
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:

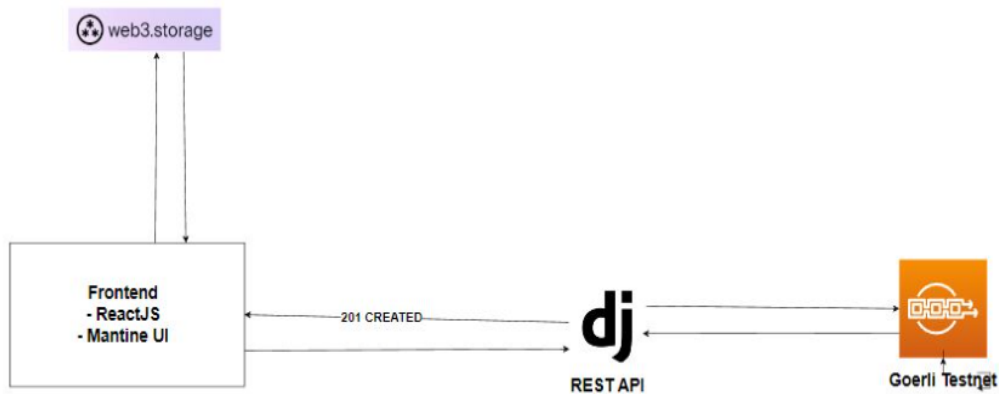
- Creation of a unique Health ID using Aadhaar Number.
- Storage of Electronic Health Records (EHRs) mapped to Health Identity in the blockchain.
- Integration of different sectors in the medical industry.
- Encourage better administration of the health sector by utilizing health data analytics.

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

A decentralized health framework

HealthKard is a next generation health care IT solution designed to help the patients store their health records on the blockchain.

- **Storage** – HealthKard becomes a decentralized and encrypted store for your medical records with the ability to allow approved entities like hospitals to access the reports and medical data.
- **Ease of Accessibility** – Login using MetaMask making blockchain adoption easy and seamless. It offers a universal Medical QR that can be used by health officials to instantly gauge and keep track of the patient's medical history.
- **Free and open source** – HealthKard is completely open source and decentralized at all layers of the stack making it easy to access and censorship-resistant.

For Patients

For Health Experts



2.2.2 Objects and Actions

Header

It comprises of the navigation bar with hyperlink to the following pages:

1. About
2. Logo
3. Patient Login
4. Expert Login

Hero Image:

It is just a simple image used to beautify the Design

Features:

It showcases the features of our web application

About:

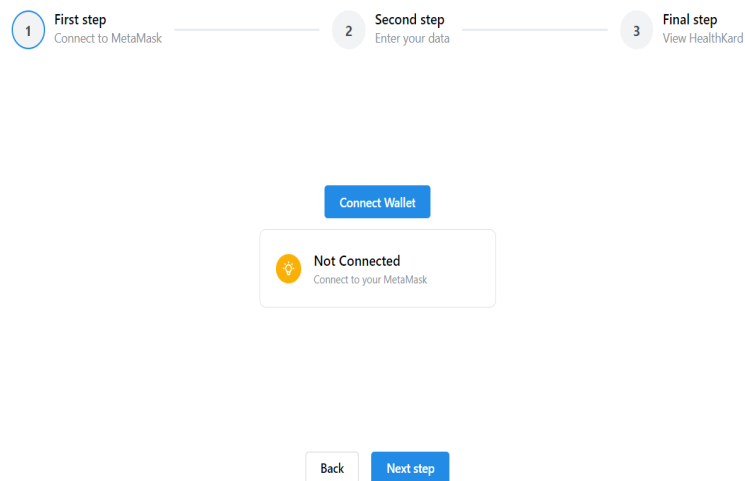
It is a short description of our web application

2.3 Patient Login

The page for the user to login using his MetaMask and create his health card.

2.3.1 Screen Images

Figure 2.2: Patient 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.

2.4 Enter Patient Details

This page asks the user to enter his details to be submitted on the card.

2.4.1 Screen Images

Figure 2.3: Patient Form

The screenshot displays a patient registration form with a progress indicator at the top. The progress bar shows three steps: 'First step' (Connect to MetaMask) with a checkmark, 'Second step' (Enter your data) which is the current step and highlighted with a blue circle and the number '2', and 'Final step' (View HealthKard) with a circle containing the number '3'. The form fields are as follows:

- Full Name ***: Text input field containing 'Ada Lovelace'.
- Date of birth ***: Date picker field showing 'Pick date'.
- Blood Group ***: Dropdown menu showing 'B +ve'.
- Gender ***: Dropdown menu showing 'Male'.
- Aadhar Number ***: Text input field containing '832226145695'.
- Phone Number ***: Text input field containing '9820273593'.
- Email ***: Text input field containing 'your@email.com'.
- Photo Upload**: A dashed rectangular box with the text 'Drop passport size photo here'.
- Buttons**: 'Back' and 'Submit' buttons at the bottom.

2.4.2 Objects and Actions

Enter Patient Data

Enter the patient data and photograph with a submit button to upload to IPFS.

2.5 View Patient Healthcard

This page asks the user's Aadhar Card and shows the user's Health card.

2.5.1 Screen Images

Figure 2.4: Patient Card


Progress bar: **First step** (✓) Connect to MetaMask | **Second step** (✓) Enter your data | **3** **Final step** View HealthKard

Aadhar Number *

928351928350

Submit

HealthKard



Anurag Singh

- Email: anurag@gmail.com
- Phone: 9820273593
- Aadhar No.: 928351928350
- Date of Birth: 06/02/2001
- Gender: Male
- Blood Group: B +ve

2.5.2 Objects and Actions

Enter Patient Data

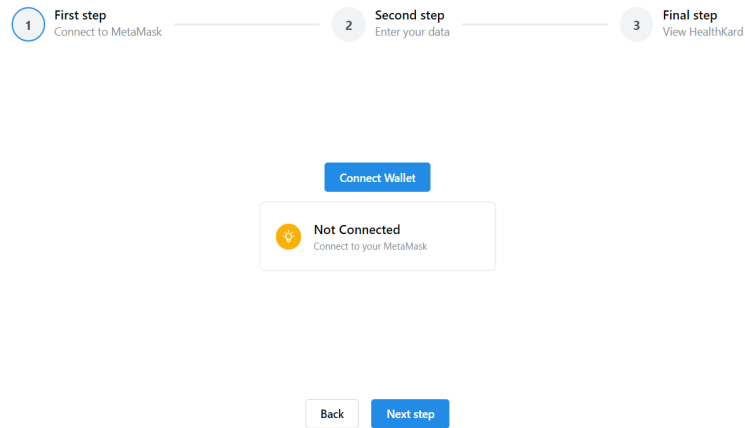
View the patient's health card by fetching details from the blockchain.

2.6 Health Expert Login

The page for the user to login using his MetaMask and create his health card.

2.6.1 Screen Images

Expert Login Page



2.6.2 Objects and Actions

Connect Wallet

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

2.7 Enter Health Expert Details

This page asks the user to enter his details to be submitted on the card.

2.7.1 Screen Images

Figure 2.5: Expert Form

The form is titled "Expert Form" and is part of a three-step process. The first step is "First step: Connect to MetaMask", the second step is "Second step: Enter your data" (which is currently active), and the third step is "Final step: View HealthKard".

The form fields are as follows:

- Full Name ***: Text input field containing "Ada Lovelace".
- Date of birth ***: Text input field containing "Pick date".
- Blood Group ***: Text input field containing "B +ve".
- Gender ***: Text input field containing "Male".
- IMHA Registration Number ***: Text input field containing "608901212745".
- Phone Number ***: Text input field containing "9820273593".
- Email ***: Text input field containing "your@email.com".
- Qualification ***: Text input field containing "MBBS".

Below the form fields is a dashed box with the text "Drop passport size photo here".

At the bottom of the form are two buttons: "Back" and "Submit".

2.7.2 Objects and Actions

Enter Patient Data

Enter the patient data and photograph with a submit button to upload to IPFS.

2.8 View Health Expert Healthcard

This page asks the user's IMHA Registration Number and shows the user's Health card.

2.8.1 Screen Images

Figure 2.6: Expert Card


Progress bar: 1 First step Connect to MetaMask | 2 Second step Enter your data | 3 Final step View HealthKard

IMHA Registration Number *

294857294857

Submit

Expert HealthKard



Umang Thadani

- Email: umang@gmail.com
- Phone: 9820273593
- IMHA Registration No.: 294857294857
- Qualification: MBBS
- Date of Birth: 05/02/2009
- Gender: Male
- Blood Group: B +ve

2.8.2 Objects and Actions

Enter Patient Data

Enter the patient data and photograph with a submit button to upload to IPFS.

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:	<u>User enters incorrect data and is eventually not allowed to create the health identity.</u>
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

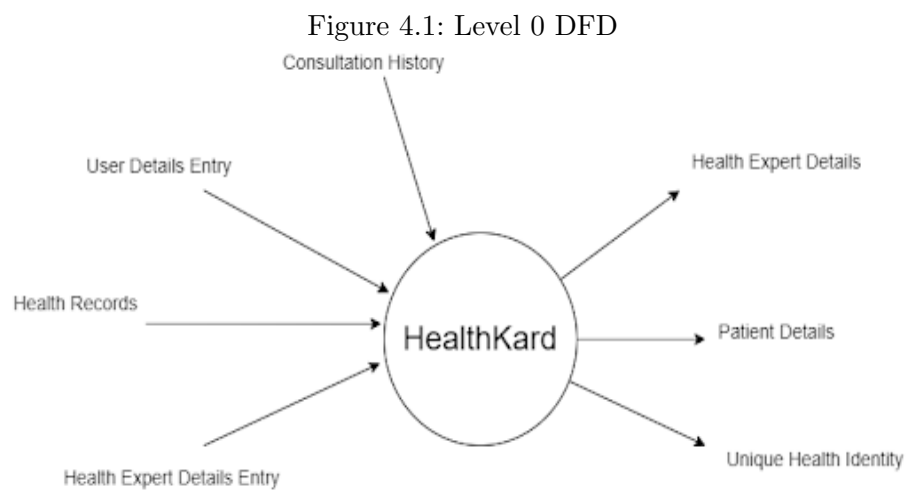
Use Case ID:	3		
Use Case Name:	Access Control for EHRs		
Created By:	Umang	Last Updated By:	Anurag
Date Created:	01/03/2023	Date Last Updated	05/03/2023

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



4.2 Level 1 DFD with description

Figure 4.2: Level 1 DFD

