Organ Donation Decentralized Application Using Blockchain Technology

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***Abstract*—The proposed system is an organ donation decentralized app using blockchain technology. It would be a web application for patients to register their information—most importantly medical ID, blood type, organ type and state. The system would work on a first-in, first-out basis unless a patient is in critical condition.**

Keywords: Blockchain, decentralised, donation

I. INTRODUCTION

Donating an organ or organs is one of the most noble act of humanity, saving the lives of those who suffer serious maladies that require organ transplantation. When the human body becomes infected with disease crucial organs in the body, such as the kidney, lungs, heart, pancreas, liver, or intestines become non-functional, making life unbearable usually leading to death. Anyone can become exposed to a disease. In fact, a person is added to the national organ waiting list in Saudi Arabia every ten minutes. Making an organ donation is a crucial contribution to saving lives. Organ transplantation operations began in the 1950s and revolutionized medicine, saving innumerable lives and making life easier for those who suffer long term diseases. In the case of donors, they may be alive, dead, or in some countries, brain dead. Any live person must be perfectly healthy to donate, and donation is only allowed for organs that will not affect their health, such as a kidney, liver, lungs or bone marrow. There are no maximum or minimum age limits for organ donation, but the organ must be in a good condition and its loss will not present a threat to life. In most countries minors can only donate organs if one of their guardians gives consent. In the case of deceased organ donations, a donor must have given their consent while they were still alive, usually by signing their name in the donation system. The Saudi Centre for Transplantation handles the processes related to organ donation and transplantation. [1][2]

II. PROBLEM STATEMENT

The problem facing organ donation systems around the world is the same, more people on the waiting list than actual donors, and the gap is widening each year. The length of the waiting list may mean patients die before donation takes place.

Modern systems responsible for gathering organ donations and handling processes leading up to organ transplantations can lack transparency. They are also usually slow, which is intolerable in such a serious, life threatening matter. These systems are rarely up-to-date with the minimum security requirements, and with improvements in modern computer processing power and algorithms, it is best to take a cautious approach to avoid future complications.

Recently there has been an increase in security breaches, compromising user privacy and the integrity of the system. Modern systems handle and manage data via traditional databases, however most hospitals, health ministries and other medical facilities do not have a uniform system for communicating data. [3]

III. BLOCKCHAIN

Blockchain is a distributed database that has the ability to manage an ever-growing list of named logs (blocks), with each block containing a time stamp and a link to the previous block. Each set of transactions is linked to a series, which gives all participants a comprehensive picture of the entire system. The series of blocks is designed so they can retain the data stored in them without modification, meaning information is stored in a cluster chain. It is therefore impossible to falsify a block or add other non-genuine information without the approval of all parties involved.

IV. ADVANTAGES

A) It creates a decentralized and distributed system, meaning no node in the system has overall authority.

B) Blockchain is a permanent ledger, so any unauthorized alteration will not go unnoticed.

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C) *Transactional processing is blockchain supported while being cost effective, which is convenient for non-profit projects.*

D) *It is a quick and precise method that rejects malicious activities and exploitation attempts.*

E) *Blockchain increases the speed of the organ donation process.*

V. LITERATURE REVIEW

A) Centralized systems

Centralized systems are databases that are maintained and stored in a single location. To access data, one has to connect to a server, the main computer of the database, so the data can be processed.

B) Decentralized systems

This type of database is a bit more complex. A decentralized database does not have a single location and instead pieces of information are stored in different locations which are all connected to each other. Processing data in this type of database is distributed between different nodes on a decentralised network. All the nodes have the data, which is being accessed by clients on each individual server.

C) Distributed systems

In this system the devices containing data are not connected to a single server, but instead data is distributed to different devices in the same location or spread to interconnected servers. Each node that contains information has its own data and equal authority, which is essentially how large companies tackled the problems of centralized networks. But, as the number of users grew, this created the same problems traditional centralized systems faced.

Blockchain is neither centralized nor decentralized. While a blockchain is definitely distributed, it is not necessarily decentralized. Centralization or decentralization simply refers to the participation rights on the distributed ledger. In a decentralized network, anyone is welcome to participate and transact. A centralized network contains various parties with known identities, validating the system because only those that are credible can participate and post to the ledger, making it an audited system. [4]

After we studied previous systems, we try to compare between them so we can know the advantage and disadvantage for each one, and we summarized the results on the follow.

Table 1: comparison between the systems

System	Centralized	Distributed	Decentralized
Costly	Yes	No	No
Ease of use	No	Yes	Yes
Speed	Slow	Moderate	Fast
Scalability	No	Yes	Yes
Security	No	No	Yes
Reliability	No	No	Yes
Permanent	No	No	Yes
Transparency	No	No	Yes
Accessibility	No	No	Yes
Transparency	No	No	Yes
Accessibility	No	No	Yes

VI. RELATED WORKS

Kidner is a blockchain-based kidney donation system that proposes a Kidney Paired Donation module instead of using the usual kidney waiting list. For example, if a person wants to donate to one of their family members but their kidney is incompatible with their loved one, the system matches the donor's kidney to another patient who also has an incompatible donor's kidney. Our system proposes a broader solution which not only includes live organ harvesting but also deceased organ harvesting, thus saving more lives. [5]

VII. ALGORITHM WORK

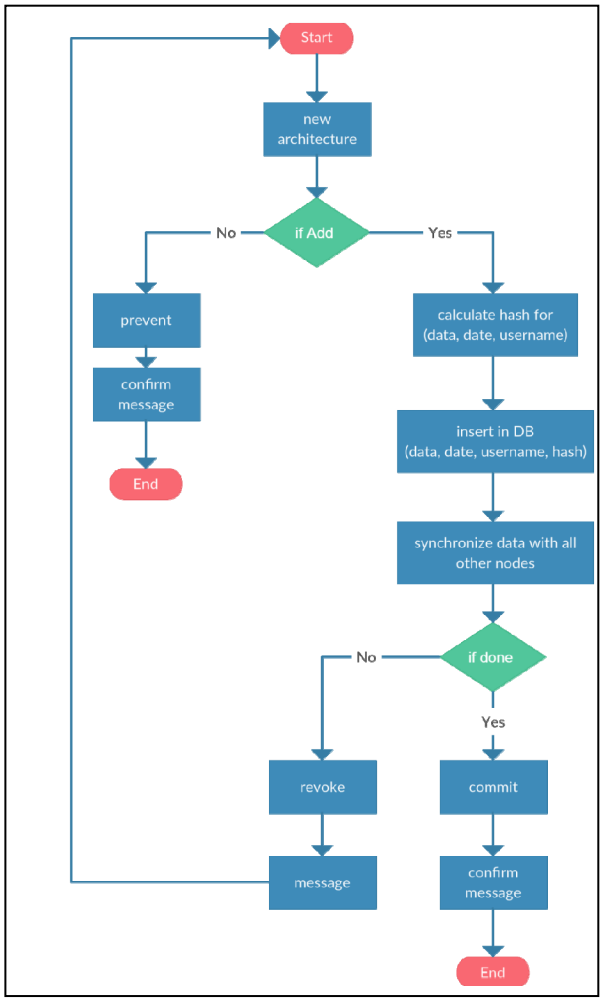

Figure 1: Algorithm flowchart

VIII. METHODOLOGY

In this paper the system proposed is a blockchain based website that would secure and automate the organ donation process while protecting sensitive patient and donor medical records using blockchain technology to eliminating any possibility of manipulation. It is designed specifically for use in the medical field related to organ donations, hospitals,

patients, organizing the donation process, and making it accessible while maintaining the integrity of the system. It will provide an easy solution to maintain the anonymity of medical records.

The system has four modules with the following functions:

A) Administration:

- Manage centers.
- Manage general information
- Donation center:
- Manage donation data
- View matching report
- Search

B) Donor:

- Apply as donor
- Edit contact information
- View information about donation
- View map
- Check request status

C) System:

- Hashing data
- Distributing data
- Matching data

IX. IMPLEMENTAION

The blockchain is implemented through making each center in the system a full node, where it is responsible for performing and maintaining the integrity of the transactions happening in the system.

ADMIN INTEFACES:

A) Manage center

Here a new donation center can be added, or an existing center can be modified in terms of location and name.

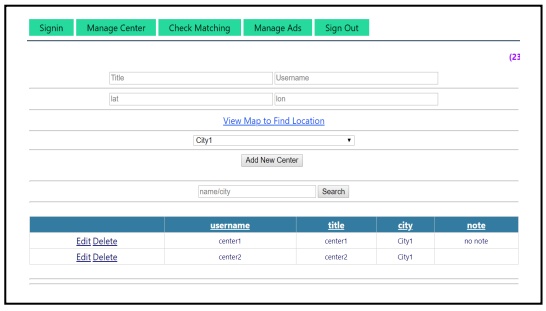

Figure 2:Manage interface

B) Manage ads

The ads appearing on every page of the website can be managed only through the center, a new can be created by inserting its title and description.

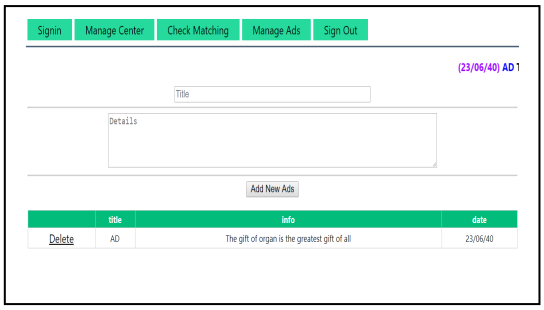

Figure 3:Ads interface

C) Check matching

The admin can check the matching process.

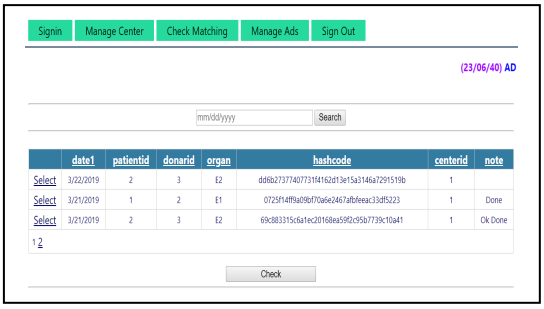

Figure 4:Check Matching interface

CENTER INTEFACES:

A) Manage donor

This page allows for managing the donors by accepting or rejecting their donation and also searching for them.

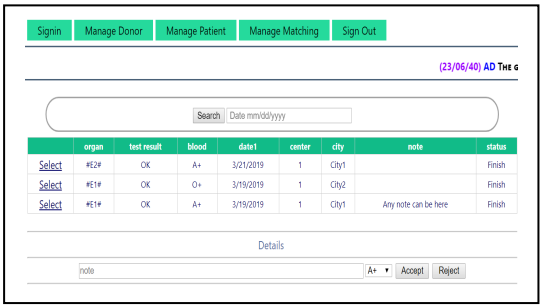

Figure 5:Manage donor interface

A) Manage patient

This page allows for managing the patients by accepting or rejecting patients who are in need of donation and also searching for them.

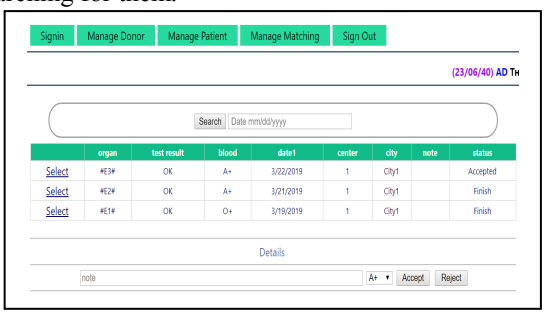

Figure 6:Manage pateint interface

C) Manage matching

This page allows for managing the matching process in terms of searching for matches and donors.

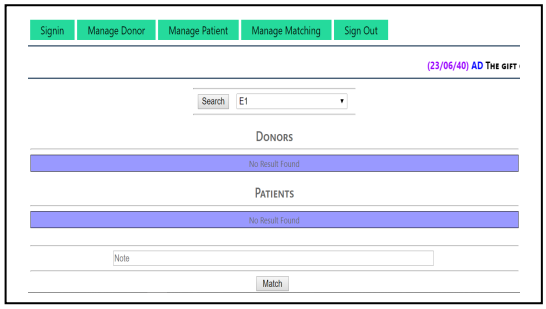

Figure 7:Manage matching

DONOR INTEFACES:

A) Register

In login page you can see the register link to create your username and password including your information.

Figure 8:Register interface

B) Apply as donor

A user can apply as a donor through.

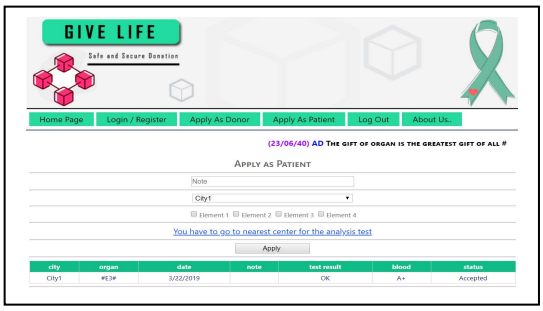

Figure 9:Apply as a donor interface

B) Apply As patient

A user can apply as a patient through.

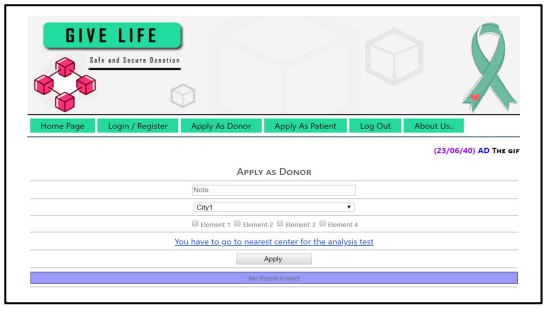

Figure 10:Apply as a patient interface

CONCLUSION

The proposed system is designed to meet the Saudi Arabia requirements, but with a decentralized take on the current system used, with the use of blockchain technology.

So we concluded that our system is better security wise, and it provides automation than current systems. A much faster system with improves scalability, as it can handle increased growth in the amount of work. Transparency in increased, and corruption is almost impossible to occur.

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