HealthAI

One Stop Destination for all your health concerns

The Team

The members of team HealthAI crossed paths in college based clubs like The Robotics Club and IEEE Society because of their aligned interests. However, it was the pandemic induced lockdown which gave us the opportunity to collaborate. Recognizing our complementary skillsets and our mutual interest in solving real world problems through technology, we decided to submit our solution for alleviating the stress and load on healthcare facilities during this pandemic to Imagine Cup .

Akash Srivastava, *VIT Chennai, Electrical and Electronics Engineering , 2021*

A wholesome human being having the fragment of spices such as leadership, project operation and management. Currently embracing career in full stack software development. Besides the professional skills, sketching as his extracurricular activities. Akash is a bucket of innovations and loves playing with numbers.

Karthik P, *VIT Chennai, Electronics and Computer Engineering, 2022*

Karthik is a tech geek who actively collaborates in communities that aim at mentoring other enthusiastic students. He has organized online tutorials and written blogs to simplify the understanding of Data Science for beginners. Research in Machine learning is his main interest, and he aims in developing better technology and applications in the field of Medicine and Agriculture.

Mansi Parashar, VIT Chennai, Computer Science and Engineering, 2022

Mansi is an enthusiastic learner who is active in many cultural, non-technical, and technical clubs across the campus. With a background in Biotechnology, she strives to bridge the gap between Healthcare and Technology. Adept with Full Stack Development and curious about Machine Learning and its facets, Mansi aims to create tech that makes a difference.

Devashish Srivastava, VIT Chennai, Computer Science and Engineering, 2021

Techie who loves to learn and explore new things. Devashish is an ambitious individual who is looking to broaden his career path. Machine Learning Enthusiast, Quick learner and Passionate about Coding.

The Concept

With the rapid spread of COVID-19 and its detrimental impact on societies across the world, it was shown just how fragile the HealthCare system is, and how it buckles under severe load and risk. There is **physical and mental exhaustion of the healthcare workforce**, along with **worn-out hospital infrastructure.** Also, a **growing "backlog" of healthcare procedures.** For example, the inability or fear of high-risk patients to consult a doctor is disrupting chronic disease management and delaying some critical cancer care procedures. In France, consultations have fallen by 40% among general practitioners and by 50% among specialists since the beginning of the epidemic, even when accounting for the surge of tele-consultations.[source]

The Pandemic revealed major gaps in the current healthcare institution.

We propose using cutting edge technology to bridge this gap. Our primary goal is to reduce the load on HealthCare facilities at times of breakouts – It needn't be only COVID-19, but also for seasonal flu, viral season etc. so that people who actually require intensive care are able to obtain it, reducing threat of loss of life. Our secondary goal is to curb false information during such critical times. Fraudulent news is prevalent, which causes panic amongst the masses and makes them rush to the clinics, resulting in an even more increase in load.

Our solution addresses these critical problem statements in a threefold manner. We develop a "Health Monitor"- An application that can act like Early Diagnosis, and give users probability of COVID infection based on their symptoms. We acquire an approved list of symptoms from registered medical professionals, and constructed a robust Machine Learning Algorithm for the prediction task. We also incorporated the feature of report generation. This lets the users make informed choices about the need to visit Hospital/Clinic, based on their results, and also suggests possible course of action.

To reduce panic caused by spread of unverified news, we suggest an Artificial Intelligence powered FAQ ChatBot : AI Doctor. The knowledge base has been collected from verified sources like WHO, and trained using NLP. The AI Doctor, deployed as an Azure Bot, serves as a platform to gain verified, correct information about the pandemic in an interactive manner. It serves as an official information center, hence reducing the load on Primary Workers and Care Providers through innovation in Technology.

Finally, we propose an innovative solution which empowers the general masses to make informed decisions and practice social distancing of their own accord. The third module, HotSpot, makes use of Azure Maps and highlights COVID hotspots on the map using colored markers. This would be a boon to society as it would simplify social distancing and help people plan ahead, and also analyze the demography of COVID-19 clusters at societal level.

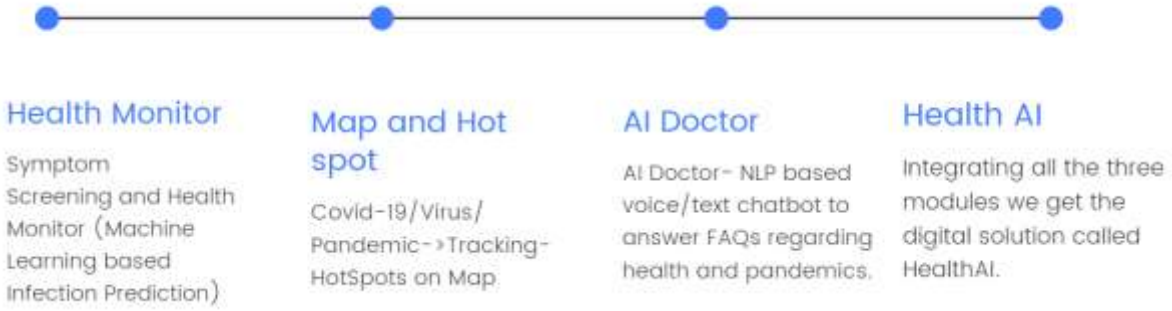


Figure : The Concept

Target Audience or Market:

"Going digital" is not enough — "being digital" appears to be the new necessity for all healthcare organizations."

With the direct impact on our lives, healthcare has become one of the largest growing industries today. The healthcare market has undergone major changes. Patients tend to be dissatisfied with poor service and lack of transparency around price, quality, and safety. Today they are seeking accessible, customized, and convenient healthcare services.

According to the Accenture 2019 Digital Consumer survey, convenience becomes the top factor when seeking medical treatment. People are also paying attention to the affordability and reputation of a medical provider.

With regards to our application, the major portion of target audience would be the younger generations, often referred to as Generation Z and Millennials, they are more likely to choose a digital provider who offers digital services and solve their queries. This web app is for anyone who are concerned about their health and get diagnosed in order to treat themselves at an early stage. Also, we are only focusing upon Indian audience with respect to geographical boundaries.

Estimated Size of Target Audience: 63.6%; https://en.wikipedia.org/wiki/Demographics_of_India

Age structure	
0–14 years	28.6% (male 190,075,426/female 172,799,553)[5]
15–64 years	63.6% (male 381,446,079/female 359,802,209) (2009 est.)
65 and over	5.3% (male 29,364,920/female 32,591,030) (2009 est.)

Figure: Age Structure

Personas

The Family

As lockdown restrictions relaxing, The Family wants to start going out. Being cooped up at home has taken its toll. They log onto HealthAI and check the HotSpots in their area, decide that the beach is too risky, and hence go to a less risky spot in the outskirts.

Now after their trip, The Son feels a little feverish. Panicked, The Family logs onto HealthAI and uses Health Monitor for early diagnosis. Phew! The symptoms are that of a seasonal cold. The report suggests they wait for 4-5 days, and if it doesn't subside, they can use HotSpot to locate a clinic in a relatively COVID free zone for a general checkup.

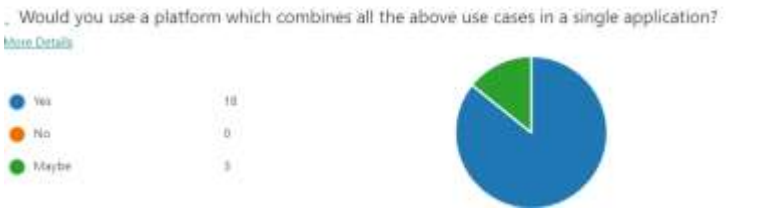
Being Responsible citizens, they decide to quarantine anyways. The Daughter wants to know the prescribed methods for home quarantine, and AI Doctor is there to help her with her queries about duration and methods.

Feedback

Microsoft Forms was integrated in our web application to facilitate feedback collection after testing.

The audience for testing was chosen based on our target audience – People who have to go out quite often due to work or School/College, and people involved in COVID-19 HealthCare.

Some key results based on the desirability of our solution to the described problem statement:



Summarizing Feedback Results based on the UI/UX of the Application:

Few Selected Questions	Average Score (/5)
Rate the Website in terms of Design and Aesthetics	4.38
Rate the website in terms of ease of use	4.29
Rate the website in terms of responsiveness and User Interface	4.24

Conclusions :

- We can infer that users do subconsciously have a need for the modules described by AI Doctor, Health Monitor and Hotspot
- Users are willing to use such a health platform which integrates and automates their tasks
- Users rated the website good in terms of UI/UX. However, they seemed to feel like more responsive components can be used.
- Users also show that information entering can be made more user friendly using design innovations. Following this feedback, we incorporated design innovation to present a fresh way for information inputting.

How it works:

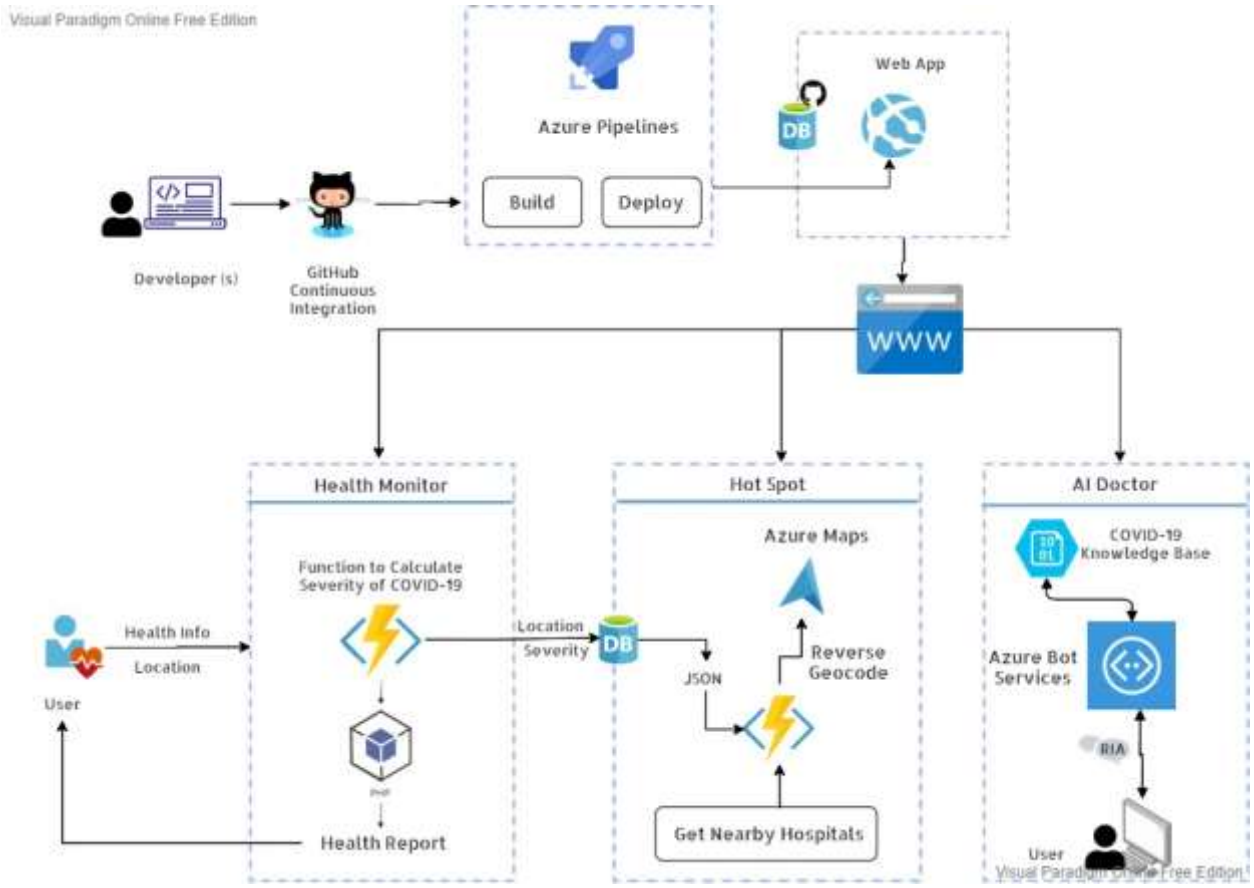


Figure : Architecture Overview

HealthAI is built as an application which integrates various ambitious modules to provide a single holistic health solution and consulting destination for users.

We will first discuss our modules, and then the overall product.

Module 1: Health Monitor

- Health Monitor serves as an **Early Diagnosis too**l for users to gauge whether their symptoms map onto a COVID infection or not, and if so, to what extent.
- It makes use of **Custom Machine Learning pipelines,** constructed using algorithms like Logistic Regression and Random Forest Regression. These pipelines were implemented in the backend keeping in mind **minimal lag for prediction** to enhance user experience. **Microsoft Azure Notebooks** were used for achieving High Performance Computing during training of data.
- An interactive frontend is used to obtain user information like their **symptoms and location**.
- Our trained model then uses this information to **predict the probability of COVID-19 infection**. Moreover, A **PHP Backend** is used to generate a **complete Health Report** for the user based on results of the model and number of cases in their locality**, giving remedies, guidelines and steps to follow based on the results.**
- Keeping in mind the user's expectations of Health Monitor, to ensure that complete use of the Health Monitor is made, we have added functionalities of integrating local Current Affairs and News related to the Pandemic

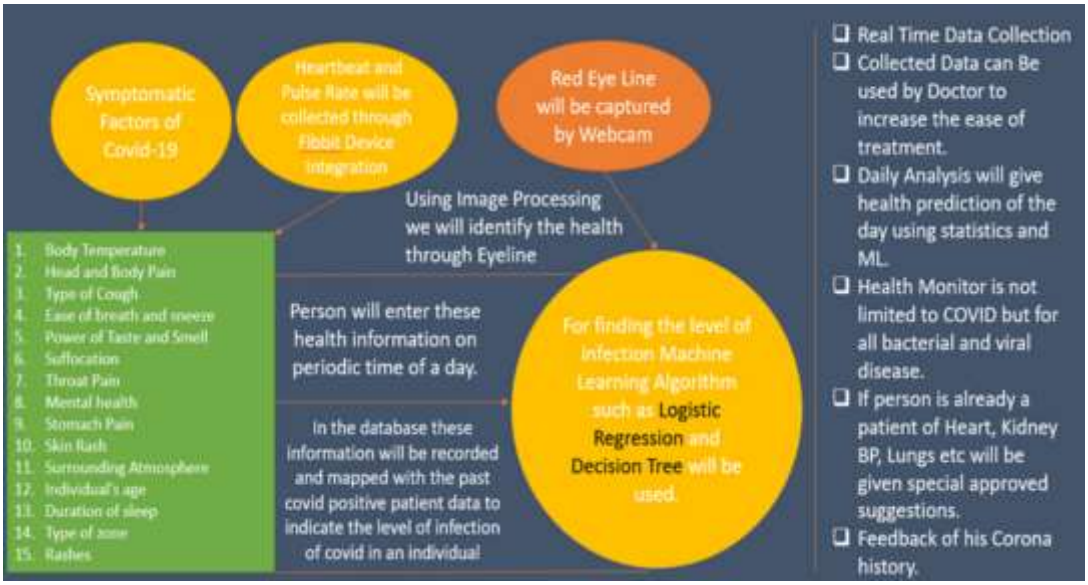


Figure : Overview of Health Monitor

Module 2 : HotSpot

HealthAI HotSpot is an innovative feature yet to be seen in the commercial market.

It includes 3 major functionalities :

1. Mapping the severity of COVID-19 using JSON file acquired from Health Monitor to update hotspot zones.
    - By initializing **Azure Maps API** using primary key after creating the resource on Microsoft Azure, the json file is loaded. It contains **severity score along with latitude and longitude**.
    - **Reverse Address Lookup** is implemented by passing the person's coordinates and the color of the pin (red, orange and green)is set according to a range.
    - The Symbol layer was **modified from default Azure** icons by using icon **imageSprite API** for revitalizing the User Experience.

2. Getting nearby hospitals and Visualizing them on a responsive map
    - In order to get nearby hospitals, An Azure Maps SearchURL() pipeline was created and query was set to 'multi-speciality hospital' and the range of search was set to 10km. Pop up feature was enabled when hovered over the hospital to give the details of the hospital using setPopupOptions().

3. Viewing current statistics of COVID-19 across the globe,
    - For the statistics, bingwidget by Microsoft was embedded into the webpage and the datatype was set to 'covid19_map'.

Hence, The HotSpot Module makes complete use of the various Map Services provided by Microsoft, in terms of Platform and APIs, to bring in Innovation in analysing the demography of patient map at a societal level, and facilitating social distancing.

Figure : Hotspot overview

Module 3 : AI Doctor

The AI Doctor module is an inbuilt ChatBot in HealthAI Application. A ChatBot can be defined as a computer program designed to simulate conversation with human users. Our ChatBot is specialized in responding to queries about the pandemic, and latest developments regarding COVID-19.

Algorithm

- Frequently Asked Questions (FAQs) about the pandemic are carefully curated from verified sources like the World Health Organization, CDC.
- A JSON file for the same is constructed using the FAQs, and the ChatBot is trained using Azure bot services.
- The Azure Chatbot is deployed along with the HealthAI Application with a custom UI/UX which follows the principles of Human Computer Interaction for innovation in User Experience.
- Currently, the ChatBot has not been given a "personality". Azure bot service provides inbuilt personality that can be integrated into the chatbot. Hence, this is one feature we can look ahead to make use of.

Human Computer Interaction

The principles of Human Computer Interaction are given the utmost priority in AI Doctor.

- Familiarity: The Chatbot is designed with a pleasing UX resembling the chat applications that are used on a daily basis.
- Responsiveness: After the user sends their query, and before the appropriate answer is delivered, the typing signal of 3 dots appear to reduce user confusion, letting them know that the query was received successfully and the response is on its way. Also message status(Sending/Sent) is dynamically updated.
- What You See Is What You Get (WYSIWYG): From our research, we have found that users tend to distrust chatbots which act like a real person is holding the conversation, when it is not the case. The AI Doctor with its appearance, makes no false claims about not being a bot. It gives factual, credible information about the Pandemic, ensuring that the users are given proper information and reduces panic caused due to rumors.

Technology Stack

AI Doctor makes use of

1. Azure Bot Services
2. HTML/CSS and Bootstrap for frontend
3. JavaScript
4. Natural Language Processing

Final Product:

The modules are integrated in the single application. The application is **deployed and hosted** on the net using **Microsoft Azure CI/CD pipeline**, with **GitHub integration**. The use of Azure Services for deployment lends production standards.

As the application is deployed on the cloud, there is a professional degree in terms of scalability, reliability and security which are provided by Microsoft Development Services.

By hosting it and obtaining the software as a **shareable link on the internet**, we have also demonstrated the **working protype as a proof of concept.**

Concluding Remarks:

- Thus, by incorporating Machine Learning, we give the application a degree of innovation in health monitoring. Using Azure Services of Maps and Bots make it easy to integrate for AI Doctor and Hotspot, making the **User Experience more flexible, dynamic and relatively fast.**
- The product has scope for inclusion of Audio support in the ChatBot, using Text-to-Speech APIs for the **visually impaired**, or those not in the habit of typing/using the keypad.
- Add Support for **Regional Language integration**, and generate the report in the regional language too, making it easier for everyone to use.
- We aim for making it an **inclusive application irrespective of age and educational background**.
- The application avoids making any conclusions based on the **gender identity or sexual preference** of the person in any of our modules, in order to be respectful to the LGBTQIA+ Community.

Core Technologies

The core technologies involved in HealthAI:

- Machine Learning using Python and Jupyter Notebooks for Artificial Intelligence based Early Diagnosis.
- Natural Language Processing for FAQ ChatBot
- PHP for Backend
- HTML/CSS and JavaScript for User Interface
- Bootstrap for styling and enhanced User Experience

Platforms and APIs used are:

- Microsoft Azure Maps Services for HotSpot visualization
- VS Code for Web Development
- searchPOI API for detecting nearby hospitals and clinics
- Bingwidget by Microsoft for COVID-19 Stats
- Microsoft Azure Bot Services for training and deploying AI ChatBot
- GitHub for Continuous Integration
- Microsoft Azure CI/CD pipeline for deployment

The Business Plan:

Competition:

Without a doubt the pace at which new technology is impacting our everyday lives is increasing at lightning speeds. In 2014 it was documented that 29% of all people said that their phone was the first and last thing they looked at everyday which is a telling sign of how connected we are all becoming to technology.

There are already web and mobile apps that fill different roles, from providing access to information saved in different databases to managing communication between doctors and patients, monitoring their state, and scheduling appointments in clinics.

Digitization has already paved its way to healthcare, enabling health companies to get closer to patients and assist them when needed. Consequently, many providers want to create a medical app.

Our application aims at providing guidance whenever required through AI Chatbot so that the user can be rest assured of the fake news that always terrifies them. Users can get diagnosed and maintain their data records, as per the diagnosis they can be aware of their health which can provide them a healthy vibe during this time of pandemic. Since we need to overcome the challenge of maintaining social distance, we have also provided a hotspot area map through which users can get to know about their neighborhood and hence, take the necessary precautions accordingly.

Our application will support the challenging economics and can increase levels of self-care and accelerate transformation towards practice and services that monitor, inform, enable and support on-going management of conditions and vulnerability.

Business Model

The best way to put your app strategy in one place is to create a business canvas. The market is still unfolding, and there is a high demand for healthcare applications.

There are several ways through which our application can make money. With regards to our application, Freemium business model is a perfect fit, this monetization model can provide us good amount of profit in the initial stage.

Freemium: With a freemium, a user gets two versions of the same app: free and premium. With a free version, a user is typically introduced to the basic functions, while the premium version gives access to more advanced features. The Freemium model adds to the user's commitment and engagement.

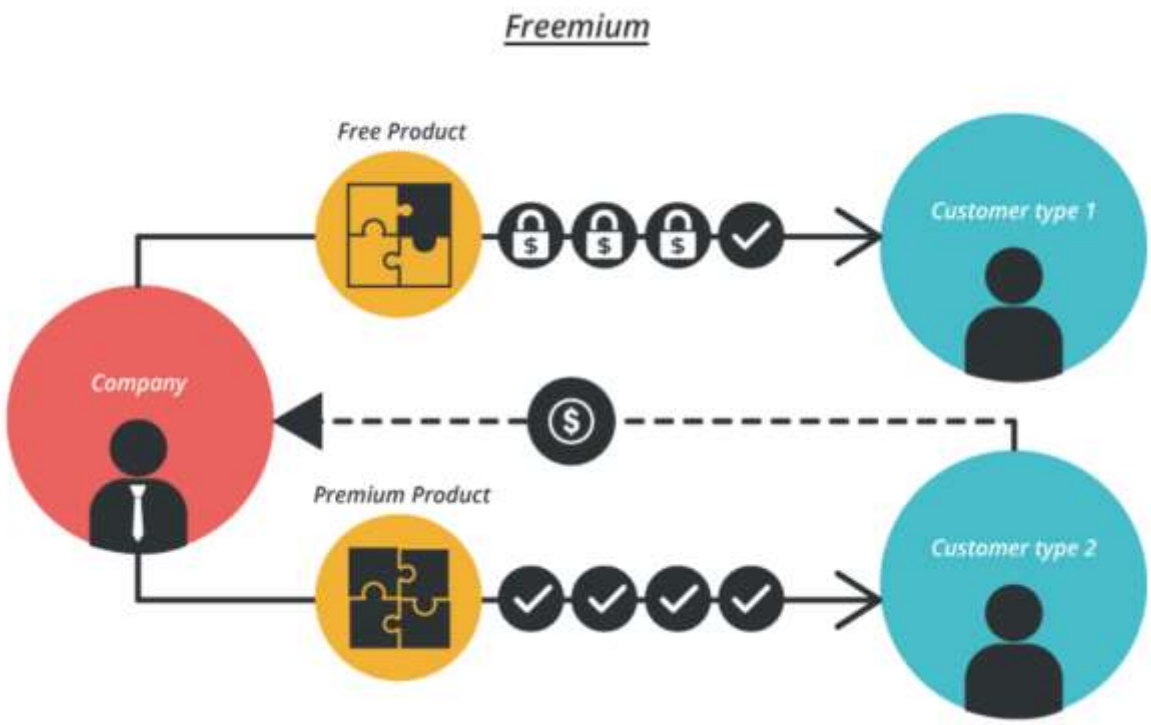


Figure: Business Model

When done right, the freemium business model can help drive massive traffic to our website as it offer a "try before you buy" experience that overcomes user resistance to paying, and convert free users to paying customers.

It is easy to get a large user base when you offer your product for free. When starting up, our free users can be our future customers. These customers can be our source of revenue when they upgrade to a paid version. Moreover, we can use free to build brand awareness that you can later leverage for cross-sales or upgrades.

This point is very crucial with regards to our application. Customers using premium apps expect a certain level of service and commitment from the developers. This can mean cutting down on costs and reduced downtimes in case of any problems. As such, free users may upgrade to get the support of the developer and hence this can give our application a very powerful boost in order to make our position strong in the health care market.

Additional Information:

- Prototype link : https://healthai1.azurewebsites.net
- HealthAI Software instructions : https://vitacin-my.sharepoint.com/:w:/g/personal/mansi_parashar2018_vitstudent_ac_in/ETD71FPV_t1NpX6o-nkTnPsB7pR8qGeo4wNx0oqShe5OtA?e=EfZAgK
- Link to Source Code : https://github.com/AkashSrivastava1721/HealthAI_Imagine_Cup_2021