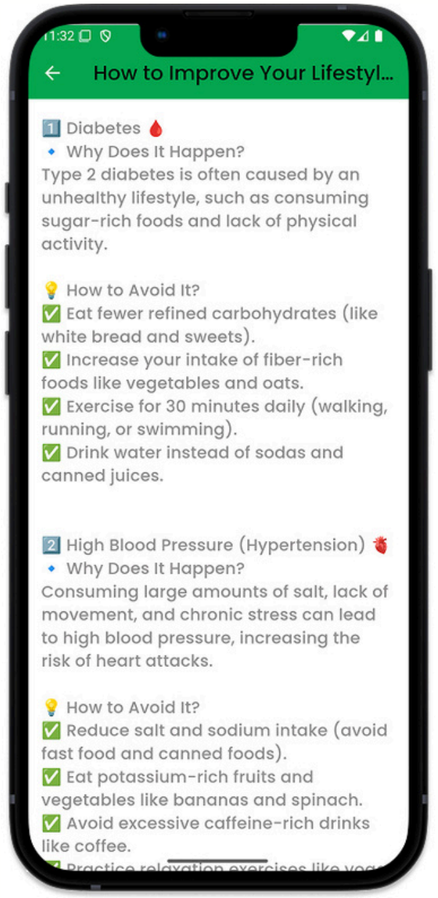
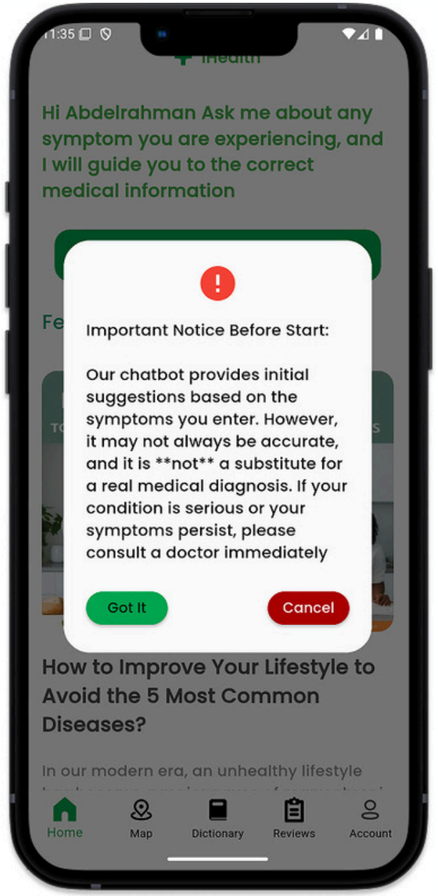


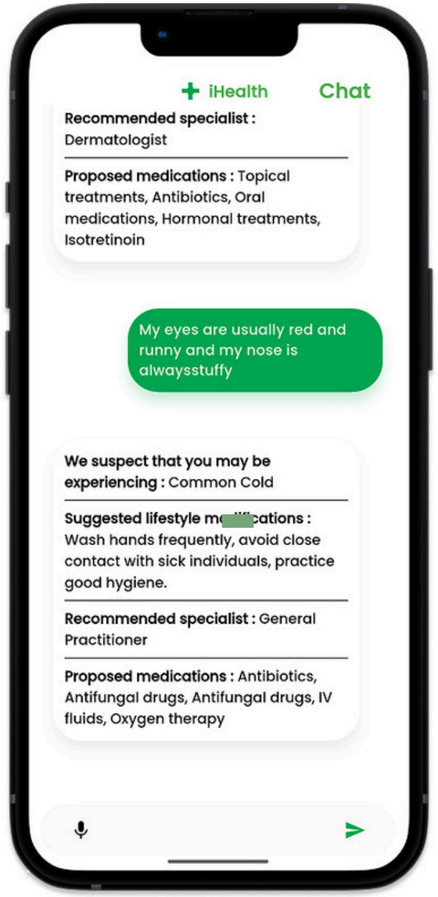



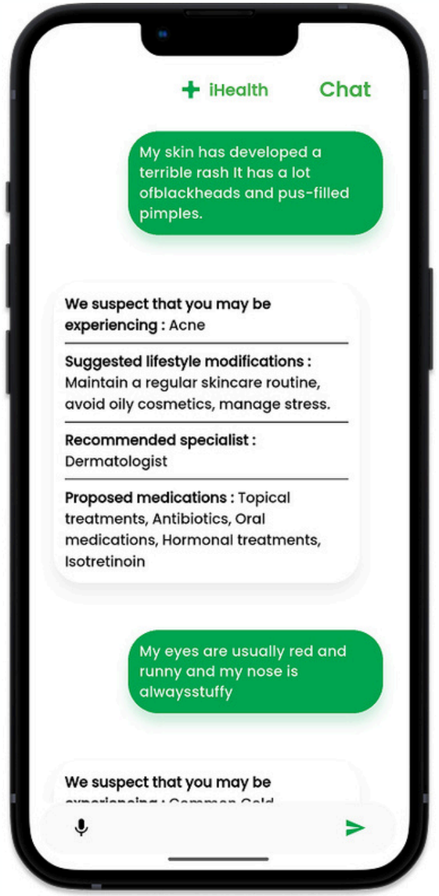




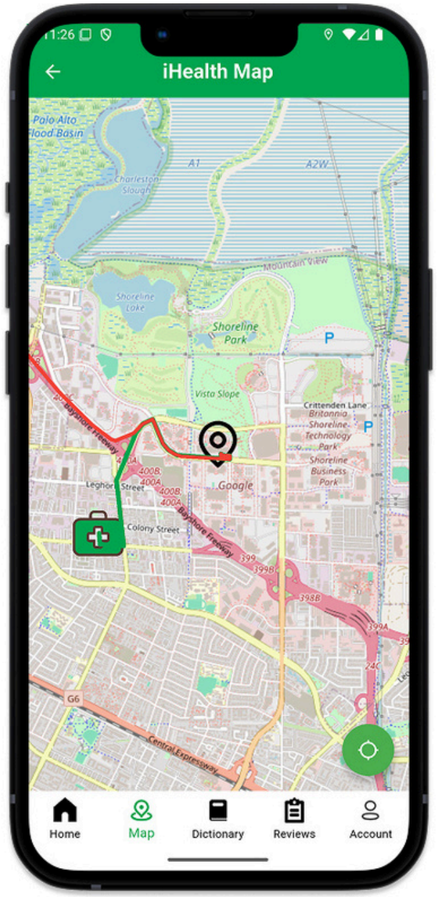
# Chatbot

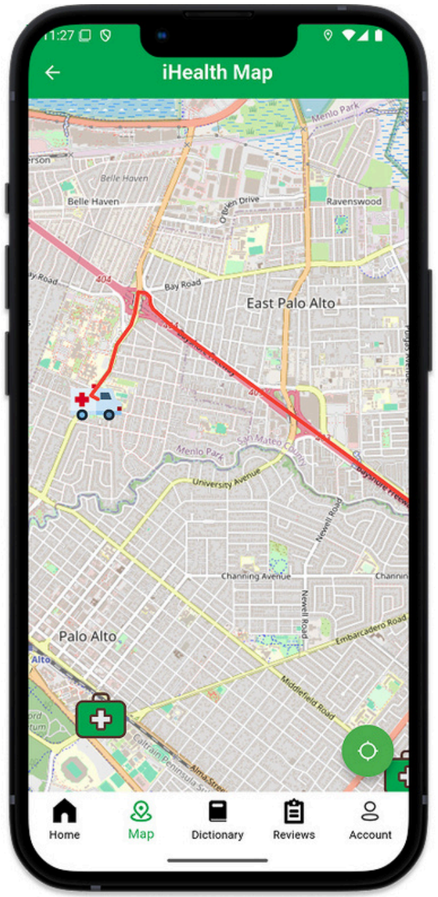

Hi Abdelrahman Ask me about any symptom you are experiencing, and I will guide you to the correct medical information
Important Notice Before Start:
Our chatbot provides initial suggestions based on the symptoms you enter. However, it may not always be accurate, and it is **not** a substitute for a real medical diagnosis. If your condition is serious or your symptoms persist, please consult a doctor immediately
Got It
Cancel
How to Improve Your Lifestyle to Avoid the 5 Most Common Diseases?
In our modern era, an unhealthy lifestyle
Home
Map
Dictionary
Reviews
Account

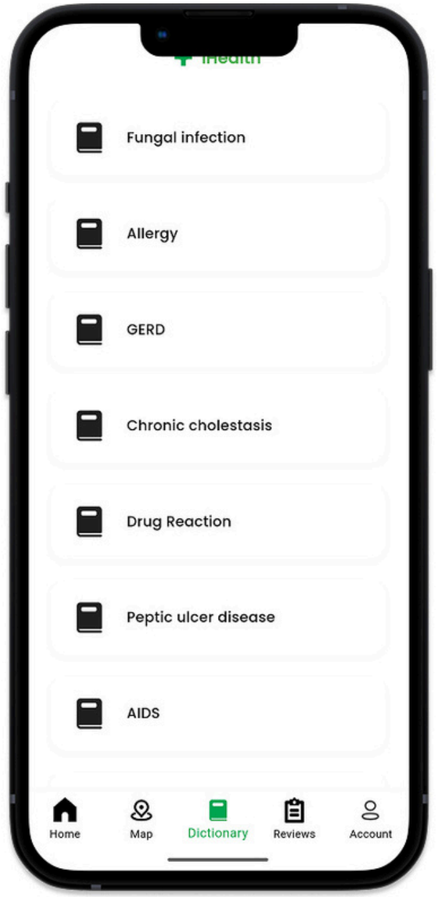

iHealth
Chat
Recommended specialist : Dermatologist
Proposed medications : Topical treatments, Antibiotics, Oral medications, Hormonal treatments, Isotretinoin
My eyes are usually red and runny and my nose is alwaysstuffy
We suspect that you may be experiencing : Common Cold
Suggested lifestyle modifications : Wash hands frequently, avoid close contact with sick individuals, practice good hygiene.
Recommended specialist : General Practitioner
Proposed medications : Antibiotics, Antifungal drugs, Antifungal drugs, IV fluids, Oxygen therapy

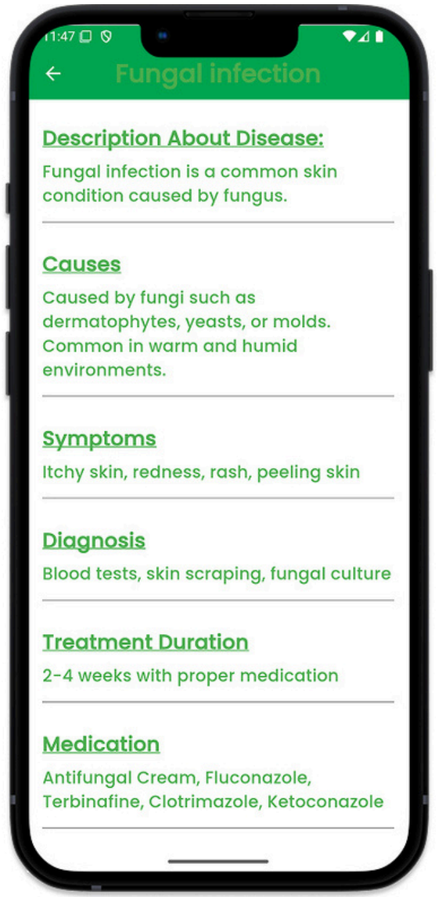

iHealth
Chat
My skin has developed a terrible rash It has a lot ofblackheads and pus-filled pimples.
We suspect that you may be experiencing : Acne
Suggested lifestyle modifications : Maintain a regular skincare routine, avoid oily cosmetics, manage stress.
Recommended specialist : Dermatologist
Proposed medications : Topical treatments, Antibiotics, Oral medications, Hormonal treatments, Isotretinoin
My eyes are usually red and runny and my nose is alwaysstuffy
We suspect that you may be

# Application



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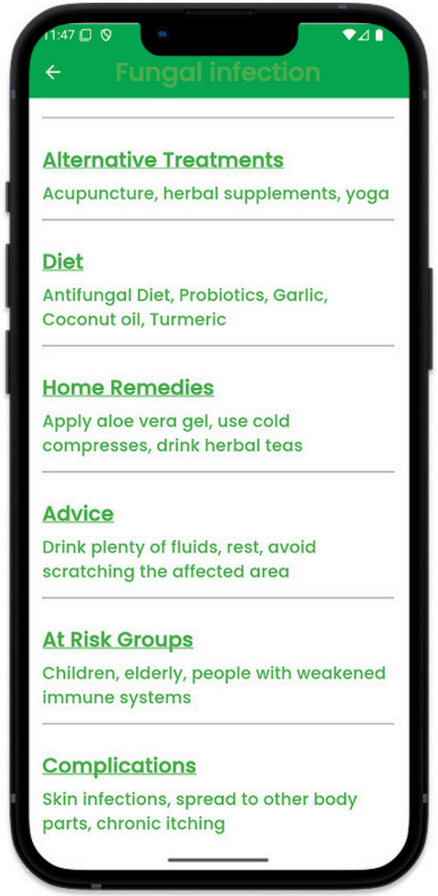


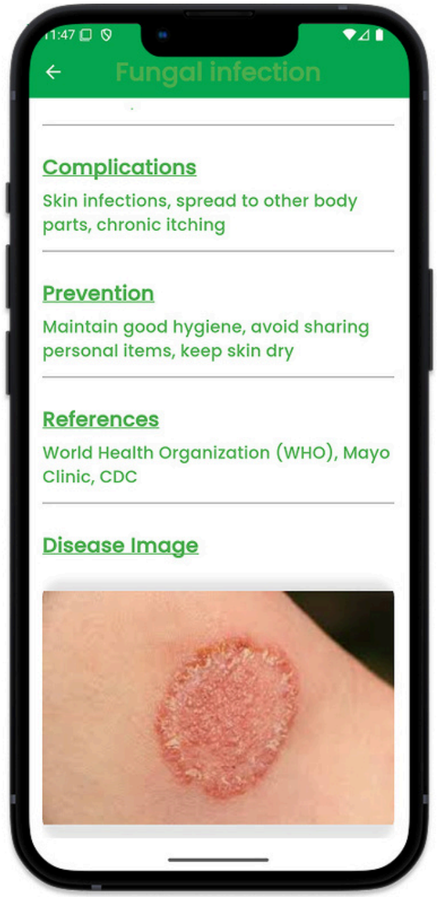


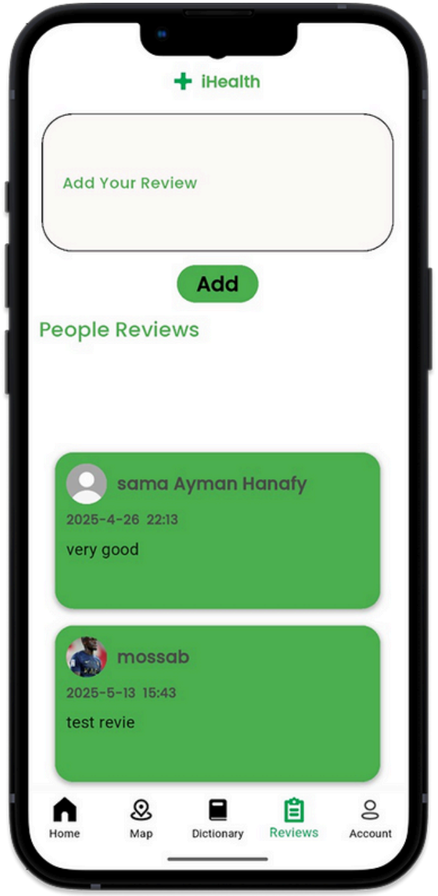

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# Future work

In the future, we will search for more Datasets in order to collect different and larger number of observations and utilize advanced Deep learning techniques to help us effectively in the natural language processing part to make chatbot even more interactive with the patient.

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# REFERENCES

- Papers


[1] SMITH, J., & LEE, A. (2024). MULTILINGUAL HEALTHCARE CHATBOT USING MACHINE LEARNING. JOURNAL OF MEDICAL INFORMATICS, 12(3), 145-162. HTTPS://SCHOLAR.GOOGLE.COM/SCHOLAR?HL=EN&AS_SDT=0%2C5&Q=MULTILINGUAL+HEALTHCARE+CHATBOT+USING+MACHINE+LEARNING&BTNG=

[2] DEVI, R. R., BANERJEE, H., & SAHA, B. (2022). HEALTHCARE CHATBOT USING DECISION TREE ALGORITHM. INTERNATIONAL JOURNAL OF INNOVATIVE SCIENCE AND RESEARCH TECHNOLOGY, 7(10). HTTPS://DOI.ORG/10.5281/ZENODO.7315590

[3] ATHULYA N, JEESHNA K, AADITHYAN SJ, SREELAKSHMI U, & ROSE HN. (2021). HEALTHCARE CHATBOT. INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT), 9(4), 194-202. AVAILABLE AT: HTTPS://IJCRT.ORG/PAPERS/IJCRTH020011.PDF

## Dataset

[4] Symptom2Disease Dataset
https://www.kaggle.com/datasets/niyarrbarman/symptom2disease

## Selected book for ML & NLP

[5] Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. (2nd ed.). Geron Aurelien. (2019). O'Reilly Media, Inc.

## Dart & Flutter

[6] Dart docs https://dart.dev/guides

[7] Flutter docs https://docs.flutter.dev/

## Selected book for Flutter

[8] Hands-On Flutter with Frank Zammetti, in 2019. The printing house is Apress Media, LLC.

HEALTH

# THANK YOU FOR YOUR ATTENTION

- Hospitals and Clinics
- Healthcare Professionals
- Medications and Treatments
- Preventive Care