International Journal of Future Generation Communication and Networking
Vol. 13, No. 3, (2020), pp. 1287–1295

Blockchain Technology for Real Estate Documents Protection Using Ethereum

Sandesh S. Mahamure[1] , Dr. Sanjeev J. Wagh[2],

[1]*Software Developer, Tecknack Technologies Pvt. Ltd, Pune.*
[2]*Proffesor. Department Computer Engineering, Government College of Engineering, Karad.*

Abstract

The blockchain is becoming the buzzword in the cybersecurity domain which stores the customer's information in its block structure, apply required functions in terms of secure transaction and at the same time, it builds the trust in all participating stakeholders of the transaction. This helps to develop a secure ecosystem in an open environment. The researcher from academic and industry confirms that blockchain will be treated as a milestone in the domain of cybersecurity. The applicability of this is ranging from cryptocurrency like bitcoin, smart contracts, banking, end to end supply chain management and healthcare and so on. Although blockchain is getting huge attention from the large researcher community, privacy and security will always be at the centre of debates while deploying the application. Because of its huge resource requirement and difficulty in moulding it according to the application, it becomes a challenging task to implement blockchain in a real-life scenario.

This paper presents a comprehensive literature survey and gap analysis concerning security and privacy preservation of the blockchain. The objective of research work is to provide an additional layer of blockchain security to avoid the frauds and develop quality trust in the participating stakeholders. For that, we have implemented blockchain to provide security to documents and information related to property. This paper also discusses the timing consideration of the transaction. This paper also presents the layered architecture which gives an idea of implementation of blockchain in various applications. We have used python 3 as a programming language for the client application, solidity for the smart contract, the remix is used to compile and deploy smart contract and Ganache is used to connect smart contract to machine.

Keywords: *block chain, real estate, Etherium, miners, wallets, smart contracts, crypto-currency etc*

1. Introduction

Blockchain get huge attention when bitcoin changes the thought process of the financial transaction. It is getting attention from both academic as well as an industry due to its potential in all verticals of the research domain. In simple words, the blockchain is the distributed ledger maintained to keep the records safe. All the data is stored in blocks and the hash values of the current block are put into the next block. This makes the system trustable and secure. Currency transaction between two entities is always controlled by a third party transaction. In such transactions, the bank plays a vital role of middlemen to provide surety of transaction. This scenario is common for all other domains. At the same time, data and information are managed by a third party organization. The goal of blockchain technology is to create a decentralized environment where peer to peer transactions without any third party governing body.

Blockchain is a distributed ledger that maintains a continuously growing list of records that is appended by the participating nodes in the chain. The transaction record is saved in a public ledger of every transaction completed. The transaction is done under the umbrella of blockchain not governed by any third party organization which acts as a middleman. The information of all the completed transactions is available on each participating node of the chain. The next block of chain stores the hash value of the previous block. This makes blockchain more trustable. If an intruder tries to change the information of one block that leads to changes in hash values which are stored in the next block which is not possible due to the immutable nature of the blockchain. Blockchain also helps to maintain the privacy of data.

ISSN: 2233-7857 IJFGCN

Blockchain can be used as the backbone of the security structure in various business domains including banking, real estate, health care, supply chain management, retail industry, transportation etc. Real estate is one of the domains where every person invests his money. It is one of the important domains which drives the economy of the country. A lot of advancements are expected in this particular domain but unfortunately this domain is not getting technological attention as required due to various reasons. The most frauds are carried out due to traditional methods that are followed in the real estate domain. The broker is involved in the deal so they take some percentage of transaction which leads to increased price in property due to which parties suffer from financial loss. The builder makes false promises to customers to meet their funding requirements, once they receive sufficient amounts. so there is a need for a smart contract signed by both customer and builder. One more scam the scammer does is that they create duplicate or fake title deeds of vacant or disputed land due to which property developer or customer face huge financial loss. Other frauds are like delay in construction of a property, deviation from the actual plan, selling already sold property [1].

With the help of smart contracts, blockchain can provide transparency between property developers and customers. Whatever financial transaction is done that must be done under the protection of blockchain technology. If all the documents that are related to property published on the distributed ledger then fraud related to property documentation can be avoided. At the same time, it maintains the privacy of data. The blockchain has the ability to protect against real estate frauds.

This paper proposes a novel architecture and its implementation related pseudo-code. These papers provide implementation details of blockchain which consist of various components like smart contracts, clients, gas, ganache, miners etc. we have implemented a prototype which concludes that the real estate with blockchain can avoid frauds and also helps to build trust in its all stakeholders. The paper is organized as follows. After Introduction we have done a comprehensive literature survey. The gap analysis section talks about the parameter consideration, pros and cons of other methodology. The proposed methodology discusses layered architecture with pseudocode and time complexity of the transaction. After that implementation section elaborates about the tools and language used with its justification. Conclusion and future work section provides an idea about observations, learning from research and the next things to do.

2. Literature Review

This section consists of a comprehensive analysis of various papers that gives an insight into ongoing research in this particular domain.

[2] Sabarish Krishna D, Soumi Aakash V, Sivaprakash M & Madhumathi C.S(2019) "Secured Real Estate Transactions using Blockchain Technology". e-issn 23950056

The traditional real estate sector now faces a variety of problems including trust issues, data distribution without compromising data security. This particular domain is unable to maintain its trust and transparency of record management. The author Sabarish Krushna D. et al. [2] presents a novel architecture that satisfies most of the need for peer to peer transaction. This approach tries to solve problems like a transaction between seller and buyer and the Documents and information associated with this transaction will be distributed and alteration of such information is almost impossible. In this paper, the author provided generic architecture to provide a solution.

[3] Uzair, M. M., Karim, E., Sultan, P., & Ahmed, S. S. (2018). "The Impact of Blockchain Technology on the Real Estate Sector Using Smart Contracts."

The researchers from various domains invest their time and efforts to use the potential of blockchain in their respective domain. Because the blockchain can make a drastic change in various domains. The author Muhammad Mansab Uzair et al. [3] proposed a methodology that includes all the stakeholders of real estate like investors, residents, government, and real estate agents. For data analysis authors made a

ISSN: 2233-7857 IJFGCN

questionnaire and this was filled by all stakeholders. For data analysis, they have used various statistical methods. The author also recommended their government to implement blockchain to avoid fraud cases in real estate.

[4] Malviya, H. (2017). "Blockchain for commercial real estate". *Available at SSRN 2922695*.

The traditional real estate processes now facing the problem of speed of transaction, cost and additional security features need to consider the author Hitesh Malviya et al.[4] presents the impact analysis of blockchain on real estate. The authors mainly concern about how to improve the cost of the transaction, reduce the no of frauds and improve the transparency. The authors also emphasize virtual financial identity for transactions.

[5] Bhatia, K., Vij, J., Kumar, H., Sharma, Y., & Sharma, A. (2019). "Exploration of Blockchain Based Solution for Real-Estate".

Real estate is one of the major domains which helps countries' economies. There are millions of transactions carried out in this particular domain. As far as policies and methodologies are concerned, we are using the traditional approach. The author Karan Bhatia et al. [5] addresses many issues related to the real estate domain which includes the overhead of paperwork, leased land with fake identities, illegal land acquisition etc. the authors explored what are the possible scenarios where we can apply blockchain and provide the solutions. The authors proposed the data format for data storage in the blockchain and additional information will be added to the block after the transaction.

[6] Nijland, M., & Veuger, J. (2019). Influence of blockchain in the real estate sector. International Journal of Applied Science, 2(2), p22-p22.

The author Max Nijland et al. [6] addresses various problems related to the buying process of commercial estate. The authors classify the problems at various levels. According to the authors, the blockchain can share the data safely and securely. But blockchain is in the early stage of development so right now it's not yet suitable for the implementation in the commercial real estate sector. The authors researched various questionnaires to understand the loopholes of the end to end process of buying and selling of properties.

3. Gap Analysis

From the comprehensive literature survey, we have done a gap analysis of methodologies mentioned by authors. We have considered the parameters like implementation feasibility, support to a legacy system, the platform used for implementation, methodology and key points. Implementation feasibility tells about whether the proposed model is feasible for implementation or not. Next is whether the proposed model can accommodate an existing system or not. There are various platforms used for implementation one of the implementation platforms is ethereum and other is the local machine. The methodology gives an insight into the method has been provided in the paper and last are key points of the paper. Table 1.1 shows the gap analysis.

Sr. No.	Implementation feasibility	Legacy support	Implementation Platform	Methodology	Key points
1[2]	No	--	--	--	Provided architecture that satisfies most of

ISSN: 2233-7857 IJFGCN

					the needs of peer to peer transaction
2[3]	Yes	Yes	Etherium	Statistical methods are used for data analysis	Consider all stakeholder of involved in transaction
3[4]	No	--	--	Assignment of virtual financial identities	Reduce the cost of transaction, fraud detection.
4[5]	--	No	--	--	Provide impact analysis after implementation. Discuss about implementation scenario
5[6]	No	--	--	Theoretical model provided for the buying and selling of properties	Impact analysis on real estate sector

Table 1.1: Gap Analysis

4. Proposed Architecture.

There are various problems in the traditional real estate domain. It is not always possible to replace new systems with previous systems. So, for some time both systems must coexist and once the new system gets matured then we can replace the previous one. In real-time there is fraud related to document and ownership of property. This problem can be solved by storing the digitally signed documents of property that can be stored in the block and encryption is applied. The hash value of the current block will be stored for the next block. The blockchain forms peer to peer communication so the validity of buyer and seller might be the concern. This problem can be solved by data miners which help to authenticate or validate the involved parties. Due to the immutable nature of blockchain, no one can alter the information. At the same time, all the records are stored in a distributed manner.

The layered architecture presented in the following fig 1.1. The foundational layer is for the device to device communication where the device can use public or private infrastructure for the communication. The middle layer is mostly responsible for the entities involved in the blockchain operation and operational elements that are required to run the block chain smoothly. Top layer carries responsibility of resource management at the cloud.

ISSN: 2233-7857 IJFGCN

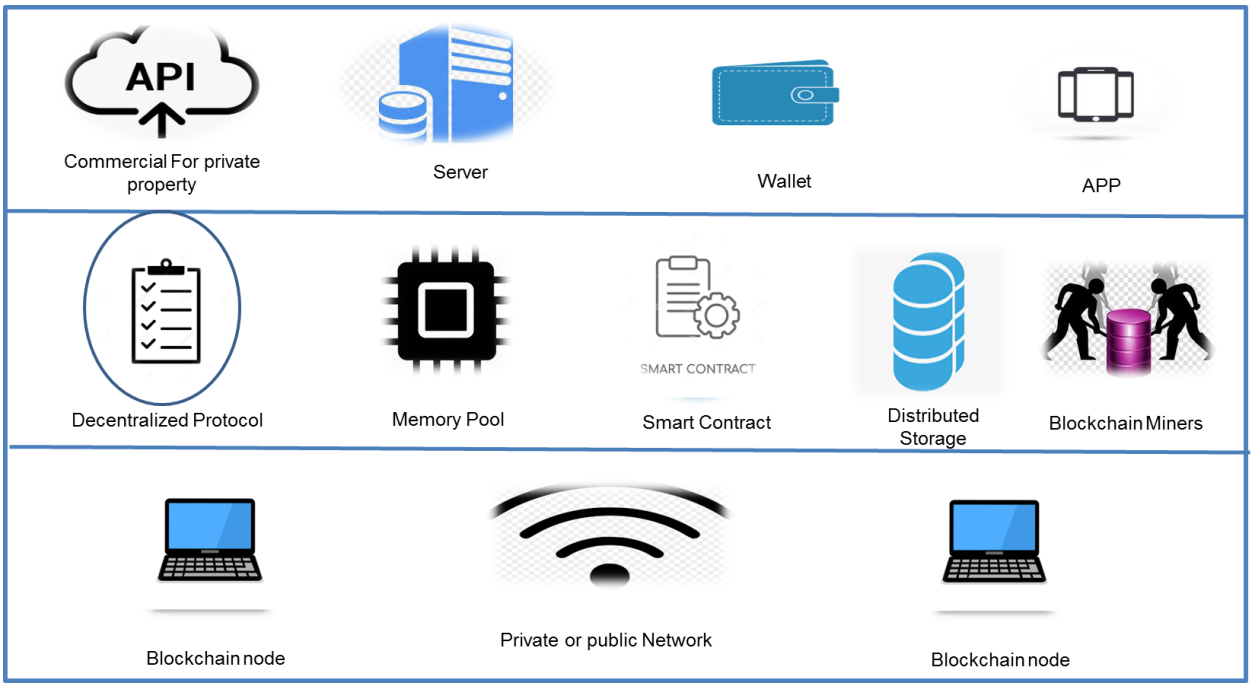


Fig1.1: system architecture

In the proposed work the transaction is done between sender and receiver. The data block consists of list of hash computed for the documents required to purchase a property and take land on lease mode.the documents are extracts, mutation register extracts which contains the previous owner of the property, power of attorney certificates which certifies sellers authentication, building plan copy, contracts for leasing documents which includes a period of the lease and other rules and regulations, identification documents of sender and receiver. We can also include other documents like sale agreement, possession letter etc. All these documents are digitally signed. The disadvantage of storing documents on a block chain is that the size of the block is limited. As our data grows the cost of transaction also increases. So we only store the hash value of the document in the block chain. It helps to optimize memory and reduces cost of transaction. The documents are physically uploaded on another server. The copy of transaction and data automatically sends to all the other stakeholders of the transaction. All these documents are put into the block and the hash value of the entire block is computed. At the same time, we need to provide an access control mechanism to secure private information about the property. So, in the proposed work each property has a unique digital identification number which is required to access the info of the property.

The pseudocode is shown below:

start

hash_value = propertyid + ds(key_gen(pr,pb),sign(encr(doc_id)),verify(tg, pb,doc_id))

the hash token consists of propertyid(unique identifier for property) and appends the hash value computed for the documents individually.

hash_doc_list = the list of hahvalues of documents

set the flag = false

iterate hash_doc_list and check the doc

if SHA(de(hash_doc_list[i]+propertyid))==hash_value

then set flag to true else discard the transaction

if flag = true then publish the transaction on cloud application

end

ISSN: 2233-7857 IJFGCN

5. Time Analysis of Transaction

we are assigning property id to each individual property

t(n) is amount of time require for the entire transaction

t(encr(d_i)): the time require to encrypt document i

t(ds(d_i)) :the time required to add the digital signature

t(dl) :the time required for addition of docs_hashes in the list is O(n)

t(check_dl) : the amount of time required for check authenticity of document which takes around O(n) for n documents which compute hash and check with existing hash which is present in list

$t(n) = t(hash\_value) + t(encr(d_i)) + t(ds(d_i)) + t(dl) + t(check\_dl) + C$ .....(1)

$t(hash\_value) = nt((encr(d_i)) + c$ .....(2)

so replace 2 into 1

and the amount of time required for adding hash values in the list take o(n) time

$t(n) = nt((encr(d_i)) + t(ds(d_i) + O(n) + O(n) + 2C$

$t(n) = nt((d_i)) + t(ds(d_i)) + O(n) + 2C$ .....(3)

The time required to add a transaction is increasing based on the data of the transaction. Generally the size of the block is 1 kilobyte. So storing more data in the blockchain may cost in fortune. The C is Constant time required for additional processing and delays as well.

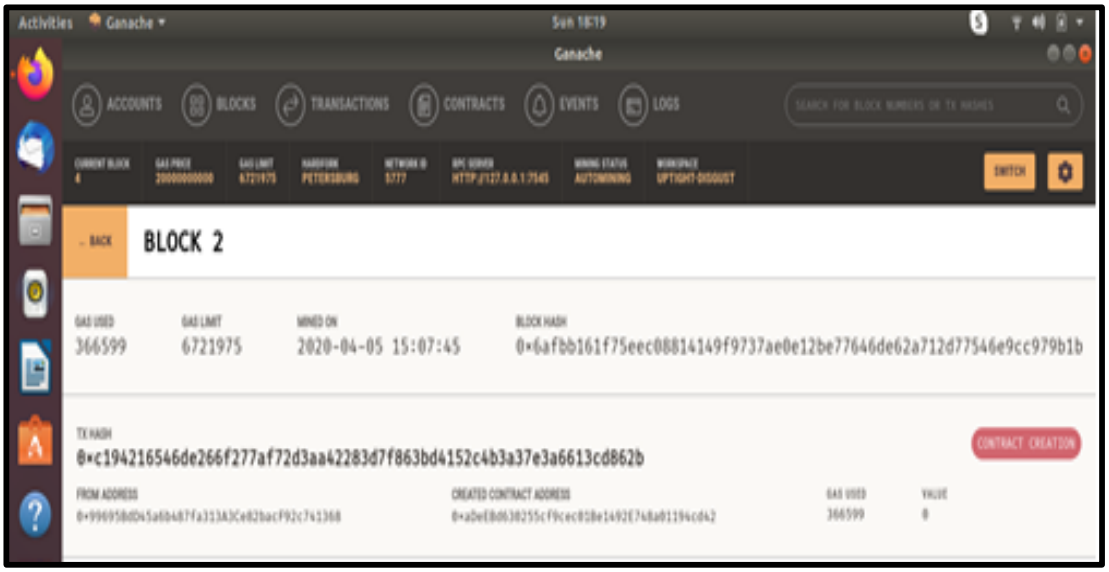
From the eq(3) it seems that for $nt((d_i))$ is the dominating factor in the transaction.

6. Environment Setup:

The entire implementation is done on the ubuntu 18.08 LTS and we have used python 3.6 version for implementation. We have also used libraries like web3. We have used an online editor named remix to compile and run the smart contract and provide the output. From which we are taking abi, bytecode, address. This library consists of various functions that help in computing keys and addresses. The web3 acts as an interface to the ethereum. The next thing we have used is ganache which provides private blockchain on localhost. For building prototypes we have used this utility. The etherium is a platform to perform transactions on the internet. Where we can code and deploy applications, used crypto-currency called Ether. Its digital money required to perform the transaction.[10]

7. Implementation Discussion:

We have implemented prototype of our proposed algorithm in python some of the snapshot of implementation is provided below:



ISSN: 2233-7857 IJFGCN

Fig 1.2 : Representation of block on ganache

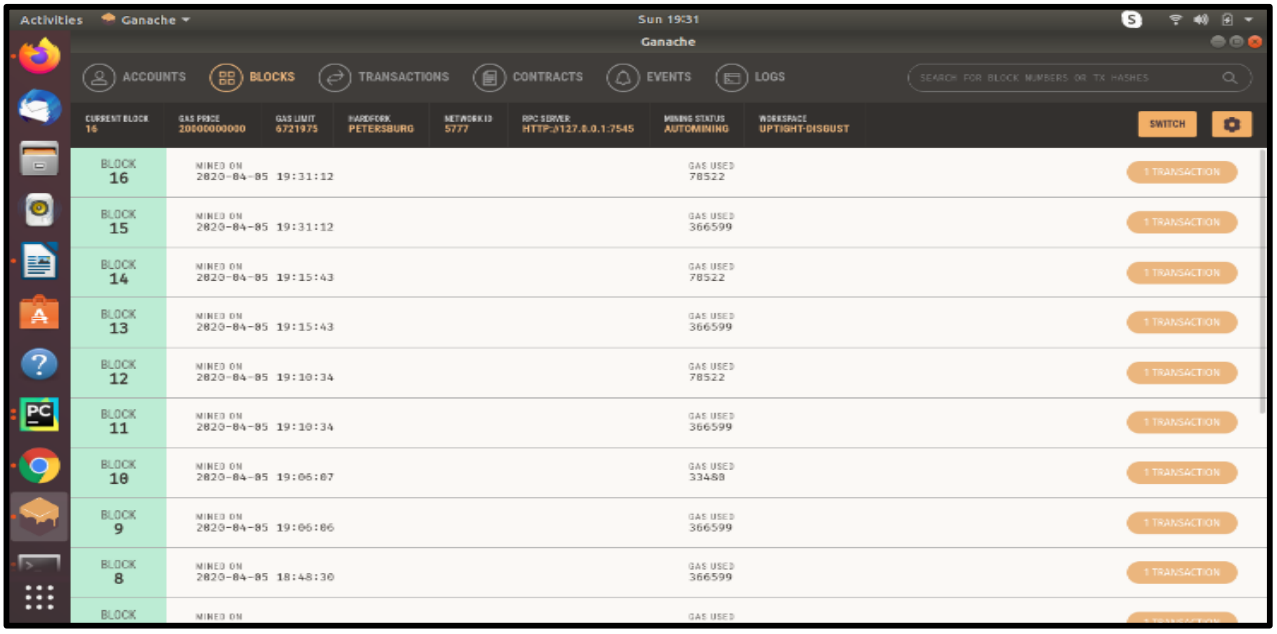


Fig 1.3: Abstract View of blocks

For the implementation we have used ganache which helps to implement blockchain on localhost. The fig 1.2 represents the data block which consists of gas used for the transaction, gas usage limit, time and date, block hash, transaction hash, the parties involving the transaction etc. the list of all the blocks is depicted in fig 1.3. We can check the individual block also. The individual block is depicted in following fig 1.4. The Fig show details of the individual block including its data which is encrypted. For block chain implementation when any transaction happens some part of the transaction i.e. gas must be given to the miners. In real time scenario, The configuration of each node for blockchain implementation must be high due to huge computational requirements.

ISSN: 2233-7857 IJFGCN

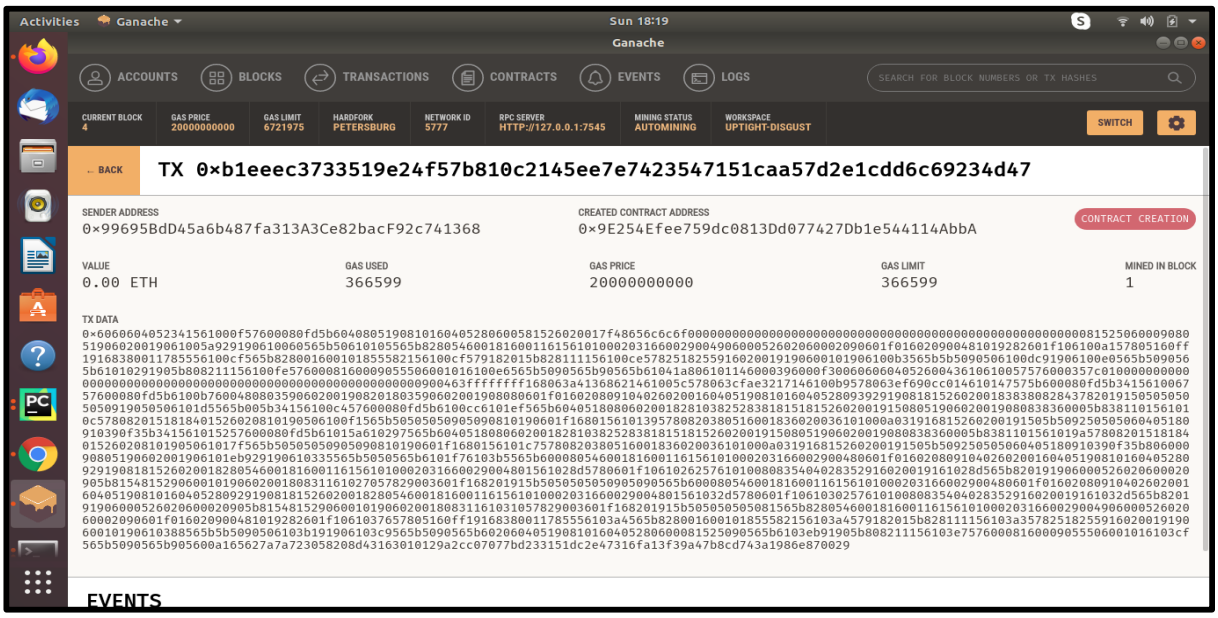


fig 1.4 details of individual blocks

The smart contact is the contact that binds all the involving parties. For this prototype the language chosen for the contract is solidity. We have to write code for smart contracts. For the compilation and deployment we have used an online platform i.e. remix. Then we have connected that contract to localhost. From python we need to manage the data and block. The snapshot of that provided below.

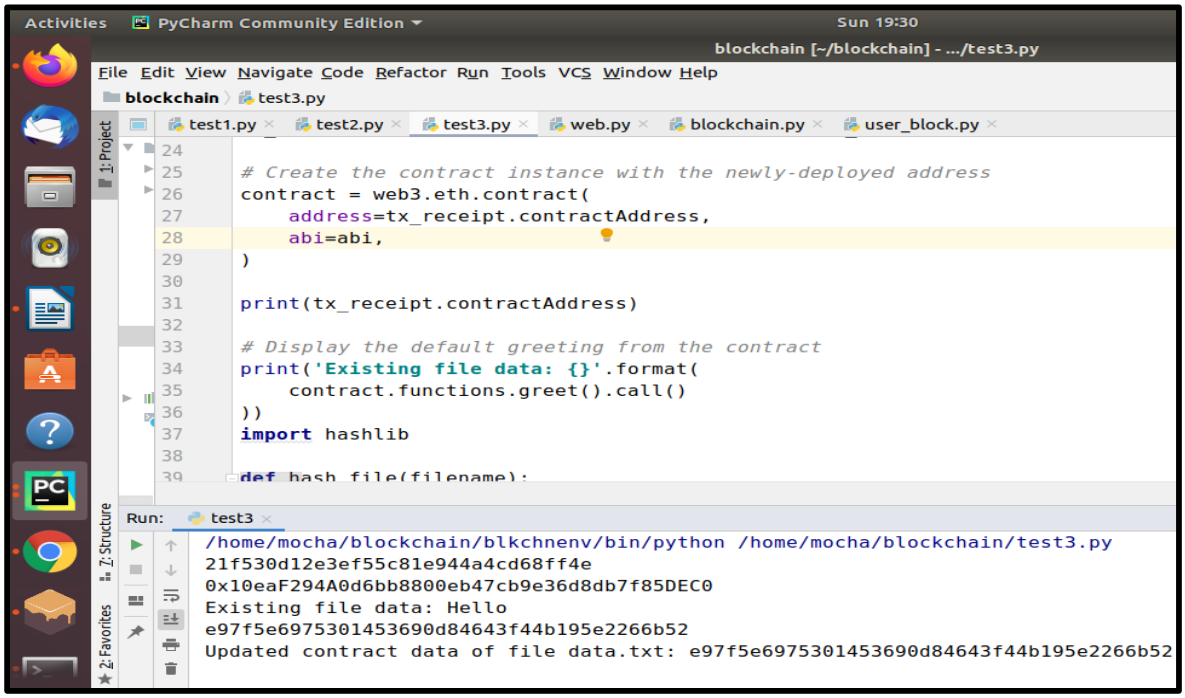


Fig 1.5: snapshot of final output

8. Conclusion and Future Work

The blockchain is becoming a driving force in the cybersecurity domain. Now, the huge research is going on the adoption of blockchain in various domains and its seamless integration with real-life

ISSN: 2233-7857 IJFGCN

applications. This paper presents a novel approach to implement blockchain in real estate domain that avoids the frauds and harassment of stakeholders. This approach also helps to improve the speed of work as well as build trust in stakeholders. We have implemented the prototype of proposed work using python 3 and ethereum platform. All the transactions are performed with the help of exchanging the gas unit and also smart contracts in solidity language. Still, there is the scope to optimize proposed methodology and improve the transaction time which we consider as part of future work.

References

[1] Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K. (2016). Where is current research on blockchain technology?—a systematic review. *PloS one*, *11*(10), e0163477.
[2] Sabarish Krishna D, Soumi Aakash V, Sivaprakash M & Madhumathi C.S(2019) Secured Real Estate Transactions using Blockchain Technology. *e-issn 23950056*
[3] Uzair, M. M., Karim, E., Sultan, P., & Ahmed, S. S. (2018). The Impact of Blockchain Technology on the Real Estate Sector Using Smart Contracts.
[4] Malviya, H. (2017). Blockchain for commercial real estate. *Available at SSRN 2922695*.
[5] Bhatia, K., Vij, J., Kumar, H., Sharma, Y., & Sharma, A. (2019). Exploration of Blockchain Based Solution for Real-Estate.
[6] Nijland, M., & Veuger, J. (2019). Influence of blockchain in the real estate sector. *International Journal of Applied Science*, *2*(2), p22-p22.
[7] https://hackernoon.com/learn-blockchains-by-building-one-117428612f46
[8] https://www.dappuniversity.com/articles/web3-py-intro
[9] https://programtheblockchain.com/posts/2017/12/19/testing-and-deploying-smart-contracts-with-remix/
[10] https://ethereum.org/what-is-ethereum/

ISSN: 2233-7857 IJFGCN