Pulse

DEVELOPER

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DEMO VIDEO

https://youtu.be/_2eicgCvFJY

PROJECT OUTLINE

Executive Summary

Pulse is an **AI-powered** healthcare application, aims to provide accessible and affordable healthcare services to people worldwide. The application includes NCD's diagnosis tools, AI diet planner, mental health diagnosis, and AI self-diagnosis, utilizing state-of-the-art technologies like **TensorFlow & Scikit-learn**. Pulse loosely coupled architecture allows for easy integration, making it a versatile solution to meet the specific needs of healthcare providers. The application also includes features where users can maintain their medical profile, analyse their diagnosis history, book appointments, read blogs, report bugs, and much more.

Tools & Technologies

Backend	Web Framework: Django Framework,Python Database: SQLite (Local), MySQL (Production)
Frontend	Languages: HTML, CSS, Javascript API's : Gmail , Bootstrap, Google Fonts
AI and Machine Learning	Tensorflow, Scikit-Learn, Random Forest Classifer, Random Forest Regressor, Gradient Boosting Classifer, Gradient Boosting Regressor, Support Vector Machine, Pandas, Numpy, Seaborn, Matplotlib, Joblib
Google Cloud Platform	Cloud SQL for Database Google App Engine: Deployment Server Cloud Storage: Hosting Static & Media Files, Machine Learning Models
Others	Anaconda for Package Management Powersell for command line operations
Software Requirements	Development : Atom IDE,Visual Studio Code, Jupyter Notebook, Google Colab

PLANNING

Identification of Problem

The existing healthcare systems often struggle to provide **timely and cost-effective solutions**, especially in resource-constrained areas, exacerbating the burden on individuals, families, and healthcare providers. The **lack of accessible and affordable healthcare services** poses a significant barrier to addressing the global health burden accompanied by following challenges:

1. **Non-communicable diseases (NCD's**) including CVD, diabetes etc. continueto be a significant health concern globally. Access to **early detection and accurate diagnosis** of these NCDs is crucial for effective management and improved health outcomes. NCDs account for approximately 71% of all deaths worldwide, with CVD being the leading cause.
2. **Mental health** disorders affect people of all ages and have a substantial impact on individuals and societies. Globally, around **1 in 4** people will experience a mental health disorder in their lifetime. However, the treatment gap for mental health is significant, with approximately 50% of people not receiving the mental health services they need.
3. **Malnutrition** including both undernutrition and micronutrient deficiencies, contributes to increased morbidity and mortality rates, impaired cognitive development, and reduced productivity.
4. Limited healthcare facilities, scarcity of specialized expertise, and inadequate diagnostic tools hinder the early identification, precise diagnosis, and effective treatment of these health conditions. Approximately half of the world's population still **lacks access to essential healthcare services**.

Project Objectives

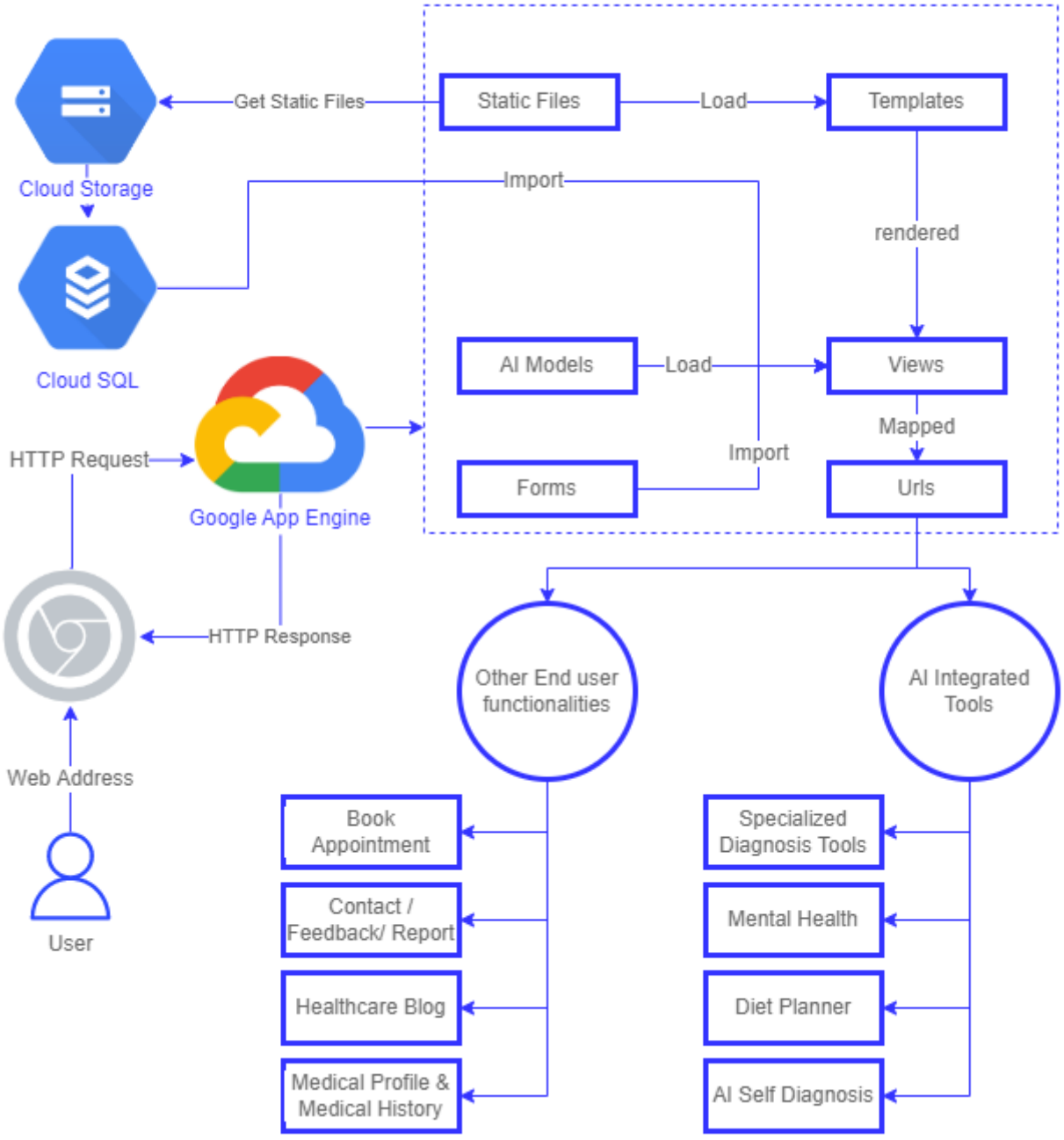
1. Develop and implement advanced machine learning algorithms and diagnostic tools within Pulse to enable early detection and accurate diagnosis of non-communicable diseases.
2. Improve accessibility and affordability of healthcare services by leveraging cloud computing technology, enabling individuals worldwide to access Pulse diagnostic tools and resources.
3. Enhance mental health diagnosis capabilities within Pulse, addressing the significant treatment gap in mental health services and promoting mental well-being. Enable individuals to access reliable and convenient mental health assessment and support through the application.
4. Integrate a comprehensive AI diet planner into Pulse, empowering users to make informed decisions regarding their nutrition and overall health. Provide personalized dietary recommendations based on individual health profiles and needs.
5. Enable users to maintain their medical profiles, access their diagnosis history, book appointments with healthcare providers, read educational blogs, and report any issues or bugs encountered within the application.

Target Users

- Healthcare Experts & Common Users
- Users vulnerable to diseases which account for higher mortality rate due to misdiagnosis
- Users vulnerable to mental health problems (students, working professionals etc.)
- Users falling under underweight or overweight category
- Users lacking healthcare services in resource constrained areas.

ARCHITECTURE

The design presented incorporates Djang, Google Cloud Platform (GCP), and Machine Learning to create a comprehensive solution. ML models, stored in Google Cloud Storage, are loaded in views.py for prediction. Static and dynamic files are hosted in Google Cloud Storage, and the application is made device-responsive using Google App Engine.



MODULES

AI & Machine Learning Modules				
Module Name	**Technology**	**Algorithm Used**	**Outcome**	**Accuracy**
NCD 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%

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.

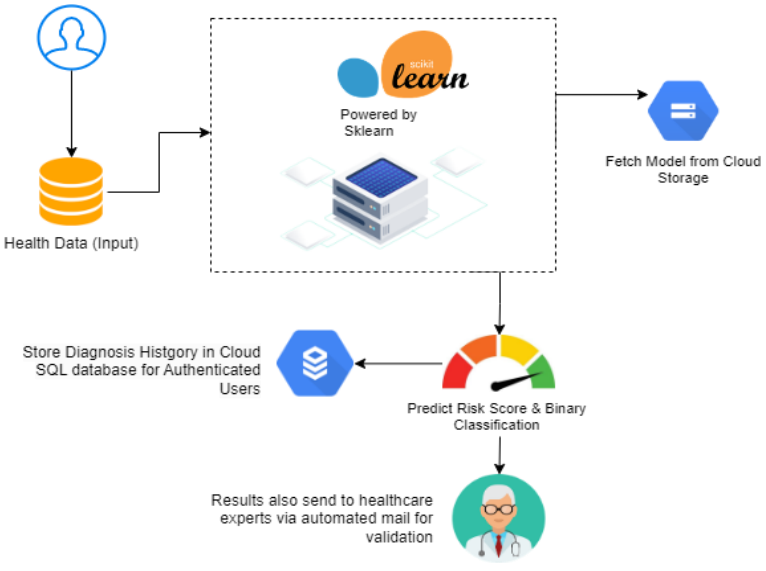
WORKING (AI & ML MODULES)

1. Non Communicable Diseases (NCD) Diagnosis

The burden of NCDs affects individuals, families, and healthcare systems, emphasizing the need for accessible and cost-effective solutions. Pulse 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, Pulse enables **early detection & accurate diagnosis**, leading to improved health outcomes.

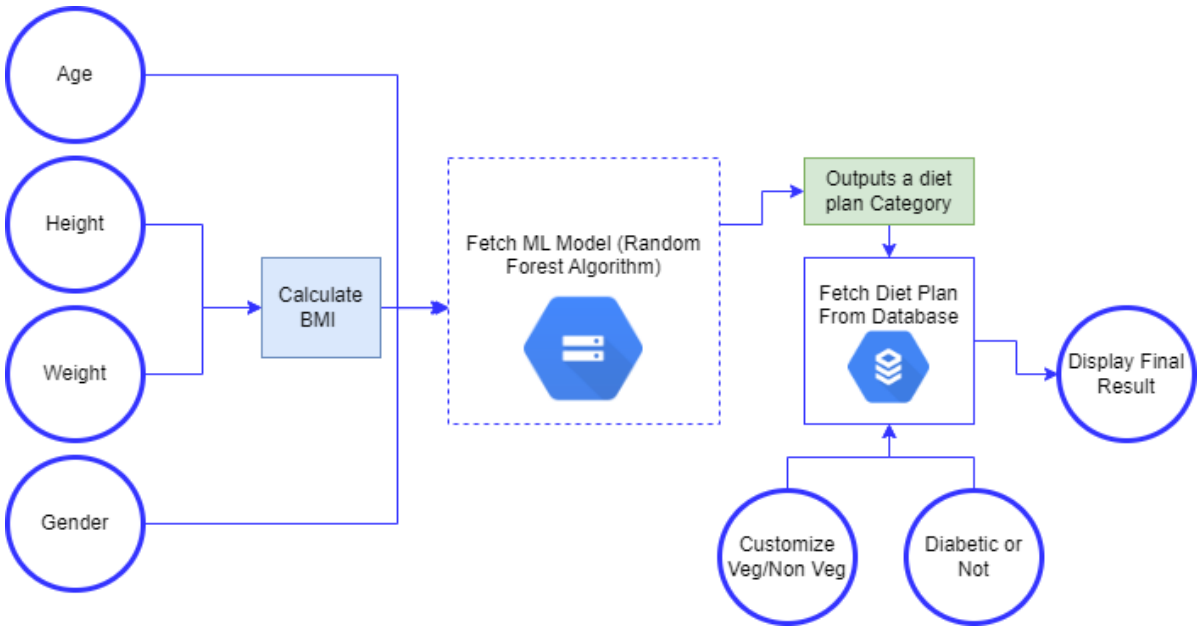
The user input health metrics as instructed in the dashboard. This is sent in the backend for prediction. The application fetch **ML model (Utilized Scikit-Learn)** from **Google Cloud Storage**, make the prediction & return the **risk score and binary classification** of the disease. If the user is authenticated, three tasks are followed:

- The results are sent to user via automated mail using **SMTP.**
- The results are also sent to **healthcare experts for validation** of results
- The **diagnosis history** is stored in the **Cloud SQL Database.**



2. Personalized Nutrition for Optimal Health

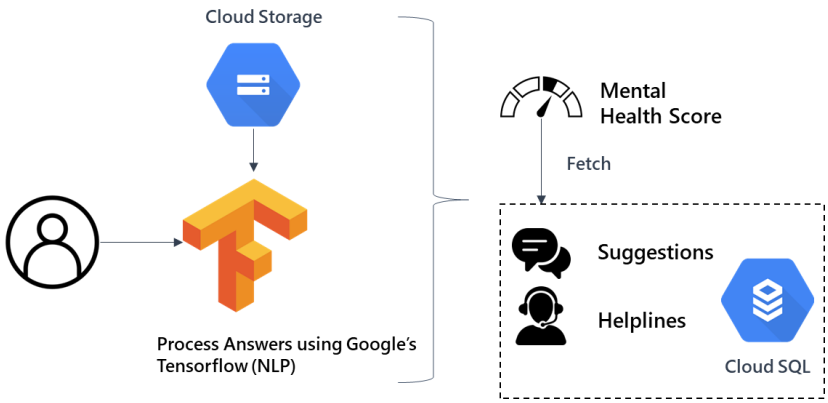
Pulse diet planner is an innovative feature designed to provide personalized and AI-driven meal plans. It leverages advanced algorithms and machine learning techniques to create customized diet plans tailored to individual needs and goals.
The diet planner takes into account various factors, including an individual's age, gender, weight, height, activity level, dietary preferences, and any specific dietary requirements or restrictions. By considering these factors, Pulse diet planner ensures that the generated meal plans are well-suited to each user's unique nutritional needs.



3. Mental Health

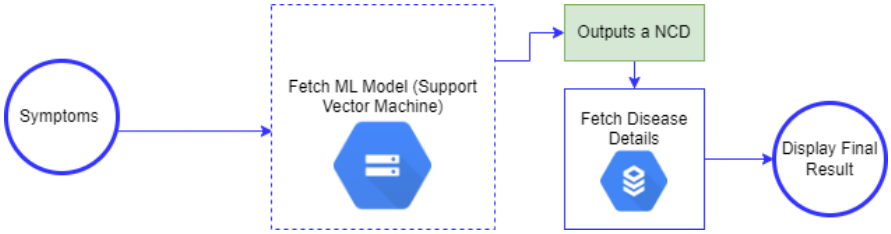
Pulse mental health tool, powered by TensorFlow, goes beyond diagnosis and prediction by providing users with a comprehensive mental health score and valuable suggestions for support. By leveraging TensorFlow's capabilities, Pulse analyzes input data related to behavioral patterns, symptoms, and other factors to generate an individual's mental health score.
In addition to the mental health score, Pulse tool utilizes Google Cloud SQL to fetch a curated set of suggestions and helpline information.

The user have to answer a few questions. It is Processes Using **NLP.** When the results are processed the users are presented with the **Mental Health Score** in the Range of 0 to 100. If the score is low, users are presented with a set of **helplines & suggestions** which are fetched from **Google Cloud SQL Database**.



4. AI Self Diagnosis (Only for NCD's)

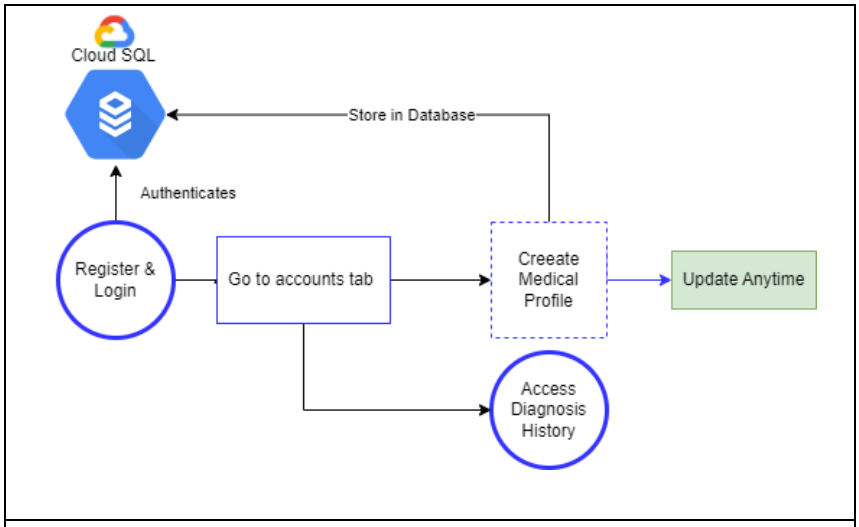
The AI Self Diagnosis tool is trained with **SVM (Support Vector Machine**). The User have to provide a few symptoms, then the model is fetched from **Google Cloud Storage** and users are presented with any **NCD's** they are suffering. The results are fetched from **Cloud SQL Database** where all the details regarding disease including precautions & medication are present.



WORKING (NON-AI MODULES)

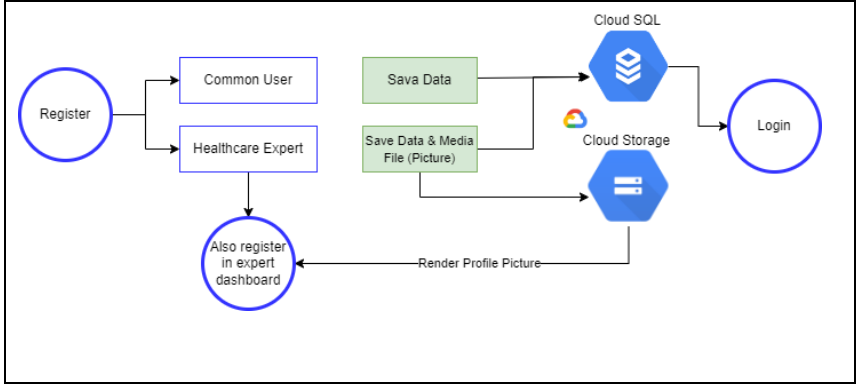
Medical History & Medical Profile

User needs to first register & login to the application to create medical profile and access their diagnosis history. Although user can still diagnose and use AI Tools without authentication, but their history is not stored when logged Out. Since we need user account ID to store history. The diagnosis history and medical profile data are rendered & updated via **Google Cloud SQL Database.**

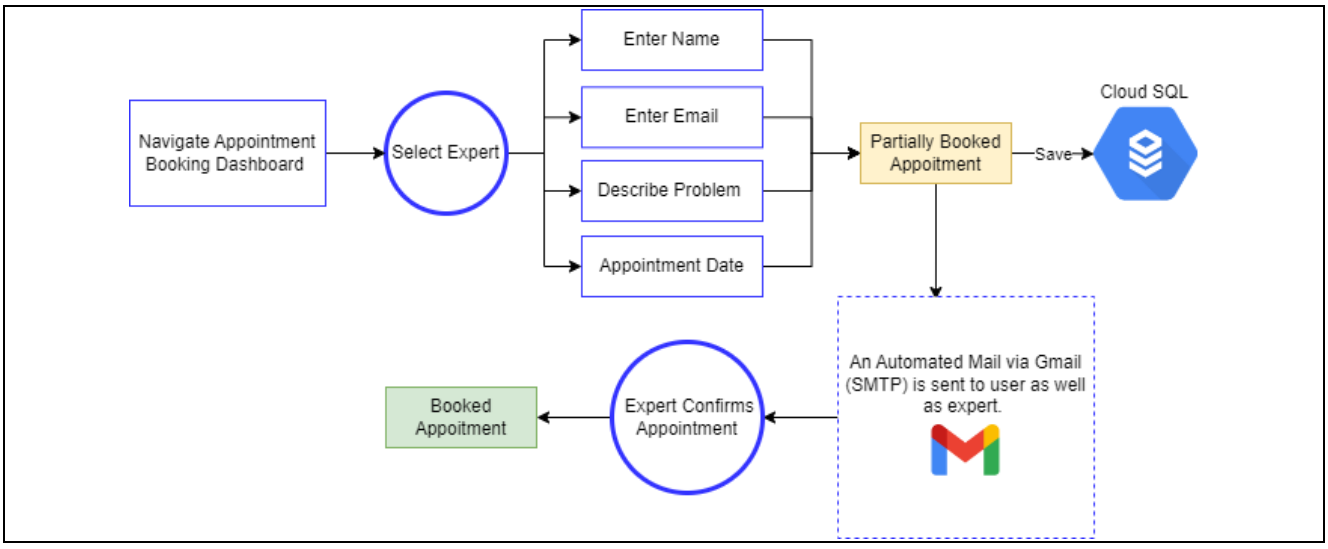


User Registration

You can register as common user as well as a healthcare expert. Both are registered & authenticated via **Cloud SQL Database**. The Expert are also featured in Expert Dashboard so that users can book appointments & contact them. The media files (Expert Profile Picture) are uploaded in **Google Cloud Storage.**

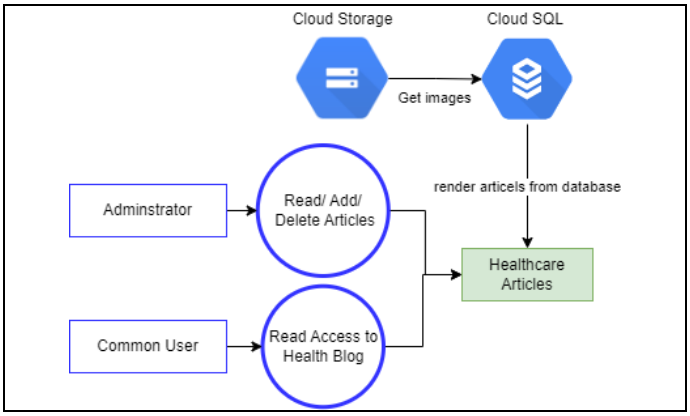


Book Appointment



Health Blog

Render articles from Google Cloud SQL Database & Images from Cloud Storage. The administrator can dynamically add/ remove/ update articles from the **Django administration.** The articles are stored in **Google Cloud SQL Database**.



The Application is Equipped with variety of other dynamic functionalities including:

- **Quick Search** (Search Any Article & Diagnosis Tools from the navigation bar)
- **Report a bug** (Report a bug button is available in every tool page, if any bugs found you can report)
- **Password Reset** (Integrated with login page, link is sent via mail to reset the password)
- **User Rating** (you can also rate us in the rating tab present in the navigation)
- **Contact Us** (Contact us via the form available in the end of the homepage)

CONSCUSION & FUTURE SCOPE

We have identified the challenge of identifying and providing **timely and accurate diagnosis** of non-communicable diseases and addressing the lack of accessibility and affordability of healthcare services. Our solution, Pulse, is an **AI-powered** healthcare application that includes NCD's diagnosis tools, an AI diet planner, mental health diagnosis, AI self-diagnosis & cover essential healthcare services. By harnessing the power of AI and Google Cloud, Pulse aims to overcome the challenges in global healthcare, making essential healthcare services accessible and affordable for people from all walks of life. Pulse 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.

Some possible future scopes include:

1. **Partnerships with Healthcare Providers:** Collaborate with healthcare providers such as hospitals and medical organizations to integrate Pulse platform into their existing systems. This partnership would enable healthcare professionals to recommend and use Pulse as a supplementary tool for diagnosis, treatment and patient engagement.
2. **Collaboration with Government and NGOs** working in the healthcare sector to leverage their networks, resources, and expertise. Engage in public-private partnerships to facilitate the adoption of Pulse in public healthcare systems and expand its impact on a larger scale.
3. **Multi-language Support:** This would involve providing language options for users to access Pulse features and content in their preferred language, thereby enhancing inclusivity and accessibility.
4. **Blockchain-Based Identity Verification:** Enhance user authentication and eliminate the risk of identity fraud. By utilizing blockchain for identity management, Pulse can provide a secure and trusted environment for users to access the platform's features and services.
5. **Immutable Health Records using blockchain:** Storing health records on a blockchain can ensure their immutability and accessibility across healthcare providers.