SOFTWARE DESIGN DOCUMENT

for

HEALTHKARD

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1 Introduction

1.1 Design Overview

HealthKard aims to develop the foundations necessary for supporting digital health infrastructure for maintaining health data in a decentralized and secure way. A few major advantages to this project will be ease of access, user consent for every sophisticated transaction, and portability across national borders.

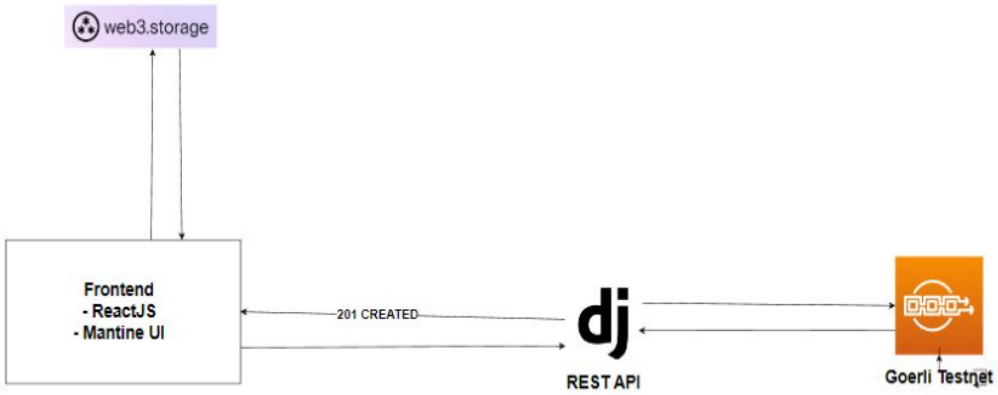
HealthKard aims to implement the following modules:
• Creation of a unique Health ID using Aadhaar Number.
• Storage of Electronic Health Records (EHRs) mapped to Health Identity in the blockchain.
• Integration of different sectors in the medical industry.
• Encourage better administration of the health sector by utilizing health data analytics.

1.2 System Architectural Design

1.2.1 Client-Server Architecture

We choose client-server architecture for our system. There are two types of clients: Normal Users and Health Experts, each having a different interface. Both of these types of users interact with the same server with a common database and blockchain. Therefore, we separate concerns for application program and data management in our system.

Figure 1.1: Architecture



1.2.2 Model-View-Controller

This is our second choice of architectural design. We chose Client-Server over MVC due to the fact that there is minimal dynamic content and need for dependency mechanism since the entire data needs to be changed, if any changes are applicable, only when the page reloads.

1.2.3 System Interface Description

Ethereum Blockchain

We use the Ethereum Blockchain to save users' health records linked to the respective users' MetaMask account. The users' MetaMask Account is further linked to their Aadhar Card number.

File System

We use a modular file system where the Front End and Back End of the application are separated into different modules to improve maintainability.

Hardware Interfaces

1. Processor: x86 or x64
2. RAM: 512 MB (minimum), 1 GB (recommended)
3. Hard disk: up to 512 MB of available space may be required.

Software Interfaces

1. Operating System: Any OS that can support a gunicorn server.
2. Front End Stack: ReactJS, Recoil, MUI, TailwindCSS.
3. Back End Stack: Django REST Framework, PostgreSQL.
4. Browser Requirements: Any modern web browser having MetaMask extension.

Communication Protocols

1. The client side and the server endpoint will communicate using standard HTTP (Hyper Text Transfer Protocol) which is a generic stateless protocol.
2. The email system will use the SMTP protocol.

2 Software Designs

2.1 Detailed Description of Components

2.1.1 Authentication

1. Allow new users to login/register.
2. Verify their identity using the Aadhar APIs.
3. Change Password and Logout
4. Create profile for Health Expert.

2.1.2 Health Card creation

1. Link users' MetaMask to their Aadhar Card.
2. Save users' Health Records over the Blockchain.
3. Allow health experts to access users' data only after their consent.

2.1.3 EHR Storage

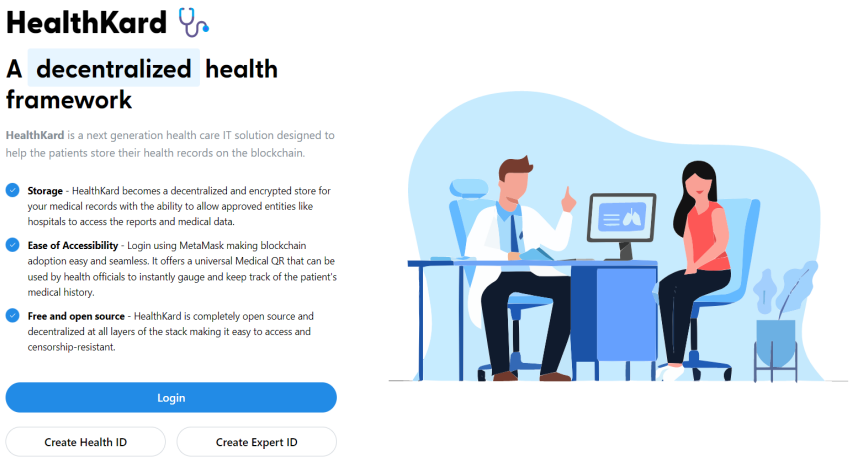
1. Storage of Health Records.
2. Share EHRs with health experts and maintain access control protocols.

2.2 Landing Page

A landing page is any web page that a customer can land on, but in marketing, it's usually a standalone page that serves a single and focused purpose, separate from your homepage or any other page.

2.2.1 Screen Images

Figure 2.1: Landing Page



2.2.2 Objects and Actions

Hero Image:

It is just a simple image used to beautify the Design

Description:

It showcases the features and short description of our web application

Action Buttons:

We have the following buttons here

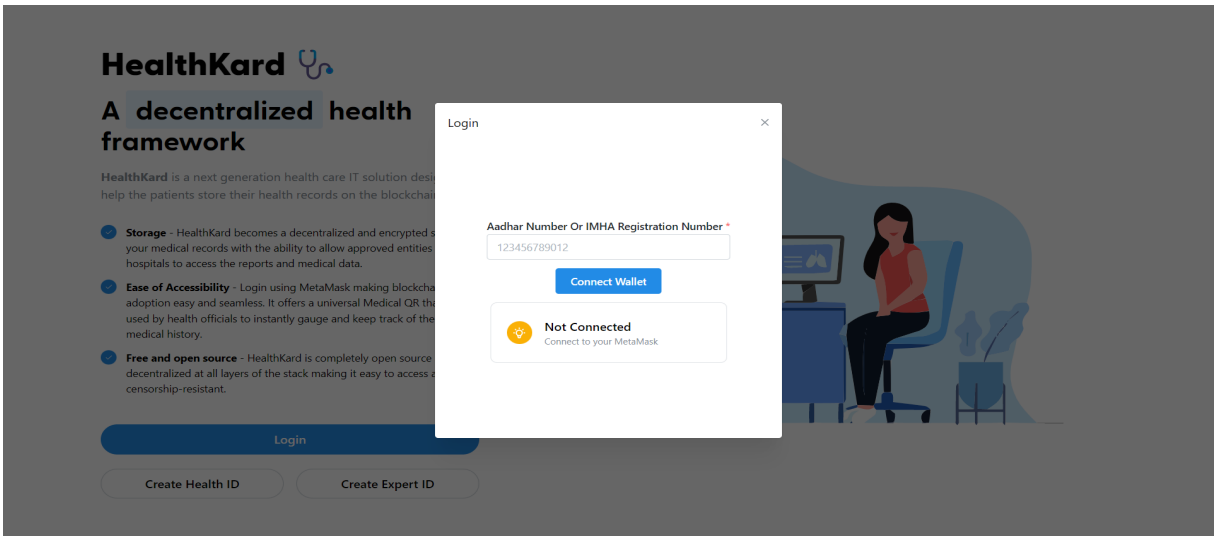
1. Login: If you already have an account, simple connect your wallet and add your Aadhar (For Patients) and IMHA (For Health Experts)
2. Create Health ID: Patients can click on this button and go ahead with creating their health identity
3. Create Expert ID: Health Experts can click on this button and go ahead with creating their expert identity

2.3 Login

The modal is for users to login using their MetaMask and Aadhar ID (For Patients) or IMHA Registration Number (For Health Experts).

2.3.1 Screen Images

Figure 2.2: Login Page



2.3.2 Objects and Actions

Connect Wallet

It comprises of the current connection status and asks the user to connect if not connected.

Aadhar or IMHA Input

Patients enter their Aadhar ID or IMHA mapped to their HealthKard to login

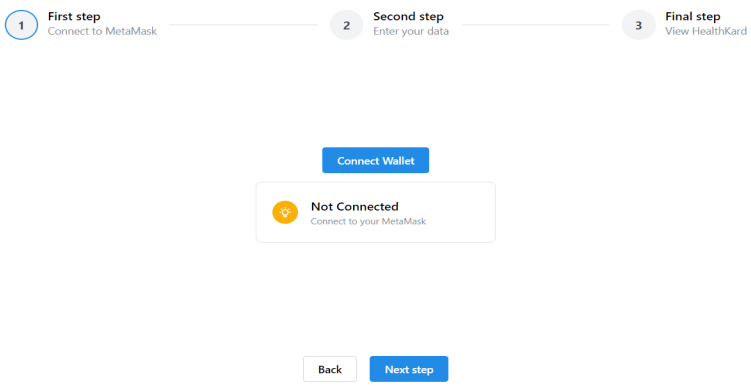
2.4 Create Patient HealthKard

This page asks the user to enter their details to be submitted on the card and create an NFT.

2.4.1 Connect Metamask Wallet

Screen Images

Figure 2.3: Connect Wallet



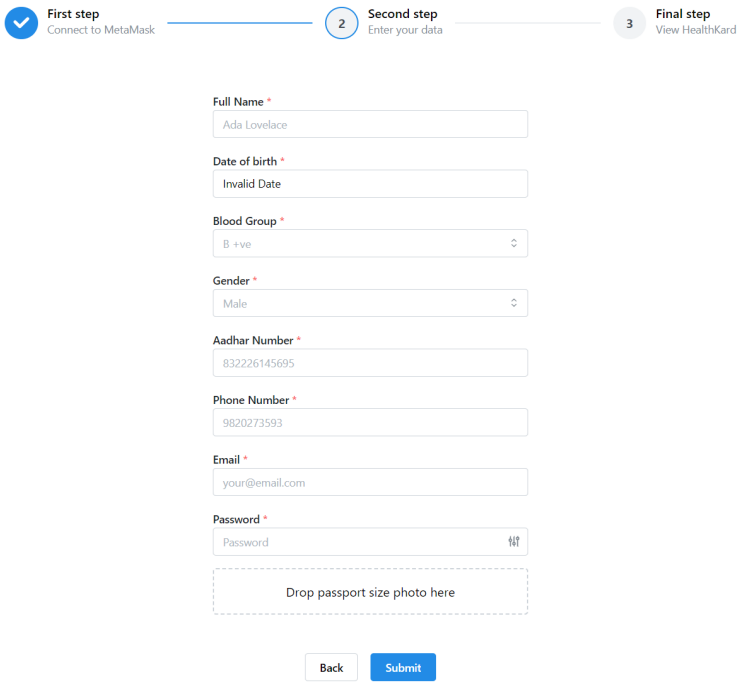
Objects and Actions

Connect Wallet: Connect your metamask wallet to the portal

2.4.2 Patient Form

Screen Images

Figure 2.4: Patient Form



Objects and Actions

Form Fields: The following form fields are required to be filled in order to create a HealthKard

1. Full Name
2. Date of Birth
3. Blood Group

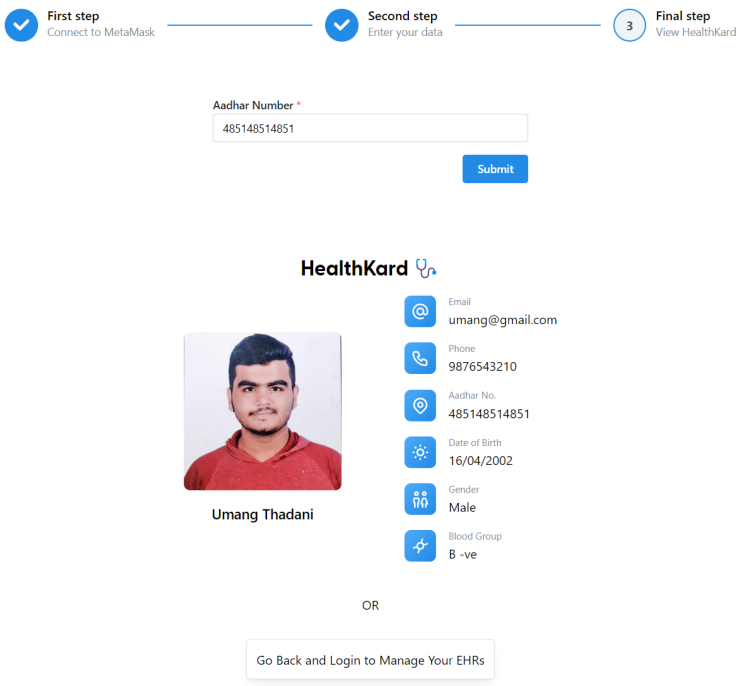
4. Gender
5. Aadhar Number
6. Phone Number
7. Email
8. Password
9. Passport size photo

2.4.3 Patient HealthKard

This page shows the user's HealthKard.

Screen Images

Figure 2.5: Patient Card



Objects and Actions

View the patient's health card by fetching details from the blockchain.

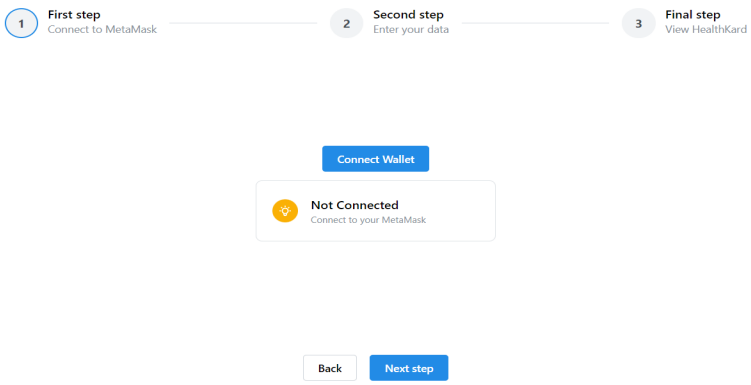
2.5 Create Expert HealthKard

This page asks the user to enter their details to be submitted on the card and create an NFT.

2.5.1 Connect Metamask Wallet

Screen Images

Figure 2.6: Connect Wallet



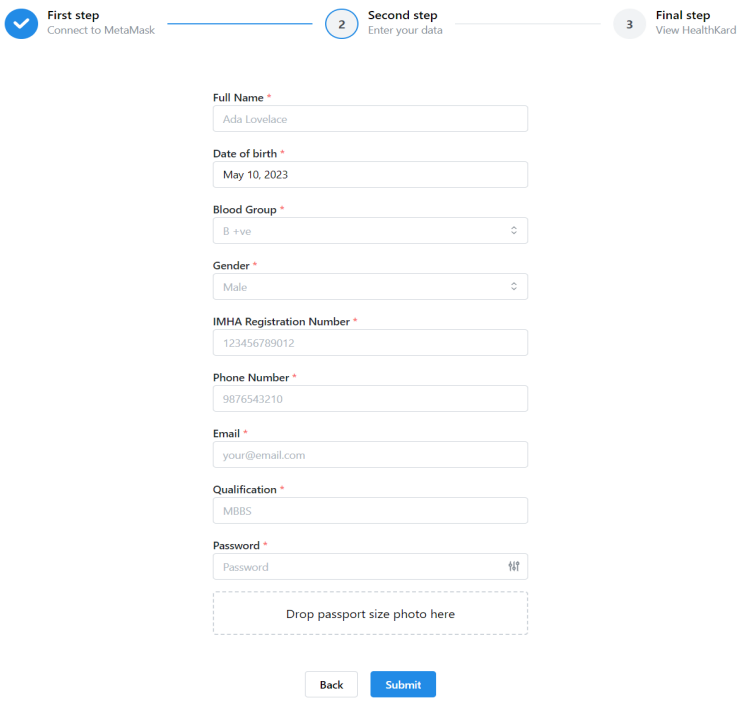
Objects and Actions

Connect Wallet: Connect your metamask wallet to the portal

2.5.2 Expert Form

Screen Images

Figure 2.7: Expert Form



Objects and Actions

Form Fields: The following form fields are required to be filled in order to create a HealthKard

1. Full Name
2. Date of Birth
3. Blood Group

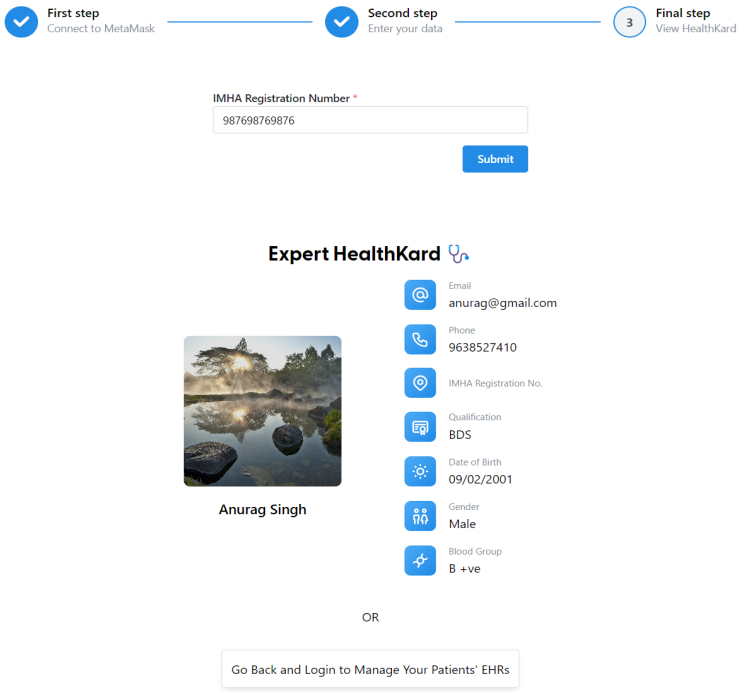
4. Gender
5. IMHA Registration Number
6. Phone Number
7. Email
8. Qualification
9. Password
10. Passport size photo

2.5.3 Expert HealthKard

This page shows the user's HealthKard.

Screen Images

Figure 2.8: Expert Card



Objects and Actions

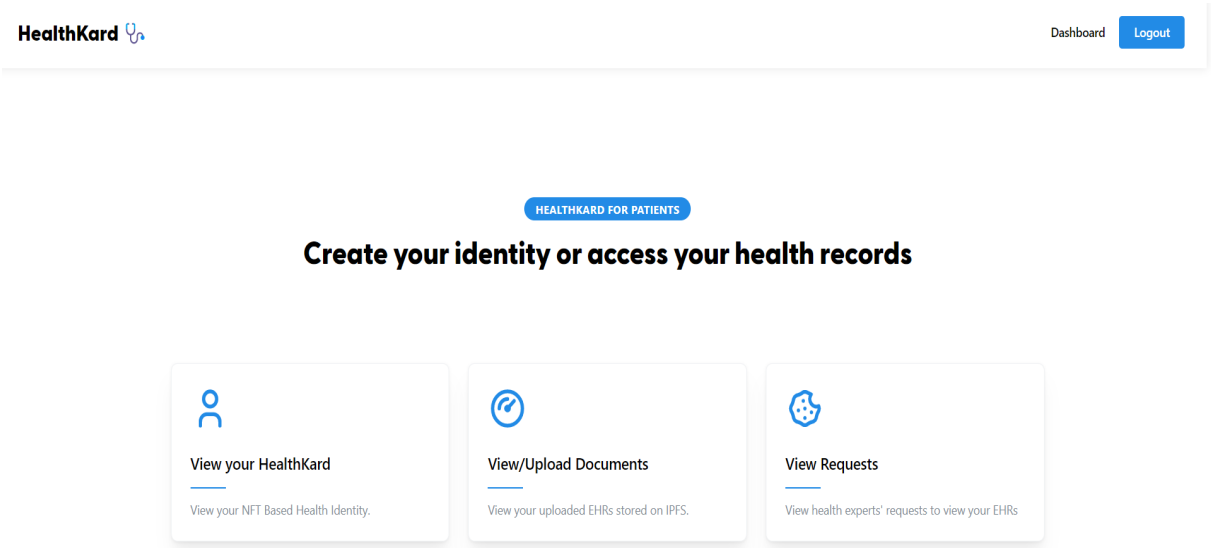
View the patient's HealthKard by fetching details from the blockchain.

2.6 Patient Dashboard

This page shows the patient's dashboard.

2.6.1 Screen Images

Figure 2.9: Patient Dashboard



2.6.2 Objects and Actions

Patient Profile

Redirects you to your profile page

2.6.3 View/Upload Documents

Redirects you to a page where you can manage your Health Records

2.6.4 View Requests

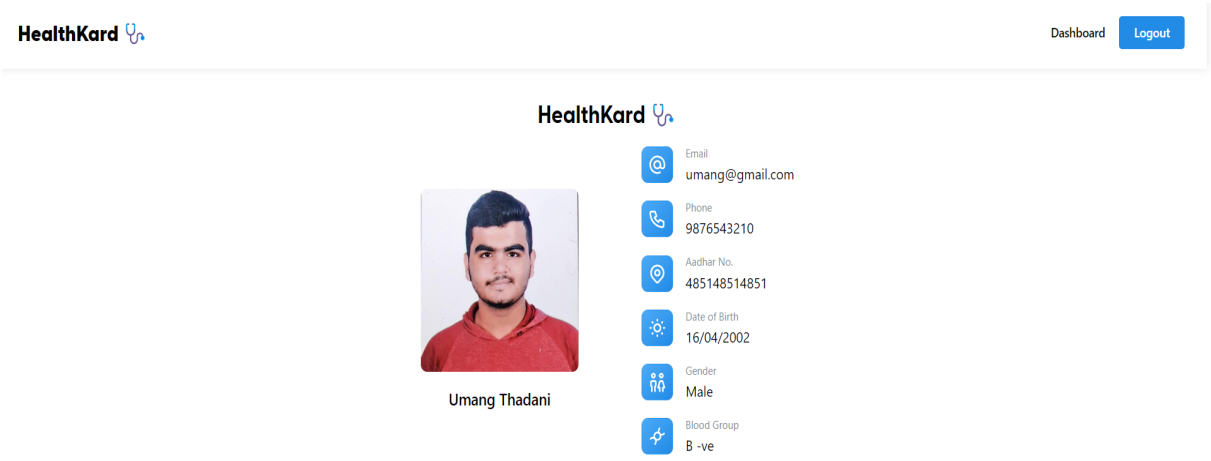
Redirects you to a page where you can manage access of your Health Records

2.7 Patient Profile

This page shows the patient's HealthKard.

2.7.1 Screen Images

Figure 2.10: Patient Profile



2.7.2 Objects and Actions

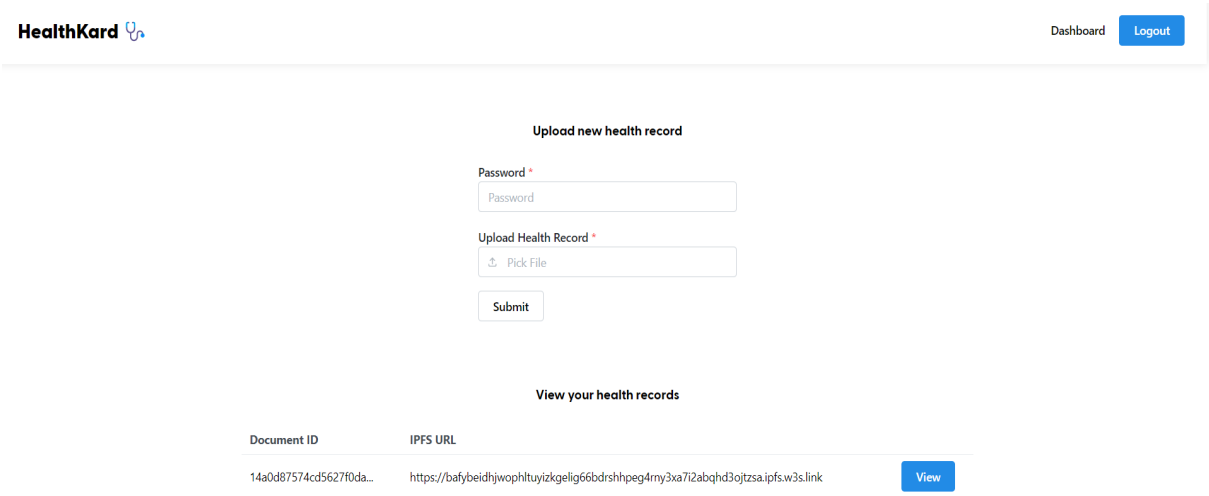
View the patient's HealthKard by fetching details from the blockchain.

2.8 View/Upload your Documents

This page shows the documents owned by the patients with the ability to upload another EHR.

2.8.1 Screen Images

Figure 2.11: Manage Documents



2.8.2 Objects and Actions

Upload EHR Form

The form consists of two fields:

1. Password: The one that the patient had used while creating their health identity.
2. Document: The EHR they want to store.

List of Documents

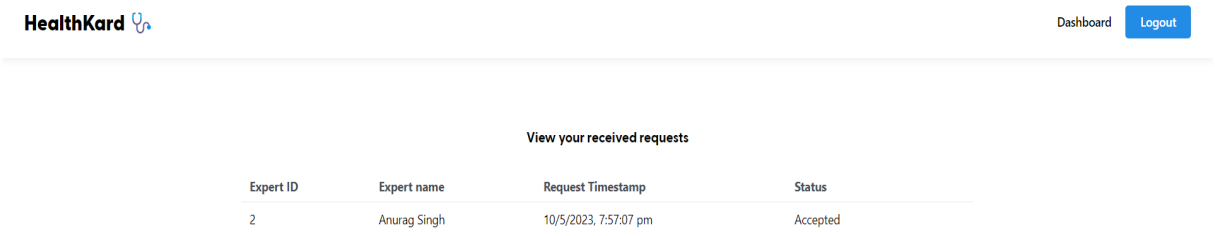
This is a list with all the documents that you have uploaded till date.

2.9 View Requests

This page shows all the requests that a patient has received with respect to EHR access

2.9.1 Screen Images

Figure 2.12: Requests List



2.9.2 Objects and Actions

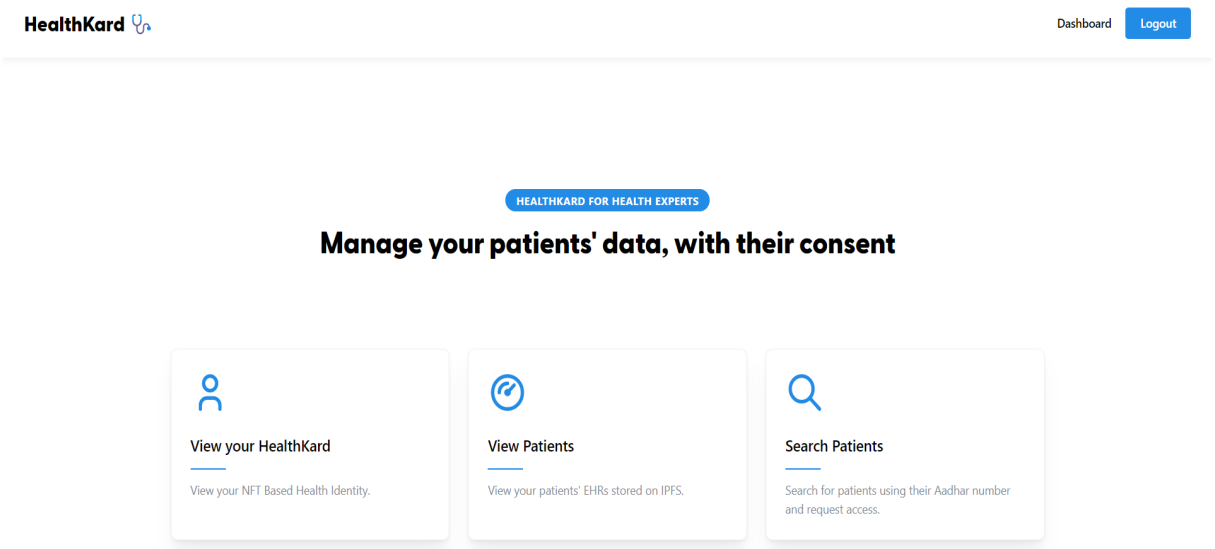
Patients can Accept or Deny a request from an Health Expert to access their EHRs

2.10 Expert Dashboard

This page shows the patient's dashboard.

2.10.1 Screen Images

Figure 2.13: Expert Dashboard



2.10.2 Objects and Actions

Expert Profile

Redirects you to your profile page

2.10.3 View Patients

Redirects you to a page where you can manage all of your Patients and their Health Records

2.10.4 Search Patients

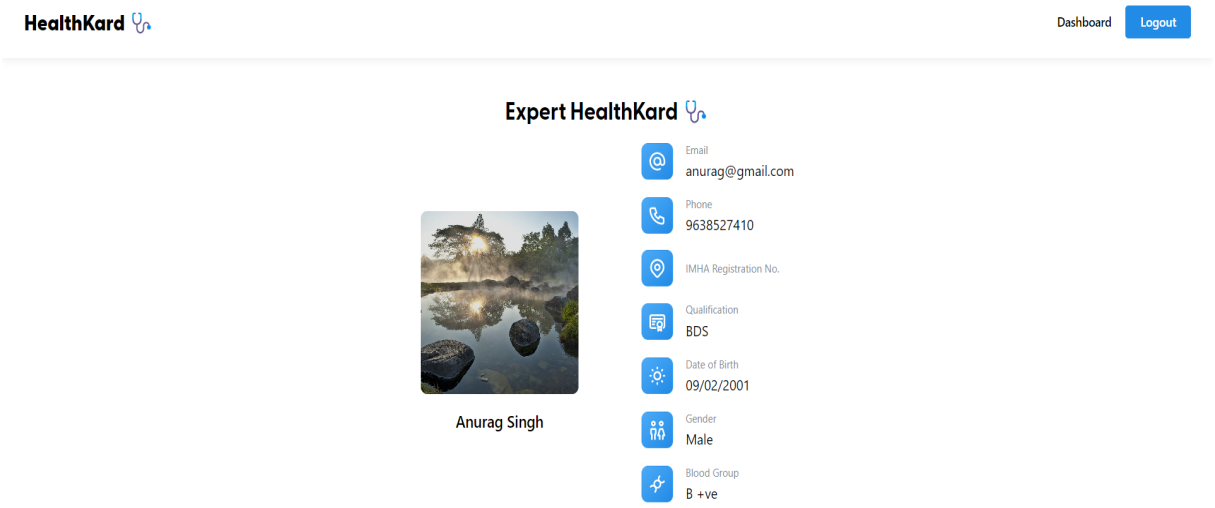
Redirects you to a page where you can search for a patient and request access of their Health Records

2.11 Expert Profile

This page shows the user's HealthKard.

2.11.1 Screen Images

Figure 2.14: Expert Profile



2.11.2 Objects and Actions

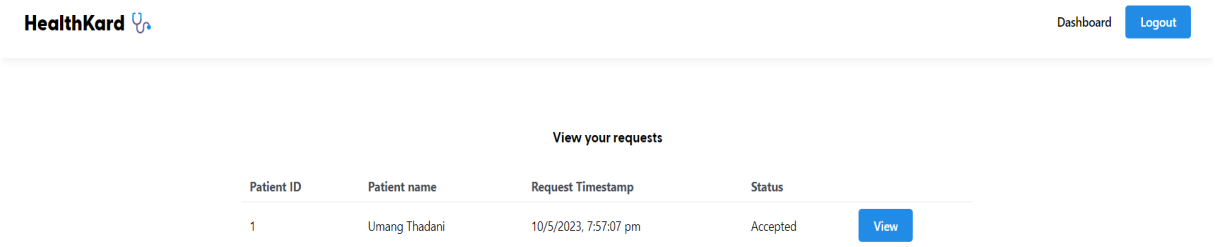
View the expert's health card by fetching details from the blockchain.

2.12 Patients List

This page shows the list of all those patients that the expert has requested access from along with the status of access (ACCEPTED, PENDING, DENIED)

2.12.1 Screen Images

Figure 2.15: Patients List



2.12.2 Objects and Actions

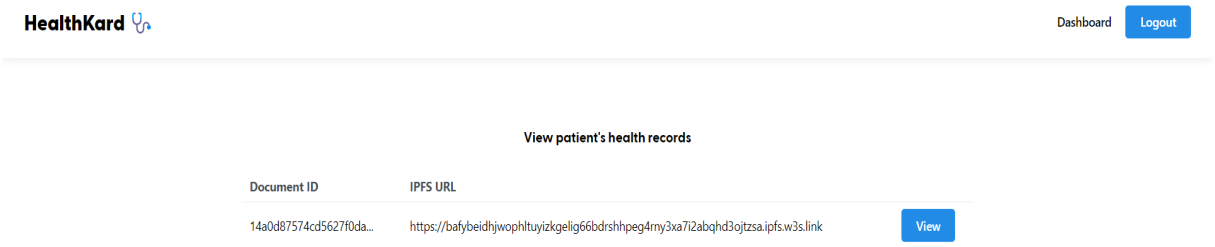
View the list of patients along with the access status. If access is granted, you will find a "View" button in front of the Patient, which will redirect you to a page with that patient's EHRs

2.13 Patient Documents

This page lists that patient's documents.

2.13.1 Screen Images

Figure 2.16: Patient EHRs



2.13.2 Objects and Actions

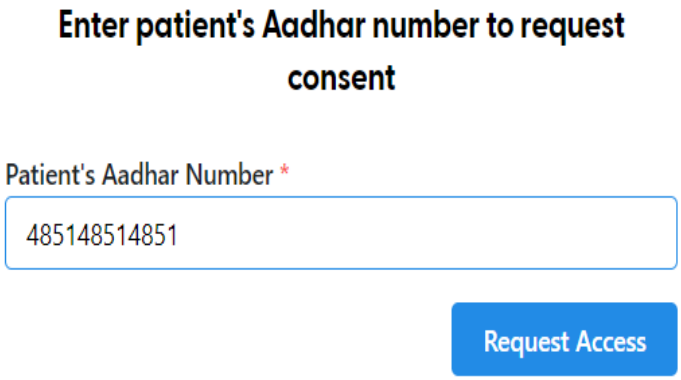
View the list of a particular patient's health records if you have been granted access by them. You will find a "View" button in front of each EHR, which will open a modal to access their records

2.14 Search Patient

This page allows searching for a particular patient and requesting access.

2.14.1 Screen Images

Figure 2.17: Search Patient



2.14.2 Objects and Actions

Aadhar Input

Enter Aadhar Number of the patient for whom you want access to their records.

2.15 Document Access - Enter Password

This page asks users, both Health Experts and Patients to enter their passwords in order to view an EHR.

2.15.1 Screen Images

Figure 2.18: Enter Password

2.15.2 Objects and Actions

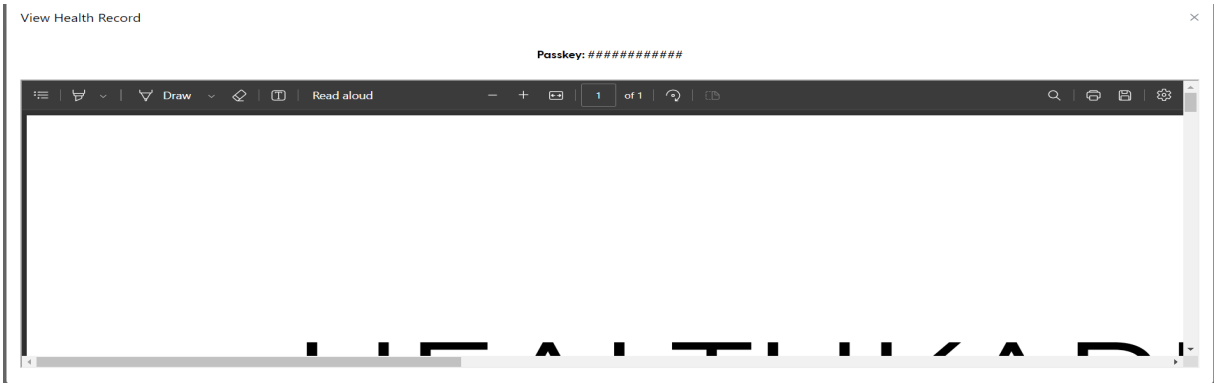
Patients can access their own EHRs and Experts can access their patients' EHR by entering their individual passwords here

2.16 Document Access - View EHR

This page shows the patient's EHR along with a passkey to decrypt the same.

2.16.1 Screen Images

Figure 2.19: Health Record



2.16.2 Objects and Actions

View the patient's health record by entering the passkey as mentioned.

3 System Architecture

Use Case ID:	1		
Use Case Name:	Unique Health ID Generation		
Created By:	Anurag	Last Updated By:	Umang
Date Created:	29/10/2022	Date Last Updated:	03/11/2022

Primary Actors:	New / Existing user
Secondary Actors:	IPFS, Ethereum Blockchain
Description:	The user will have to create his own health identity.
Trigger:	Submission of required details in the form.
Preconditions:	User must not already have a Health Card linked to his Aadhar Number.
Postconditions:	If another user tries to use the same Aadhar Card, they must not be allowed to create that Health Card
Normal Flow:	User enters his Aadhar Number, the necessary details and creates his Health identity.
Alternative Flows:	User enters incorrect data and is eventually not allowed to create the health identity.
Exceptions:	NA
Priority:	High
Frequency of Use:	High
Business Rules:	Single source of truth for data on the blockchain.
Special Requirements:	NA
Open Issues	NA
Assumptions:	NA
Notes and Issues:	NA

Use Case ID:	2		
Use Case Name:	Storage of Health Records		
Created By:	Umang	Last Updated By:	Anurag
Date Created:	01/03/2023	Date Last Updated	05/03/2023

Primary Actors	Patients
Secondary Actors	IPFS, Ethereum Blockchain
Description	Patients should be able to add digital records to the system
Trigger	Upload option in the webpage
Preconditions	Patient must be authorized on the portal
Postconditions:	NA
Normal Flow	User uploaded document should be uploaded to IPFS in encrypted form and its url should be stored on Ethereum
Alternative Flow	NA
Exceptions	NA
Priority	High
Frequency of Use	High
Business Rules	Secure storage of EHR
Special Requirements	NA
Open Issues	NA
Assumptions	NA
Notes and Issues:	NA

Use Case ID:	3		
Use Case Name:	Access Control for EHRs		
Created By:	Umang	Last Updated By:	Anurag
Date Created:	01/03/2023	Date Last Updated	05/03/2023

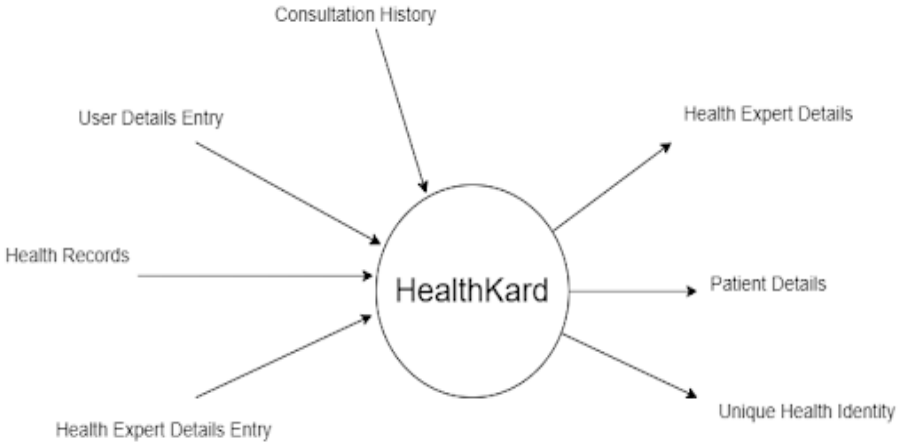
Primary Actors	Health Experts, Patients
Secondary Actors	IPFS, Ethereum Blockchain
Description	Health Experts request access for a document from the patient, the patient can grant or deny access
Trigger	Health Experts request access from patients for a particular EHR
Preconditions	Patient and Health Expert must be authorized on the portal
Postconditions:	NA
Normal Flow	User grants access and so only that health expert can access the document for which they have been given access for
Alternative Flow	User denies access and so health expert cannot access the document for which they have requested access for
Exceptions	NA
Priority	High
Frequency of Use	High
Business Rules	Secure sharing of EHR and Access Control Mechanism
Special Requirements	NA
Open Issues	NA
Assumptions	NA
Notes and Issues:	NA

4 Data Flow Designs

DFD is created from the SRS document provided.

4.1 Level 0 DFD with description

Figure 4.1: Level 0 DFD



4.2 Level 1 DFD with description

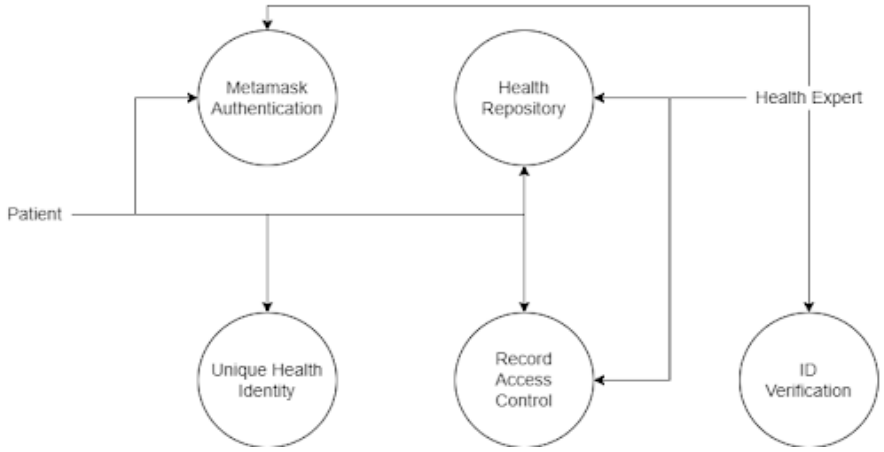



Figure 4.2: Level 1 DFD