

Design Document

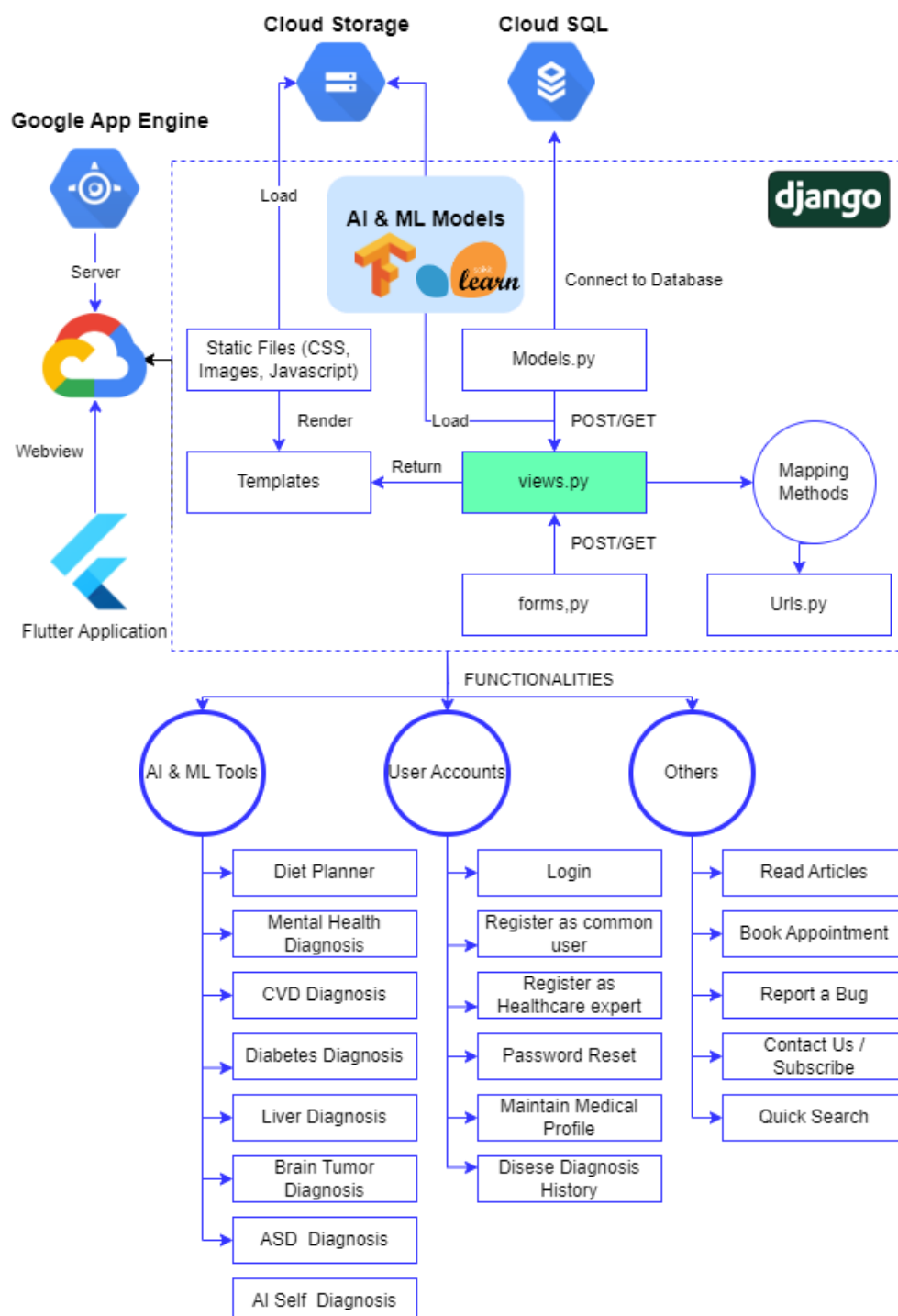
We have created both Android Application (Using Flutter) & Web Application using Django.
The application is deployed using **GCP (Google Cloud Platform)**

System Architecture

In the below diagram you can see a dotted block, this is the **Django backend**. **views.py** is the core of django application where we provide logics & algorithms & return the frontend instances.

- The Methods in views.py returning instances are rendered in **urls.py** and **mapped** with desired urls.
- The **database structure** is defined in **models.py** and all the database objects are stored in **Cloud SQL Database**.
- The AI Models (**Tensorflow & Sklearn**) are stored in **Google Cloud Storage** & are loaded then in views.py for prediction.
- All the Static files as well as dynamic files are stored in **Google Cloud Storage**.
- The **Django Application** is Device Responsive. It is deployed using **Google App Engine**. The deployed application is rendered by **Flutter Application** using **WebView** Plugin.

Thus we can now access our application both as a Web Application as well as a Flutter Application.



System Components

(Google Technologies are highlighted in Red Colour)

Backend	Web Framework : Django Framework Programming Language : Python Android : Flutter , Dart , WebView
Frontend	Languages: HTML , CSS , Javascript API's : Gmail , Bootstrap, Google Fonts
AI and Machine Learning	Major : Tensorflow , sklearn (Random Forest Classifier, Random Forest Regressor, Gradient Boosting Classifier, Gradient Boosting Regressor, Support Vector Machine) Others : Pandas, Numpy, Seaborn, Matplotlib, Joblib
Google Cloud Platform	Cloud SQL (MySQL) for Database Google App Engine : Deployment Server Cloud Storage : Hosting Static & Media Files, Machine Learning Models
Others	Anaconda for Package Management Powershell for command line operations
Software & Hardware Requirements	
Software Requirements	Development : Atom IDE, Visual Studio Code , Android Studio, Jupyter Notebook , Google Colab Others : Windows Powershell, Any suitable browser
Hardware Requirements	Operating System : Windows 10 Processor : Intel(R) Core(TM) i3-6006U System type : 64-bit operating system, , x64-based processor RAM 4 GB

Modules

AI & Machine Learning Modules				
Module Name	Technology	Algorithm Used	Outcome	Accuracy
Specialized Diagnosis Tools (Diabetes, CVD, Liver Disease, Brain Tumor)	sklearn	Random Forest Gradient Boosting	Risk Score, Binary Classification	90% (Average of four tools)
Mental Health Diagnosis	Tensorflow	https://tfhub.dev/google/tf2-preview/gnews-swivel-20dim/1	Mental Health Score, Suggestions, Helplines	86%
AI Self Diagnosis	sklearn	Support Vector Machine	Disease, Precautions , Medication	94%
Diet Planner	sklearn	Random Forest	Diet Supplements, Detailed Nutrition Analysis	100%
Autism Spectrum Disorder	sklearn	Random Forest	ASD Traits	95.9%

Other Modules	
Module Name	Description
User Registration	User can register to pulse and log in to the application. Logged in user also receive the automated mail delivered results for specialized diagnosis tools. User can also reset their password. One can register as a common user or as a healthcare expert.
Medical History Storage & Medical Profile	User can access their diagnosis history(results, input metrics, date diagnosed) and can create their medical profile in the accounts tab.
Health Blog	We also provide the health blog with number of articles on disease, precautions, symptoms and more.
Report / Feedback	We also provide a contact form where user can write to us or provide any feedback and can also report a bug if any tool is not functioning properly.
Book Appointment	You can also book an appointment with the expert of your choice in the contact expert dashboard. You will receive an automated mail for booking confirmation and within 48 Hrs the expert will revert you back regarding your appointment.
Validation of results	Once the results are processed when you use our specialized diagnosis tools, the results are also sent to the healthcare expert registered with Pulse and specialized in that particular field. Thus it reduce the chances of misdiagnosis which is validated by the healthcare expert as well as by the AI model.

Features

1. Non Communicable Diseases (NCD) Diagnosis

Targets Covered:

- UN SDG INDICATOR 3.4.1: Mortality rate attributed to Non-Communicable Diseases (NCD)
- UN SDG INDICATOR 3.8.1 is coverage of essential health services

The burden of NCDs affects individuals, families, and healthcare systems, emphasizing the need for accessible and cost-effective solutions. Orchid incorporates advanced machine learning algorithms to predict the occurrence of NCDs like cardiovascular diseases, diabetes, liver disease, and brain tumors. By offering precise diagnosis and personalized treatment plans, Orchid enables **early detection & accurate diagnosis**, leading to improved health outcomes.

2. Personalized Nutrition for Optimal Health

Targets Covered:

- SDG INDICATOR 2.1.1 : Prevalence of undernourishment
- SDG INDICATOR 2.2: End all forms of malnutrition

Orchid's diet planner is an innovative feature designed to provide personalized and AI-driven meal plans. It leverages advanced algorithms and machine learning techniques to create customized diet plans tailored to individual needs and goals.

The diet planner takes into account various factors, including an individual's age, gender, weight, height, activity level, dietary preferences, and any specific dietary requirements or restrictions. By considering these factors, Orchid's diet planner ensures that the generated meal plans are well-suited to each user's unique nutritional needs.

3. Mental Health

Targets Covered:

- UN SDG INDICATOR 3.4.1: Promote mental health & Wellbeing

Orchid's mental health tool, powered by TensorFlow, goes beyond diagnosis and prediction by providing users with a comprehensive mental health score and valuable suggestions for support. By leveraging TensorFlow's capabilities, Orchid analyzes input data related to behavioral patterns, symptoms, and other factors to generate an individual's mental health score.

In addition to the mental health score, Orchid's tool utilizes Google Cloud SQL to fetch a curated set of suggestions and helpline information. These suggestions encompass self-help techniques, coping strategies, and resources tailored to the individual's mental health needs.

4. Autism Spectrum Disorder for Toddlers

Targets Covered:

- UN SDG INDICATOR 3.4.1: Promote mental health & Wellbeing

The ASD diagnosis tool for age groups 1 to 3 serves as a **valuable resource for parents** who suspect their child may be on the autism spectrum. Our ASD detection tool is a cutting-edge application designed to aid in the early identification of autism spectrum disorder (ASD) in children aged 1 to 3. Powered by the Random Forest

algorithm and built with Scikit-learn, this tool leverages machine learning to predict ASD traits based on a comprehensive set of behavioral features and individual characteristics. **Benefits:**

1. **Early Detection:** Timely identification of ASD traits enables early access to crucial support services.
2. **Improved Outcomes:** Early intervention can lead to improved developmental outcomes.
3. **Efficient and User-Friendly:** The tool is designed for ease of use, allowing healthcare professionals and caregivers to efficiently assess ASD traits in young children.
4. **Data-Driven Insights:** The tool generates valuable insights and predictions based on comprehensive data analysis, aiding healthcare professionals in making informed decisions.

5. Beyond Diagnostics

Targets Covered:

- UN SDG INDICATOR 3.8.1 is coverage of essential health services

The inclusion of features like maintaining medical profiles, analyzing diagnosis history, booking appointments, and accessing informative blogs adds further value to the application. These features in Orchid brings significant benefits to the overall healthcare experience:

- A. **Medical Profile Maintenance:** By allowing users to maintain their comprehensive medical profiles, Orchid ensures that essential health information is easily accessible and securely stored. This feature addresses the problem of limited accessibility to medical records, especially in resource-constrained areas.
 - B. **Analysis of Diagnosis History:** Orchid's capability to analyze diagnosis history provides valuable insights into an individual's health journey. This feature allows users and healthcare professionals to track progress, identify patterns, and make informed decisions regarding treatment and interventions. It overcomes the challenge of limited accessibility to diagnosis history, contributing to improved continuity of care and better health outcomes.
 - C. **Appointment Booking:** By offering a convenient and user-friendly platform for booking appointments, Orchid ensures that individuals can access the care they need in a timely manner, reducing delays and improving overall healthcare access. Leveraging the power of **Gmail SMTP** in the backend, Orchid automates the appointment booking process by sending automated emails to both the user and the expert.
 - D. **Access to Informative Blogs:** Orchid's provision of informative blogs offers a valuable resource for individuals seeking information and guidance on various health topics. This feature helps address the problem of limited access to reliable health information, empowering users to make informed decisions about their health and well-being.
 - E. **Secured Authentication :** Our platform provides a seamless user experience with robust authentication mechanisms powered by *Google Cloud SQL database* and *Django's SHA-256 hashing*. algorithm. By leveraging advanced technologies, we offer secure registration and login functionalities for both healthcare experts and common users. Through a sophisticated integration of Google Cloud SQL, we ensure that user credentials are stored and managed in a highly secure and reliable environment. Additionally, the implementation of Django's SHA-256 hashing. algorithm guarantees the integrity and confidentiality of user passwords, ensuring that sensitive information remains protected.
 - F. **Error Reporting**
6. **Loosely Coupled Architecture:** Orchid's loosely coupled architecture allows for easy integration & scalability, making it adaptable to the specific requirements of healthcare providers.
 7. **Accessibility & Affordability:** This comprehensive approach facilitates precise diagnoses and offers a one-step solution for both healthcare experts and common users, enabling efficient and accurate healthcare services. The problem statement highlights the challenges of accessibility and affordability in healthcare. The mobile app is built with Flutter, while the web application is built with Django, providing a seamless user experience across platforms
 8. **Usage of Advanced Technologies:** The application leverages advanced technologies such as TensorFlow and Scikit-learn for disease prediction, while the use of Flutter and Django ensures a seamless and user-friendly experience across platforms.

Summary

By incorporating these features, Orchid goes beyond the core functionality of disease prediction and diagnosis. These features contribute to addressing the challenges of limited accessibility and affordability of healthcare services, ultimately improving health outcomes and fostering a more inclusive and patient-centered healthcare experience. By harnessing the power of AI and Google Cloud, Orchid aims to overcome the challenges in global healthcare, making essential healthcare services accessible and affordable for people from all walks of life. Orchid transcends the boundaries of mere diagnosis, offering a holistic healthcare platform to its users. These features converge to create a cohesive ecosystem that seamlessly integrates with the users' healthcare journey, empowering them to take charge of their well-being.