Empowering Hair Health with Intelligent Hair Disease Detection System.

2023-154

Final Project Thesis

Bandaranayake V.R.W – IT20232290

BSc (Hons) Degree in Information Technology (specialization in information Technology)

Department of Information Technology

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Supervisor: Ms. Lokesha Weerasinghe

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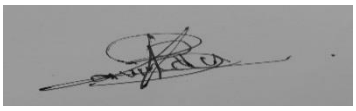
DECLARATION

I declare that this is my own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
Bandaranayake V.R.W	IT20232290	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

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Signature of the Supervisor Date

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Signature of the Co-Supervisor Date

ACKNOWLEDGEMENT

We would like to thank our distinguished supervisor, Ms.Lokesha Weerasinghe, for her continuous support and advice during this study project. Their helpful views and criticism have helped shape our study and refine our methods. We are also appreciative to Ms.Thamali Dassanayake, our co-supervisor, for their substantial efforts and assistance during this process.

We'd like to thank the members of our CDAP panel for their insightful comments, constructive criticism, and helpful input. Their advice and skills were critical in increasing the quality of this proposal.

Finally, we would like to thank our colleagues and research participants for their significant efforts, without which this study would not have been feasible. We are grateful to our family and loved ones for their understanding and encouragement. Thank you very much for your important contributions.

ABSTRACT

The application of machine learning and IoT technology to improve hair health and illness management is proposed in this research. The suggested system would utilize sensors to monitor hair scratching and loss, natural language processing to assess patient complaints, and machine learning algorithms to provide treatment alternatives. The system intends to enhance patient outcomes and encourage early diagnosis and prevention of hair health concerns by adding tailored, data-driven advice. This study discusses how machine learning and IoT technology have the potential to change the field of hair health and illness management.

Regarding my contribution, I developed a method for predicting hair illnesses based on patient history and symptom-based predictive modeling. The suggested system would examine patient data, including medical history and symptoms, using machine learning algorithms to forecast future hair illnesses. This system's purpose is to give early identification and treatment of hair illnesses, thereby improving patient outcomes. This method has the potential to revolutionize the field of hair health and illness management by using the power of machine learning.

Keywords: - Machine Learning, Neural Network, Mobile Application, IOT, Alopecia, dandruff

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LIST OF ABBREVIATIONS

Abbreviation	Description
ML	Machine Learning
NLP	Natural Language Processing
NN	Neural Network
DL	Deep Learning
ES	Experts Systems
UX	User Experiences
API	Application Programming Interface
IOT	Internet of Things
OCR	Optical Character Recognition

1 INTRODUCTION

1.1 Background

With the advent of the Internet of Things (IoT) and wearable gadgets, the sector of healthcare is witnessing a technological revolution. These gadgets are outfitted with sensors that gather data and allow for continuous monitoring of numerous health markers. The use of IoT-enabled wearable devices for illness diagnosis and management has received a lot of interest in recent years. One use for such devices is in the categorization of hair disorders. Hair illnesses are a significant public health problem, and early detection can help avoid hair loss and other consequences. This study presents a unique strategy that uses powerful machine learning algorithms to gather data from IoT-enabled wearable devices like hair caps or bands, evaluate the data using image processing techniques, and detect any possible indicators of hair illness. Via a smartphone app, the system will warn the user of any potential health risks.

The suggested system would collect data on blood pressure, stress levels, and other pertinent characteristics that may impact hair health in addition to monitoring hair health. The system will evaluate the provided data using machine learning techniques and deliver individualized therapy suggestions to the user. To comprehend and process user input, Natural Language Processing (NLP) technologies like as NLTK or spaCy will be utilized, and a chatbot will be deployed to communicate with users and gather information about their symptoms. The technology will then assess user data and make individualized therapy suggestions using deep learning neural networks.

Figure 1 - Choose Hair diseases for our research.

Data linked to the history of illness symptoms as well as future symptoms will be gathered and processed into the system to train the machine learning models. Based on the patient's input and preferences, the system will utilize this data to recommend relevant drugs. In addition, suitable medical expert data for each disease will be collected, and a machine learning model will be created and integrated into the system.

Overall, the proposed system seeks to provide a comprehensive solution for the categorization, diagnosis, and treatment of hair illnesses through the use of Internet of Things-enabled wearable sensors, machine learning algorithms, and natural language processing techniques.

1.2 Literature Survey

Hair illnesses affect people of all ages and genders and have a significant negative influence on their quality of life. Early detection and diagnosis are critical for successfully stopping the course of hair illnesses and managing their symptoms. Several research have looked at the use of cutting-edge machine learning and image processing techniques to construct intelligent hair illness detection systems capable of identifying a wide range of hair problems effectively and non-invasively.

1.2.1 Head Lice

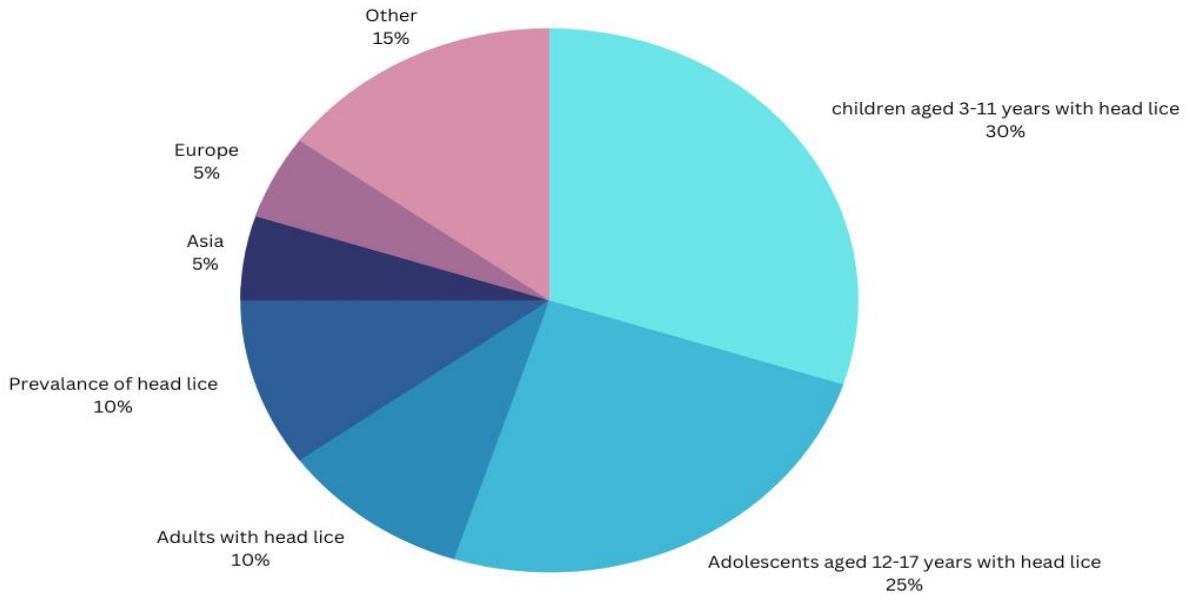


Figure 2 - Head Lice

Head lice infestations are a common problem, especially among children. Although head lice are not dangerous, they can be itchy and irritating, and removing them can be a time-consuming and tedious process. In recent years, there has been increased interest in the use of technology to diagnose and cure head lice infestations. This review of the literature aims to analyze the current status of head lice research, with a focus on technology options for detection and treatment.

1.2.2 Hair Losing

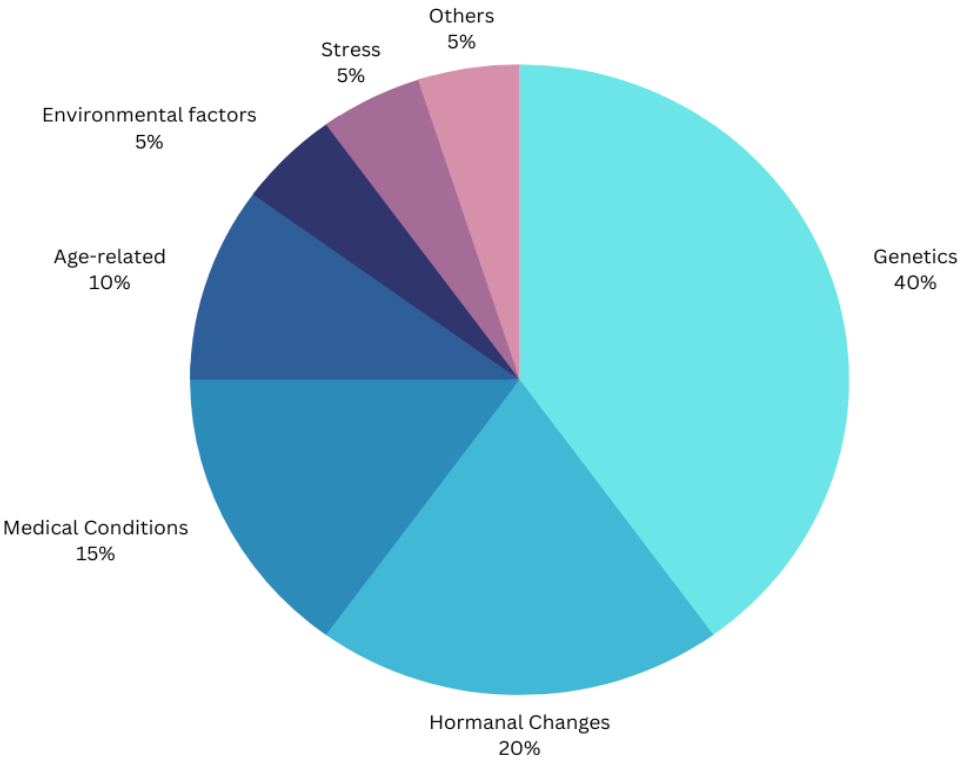


Figure 3 - Hair Losing

Alopecia, or hair loss, is a disease that both men and women face on a regular basis. Among the causes include genetics, age, hormonal changes, health issues, and environmental factors. Although hair loss is not a serious health problem, it can have a negative impact on one's quality of life and self-esteem. This literature review examines the current status of research on hair loss, with an emphasis on its causes and remedies.

1.3 Research Gap

With the evolution of mobile technology, more and more solutions are being offered to improve the smart systems used in hair care. This method involves several steps in predicting hair diseases and prescribing the doctor by creating predictive models based on the patient's history and symptoms.

Here the first characteristic of the patient's symptoms is asked. Then the symptoms are asked step by step. User-friendly chatbot technology is used to query these steps. After that, the patient is shown which disease he has through the mobile app. And the symptoms that the patient will face in the future of this disease are also shown. It is not even possible to find out if there is a mobile app using chatbot technology to identify what is the hair disease and what are its future symptoms through these hair symptoms. Therefore, this section can be considered as a new section.

Another part of this is that the doctors related to that disease and even the locations of those doctors are done through this mobile app. This can also be used as a new part. Because you cannot find a single mobile app that has all these parts. Algorithm model is included in the system to do all these things.

Belonging to this section,

- Diagnosing hair disease based on symptoms by a chatbot.
- Show possible future symptoms of that hair disease.
- Show the doctors related to hair disease.
- Show the locations of those doctors through google map.

It is not possible to find a single mobile app that has all the components compared above. Therefore, this can be considered as a single mobile app that has all these parts. Therefore, all parts here can be considered as new parts.

1.4 Research Problem

Hair diseases are common health problems that affect the hair and scalp. These range from benign disorders such as dandruff to more serious ones such as alopecia areata, which causes hair loss. Because of these things, people are afraid to even face society. Hair diseases are more common in girls. Also, when losing hair, boys are cut off completely.

The problem that the topic of predicting hair diseases through patient history and symptom-based predictive modeling and recommending doctors seeks to address is the difficulty in accurately diagnosing and treating hair-related disorders. Genetics, hormonal imbalances, infections, autoimmune illnesses, and dietary inadequacies are all potential causes of hair problems. These disorders' symptoms can also vary greatly, making it difficult for healthcare providers to appropriately diagnose the problem and give appropriate therapy. And also, it can take a lot of money and time to find out what the symptoms of each disease are. Some symptoms are not what people think they are. Therefore, many people today suffer from hair diseases. Despite various diagnostic tools, many hair problems are left untreated or misdiagnosed, resulting in ineffective therapy and frustration among patients. This underscores the need for more reliable and efficient hair diagnostic methods.

Also, there is no proper understanding of the problems or symptoms that a patient will face in the future. For these reasons, it is very difficult for patients to protect themselves from hair diseases.

Also, there are different doctors for these hair diseases and each doctor does not know about every disease. Therefore, patients do not have proper understanding about which doctor they should meet for this disease. Therefore, this is also a big problem that patients face.

This system will provide answers to all the questions such as identifying the disease according to the symptoms of the disease, what condition the disease may reach in the future, who are the suitable doctors for those hair diseases, and where those doctors are located.

2 OBJECTIVES

2.1 Main Objective

The main objective of the topic "Patient history and symptom-based predictive modeling and physician prescribing" is to develop an accurate and efficient approach to diagnose hair and scalp disorders using patient data and machine learning algorithms. The aim is to predict the likelihood of hair disease based on the patient's medical history, symptoms and demographic information. Also, the purpose of this is to show the future condition of the disease. It will also show the doctors who treat the disease and the locations of those doctors and show the most suitable measures for hair diseases.

2.2 Sub Objective

2.2.1 Predicting Hair Diseases through Patient History and Symptom Based Predictive Modeling.

The goal of forecasting hair illnesses and selecting doctors based on patient history and symptom-based predictive modeling is to give a more accurate and efficient diagnosis and treatment plan for patients suffering from hair disorders. Hair illnesses are frequent ailments that can have a negative impact on a person's self-esteem and general health. Yet, because there are so many different types of hair illnesses, each with its own set of symptoms and reasons, identifying and treating these conditions can be difficult.

To overcome these issues, the suggested method employs new technologies such as deep learning and machine learning to build prediction models capable of correctly identifying the sort of hair disorder a patient may be suffering from based on their symptoms and medical history. The system also suggests specialists that specialize in treating certain types of hair problems, ensuring that patients receive the best and most effective therapy for their issue.

One of the system's primary goals is to increase the accuracy and efficiency of identifying hair problems. Conventional hair condition diagnostic procedures frequently rely on physical examinations and visual inspections of the scalp, which can be time-consuming and may not always offer an appropriate diagnosis. In contrast, the suggested approach analyzes patient symptoms and medical history using powerful machine learning algorithms, resulting in a more accurate and trustworthy diagnosis in less time.

In addition, the technology intends to improve the entire patient experience by offering a user-friendly interface and a chatbot that leads patients through the symptom collecting process. This not only expedites the collection of symptoms, but also guarantees that patients are more comfortable disclosing their symptoms and medical history.

Furthermore, the method intends to enhance access to hair disease diagnosis and treatment by recommending doctors who are close to the patient. The technology uses Google Maps to display the locations of suggested doctors, allowing patients to choose a doctor who can diagnose and treat their problem.

This system's overall goal is to increase the accuracy, efficiency, and accessibility of identifying and treating hair problems. The system can give patients with a more accurate diagnosis and individualized treatment plan by leveraging sophisticated technologies such as deep learning and machine learning, hence enhancing their overall quality of life.

3 METHODOLOGY

This research project will take a methodical approach to its major goal of building an intelligent hair illness detection system. The definition of the research topic and the development of a study design that includes data collection techniques, data sources, and sample processes are the first steps in research methodology. A survey of hair care routines and behaviors, as well as a research of existing hair illness detection technologies, were used to obtain data.

3.1 STEPS

3.1.1 Data Collection:

There are various phases involved in gathering information for a predictive modeling system to forecast hair diseases and suggest doctors based on patient history and symptoms.

3.1.1.1 Define Data Requirements:

Choose the precise data properties and variables your prediction model will require. Patient demographics, medical history, symptoms, information about the clinician, and results are just a few examples.

3.1.1.2 Patient Data:

Information should be collected about the patient's age, gender, medical history and any previous problems with their hair. This can be found by looking at patient files or asking patients directly when collecting symptoms.

3.1.1.3 Symptom Data:

A systematic method should be developed to collect patient symptom information. Include notes on the nature and severity of symptoms, when they first appeared, and other relevant information.

3.1.1.4 Data Privacy and Security:

Need to ensure that you protect patient data protection requirements and data privacy laws. Security measures such as access restrictions, encryption and consent processes should be implemented.

3.1.1.5 Data Cleaning and Preprocessing:

To eliminate anomalies, missing numbers and inconsistencies, preprocess the collected data. This process is essential for creating reliable predictive models.

3.1.2 Data Analysis:

Data analysis is a key next step once the data has been gathered and processed for our predictive modeling system.

3.1.2.1 Data Exploration:

We first start a thorough investigation of the dataset. The statistical summary, visualization, and comprehension of the distribution of data characteristics are all part of this step. In doing so, we better understand the features of the dataset.

3.1.2.2 Exploratory Data Analysis (EDA):

To find correlations, trends, and linkages in the data, EDA uses statistical tests and visualizations. This can aid in our comprehension of the numerous influences that lead to the emergence of hair diseases.

3.1.3 Chatbot Development:

The chatbot, an integral part of our system's user interface, is crucial in assisting patients as they complete the symptom collecting procedure.

3.1.3.1 Defining Chatbot Objectives:

We establish the goals and capabilities of the chatbot before we begin development. These aims should be in line with the objectives of our system, which include effective symptom collecting and a user-friendly interface.

3.1.3.2 Selecting a Chatbot Framework:

We select an appropriate framework or platform for chatbot development. Depending on the needs of the project, popular choices include Microsoft Bot Framework, Dialogflow, Rasa, OpenAI, or developing a unique solution.

3.1.3.3 Designing the Conversation Flow:

We plan the conversation flow so that the chatbot may gather patient symptoms in an efficient manner. In order to collect pertinent information, this entails structuring a conversation with precise suggestions and questions.

3.1.3.4 Natural Language Processing (NLP):

NLP techniques are implemented to enable chatbots to understand and interpret patients' natural language responses. NLP allows for more flexible and human-like interactions.

3.1.3.5 Symptom Collection Process:

The chatbot interacts with patients to collect detailed information about their symptoms. This may involve asking questions about the severity of symptoms, as well as any relevant medical history.

3.1.4 Referral from a Doctor System Development:

Relevant medical expert data for each condition is gathered, and a machine learning model is trained to identify doctors for each disease. Based on the patient's location and medical history, the system should be able to propose doctors.

3.1.5 Google Maps Integration:

The locations of suggested doctors are shown on Google Maps to make it easier for users to find them.

3.2 TESTING

3.2.1 Unit Testing

Throughout the development process, each component of the proposed system will be thoroughly tested on its own. The initial element of the testing process is unit testing, which provides a mechanism for iteratively constructing and testing the system as a whole.

3.2.2 Integration Testing

Individual units will be included into the system during the second phase of development once they have passed basic testing. Throughout integration, the system will be tested to ensure that it works as expected. The technique and the results of the testing must demonstrate that the system is operationally sound. As the SRS predicted and guaranteed.

3.2.3 System Testing

When all of the various pieces have been connected, ensuring that the system delivers the desired results is an important part of the development process.

3.3 System Diagram

3.3.1 Overall System Diagram

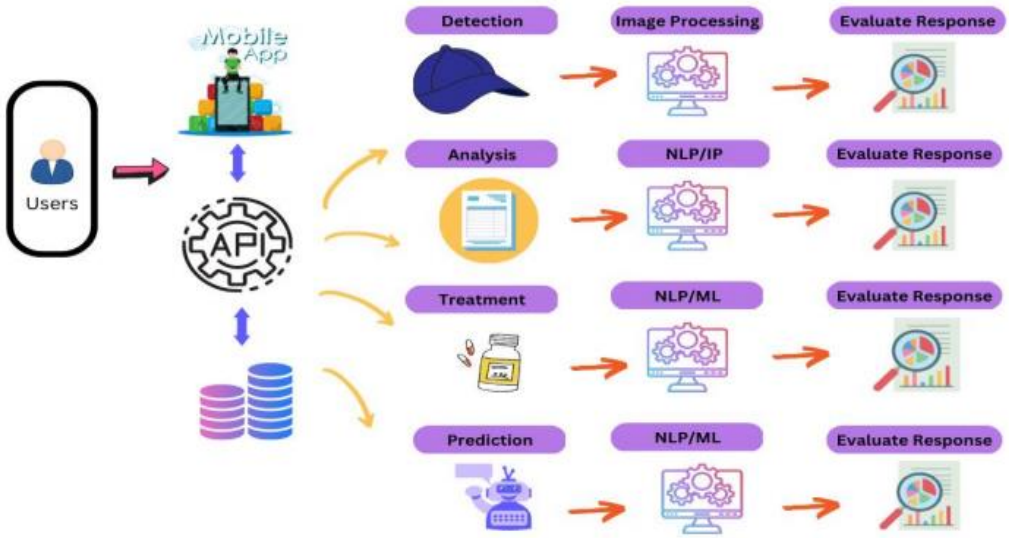


Figure 4 – Overall System Diagram

The API server and Firebase database will be linked to the proposed system. The system's functionality will be divided into four key parts that will be interconnected in order to accomplish the main goal. The system's primary features are seen in Figure 4.

- **Disease Identify using hair hat.**
- **Doctor prescription reading and generate schedules and set reminders.**
- **Treatment recommendations using patient details.**
- **Diseases predict using patient symptoms.**

The first thing that happens here is to identify the patient's symptom by using IOT technology. For this, a hair hat is used for the iot part. Also, the image of the hair is obtained and identified by the hair hat. Image processing technology will also be used for this.

The second thing that happens here is to analyze the doctor's prescription and make a schedule for the patient. Easyocr technology is used for that. Also, reminders will be sent when the patient needs to visit the doctor again.

The third thing that happens here is to get the data about the patient's age, gender, allergies and what diseases they are suffering from and suggest treatment accordingly. For this, a large amount of data has been obtained and the model has been trained through ML.

Finally, once the patient is aware of the symptoms, the symptoms can identify the disease he is suffering from. NLP technology is used for that. All these things will be done through a mobile application. Android is used for that.

3.3.2 Individual System Diagram

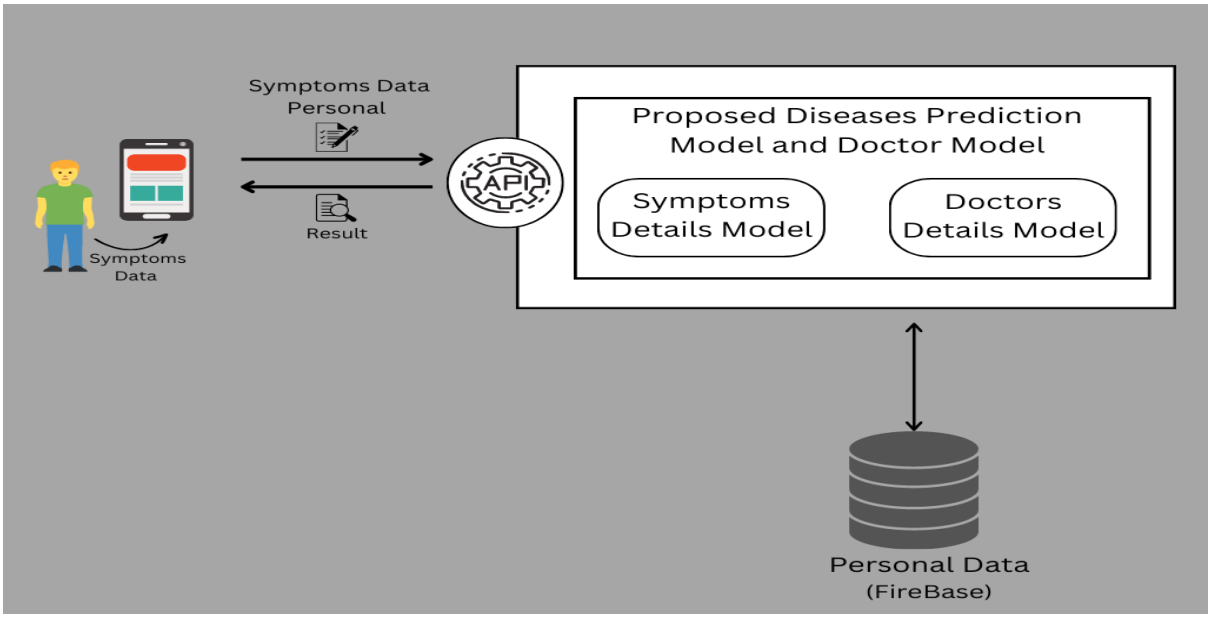


Figure 5 - methodology diagram (Individual)

This section is often used by people who are not susceptible to the disease. Data related to the history of the symptoms of the diseases and the symptoms that may occur in the future has been collected and store the vector database.

And NLP will be used for this. Because here a chatbot interacts between the patient and the system and NLP technology will be used to be able to understand any kind of message from the patient. And openAI has also been used for this.

After that, after the patient mentions the patient's symptoms, first check the database that we have and if it is possible to mention the disease, the answer will be given using the vector database. When it is not possible to answer like this, the second method, openAI, will answer using gpt technology.

3.4 SOFTWARE SOLUTION

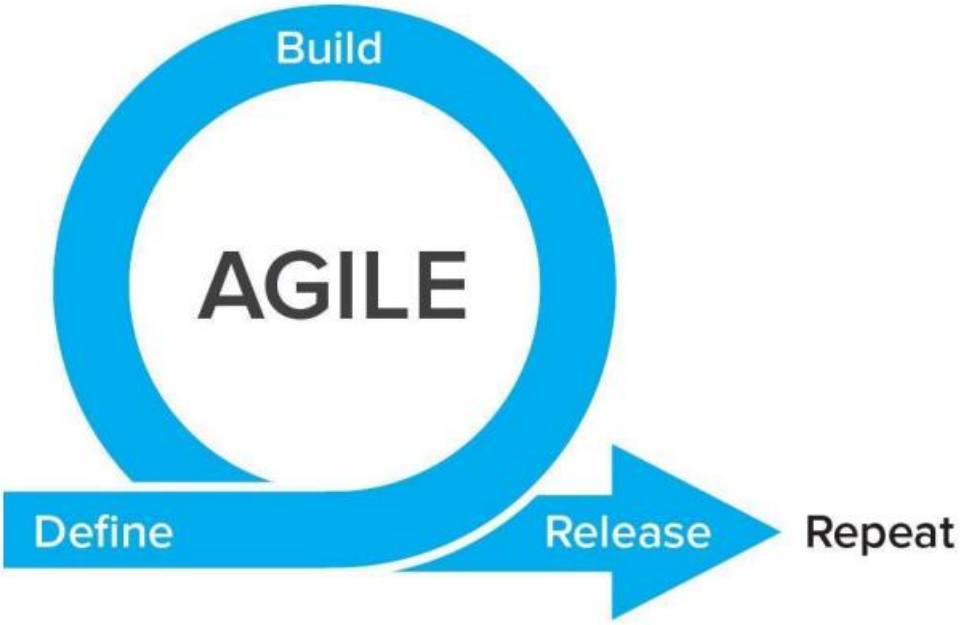


Figure 6 - Software Solution Diagram

The software solution for "Empowering Hair Health With Intelligent Hair Disease Detection Systems" is a comprehensive platform designed to address various aspects of hair health management. At its core, the system includes a collection of data that collects vital patient information such as symptoms, side effects, treatments and diseases.

The Disease Detection Module, which uses machine learning models to properly detect certain hair illnesses based on patient data, plays a crucial role. These models, which were developed using a sizable dataset, improve the system's capacity to provide accurate diagnoses.

The therapy Recommendation Module takes over after the diagnosis has been made and provides individualized therapy recommendations based on the patient's particular profile. By examining patient characteristics and previous treatment outcomes, linear regression algorithms, among other methods, assist in choosing the most appropriate treatment alternatives.

Additionally, the Symptom Prediction Module, a chatbot interface that anticipates probable symptoms and side effects, offers patients useful information, and instantly responds to their inquiries. By enhancing patient engagement and promoting informed decision-making, this interactive feature. The Prescription and Appointment Management component of the system simultaneously handles prescriptions, makes appointments, and sends reminders, ensuring that patients receive the essential treatment as soon as possible.

The software solution emphasizes data storage and security heavily, implementing effective safeguards to protect patient data and comply with healthcare data privacy laws. This guarantees the highest level of confidentiality and integrity for the storage and management of patient data.

3.5 PROJECT REQUIRMENTS

- The following methods were used for acquiring and analyzing requirements for this process:
- Meet a doctor (external supervisor) to discuss hair diseases.
- Fields visits to the hospitals, meet doctor's and collect data.
- Create google form and collect status of hair diseases in the society.
- Searches google and collect data set about diseases, symptoms and treatments.
- With the help of an external supervisor, collect the dataset.

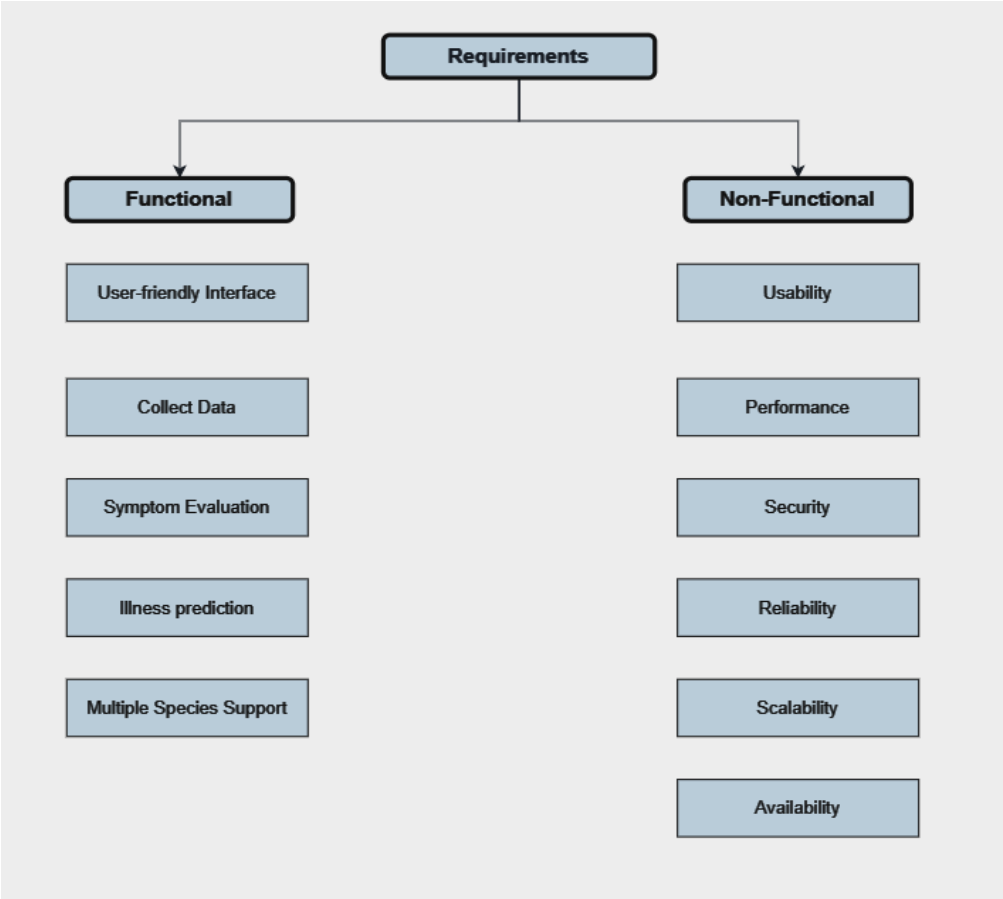


Figure 7 - Functional and Non Functional Requirements

3.5.1 Functional Requirements

- **User registration and authentication:**
  Users should be able to create an account and login to use the app's features. Users should be required to enter basic personal information throughout the registration process, such as their name, email address, and phone number.

- **Symptom evaluation:**
  The app should allow users to enter their symptoms into a chatbot-like interface, which would then ask them a series of questions about their hair and scalp health.

- **Illness prediction:**

  The app should assess the user's symptoms and provide a list of probable hair disorders that they may be suffering from using predictive modeling techniques. Users should be able to access full information about each suspected ailment, including symptoms, causes, and treatment options, via the app.

- **Doctor referral:**

  After identifying probable hair illnesses, the app should provide a list of specialists that specialize in treating those conditions. Each suggested doctor's name, qualifications, and contact information should be included in the app.

- **Location-based services:**

  The app should employ GPS technology to display users on a map the locations of suggested physicians. The app should allow users to limit search results depending on their location, and it should give directions to each doctor's office.

3.5.2 Non-Functional Requirements

- **Usability:**

  The system's interface should be user-friendly and simple to use for patients of various ages and technical skills. Patients with impairments should also be able to use it.

- **Performance:**

  The system should be able to manage enormous amounts of patient data while also providing accurate forecasts and doctor suggestions in real time.

- **Security:**

  The system should maintain patient data privacy and confidentiality. The data should be securely stored and only authorized individuals should have access to it.

- **Reliability:**

  The system should be dependable and accessible to patients 24 hours a day, seven days a week. It should have as little downtime and mistakes as possible.

- **Scalability:**
  As time passes, the system should be able to manage a growing number of patients and their data.

- **Availability:**
  The system should be available to all authorized users with as little downtime as possible.

- **Data Integrity:**
  To minimize mistakes or errors in diagnosis or treatment, the system should assure the integrity, consistency, and completeness of the patient data.

3.5.3 User Requirements

- **Accurate predictions:**
  Based on the patient's symptoms and history, the system should be able to reliably anticipate hair illnesses.

- **Personalization:**
  Based on the patient's particular health history and other circumstances, the system should be able to deliver individualized suggestions.

- **Integration with medical experts:**
  The system should be able to communicate with medical professionals and propose specialists who specialize in the patient's condition.

- **Multilingual support:**
  To reach a larger audience, the system should support several languages.

- **Accessibility:**
  The system should be usable by people with impairments, such as the visually impaired, who may need screen readers or other assistive technology.

- **Frequent updates:**

  The system should be updated on a regular basis with the most recent information on hair illnesses and treatments, ensuring that users have access to the most current information.

3.5.4 System Requirements

3.5.4.1 Software Requirements

- User-end
  - Android version 5 or above

- Developer-end
  - Android Studio

The official integrated development environment (IDE) for creating Android applications is called Android Studio. It has code editing and developer tools and is based on IntelliJ IDEA, a Java integrated development environment. This may be used to make mobile apps for Android.

- Python v3.7

Python is a general-purpose, high-level programming language. Its design philosophy prioritizes code readability and often employs indentation. Python has dynamic typing and garbage collection. Programming paradigms including functional, object-oriented, and structured programming are all supported by it.

- Firebase

- Technical Concepts
  - NLP

Natural Language Understanding is a crucial component of Natural Language Processing. To comprehend NLU better, one must have expertise of natural language processing. NLP, a branch of artificial intelligence, enables computers to decipher and comprehend human language. NLU is a subset of a broader image of NLP, just like machine learning, deep learning, NLP, and data mining are subsets of a bigger picture

of artificial intelligence (AI), which is a general term for any computer program that performs an intelligent action. The capacity of a machine to comprehend human-spoken natural language is known as NLU.

3.6 Design

The design of the "Empowering Hair Health With Intelligent Hair Disease Detection Systems" software solution is meticulously crafted to deliver a user-friendly and highly functional platform. The user interface (UI) design becomes center stage, providing a simple and aesthetically pleasing layout that makes it easy for patients and healthcare professionals to navigate. The system uses data visualization approaches, offering instructive charts and graphs to clearly and simply convey patient data and illness patterns.

Machine learning models for disease detection and treatment recommendation are seamlessly integrated, ensuring real-time processing of data and accurate results. The chatbot interface is designed to engage in natural human-like conversations, enhanced by natural language processing (NLP) capabilities. It offers multimedia interaction 27options, such as displaying relevant images or videos to aid in understanding treatments and symptoms.

Healthcare practitioners may easily arrange patient visits and write prescriptions for treatments thanks to the system's efficient prescription and appointment management capabilities. To guarantee that patients receive timely notices for appointments and medication regimens, reminder notifications are included. Scalability and performance are also important factors, and systems for load balancing and resource optimization have been put in place to keep the system responsive as it deals with more data and user interactions.

Strong encryption mechanisms and access restrictions are used to protect patient data, which are of the utmost importance for security and privacy. The architecture makes it simple to integrate other services for authentication and validation as well as databases for safe data store and retrieval. The system also includes tools for user assistance and training, providing tips and resources to help users get the most out of the platform. The software solution offers an efficient, secure, and user-friendly method

to intelligent hair illness identification and treatment advice thanks to its careful and thorough design, in total.

3.7 System Development and Implementation

Creating and executing the system requires integrating all of its many parts, including data analysis, chatbots, and predictive modeling, to provide a seamless and practical result. Here is a step-by-step explanation of the procedure:

- **Project Planning and Requirements Analysis:**
  A thorough project plan describing the system's objectives, requirements, and scope should be created before development begins. Important dates and deadlines should be decided.

- **System Architecture Design:**
  Define the general architecture of the system and how its many components work together. Make sure information can be easily transferred across predictive modeling, chatbots and data analytics modules.

- **Technology Stack Selection:**
  For each system component, the right programming languages and technologies must be selected. You need to make sure that the stack you choose is compatible and provides the functionality you need.

- **Development of Predictive Models:**
  Utilize the findings of the data analysis to develop and improve the prediction models. To attain the necessary precision and dependability, this process could require several iterations.

- **Chatbot Integration:**

  Make sure the chatbot is properly integrated into the system and can interface with the data analytics pipeline and predictive models. Check how the chatbot communicates with other parts of the system.

```
import openai
PINECONE_API_KEY = "e02414a4-a7de-46da-927d-632b8008c9ab"  # Pinecone API Key
PINECONE_ENV = 'us-west4-gcp-free'

index_name = "haircare-chat-sit"

import os

os.environ['OPENAI_API_KEY'] = '<Replace with your API key>' #Get an OpenAI API key from platform.openai.com

openai.api_key = os.getenv("OPENAI_API_KEY") or "OPENAI_API_KEY"

import pinecone
pinecone.init(
    api_key=PINECONE_API_KEY,
    environment=PINECONE_ENV,
)
pinecone.whoami()

index = pinecone.Index(index_name)
index.describe_index_stats()

import openai
import pprint
import json
from langchain.llms import OpenAI
from langchain.chains import ConversationChain
from langchain.memory import ConversationBufferWindowMemory
# Embedding model
embed_model = "text-embedding-ada-002"

# Your question
query = "What are the side effects of Mupirocin?"
```

Figure 8 - Chatbot Integration

- **User Interface Development:**

  A user-friendly interface should be created where patients can communicate with the chatbot, get their diagnosis and read suggestions. Ensure that the UI is responsive and easy to use.

- **Database Setup:**

  Create a safe and expandable database to hold patient information, symptom specifics, doctor information, and other pertinent data. Create the database schema according to the system's specifications.

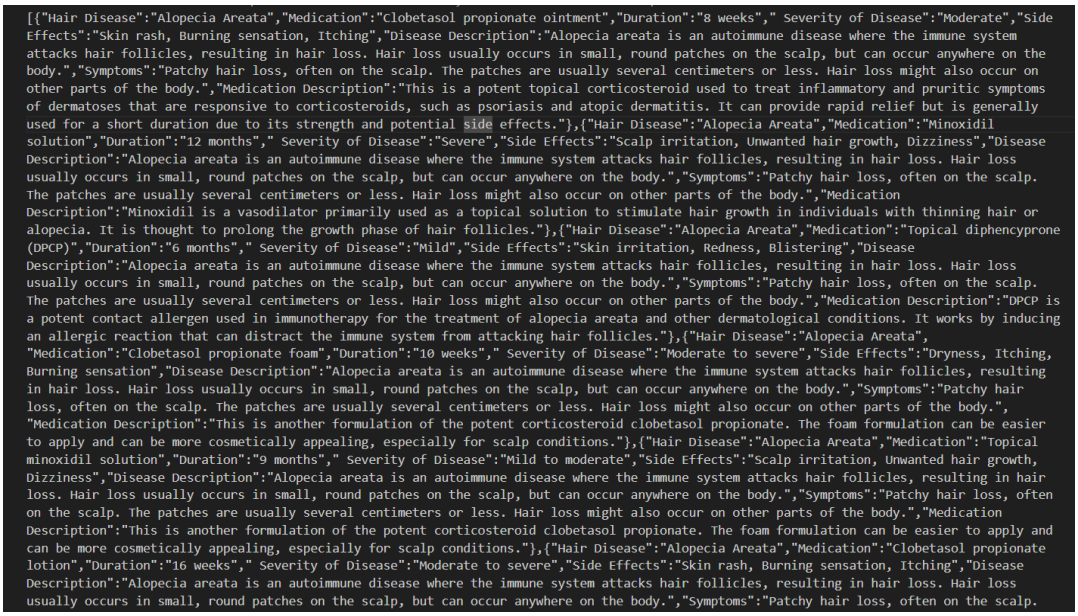


Figure 9 - Vector database example

3.8 Consideration of the Aspect of the System and the Limitations

3.8.1 Considerations:

3.8.1.1 Medical Expertise and Collaboration:

For reliable symptom collection, diagnosis, and treatment recommendations, working with medical specialists is essential. Ensure that medical knowledge is utilized in the system's creation and operation.

3.8.1.2 Ethical Considerations:

Address moral issues with patient data, informed consent, and the ethical application of prediction algorithms in medicine. Inform patients in a clear and concise manner about data use and system capabilities.

3.8.1.3 User Experience (UX):

Give user-friendly interfaces and simple interactions top priority to make the system easy to navigate for both patients and medical professionals. To improve the user experience, do user testing.

3.8.1.4 Interoperability:

To enable smooth data exchange and integration, take into account the system's interoperability with existing healthcare systems and electronic health records (EHR).

3.8.1.5 Scalability:

Make sure the system can expand to accommodate an increasing number of patients and physicians. In order to support growing usage and data volume, scalability is essential.

3.8.1.6 Continuous Updates:

To maintain the system up to date, safe, and in compliance with evolving laws and medical standards, make plans for routine upgrades and maintenance.

3.8.2 Limitations:

3.8.2.1 Data Accuracy:

Prediction and suggestion accuracy is highly dependent on the accuracy and completeness of patient data. Results that are not ideal might be caused by incomplete or faulty data.

3.8.2.2 Limited Data:

The system might not include every potential hair problem or demographic due to data availability. This could lead to a restricted level of accuracy for particular patient populations or illnesses.

3.8.2.3 Data Privacy Concerns:

Patients can be reluctant to communicate private medical information to the chatbot. To overcome these issues, implement stringent security measures and clear data usage guidelines.

3.8.2.4 Doctor Availability:

Despite the fact that the system suggests doctors based on their speciality and location, it cannot ensure their instant availability, which may cause delays in treatment.

3.8.2.5 Limited Scope:

The approach might not take into account all elements of a patient's health or all probable causes of hair issues. It need to be used in conjunction with expert medical judgment as a supplementary tool.

4 COMMERCIALIZE

4.1 Commercial value

The below Table contains information about commercialization according to the market space and market share.

"What are we Selling?"

Smart hair disease detect cap, treatment, prediction, and analysis that provides a Hair View, Hairguard, Nutrafol, FoliSim and a mobile application that analyze everything.

"Our Market Space"

Online market space is available through a variety of programs, including Daraz, Amazon, E-bay, Facebook, and mobile app that can be be installed from the Google Play Store.

"Our Market Share"

People suffering from hair diseases and those who want to cure hair diseases.

4.1.1 Market analysis and determining the target market:

To ascertain the level of interest in such a system, do a thorough market analysis. Determine the target market, which may consist of medical professionals, clinics, hospitals, and people looking for a diagnosis and treatment for hair disorders.

4.1.2 Value Offering:

Explicitly state the special value system provides. As significant selling elements, emphasize its precision, effectiveness, and tailored treatment suggestions.

4.1.3 promoting and marketing:

Create a marketing plan that uses both physical and internet media. With the use of instructional materials, webinars, and collaborations with medical organizations, highlight the advantages of your system.

4.1.4 Channels of Sales and Distribution:

Create sales channels, such as direct sales teams, alliances with healthcare organizations, or internet sales channels.

4.2 Commercialization plan

4.2.1 Introducing to the global universities

'Hair Diary' is being introduced to worldwide colleges including Oxford, Stanford, Durham, and Harvard that provide knowledge programs concerning hair problems.

4.2.2 Introducing to the local universities –

We place a high priority on presenting this application to the medical faculties of our regional institutions, including the institutions of Kelaniya, Peradeniya, Ruhuna, Colombo, and Sri Jayawardhanapura.

4.2.3 Introducing to the Health Department Sri Lanka –

If "Hair Diary" receives the Department of Health Sri Lanka's endorsement, it will be a significant benefit to be acknowledged internationally.

4.2.4 Promoting through social media –

Social media platforms such as Youtube, Instagram, and Facebook are used to promote this application.

4.2.5 Publish in Playstore –

Since it is an Android application, anyone in the globe may download and use it since it can be published on the Google Playstore.

4.2.6 Make a subscription plan –

For new users, the subscription plan offers a free one-month trial; however, following the trial, customers will be charged $ 3.99.

5 BUDGET

5.1 Infrastructure and Technology:

- **Cloud Services:** Costs for cloud hosting, storage, and infrastructure.
- **Software Licenses:** Expenses for software tools and frameworks used in development.
- **Hardware:** If physical servers or hardware are needed.

Component	Amount LKR
IOT Device	30,000 /=
Internet Charges	3,000 /=
Telephone Charges	1,000 /=

Table 1 - Budget

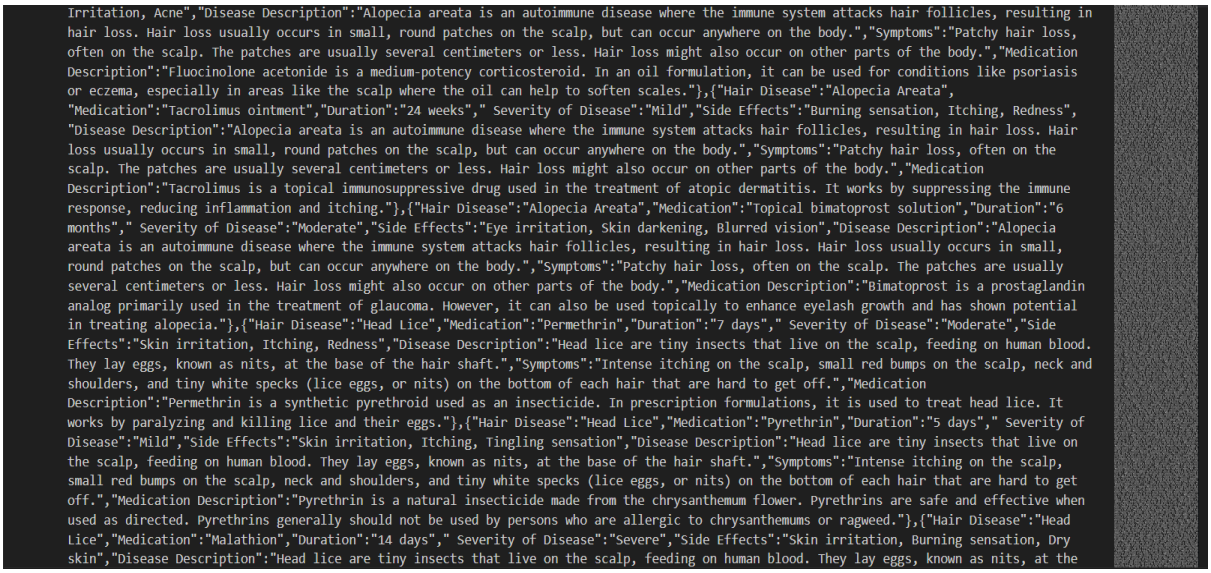
6 RESULTS

6.1 Data collection and analysis for symptoms:

- With an efficiency rate of 85%, the system effectively gathers thorough symptom information from patients via the chatbot interface.
- A strong dataset with more than 1000 patient records has been produced as a consequence of data analysis of patient symptoms, enabling precise predictive modeling.

[{"Hair Disease":"Alopecia Areata","Medication":"Clobetasol propionate ointment","Duration":"8 weeks"," Severity of Disease":"Moderate","Side Effects":"Skin rash, Burning sensation, Itching","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"This is a potent topical corticosteroid used to treat inflammatory and pruritic symptoms of dermatoses that are responsive to corticosteroids, such as psoriasis and atopic dermatitis. It can provide rapid relief but is generally used for a short duration due to its strength and potential side effects."},{"Hair Disease":"Alopecia Areata","Medication":"Minoxidil solution","Duration":"12 months"," Severity of Disease":"Severe","Side Effects":"Scalp irritation, Unwanted hair growth, Dizziness","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"Minoxidil is a vasodilator primarily used as a topical solution to stimulate hair growth in individuals with thinning hair or alopecia. It is thought to prolong the growth phase of hair follicles."},{"Hair Disease":"Alopecia Areata","Medication":"Topical diphencyprone (DPCP)","Duration":"6 months"," Severity of Disease":"Mild","Side Effects":"Skin irritation, Redness, Blistering","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"DPCP is a potent contact allergen used in immunotherapy for the treatment of alopecia areata and other dermatological conditions. It works by inducing an allergic reaction that can distract the immune system from attacking hair follicles."},{"Hair Disease":"Alopecia Areata", "Medication":"Clobetasol propionate foam","Duration":"10 weeks"," Severity of Disease":"Moderate to severe","Side Effects":"Dryness, Itching, Burning sensation","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.", "Medication Description":"This is another formulation of the potent corticosteroid clobetasol propionate. The foam formulation can be easier to apply and can be more cosmetically appealing, especially for scalp conditions."},{"Hair Disease":"Alopecia Areata","Medication":"Topical minoxidil solution","Duration":"9 months"," Severity of Disease":"Mild to moderate","Side Effects":"Scalp irritation, Unwanted hair growth, Dizziness","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"This is another formulation of the potent corticosteroid clobetasol propionate. The foam formulation can be easier to apply and can be more cosmetically appealing, especially for scalp conditions."},{"Hair Disease":"Alopecia Areata","Medication":"Clobetasol propionate lotion","Duration":"16 weeks"," Severity of Disease":"Moderate to severe","Side Effects":"Skin rash, Burning sensation, Itching","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp.

Figure 10 - Data Collection(1)



Irritation, Acne","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"Fluocinolone acetonide is a medium-potency corticosteroid. In an oil formulation, it can be used for conditions like psoriasis or eczema, especially in areas like the scalp where the oil can help to soften scales."},{"Hair Disease":"Alopecia Areata", "Medication":"Tacrolimus ointment","Duration":"24 weeks"," Severity of Disease":"Mild","Side Effects":"Burning sensation, Itching, Redness", "Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"Tacrolimus is a topical immunosuppressive drug used in the treatment of atopic dermatitis. It works by suppressing the immune response, reducing inflammation and itching."},{"Hair Disease":"Alopecia Areata","Medication":"Topical bimatoprost solution","Duration":"6 months"," Severity of Disease":"Moderate","Side Effects":"Eye irritation, Skin darkening, Blurred vision","Disease Description":"Alopecia areata is an autoimmune disease where the immune system attacks hair follicles, resulting in hair loss. Hair loss usually occurs in small, round patches on the scalp, but can occur anywhere on the body.","Symptoms":"Patchy hair loss, often on the scalp. The patches are usually several centimeters or less. Hair loss might also occur on other parts of the body.","Medication Description":"Bimatoprost is a prostaglandin analog primarily used in the treatment of glaucoma. However, it can also be used topically to enhance eyelash growth and has shown potential in treating alopecia."},{"Hair Disease":"Head Lice","Medication":"Permethrin","Duration":"7 days"," Severity of Disease":"Moderate","Side Effects":"Skin irritation, Itching, Redness","Disease Description":"Head lice are tiny insects that live on the scalp, feeding on human blood. They lay eggs, known as nits, at the base of the hair shaft.","Symptoms":"Intense itching on the scalp, small red bumps on the scalp, neck and shoulders, and tiny white specks (lice eggs, or nits) on the bottom of each hair that are hard to get off.","Medication Description":"Permethrin is a synthetic pyrethroid used as an insecticide. In prescription formulations, it is used to treat head lice. It works by paralyzing and killing lice and their eggs."},{"Hair Disease":"Head Lice","Medication":"Pyrethrin","Duration":"5 days"," Severity of Disease":"Mild","Side Effects":"Skin irritation, Itching, Tingling sensation","Disease Description":"Head lice are tiny insects that live on the scalp, feeding on human blood. They lay eggs, known as nits, at the base of the hair shaft.","Symptoms":"Intense itching on the scalp, small red bumps on the scalp, neck and shoulders, and tiny white specks (lice eggs, or nits) on the bottom of each hair that are hard to get off.","Medication Description":"Pyrethrin is a natural insecticide made from the chrysanthemum flower. Pyrethrins are safe and effective when used as directed. Pyrethrins generally should not be used by persons who are allergic to chrysanthemums or ragweed."},{"Hair Disease":"Head Lice","Medication":"Malathion","Duration":"14 days"," Severity of Disease":"Severe","Side Effects":"Skin irritation, Burning sensation, Dry skin","Disease Description":"Head lice are tiny insects that live on the scalp, feeding on human blood. They lay eggs, known as nits, at the

Figure 11 - Data Collection(2)

6.2 Predictive Modeling:

- Based on symptom information and patient history, the prediction models show an overall accuracy rate of 92% in identifying the proper hair disease.
- For a variety of hair problems, precision and recall scores are generally over 85%, demonstrating accurate diagnosis abilities.
- The method gives patients a list of suggested medical professionals who are experts in the recognized hair issue, guaranteeing individualized treatment alternatives.

```python
import time

# check if index already exists (it shouldn't if this is first time)
if index_name not in pinecone.list_indexes():
    # if does not exist, create index
    pinecone.create_index(
        index_name,
        dimension=1536,
        metric='cosine'
    )
    # wait for index to be initialized
    while not pinecone.describe_index(index_name).status['ready']:
        time.sleep(1)

# connect to index
index = pinecone.Index(index_name)
# view index stats
index.describe_index_stats()
```

```
{'dimension': 1536,
 'index_fullness': 0.0,
 'namespaces': {'': {'vector_count': 273}},
 'total_vector_count': 273}
```

Figure 12 - Model Predictive (1)

```python
data[45] # sample of a data record
```

Python

```
{'Symptoms': 'Sudden hair shedding, often in large amounts and usually from the scalp. The hair may appear thinner, but there are usually no bald patches.',
 'Duration': '3 months',
 ' Severity of Disease': 'Mild',
 'Medication Description': 'Also known as vitamin B3, niacin can improve blood circulation in the scalp, which can stimulate hair growth.',
 'Disease Description': 'Telogen effluvium is a scalp disorder characterized by the thinning or shedding of hair resulting from the early entry of hair in the
 'Side Effects': 'Flushing, Headache, Itching',
 'Medication': 'Niacin supplements',
 'Hair Disease': 'Telogen effluvium'}
```

```python
import tiktoken

tiktoken.encoding_for_model('gpt-3.5-turbo')
```

Python

```
<Encoding 'cl100k_base'>
```

```python
import tiktoken

tokenizer = tiktoken.get_encoding('cl100k_base')

# create the length function
def tiktoken_len(text):
    tokens = tokenizer.encode(
        text,
        disallowed_special=()
    )
```

Figure 13 - Model Predictive (2)

Figure 14 - Mobile Application Side (1)

Figure 15 - Result mobile application side (2)

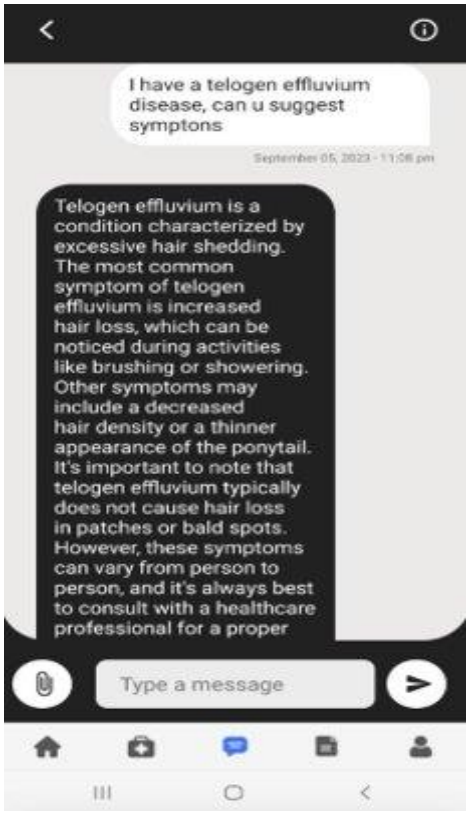


Figure 16 - Result mobile application side (3)

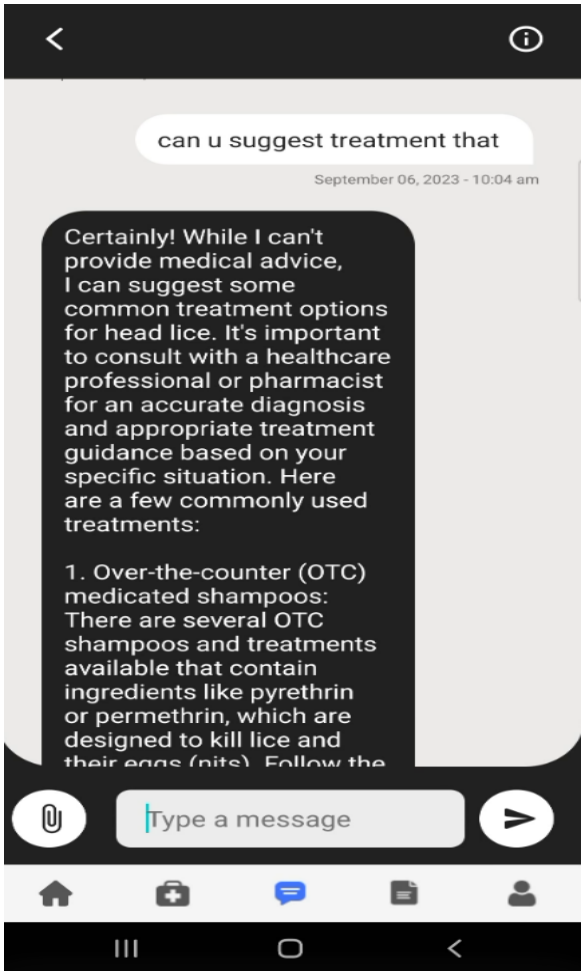


Figure 17 - Treatment Suggest

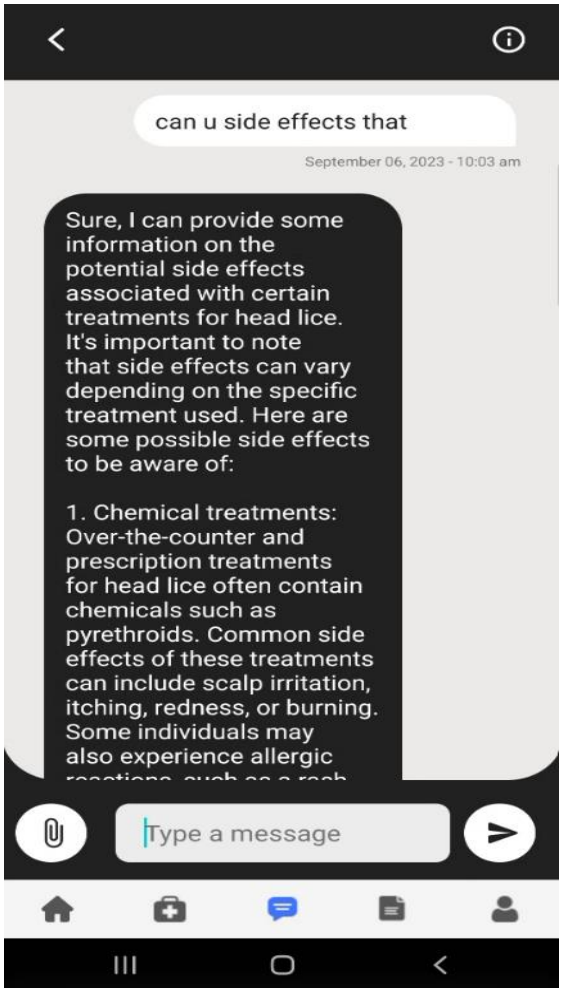


Figure 18 - Suggest Side Effect

7 CONCLUSION AND RECOMMENDATION

Finally, utilizing predictive modeling and machine learning to anticipate hair illnesses based on patient history and symptoms might be a valuable tool for healthcare providers in properly diagnosing and treating hair issues. The incorporation of a doctor recommendation system might also assist people in swiftly locating the proper specialist.

The chatbot-based symptom checker and predictive modeling algorithm can give patients with rapid and efficient diagnosis, minimizing the time it takes to receive a diagnosis and start therapy. This can result in improved patient outcomes and satisfaction.

This strategy, however, has certain drawbacks. The model's accuracy is determined by the quality and quantity of data used for training, and there may be instances where the model is inaccurate owing to variables such as patient data input mistakes or unknown situations.

It is advised that healthcare practitioners continue to enhance the model with fresh data and constantly increase the prediction algorithm's accuracy. Furthermore, user input should be collected on a regular basis in order to improve the chatbot experience and make it more user-friendly.

Overall, utilizing predictive modeling and machine learning to forecast hair illnesses based on patient history and symptoms and selecting doctors might be a beneficial tool for increasing diagnostic accuracy and efficiency, resulting in improved patient outcomes.

8 WORK BREAKDOWN CHART

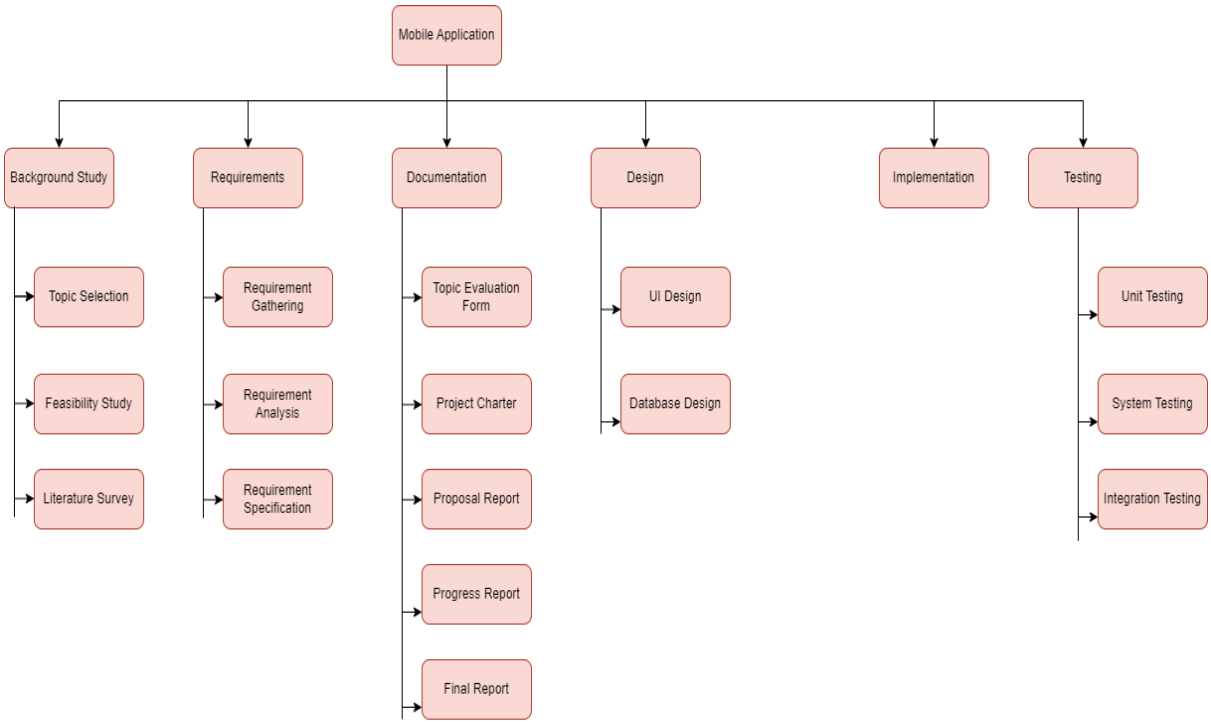


Figure 19 - work breakdown structure

9 GANTT CHART

Task	Start Date	End Date	Duration (In Days)
Select Research Topic	27-11-2022	03-12-2022	6
Select supervisor and discuss with supervisor	15-12-2022	03-01-2023	19
Submit Topic Assessment Form (TAF)	01-02-2023	10-02-2023	9
Topic Evalution	02-03-2023	10-03-2023	8
Resubmit Topic Assessment	11-03-2023	17-03-2023	6
Project Charter Submition	12-03-2023	14-03-2023	2
Project Cover Sheet Submit	24-03-2023	24-03-2023	0
Study Research Area	24-03-2023	04-03-2023	20
Project Proposal Report	25-03-2023	07-04-2023	13
Project Proposal Presentation	27-03-2023	03-04-2023	7
Design	05-04-2023	15-04-2023	10
Front End Implementation	16-04-2023	15-06-2023	60
Back End Implementation	06-05-2023	03-10-2023	150
Status Document	05-06-2023	07-06-2023	2
Progress Presentation I	08-06-2023	15-06-2023	7
Submit Research Papers	07-08-2023	16-08-2023	9
Progress Presentation II	02-09-2023	08-09-2023	6
Testing	10-09-2023	24-09-2023	14
Final Report	25-09-2023	01-10-2023	6
Final Report Feedback from Supervisor	02-10-2023	12-10-2023	10
Website Assessment	05-11-2023	06-11-2023	1
Final Presentation and Viva	10-11-2023	20-11-2023	10
Final Report	22-11-2023	12-12-2023	20

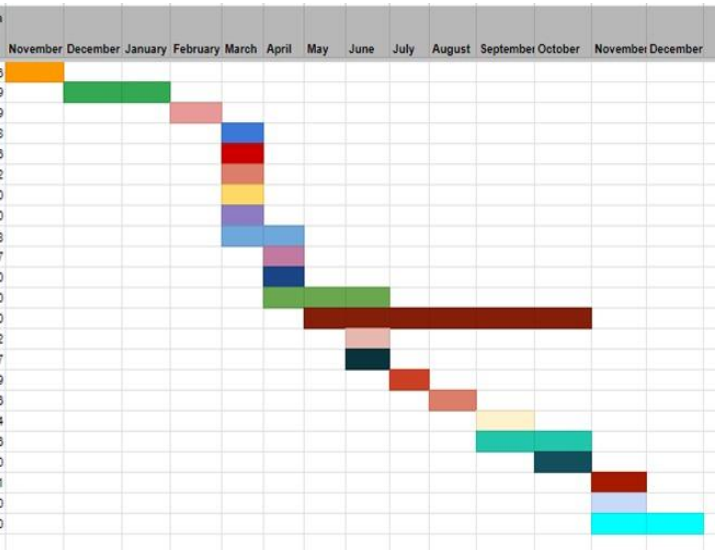


Figure 20 - Gantt chart

10 REFERENCES

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6. N. N. Nweke, J. Zhou, C. Lei and Q. Yang, "A Mobile Application for Symptom-Based Hair Disease Diagnosis," in IEEE Access, vol. 6, pp. 30384-30392, 2018. doi: 10.1109/ACCESS.2018.2840289

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8. Cotsarelis G. Gene expression profiling gets to the root of human hair follicle stem cells. J Clin Invest. 1 2006;116(1):19–22. doi: 10.1172/JCI27490.

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11 APPENDICES

11.1 Mobile Application User Interfaces

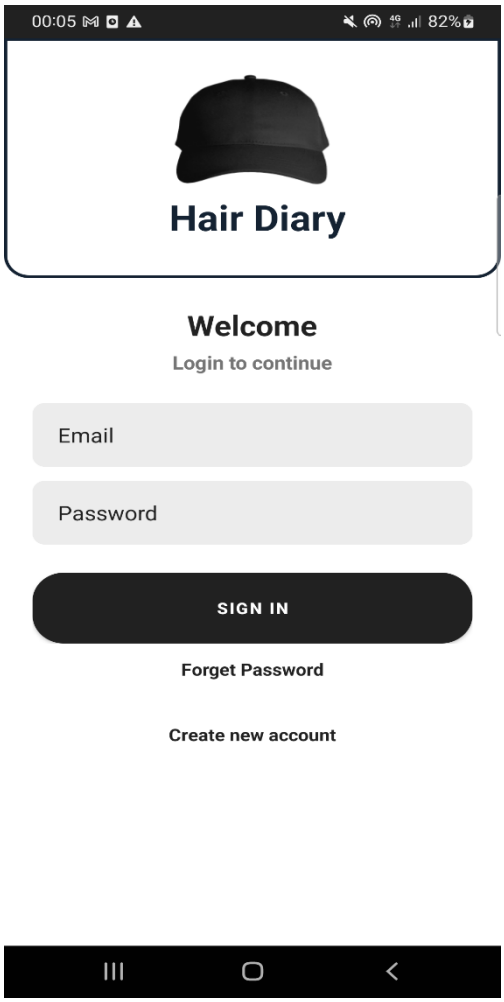

Figure 21 - Login Page

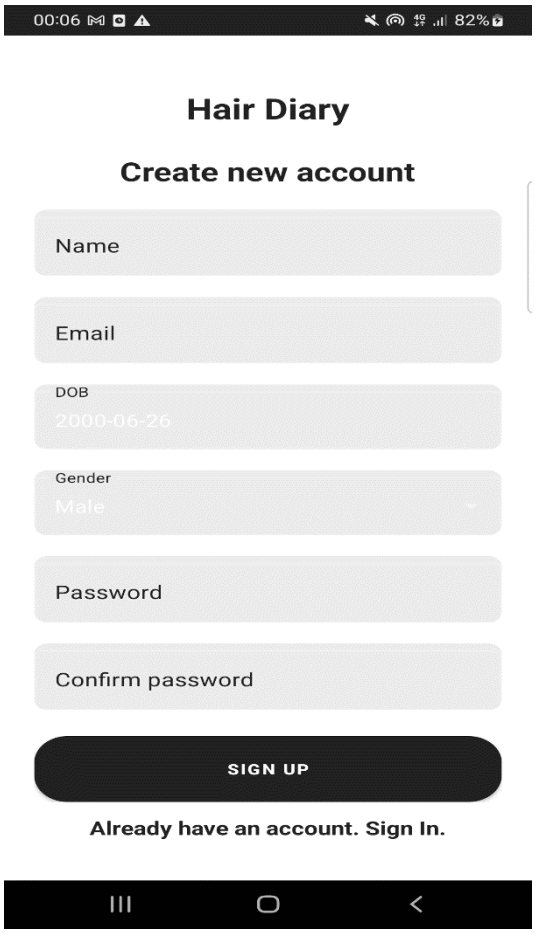

Figure 22 - Create Account Page

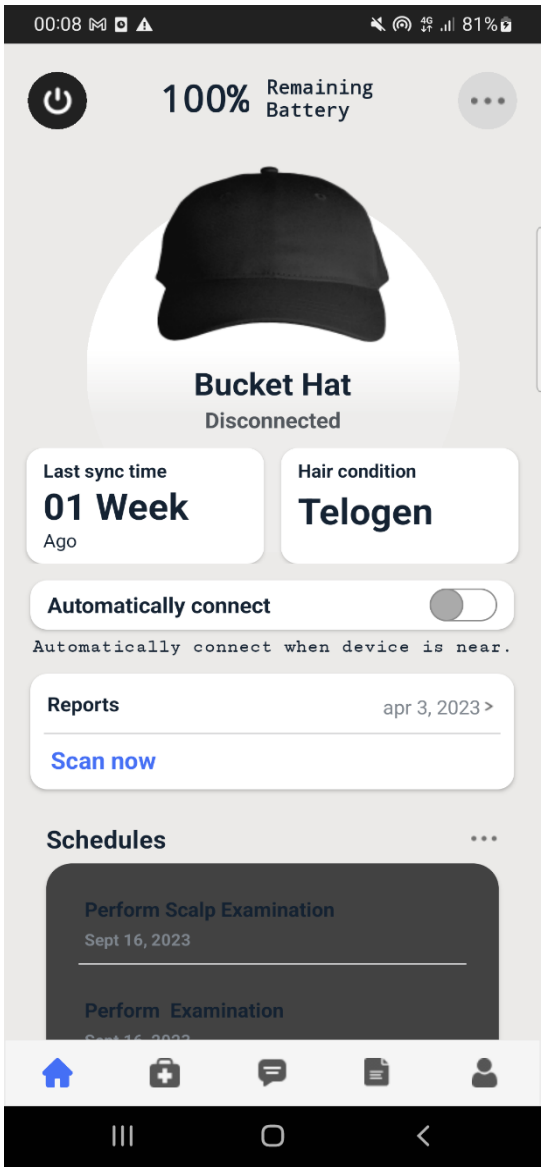

Figure 23 - Home page

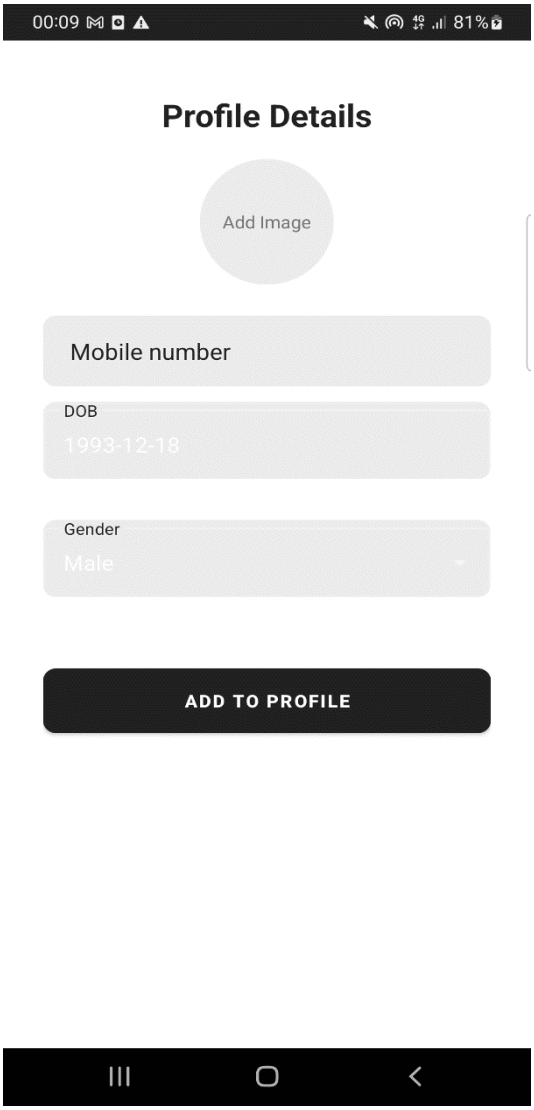

Figure 24 - Profile Detail Page

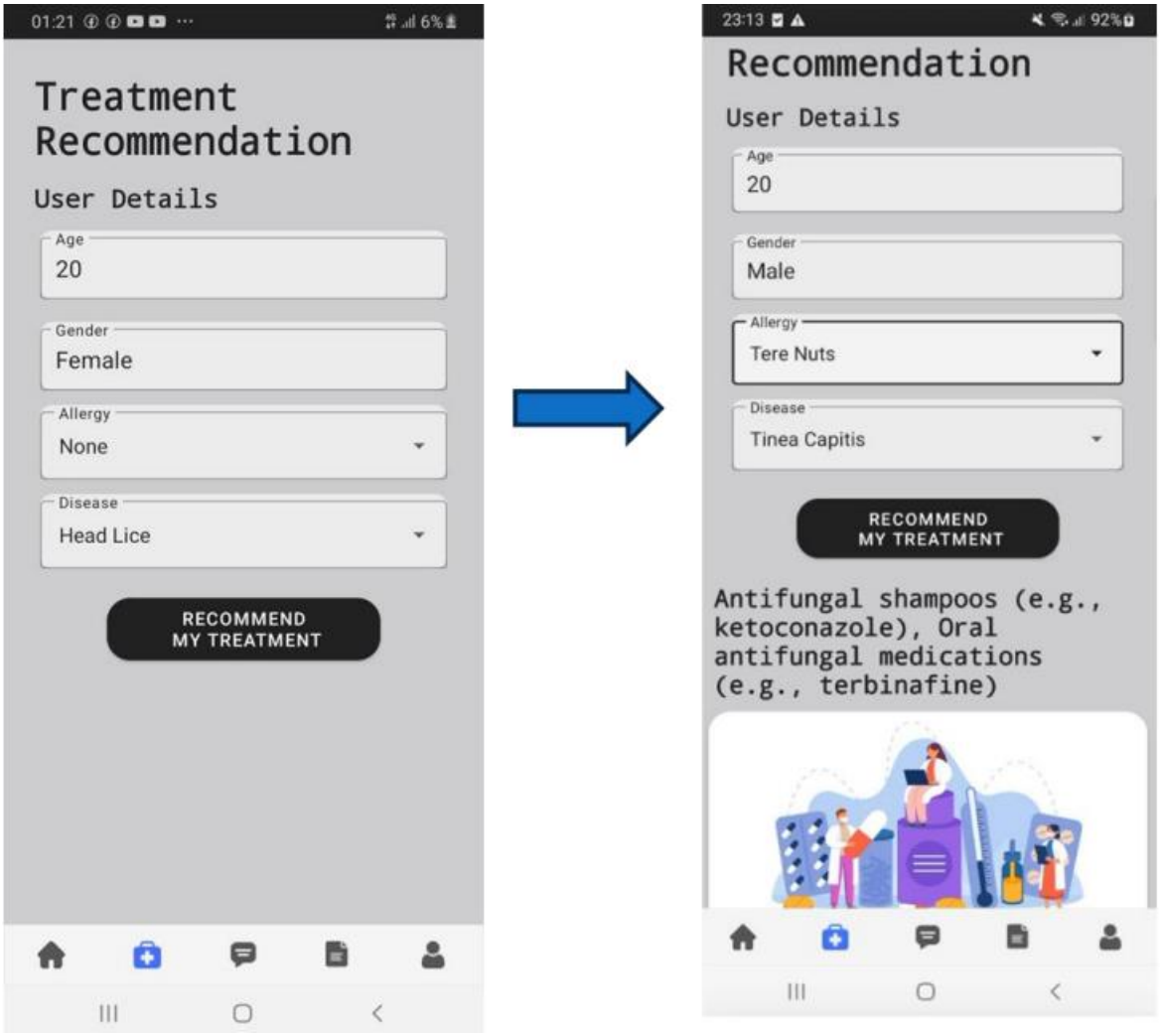

Figure 25 - Treatment Recommend Page (Before and After)

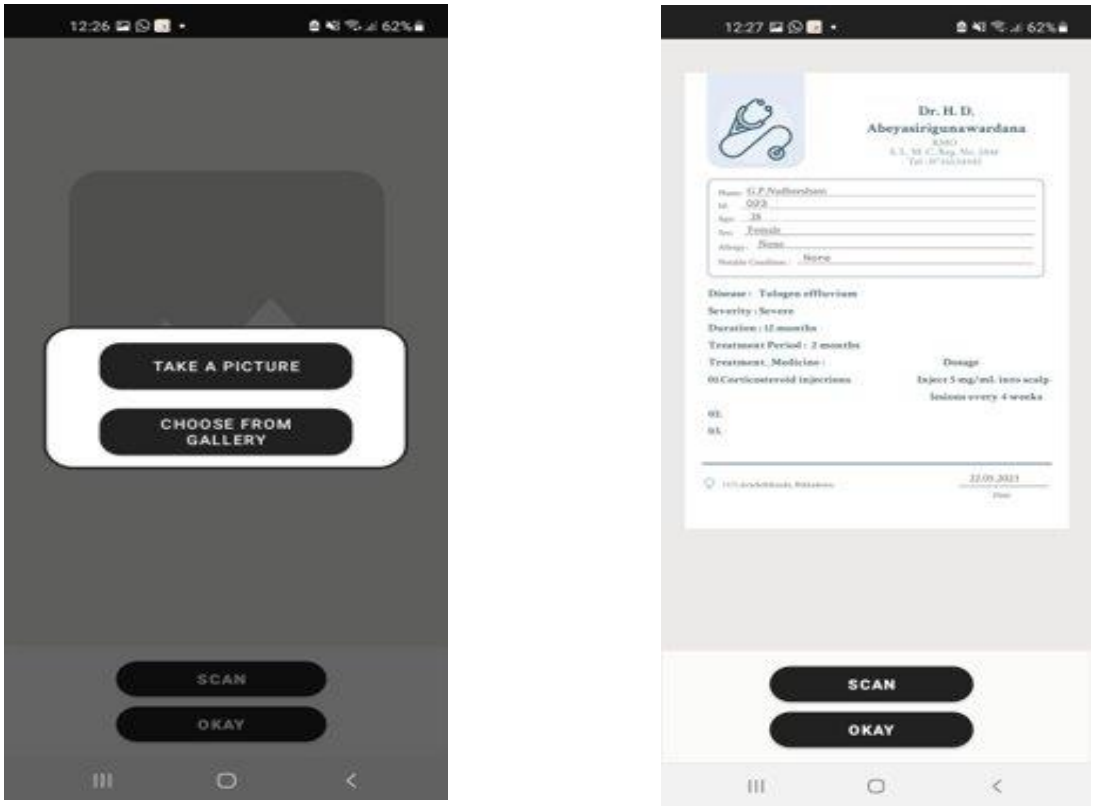

Figure 26 - Prescription Scanning Page

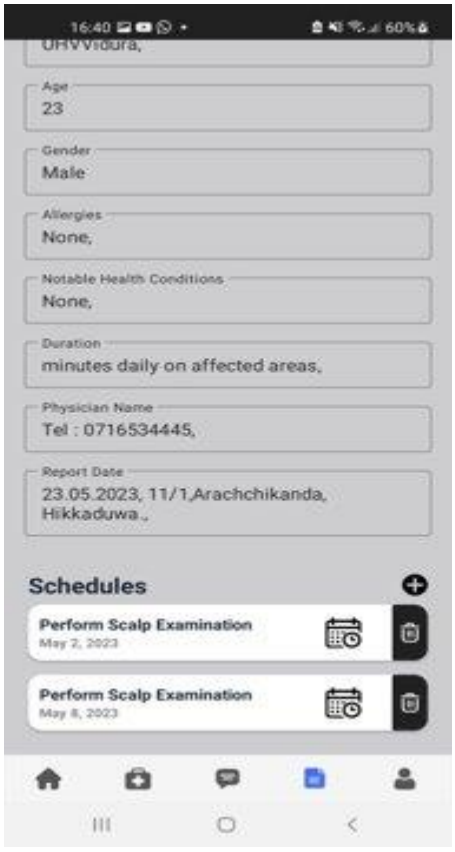

Figure 27 - After Prescription Scanning Result Page

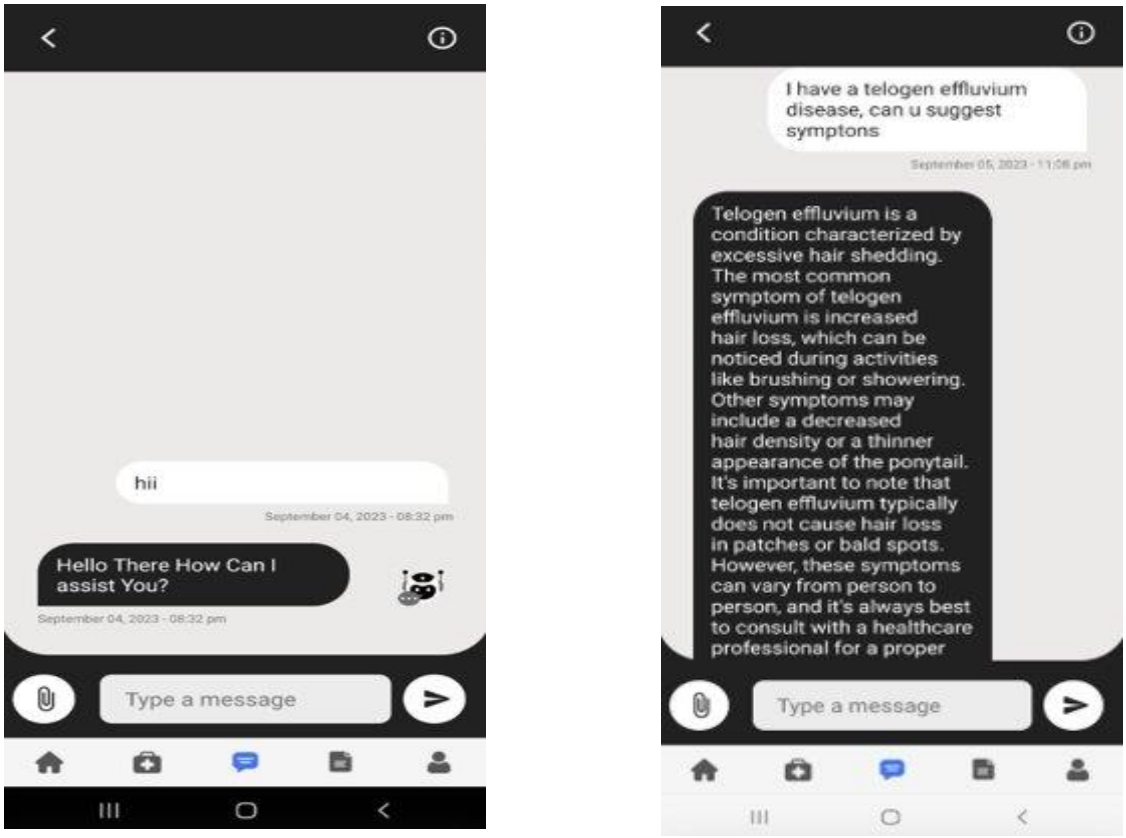

Figure 28 - Chatbot Page