A Trustworthy Decentralized Internet: An Application of Blockchain

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ABSTRACT

The Internet was created as a decentralized and autonomous system of interconnected computer networks used for data exchange across mutually trusted participants. The element technologies on the Internet, such as inter-domain and intra-domain routing and DNS, operated in a distributed manner. With the development of the Web, the Web has become indispensable in daily life. The existing web applications allow us to form online communities, generate private information, access big data, shop online, pay bills, post photos or videos, and even order groceries. This is what has led to centralization of the Web. This centralization is now controlled by the giant social media platforms that provide it as a service, but the original Internet was not like this. These giant companies realized that the decentralized network's huge value involves gathering, organizing, and monetizing information through centralized web applications. The centralized Web applications have heralded some major issues, which will likely worsen shortly. This study focuses on these problems and investigates block chain's potentials for decentralized web architecture capable of improving conventional web services critical features, including autonomous, robust, and secure decentralized processing and traceable trustworthiness in tamper-proof transactions. Finally, we review the decentralized web architecture that circumvents the main Internet gatekeepers and controls our data back from the giant social media companies.

Keywords: Block chain, decentralized web, future internet service architecture, decentralized Internet, state full web, trustworthy decentralized web.

1. INTRODUCTION

Haber envisioned many concepts of block chain technology. Their work focused on timestamping documents; this process verifies that a document was created at a specific time in a specific version by storing hash values in a timestamped block on a tamper-proof block chain. They also adopted the tree to enhance timestamping efficiency by enabling a single block to include many documents. Satoshi in 2008, conceptualized the first peer-to-peer version of cryptocurrency using the block chain technology and described how the block chain technology was well equipped to strengthen digital trust in terms of decentralization; these block chains did not require trusted intermediaries. Many IT innovators and experts regard block chain technology as one of the most meaningful technological inventions in recent years, digitizing secure ownership of assets. The technology is based on the concept of a distributed ledger, decentralized cataloguing, and large data description. Many consider block chain as a disruptive technology that will revolutionize business and redefine companies and economies. The Internet was originally invented as a decentralized autonomous system in which a participant communicates to each other using peer-to-peer interconnectivity without relying on a single server. However, the Web's advent, especially Web, allowed users to

generate their own data, share them, collaborate, and utilize service-side scripting to proliferate online services based on user's data. Giant social media platforms have built value using free-obtainable private, personal data that have been deployed on the Web. Therefore, the models for applications and several service infrastructures on the Web (Internet) have become more centralized differently from the original architectural intentions due to the business models that depend on centralized accounting and administration. The Web had been one of the representative open application platforms on the Internet since Tim Berners Lee invented it approximately 30 years ago. It connects significant amounts of information on the Internet in a hypertext manner, providing users a platform to search for the same conveniently. The Web technology basically consists of three main components: the URL (unified resource locator) representing the location to a specific site; HTTP (hypertext transfer protocol), which is the protocol for sending and receiving request and response messages; and HTML (hypertext mark-up language), which is the mark-up language for creating hypertext pages easily. Web 1.0 and Web 2.0 have revolutionized information and interactions, respectively. Presently, relatively few social media platforms are responsible for hosting essential elements of what we consider the Internet and keeping our email, social media, and web pages available to all. These giant social media platform providers own hosting servers and exercise control over how the Internet operates. The current centralized Web platform exposes the Internet to certain vulnerabilities, which are likely to worsen shortly. These vulnerabilities are mainly related to scalability and availability of resources and services, reliability for a single point of failure and bottleneck, security and privacy for user data, and trust- ability. In this study, we focus on these issues and provide a review of the potentials and capabilities of block chain for decentralized web architecture. The rest of the paper is organized as follows: we present the related work, and we discuss decentralized web architecture. Finally, we present the conclusion of our study and discuss future works and trends.

2. LITERATURE SURVEY

Issues in Centralized Web the Internet has been acting as a digital information highway that we can use ubiquitously today. The web has been the enabler for the Internet to become a hub to exchange information. The Web was initially designed in a decentralized fashion since the information on the Web can be linked to the information stored on other computers on the Internet. In the first phase (called Web 1.0) of the Web's evolution, content creators were few and the majority of users only acted as consumers of contents. The open Web platform, i.e., the collection of open technologies enabling the Web, emerged by the early 1990s; it has driven the Web 2.0 era. Any participant in Web 2.0 can be a content creator owing to the emergence of newer technologies, such as mashups, AJAX (autonomous JavaScript and XML), and REST API (representational state transfer application programming interface) in the open Web platform. The essential characteristics of Web 2.0 are openness, freedom, and collective intelligence by way of user participation. With the advent of Web 2.0, users began to interact and collaborate among themselves and share information via centralized social media platforms provided by established companies. After a long time of focus on the front-end of the web (Web 2.0), the evolution of web utilization and interaction among several paths have enabled the upgrade of the back-end of the Web. The Semantic Web (called Web 3.0) necessitates using a declarative ontological language like OWL (web ontology Language) to produce domain-specific ontologies that machines can infer information and make new conclusions, not simply match keywords . As the commercial prospects of the Web grew along with the development of Web technologies, many service platforms related to social media emerged. Presently, only a few mighty platform companies control most of these social

media platforms on the Internet. These giant platform companies are popularly, jointly known as FAANGs (Facebook, Amazon, Apple, Netflix, Google, Microsoft, and Twitter). Over time, the Web has become more centralized in terms of its architecture and technology. In the centralized Web, social media platform providers have monopolized control over user data. The data monopoly is giving rise to a new set of problems alongside our online communication consolidation. The data monopoly may cause the biggest issue that social media platform providers collect user data and sell it to an interested third party with all the user data in the hands of a few monopolistic companies, users are becoming increasingly vulnerable to hacking, surveillance, censorship, data breaches, misinformation, and so on. For example, at the behest of the Chinese authorities, Google's decision to operate a censored search engine in China has raised concerns among human rights groups about the future of the Web . The Egyptian government had blocked around 500 websites as of February 2018. The Internet traffic to and from Egypt across 80 internet service providers worldwide dropped precipitously on January 27–28, 2011. In 2011, thousands of websites experienced downtime because of the Amazon Web Services (AWS). The cause of these massive Internet outages is the monopolistic nature of major cloud service providers. With the emergence of centralized web service platforms, these select companies have control over vast user data. Therefore, Web users are losing control over the content they read. These problems have also compromised Web users' privacy, which may make them easy targets for hackers. Nearly all demographic groups in the US consider social media the most dominant news source. In fact, Facebook is the most commonly used source of news on government and politics for Millennials, especially. Thus, a few platforms can significantly influence what media users consume daily. Hence, these platforms can control what is possible to publish and what content is likely to be discovered. The following are the risks posed by the centralized Web. Since its main characteristic is to guarantee the safety and integrity of data on a decentralized network, block chain can be applied to solve the following risks; direct censorship, indirect censorship, abuse of curatorial power, abuse of privacy, monetize data, exclusion, single point of failure, data breach, and so on.

2.1 Decentralized Storage Platform

A decentralized storage platform would be considered better than a centralized storage platform to address scalability and trust issues in data storage and sharing. To solve a single-point failure, the decentralized storage platform ensures that no single server controls the entire service. User’s data is distributed and stored in peer-to-peer interconnected storage nodes that constitute a decentralized storage platform.The peer-to-peer network can operate smoothly so that users can access the data at any time. In the decentralized storage platform, the user retains ownership of his/her data and is the only one to access his/her data or permit other users. Decentralized Storage Platform consists of data integrity verification, data encryption, data decentralization functionality with block chain.

2.2 Block chain as a Value Highway

Block chain is an immutable digital ledger that records and verifies cryptographically signed transactions grouped into blocks in a distributed fashion without a central authority. Except for the genesis block in a block chain, each block cryptographically points to its immediately previous one after undergoing a distributed consensus decision and validation. The block chain platforms maintain the blocks containing the electronic cryptographic data in a distributed and consensus way. Based on a distributed block chain and consensus-based maintenance,

individually developed policing mechanisms ensure that valid transactions are added to the block chain that allows users to be pseudonymous or anonymous; users can create accounts without identifying the authorization process. Therefore, applications built on the block chain can enable the business to be with untrusted and unknown users. Block chain is based on decentralized peer-to-peer networking, in which all participant nodes provide their resources fairly, alleviating one-to-many traffic flow bottlenecks. The characteristics of block chain are to provide decentralization, transparency, non-repudiation, and traceability. A block chain is a public registry of who owns and who transacts what. The transactions are secured through cryptography, and the transaction history gets locked in blocks of data that are then cryptographically linked together and secured. This creates an immutable record of all the transactions across this network that cannot be forged. The record is replicated on every node in the network. Unlike the existing Internet, block chain enables users to deliver value without relying on a third party. As of now, it has been used to deliver various economic values such as cryptocurrency, stocks, computing resources, real estate, automobile use rights in a shared economic society, and intellectual property rights. Several cryptographic technologies, such as hashing and digital signature, have been used in block chains. Hashing is a method of calculating a relatively unique fixed-size output (called digest) for the input of nearly any size (e.g., a video stream, a text file, or an image) and is designed to be one-way and collision-free. Because it results in completely different digests, even if a single bit in the input data is modified, it provides the integrity of a block data in the block chain. For digital signatures, asymmetric-key cryptography is utilized; this provides the ability to verify someone's identity who participates in a transaction. Each user possesses a pair of private and public keys. The private key, regarded as the user's identity and security credential, is used to sign transactions digitally; the digitally signed transactions are sent to whole nodes. The public key is used to validate the transactions that are signed with the private key. When a new transaction occurs, the user submits a new transaction to the block chain ledger. The new transaction will be copied and distributed among every node in the block chain platform. It will be stored in a queue until a mining node adds it to the block chain by creating a block. Block chains allow us to write code and have binding contracts between individuals and then guarantee that these contracts will be enforced without a third party's requirement. Block chains redefine how digital trust mechanisms work using distributed consensus mechanisms and transparent tamper-evident record-keeping.

2.3 Trustworthy Decentralized Web Architecture

Current Web applications combine service and data and execute with a closed back-end database. Because of this coupling, an RSVP on an application event will not be reflected in the scheduler. Thus, similar or related data will be redundantly stored in multiple applications, such as the centralized Web application shown on the left side in Figure 2. The applications in the centralized Web compete in a single market based on data ownership. New innovative competitors in the centralized Web ecosystem may struggle to enter the market because of a lack of customer data. In this section, we introduce the trustworthy decentralized Web architecture and the data model and functional components for identity and data management. Fundamentally, decentralizing the Web is about enabling choice by breaking up artificially coupled decisions into individual options that can be combined at one’s pleasure. In a decentralized Web, we should be able to interact with websites and other people without commitment to a single social media platform. Sensitive personal data should be decoupled from applications in terms of taking back control of it. This separation allows users to enjoy the applications they want and store data where they specify. Also, this allows service

providers to develop applications without the accumulation of their own user data. An example of the data and service separation for a decentralized app application. End-users can select any service provider to store their text, photos, and videos on their own storages on the Internet and depend on any third-party services to interact with data, regardless of storage location. As an example, identity data for a crucial identity service can be provided by Web storage. In the decentralized web ecosystem, end-users have the right to control their data, unlike the centralized web ecosystem. However, although users can control the data in the decentralized web ecosystem when the service providers utilize the user's data, they can infer the data owner and infringe the user's privacy. Besides, as data generated by wearable devices and sensors in the home network and user-generated contents become valuable, data sovereignty is becoming more critical. Hence, it is desirable that the identifier be anonymized or pseudonym zed to ensure the user's privacy, and if possible, a relationship between both identifiers of data and owner must be established to claim data ownership.

3. PROBLEM ANALYSIS

3.1 EXISTING SYSTEM

In centralized Architecture, a single authority is created through which all the data must pass through. The basic components of this architecture are: node (client), server and communication link. This architecture follows the standards of client server architecture in which client sends the request to server and server responds back to those requests made by the client. Centralized system is easy to create and set up because it provides more direct control like all the permissions and processing are managed by a single central server. The server components provide services to one or many clients which make requests. Servers are classified on the basis of service they offer, for example, a web server offers a web page and a file server offers file exchange. A single computer can offer web service and file service at a time to provide data based on the type of request created by the client. The communication between different servers is known as inter server communication and this communication is fully synchronized.

3.1.1 Limitations of Existing system:

In a centralized network, all the data of the network passes through a centralized server. Therefore, a single organization holds the information. Even though centralized organizations are secure and trustable; they are not 100% secure or trustable.

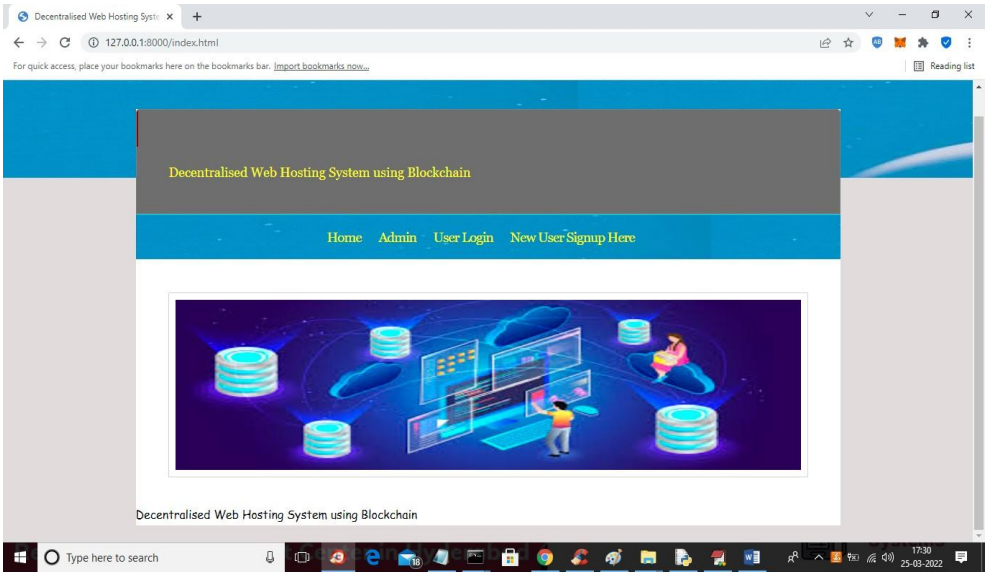
3.2 PROPOSED SYSTEM

In this research paper, we have worked out ways to demonstrate the functioning of centralized and decentralized web hosting, keeping our main focus on comparing centralized and decentralized systems with each other. We have started the paper by introducing centralized and decentralized systems with some terms and technologies, then we have explained the centralized architecture followed by a comparison table for a centralized and decentralized network. We have also discussed decentralized networks and technologies associated with them such as IPFS, encryption, etc.

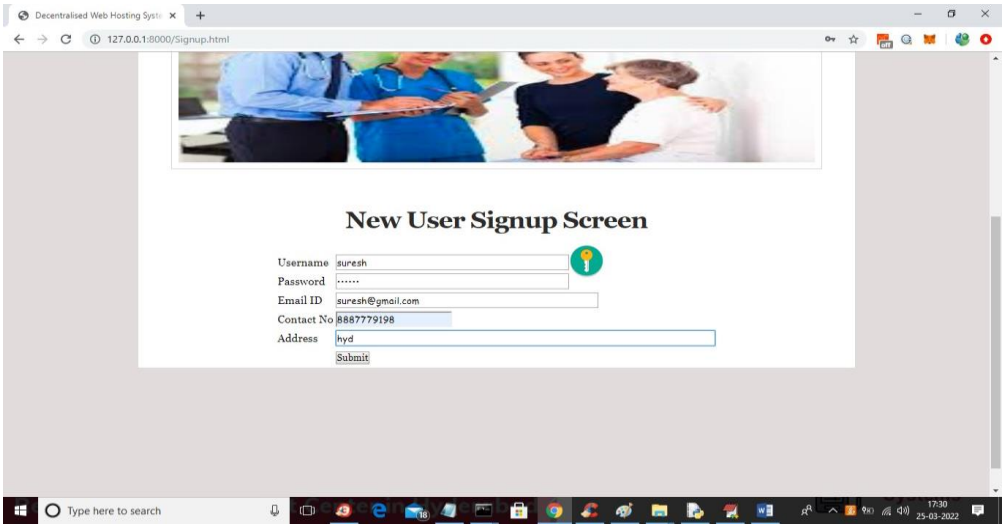
3.2.1 Advantages of Proposed system

We have discussed and provided solutions on how a decentralized network can work efficiently. Future research includes working on the limitations of decentralized networks and providing solutions to overcome the limitations. Thus, a decentralized web hosting network can be applied efficiently to overcome the limitations of a centralized network.

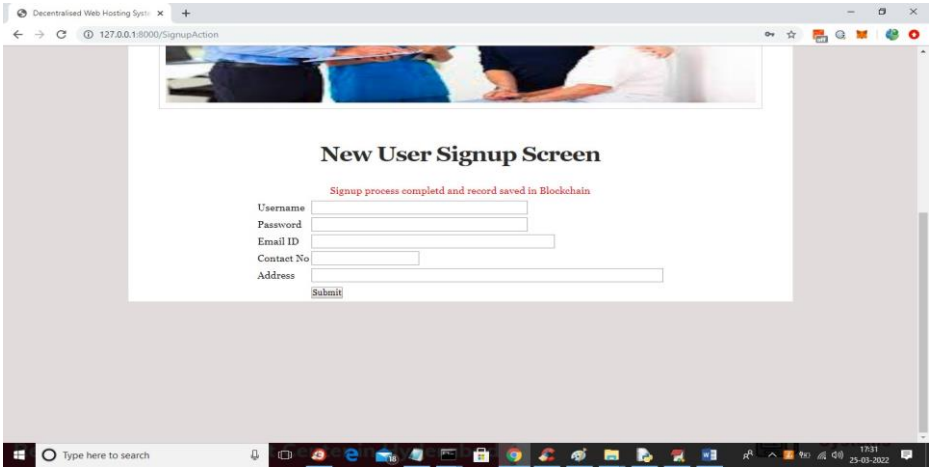
4. RESULTS



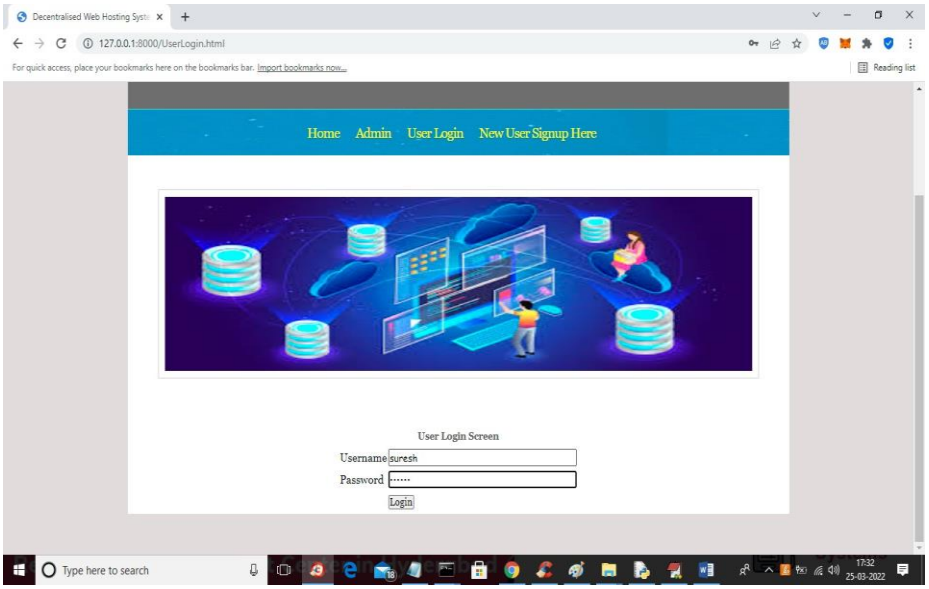
In above screen click on 'New User Signup Here' link to get below screen



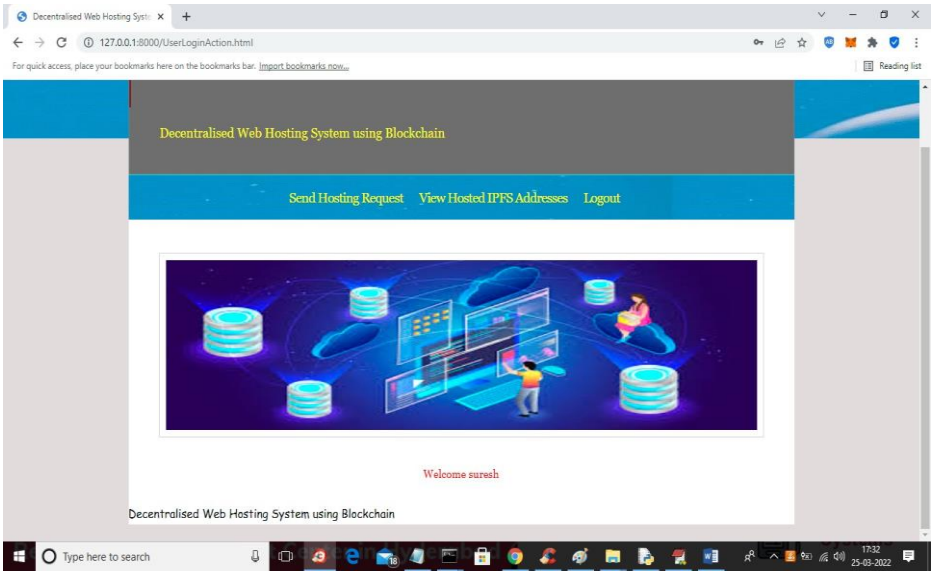
In above screen user is signup and press button to store details in Block chain and get below output



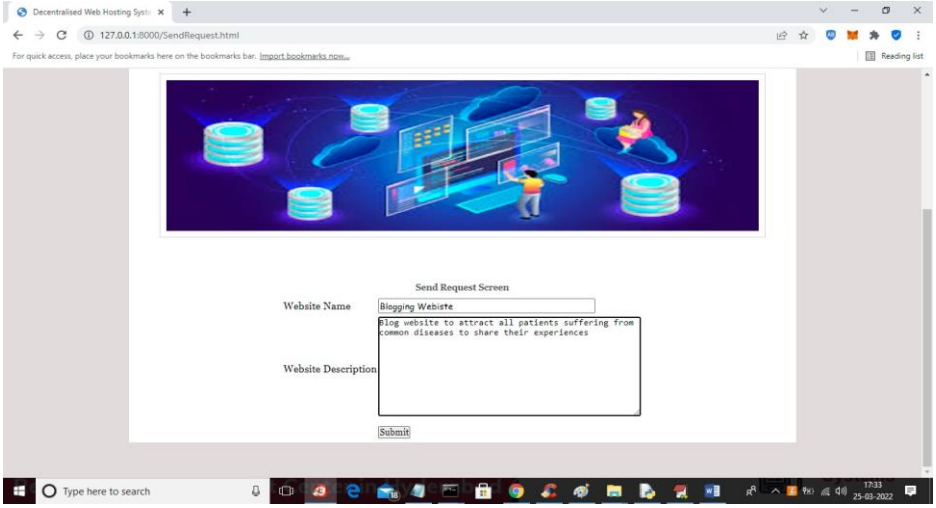
In above screen signup process completed and now click on 'User Login' to login as user



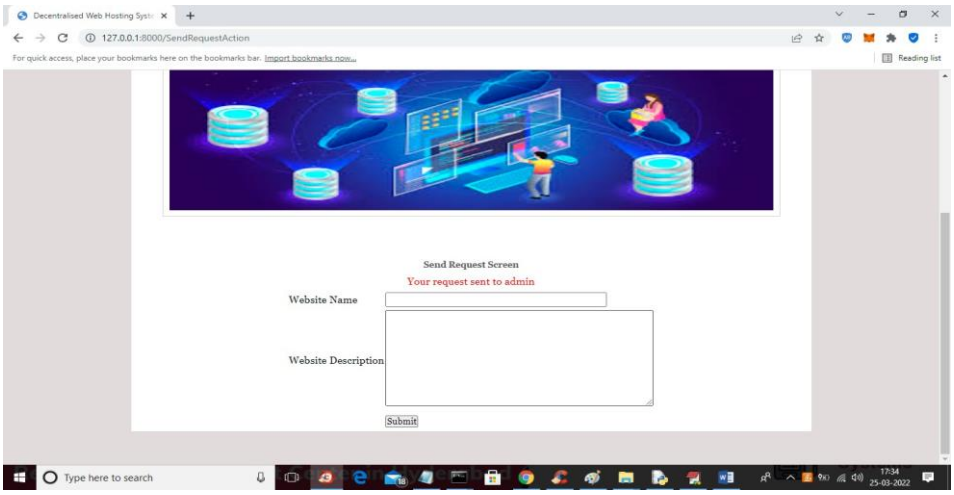
In above screen user is login and after login will get below output



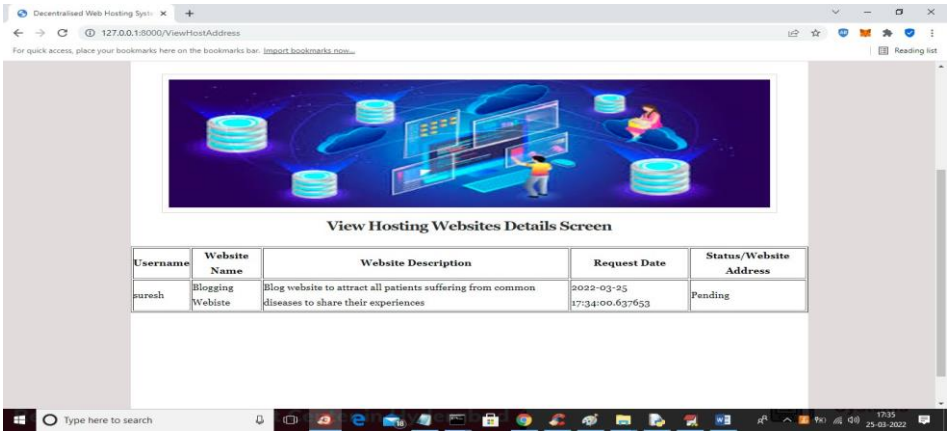
In above screen click on 'Send Hosting Request' link to send request to admin



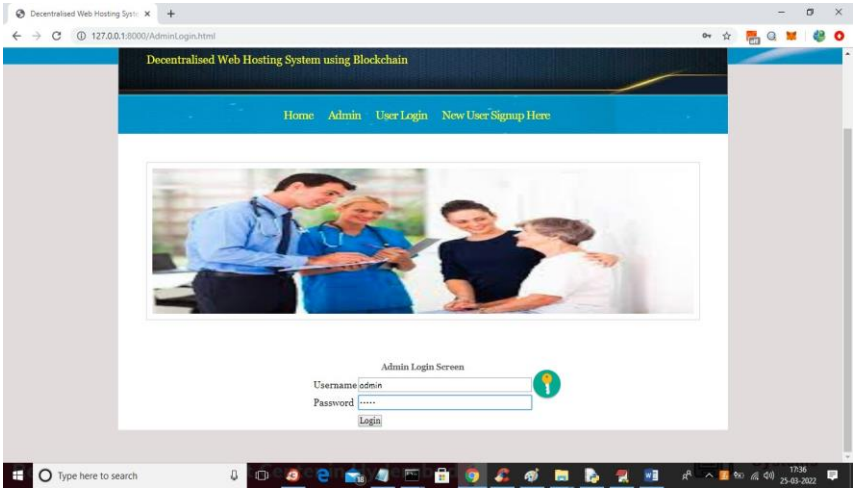
In above screen user will enter website details so admin can know about it for approval and press button to get below output



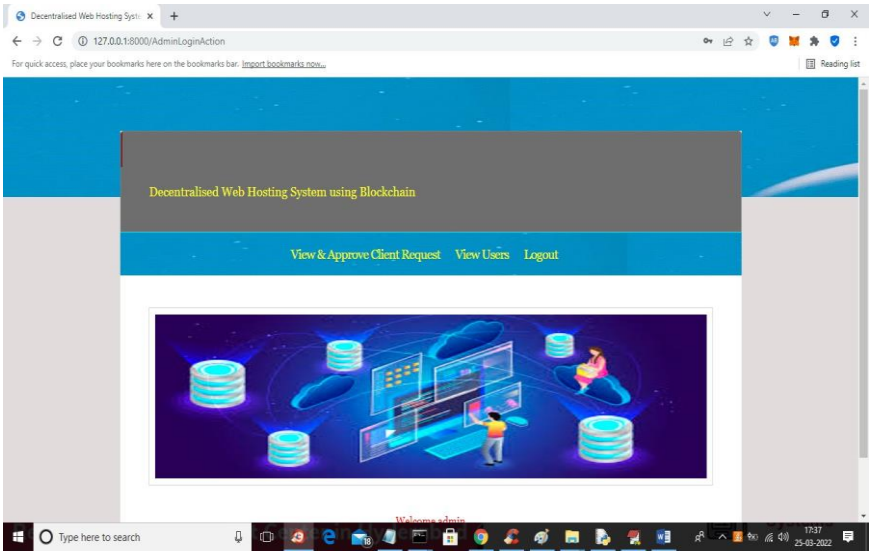
In above screen we can see request send to admin and now click on 'View Hosted IP Addresses' link to view all URL of websites deployed by this user



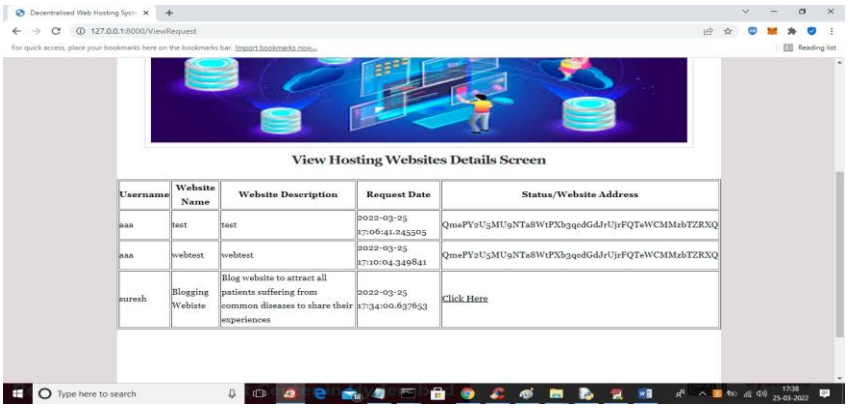
In above screen user can see details of his request and it's in pending state as admin not yet approved and admin will ask user to send code and upload it and now logout and login as admin to approve request



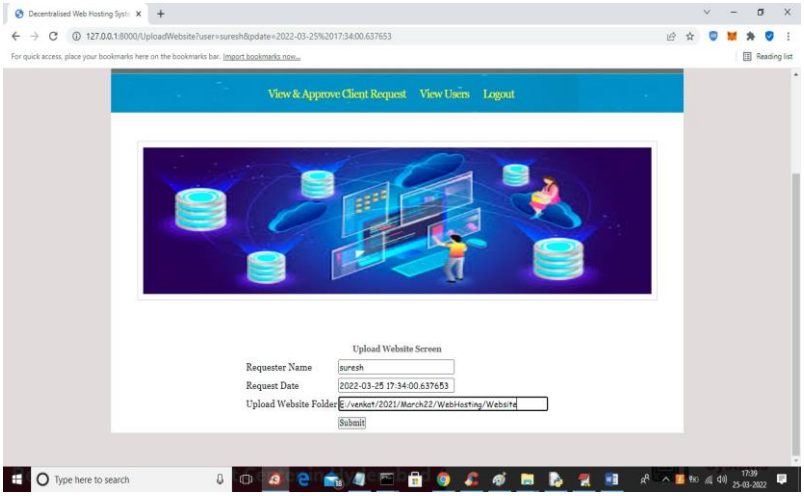
In above screen admin is login and after login will get below screen



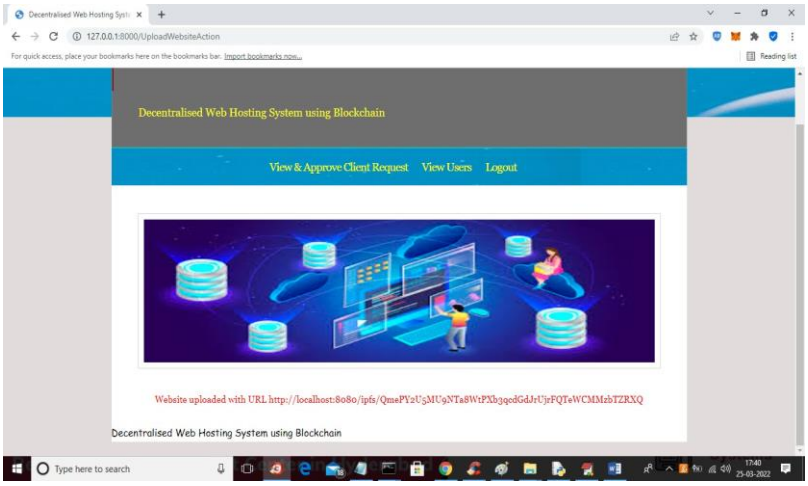
In above screen admin can click on 'View & Approve Client Request' link to view all users request



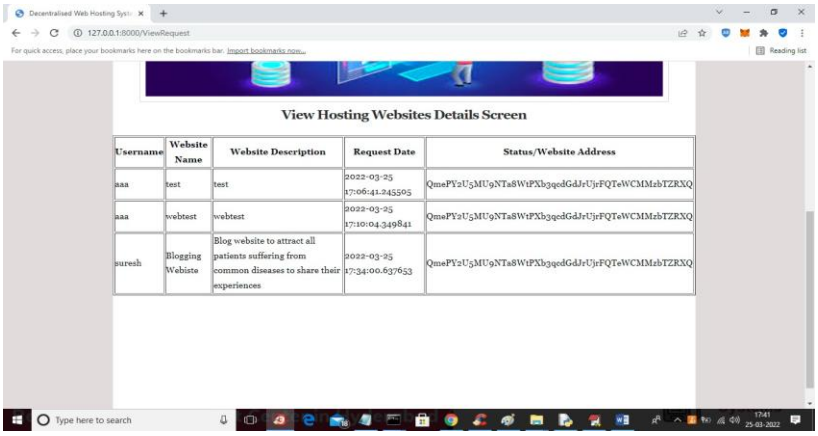
In above screen admin can view all details of user website and if request already approved then we get hash address of website deployed and if not deployed then admin will get option as 'Click Here' and admin will click on that and then upload website like below screen



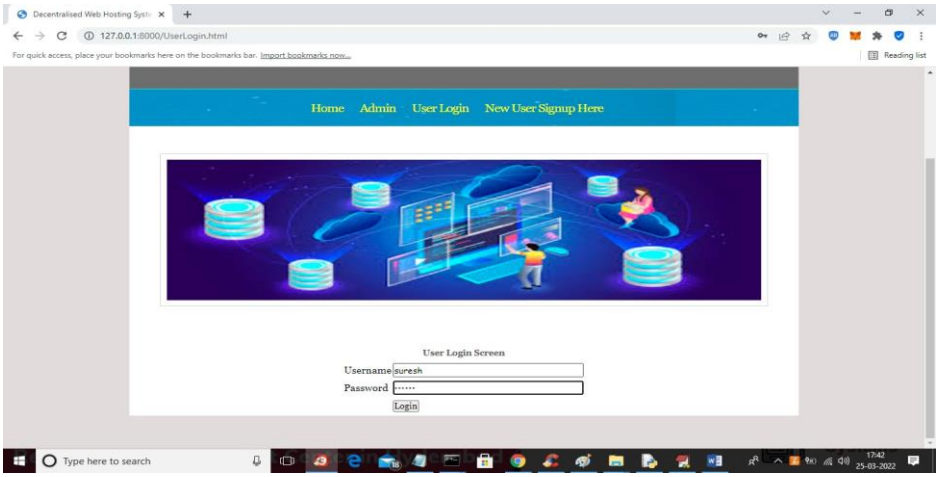
In above screen admin will just enter the path of code folder received from user and then press button to upload that path web code to IPFS and Block chain and get below output



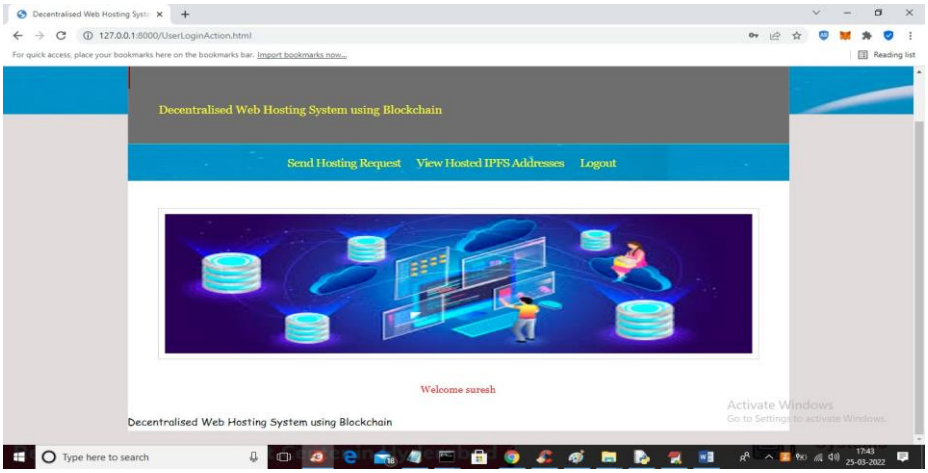
In above screen in red color text we can see web site deployed and we got URL with hash code and you can copy and paste that URL in browser to access deployed web pages and now click on 'View & Approve Request' link to check that request again



In the above screen we can see website deployed and we got address of that deployed website and now logout and login as user to see that status.



In above screen user is login and after login will get below screen



6. CONCLUSION

In this research paper, we have worked out ways to demonstrate the functioning of centralized and decentralized web hosting, keeping our main focus on comparing centralized and decentralized systems with each other. We are using block chain to provide security to websites. We are hosting applications using the block chain.

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