

Heart Diagnostics and Analytics Dashboard

H DAD

By Team Atreya

Our Project || Product && Vision

HDAD aims to bring a multitude of state-of-the-art and latest Machine Learning research in Healthcare to every clinician, anywhere and anytime.

HDAD bridges the gap between research and its application by ensuring that the best methodologies, models, metrics and other nuances are actually impacting the lives of people.

HDAD aims to provide every clinician with all the possible tools to make data-driven decisions in order to save maximum lives at stake.

HDAD leverages the power of DATA and shapes it into a go-to platform for clinician's assistance.

“Future is not about replacing the human jobs with AI/ML, it is the harmony of both” - Team Atreya

WHY ?

India presently doesn't have a centralized EHR system as in developed countries therefore a primary need of EHR exists enabling analytics and predictions.

Every moment thousands of research papers, models and methodologies are introduced all around the world, but a diminutive percentage of it directly impacts the lives of the people.

Although, For-profit organizations develop reliable and meticulously tested solutions but their availability is limited to certain clinicians due to various reasons such as costs, subscription privileges, etc.

Amalgamation of ML and Healthcare is still in its initial stage therefore we took an initiative to deliver a reliable platform for every clinician who can benefit from assistance of a data-driven decision making using ML and research.

Continued ... !

And Why Focus on Heart ?

“1 person dies every 36 seconds in USA from CVDs” - US CDC

Heart Diseases are the Leading cause of death globally. As per US CDC, about **659,042 deaths** occurred due to Heart Diseases in 2019. Heart Failure (HF) alone was mentioned on **13.4% of all the death** certificates issued in 2018.

Cardiovascular Diseases (CVDs) take **~17.9 Million lives** each year globally. CVDs cause ~50K deaths more than Cancer in US annually..

In India, out of ~10.5 Million deaths in 2010, **~1.95 Million deaths** were due to CVD which is >3 times than that of US at present.

Shockingly, there are **only 4000 cardiologists** in India whereas need is of at least 90,000. US has ~33,000 cardiologists while having 1/3rd population of India.

The World Heart Federation predicts more than **23 million CVD-related deaths** per year by 2030.

Hence HDAD !

Our project provides an array of data-driven ML based diagnostic and analytics tools for tackling Heart related issues which assists the clinicians by:

- Making accurate predictions, diagnosis and stratification of patients
- Taking prognostic decisions based on results from Models and their expertise
- Manage, visualize and analyze the patient data over time (EHR)
- Access to patient data securely from anywhere and on any device
- Access to a plethora of state-of-the-art and breakthrough research based ML models
- Using our services without putting patient identity at risk and added security features

Can we do it ? In short, YES !

Starting with Team Lead, Achal Dixit, a student researcher with a keen interest in amalgamation of **ML/AI and Healthcare**. He has collaborated with researchers from University of Michigan Medical School and Taipei Medical University, to develop a data driven triaging model for covid-19 patients which was **published in the American Journal of Emergency Medicine**. He has lead other members of team to research on Heart Failure prediction, classification and detection using ML, with **2 potential papers** submitted for review and **one accepted oral presentation in ICICA 2021 Australia Conference** as first author. He has also led multiple teams which have won numerous Hackathons. His skills include **Machine Learning, Cloud Computing, Project Management, Data Analytics** and Research.

Ashish Mishra is a **deft web-developer** who has been working on full-stack development along with other members in multiple hackathons. He has a strong portfolio of developing web-apps using stack: **React, Node, Flask, MERN, JavaScript, HTML/CSS**. He also possesses some experience as a freelancer.

Ashmit Ayush and Kumar Badal have actively worked in carrying out research which resulted in the accepted ICICA 2021. They both possess similar skill-set which includes **Machine Learning, Statistical Analysis, Literature Survey, Data Analysis**.

Our team receives eminent guidance from Professors at **Indian Institute of Information Technology Guwahati** and comments from previous Medical research collaborators at **University of Michigan**.

Our Progress So Far

We have developed a web-app with pilot ready functionality.

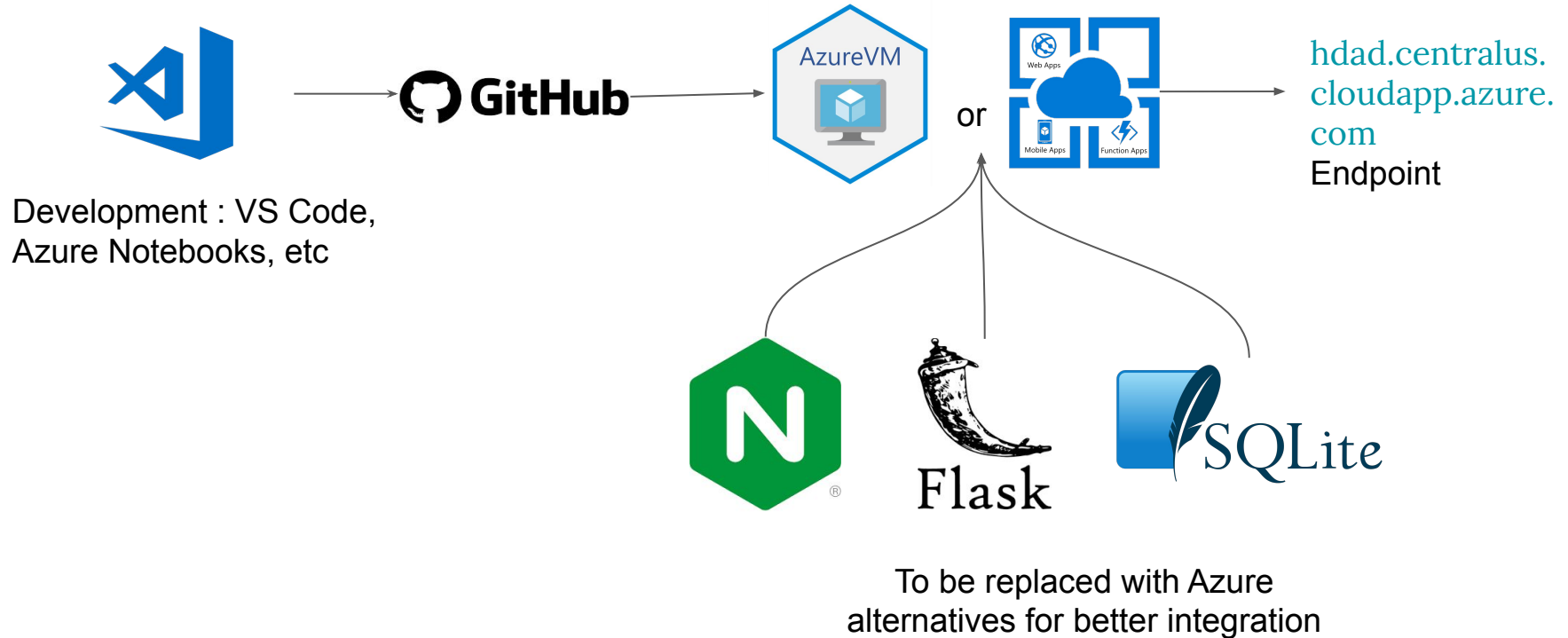
It includes patient management and analytics features.

Currently, two ML models for Congestive Heart Failure Detection and Heart Failure Classification are included. They are backed by academic research of team members, accepted and under review. HF Classification model is developed with capability of demystifying a specific class of Heart Failure, paper under review.

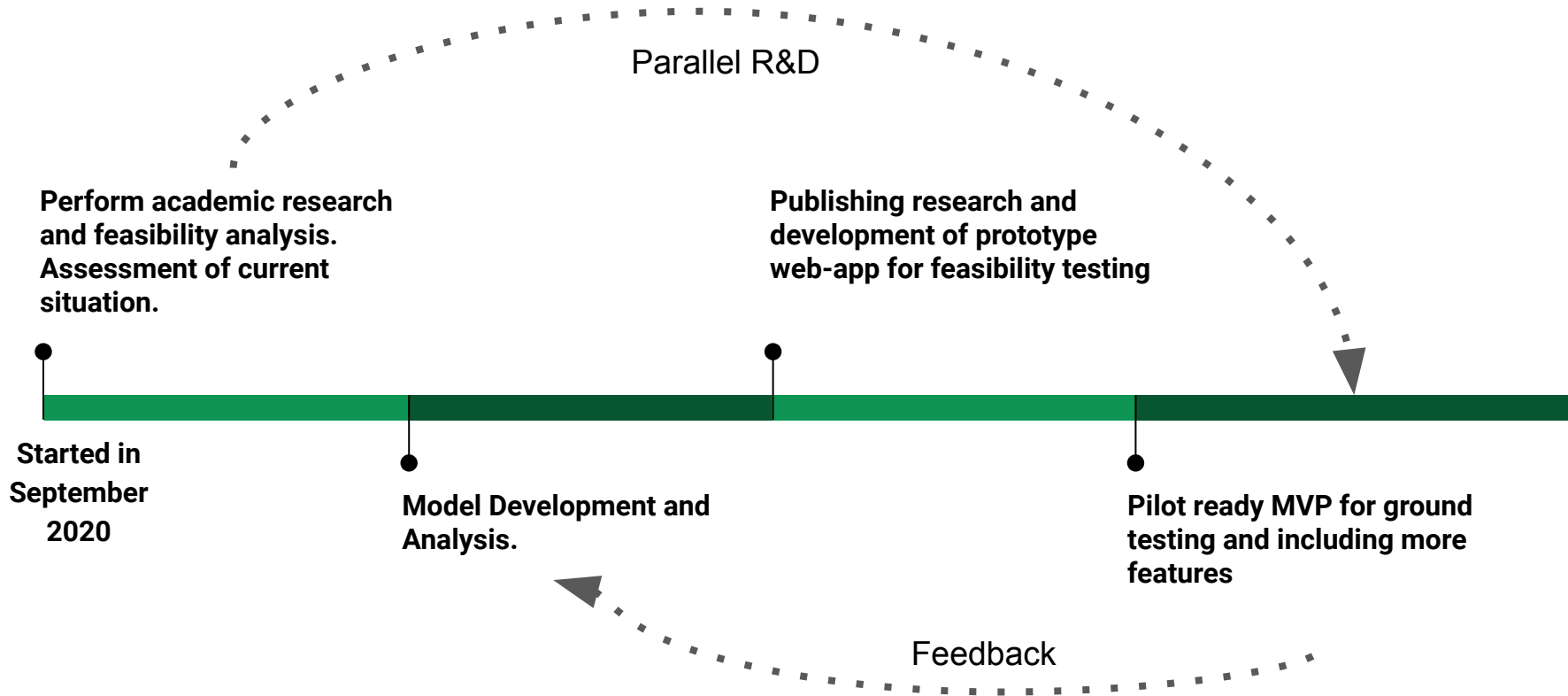
App is deployed on Microsoft Azure VM can be accessed at :

A revamped UI is also added for swift intuitive usage.

Development pipeline



Progress and design cycle



SWOT Analysis

Strength

ML based CVD prediction and diagnosis tools.
Analytics and Data Visualization of clinical attributes.

Leading Research and State-of-the-art based models to be included

High Propositional Value in current scenario.

Idea Appreciated by Medical Researchers

Opportunities

Supporting Outnumbered clinicians especially cardiologists. Preliminary EHR service with added features.

Integration with already existing EHR applications to provide automatic predictive and analytics service.

Access to economically weak countries and healthcare infrastructures including all levels, from small clinics to organizations.

Competitive advantage in India

Weaknesses

Difficult model development and evaluation for deployment. Can be tackled through Azure services

Benchmarking the model performance in real world scenarios

Certification/Standardization from authorities although can be used individually by a clinician like other services such as MDclac, etc.





Threats

Very diminutive to no threat in India and developing countries where scope is massive for EHR and ML in healthcare.

Private Organizations such as Epic Systems, MDcalc, etc which are readily used by clinicians.

Yet, they lack ML/DL and Analytics services while providing basic formula based calculators with manual inputs.

Project Model

<p>Key Partners</p>  <p>Possible Partners :</p>    <p>AIIMS All India Institute Of Medical Sciences</p>	<p>Key Activities</p> <p>Research Web-Development ML Model Dev Scale and Deploy</p> <p>Key Resources</p> <p>Researchers Web-Developers Project Managers Technology Stack Cloud Compute</p>	<p>Value Proposition</p> <ul style="list-style-type: none"> - Strengthening Heart Healthcare Infrastructure - Data-Driven assistance to every clinician - Saving lives by empowering clinicians to overcome lack of experts 	<p>Consumer Relations</p> <p>Feedback channels for continuous improvements.</p> <p>Channels</p> <ul style="list-style-type: none"> - Web-App - API - Mobile Devices 	<p>Consumer Segments</p> <ul style="list-style-type: none"> - Clinicians - Private Hospitals - Government Organizations - EHR services - Public Hospitals - Private Orgs. <p>Developing Healthcare solutions</p>
<p>Cost Structure</p> <ul style="list-style-type: none"> - Academic Research - Replicating state-of-the-art for deployment - Cloud Services - Web-Development, Design and Maintenance 			<p>Revenue Streams</p> <ul style="list-style-type: none"> - Monthly Subscription and Add-on Services - Contracts or Purchase as whole - No-cost membership to weak sections 	

Future Objectives

Addition of Computer Vision and Image Processing Models using **Azure Cognitive Services**

Developing a full-scale Electronic Health Records (EHR) into the web-app using **Azure FHIR**

Integration with other EHR to provide autonomous predictions and diagnosis.

Notification feature for alert and high risk patients.

Addition of basic features to make an all round platform for Heart Patients' Diagnostics and Analytics

To scale and reach all the clinicians who are working with lack of resources or can benefit from our project in developing countries

References

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1. Heart Disease and Stroke Statistics—2020 Update: A Report From the American Heart Association, Salim S. Virani, et al., On behalf of the American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee
2. Adam Timmis, Nick Townsend, et al., European Society of Cardiology, European Society of Cardiology: Cardiovascular Disease Statistics 2019, European Heart Journal, Volume 41, Issue 1, 1 January 2020, Pages 12–85, <https://doi.org/10.1093/eurheartj/ehz859>.