

PROJECT

HYGIEIA:

Hygieia

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Abstract:

We aim to increase government transparency and create a more cost-effective and secure way to store national transplant list and organ sharing transactions by putting the organ sharing transactions onto private permissioned blockchain and making the transaction data public while hiding the patient's personal information. This project aims to create a web application- to keep of track organ donation with blockchain technology. To achieve this we are using Hyperledger Sawtooth v1.0 which is a blockchain framework with private and permissioned property.

Introduction

This project involves the use of permissioned blockchain Sawtooth under the hyperledger umbrella on the use case relating to healthcare in particular to that of Organ Donation. Health is the most important part of a person's life and a such this project aims to introduce a permissioned blockchain into particular aspects of Organ Donation, in respect to an Organ donor list which is privacy protected and tamper proof in order to curb any exploitation and preserve privacy of members of Donor list, also it helps in ordering a Recipient list wherein members are classified in a first come first serve basis and priority is set with voting of particular member nodes with the particular criteria set for voting and with a threshold set by the admin. The main aim is to match recipient and donors by traversing transactions.

Problems with the current System

In the current system deals with an Advanced DBMS with a Organ Donor list kept by a Organ registry commission and each different hospital contains independent list of Recipient list and the entry to each list is done manually by a hospital coordinator. Current System is having certain setbacks which involve certain moving parts especially with human intervention has a risk of any and all corrupt practises. It can also have issues with priority tampering where certain recipients can have their priority move up and down based on their social standing and power. The existing system is littered with certain flaws especially, it is slow and prone to attacks, prone to tampering, and is vulnerable to errors by human intervention.

Proposed System

We are proposing a system in which organ donor and recipient list are added by the admin(National Health Service) and hospital respectively via a Web App and then from which each submissions are stored as individual transactions and then stored in a block after validation. Therein limiting the number of middlemen and eliminating any and all existing vulnerabilities. Here we use all the features of a private permissioned blockchain like immutability, scalability, permissioning and PoET.

Hill Statement

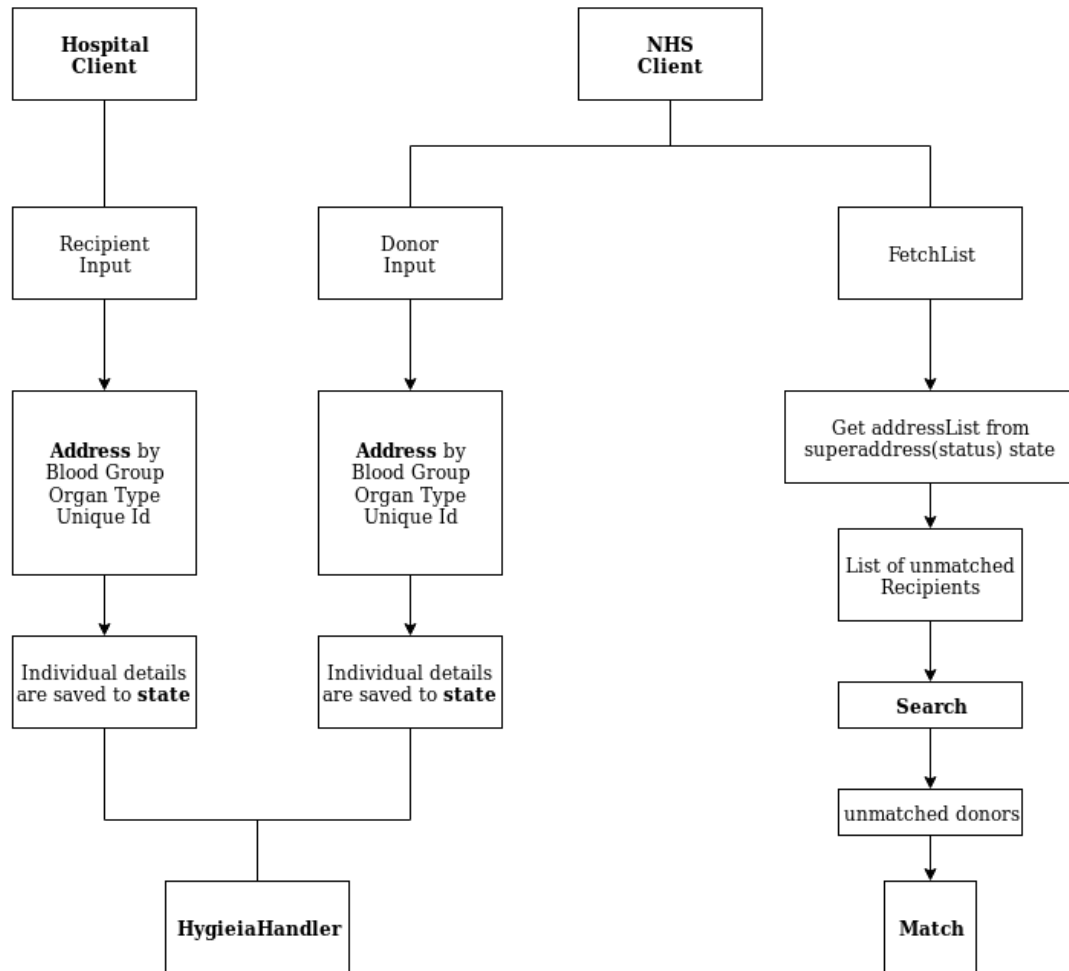
Organ Transplantation, Donation are one of the most important modern day problem, Project Hygieia Provides a unique solution to do the same more transparently and without compromising personal identities of recipient and donor.

Life Cycle of Hygieia

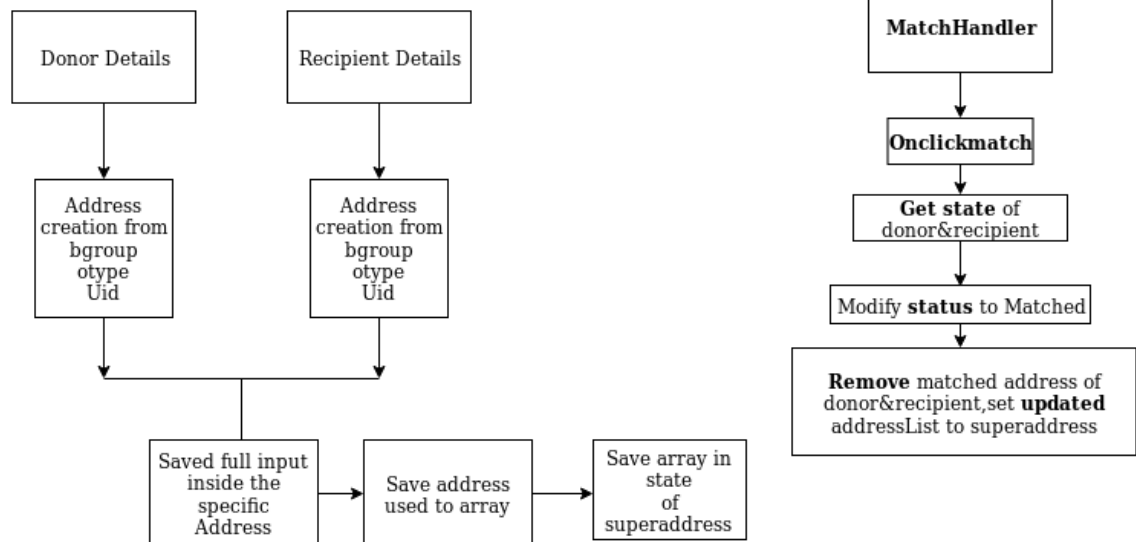
1. Donor Registration
2. Recipient Registration
3. Matching of organ by NHS
4. Status updation of the organ

REPRESENTATIONAL DIAGRAM

(1)

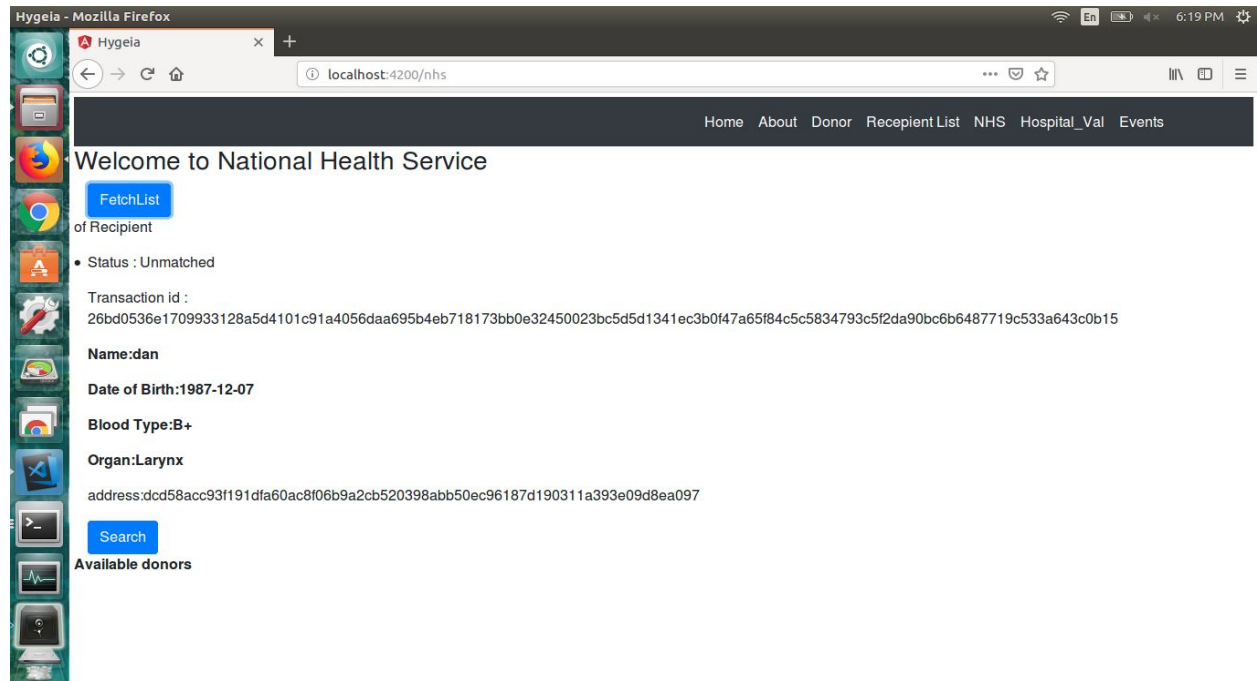


(2)

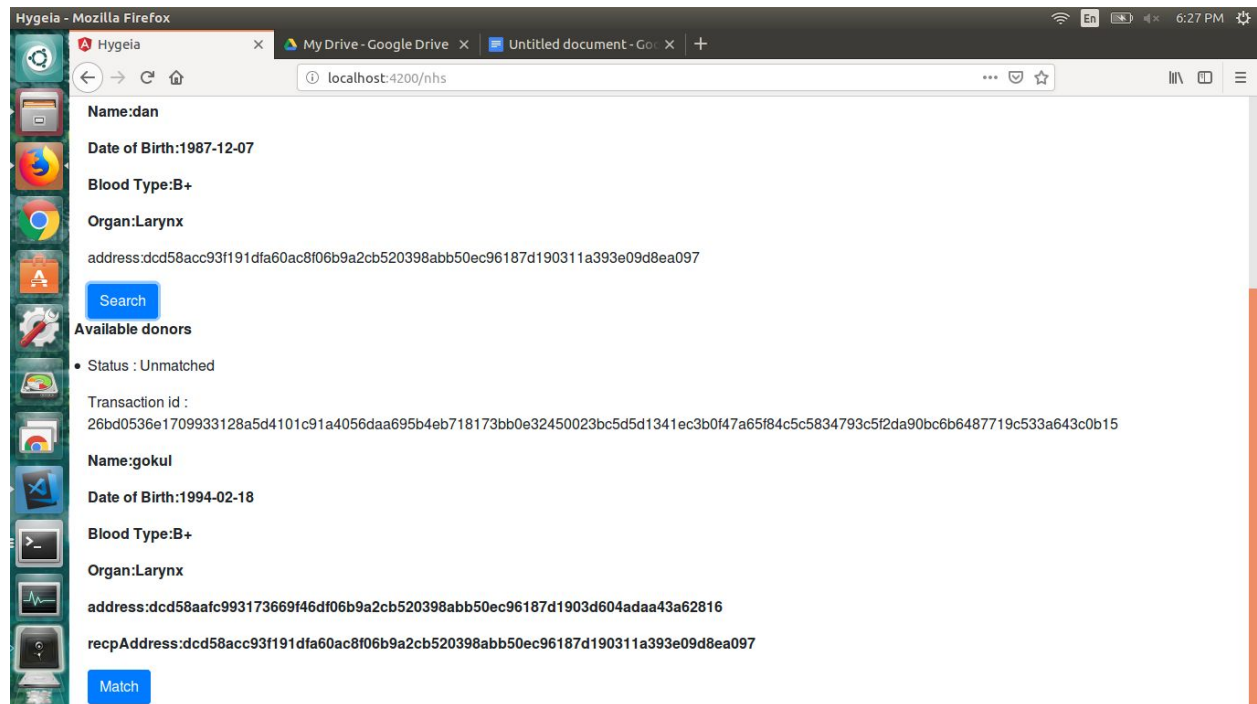


Various Test Data of Hygieia

1)Single Donor and Single recipient



When FetchList is clicked, List of Recipients are shown. Similarly when search is clicked Available donors if any are there is shown.



Match is the final step wherein we are able to match respective donors and recipients based on their organ type and blood types. Once a match is clicked, the matched donor and client will be removed from the list.

2) Multiple Donors and Single recipient

Hygeia - Mozilla Firefox

PROJECT HYGIEIA:TEST | localhost:8008/blocks | Base64 Decode and Enc | +

localhost:4200/nhs

Name: gale

Date of Birth: 1978-11-05

Blood Type: O+

Organ: Lung

address: dcd58acc93f191dfa60ac8d8334e7404708dbdff523119e60e91776209aa6ad56beb98

Search

Status: Unmatched

Transaction id: f021202b72e2f66208a3a3294b4edc272efa89e34273f8f875fdc93291d633f233acb75f12a48eccc569628f01b82ef88e559bfd8f0047399128d476d7cca7e4

Name: lean

Date of Birth: 1962-04-01

Blood Type: AB-

Organ: Lung

address: dcd58acc93f191dfa60ac8a64901f090b5f7bdff523119e60e9177d628c4c50a1130ef

Search

Status: Unmatched

Transaction id: f021202b72e2f66208a3a3294b4edc272efa89e34273f8f875fdc93291d633f233acb75f12a48eccc569628f01b82ef88e559bfd8f0047399128d476d7cca7e4

Here the blood type to match too is AB- and organ is Lungs, on searching you get multiple possible donors to whom matching is possible.

Hygeia - Mozilla Firefox

PROJECT HYGIEIA:TEST | localhost:8008/blocks | Base64 Decode and Enc | +

localhost:4200/nhs

Name: han

Date of Birth: 2008-12-25

Blood Type: AB-

Organ: Lung

address: dcd58aafc993173669f46da64901f090b5f7bdff523119e60e91776f5fc90e3cf01ef1

recpAddress: dcd58acc93f191dfa60ac8a64901f090b5f7bdff523119e60e9177d628c4c50a1130ef

Match

Status: Unmatched

Transaction id: f021202b72e2f66208a3a3294b4edc272efa89e34273f8f875fdc93291d633f233acb75f12a48eccc569628f01b82ef88e559bfd8f0047399128d476d7cca7e4

Name: sarah

Date of Birth: 1988-03-15

Blood Type: AB-

Organ: Lung

address: dcd58aafc993173669f46da64901f090b5f7bdff523119e60e9177b157e149057fc0d4

recpAddress: dcd58acc93f191dfa60ac8a64901f090b5f7bdff523119e60e9177d628c4c50a1130ef






Match

Here there are two possible matches present and matching can be done to the donor who is the most eligible.

Future Work

Here in Project hygieia the matching of the donor and recipient is done so assuming that a donor, recipient having same organ type as well as blood type will be a direct match, But in a more of a real world scenario the matching of the same requires of various other parameters which is a pretty good scope for a ML algorithm, Hence we can ensure a pretty seamless match and reduce the issues in the likes of organ rejection. Here in the project hygieia we are using a manual matching so it has to be automated and done in real time as a donor signs up and donor-recipient matching has to be done analysing the various other parameters

Used Technologies

FRONTEND	Angular Version 7.0 
BACKEND	NodeJS  RestAPI 
DATA STORAGE	Hyperledger Sawtooth v1.0 
INFRASTRUCTURE	DOCKER 

Conclusion

Project- Hygieia more or less sets a new direction in which blockchain can be implemented in the healthcare industry. Here this distributed ledger enables a seamless and transparent log of what all that happens in organ donation and transplantation. In a smaller scope while it acts just as a project which keeps track of organ handovers, but in a greater scope project-Hygieia could prove to be a solution for black market organ trade and other horrendous activities of sort.

