A Review paper on Smart Contracts in Blockchain Network based applications

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Abstract— This paper gives the review on latest and detailed application of smart contracts and its uses on various areas like Distributed Energy Transaction Mechanism,Micro servicesSystem, System for Secure Electric Vehicles Charging in Smart Community, Discovery Process ofStock Value Information in stock market,it further categorized the challenges faced in Smart contract implementation for blockchain network.

***Keywords*— Blockchain, smart contract, use case, applications**

I. INTRODUCTION

Smart Contract is an executable code that is first introduced by nick szabo in 1994, this is an executable code which is in built with the blockchain transactions to deploy terms and conditions for the transaction over the blockchain network,the use of smart contract enables the application to run transactions smoothly without any manual intervention required,this removal of manual intervention eliminates the need of third party validators for transactions .smart contracts have the ability to run on required hardware and software.

When Blockchain is concerned, smartcontracts, First application of Blockchain i.e. Bitcoin do not have the smart contract facility but Etherium platform has the ability of deploying smart contracts.

Generally Languages for writing smart contracts are-

1. solidity
2. Go
3. Python
4. Java
5. simplicity

And thecommon platforms are-

1. Ethereum
2. Ripple
3. Quorum
4. Hyperledger Sawtooth
5. Hyperledger Fabric
6. R3 Corda
7. EOS

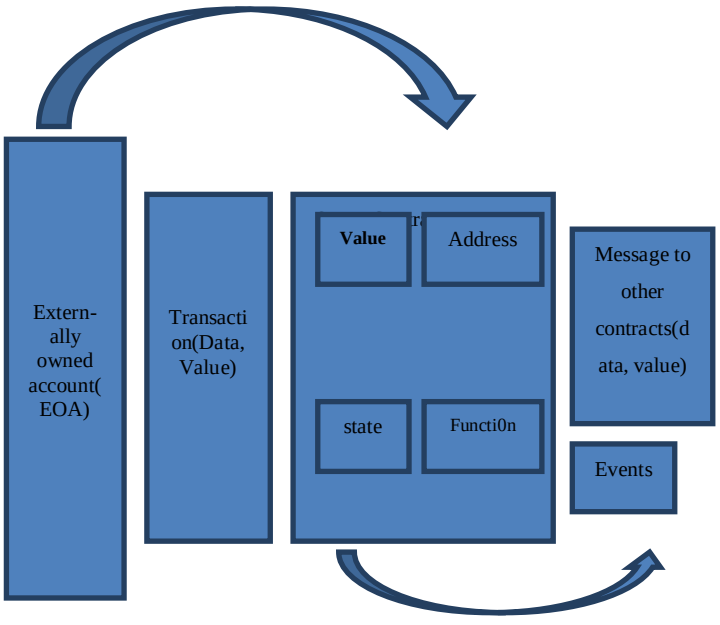

Fig.1-basic Structure of smart contract

suppose if you want to sell an asset to someone,then you can simply use a smart contract on blockchain with your asset information ,information about the

asset could be stored in blockchain and anyone can see this information who are on blockchain network,when one wants to buy your asset then you can run a smart contract which could specify the terms like how much price the asset has been sold,if there is added transportation charges if required,handling ownership of that asset etc.,when this smart contract gets executed then ownership has been transferred to the buyer and this information is again visible to the users of the network,in that way blockchain maintains the transparency of the assets ownership. For a wide range of potential applications, blockchain-based smart contracts could offer a number of benefits: Such as

Speed and real-time updates,Accuracy,Lower execution risk, Fewer intermediaries, Lower cost, New business or operational models.

II. SMART CONTRACT USE CASES

There are various Use cases of smart contract, we will discuss its working and to find the limitations and challenges faced executing smart contract on thesespecific applications.

A. Distributed Energy Transaction Mechanism,

Shaoyuan Yuet al[1] discusses the Chinese power distribution market,now a days there are various form of energy, be it electrical energy ,solar energy ,hydraulic energy,so that various no of Energy providers are there instead of centrally adopted energy provider ,it makes distribution of more robust and dynamic,now users would become prosumers,a prosumer is a consumer who becomes involved with designing or customizing products for their own needs whenever they want to buy the energy or sell the energy. They proposes Smart contract for Distributed energy transaction,this smart contract will work on the consortium based blockchain network of Prosumerswhich executes transactions between peer to peer nodes.The functions which are in built on the smart contractas shown in Fig 2.

The main limitation on this p2p approach is how to localize the prosumers on the trading platformif the number of prosumers would get increased, as blockchain have network scalability problem,

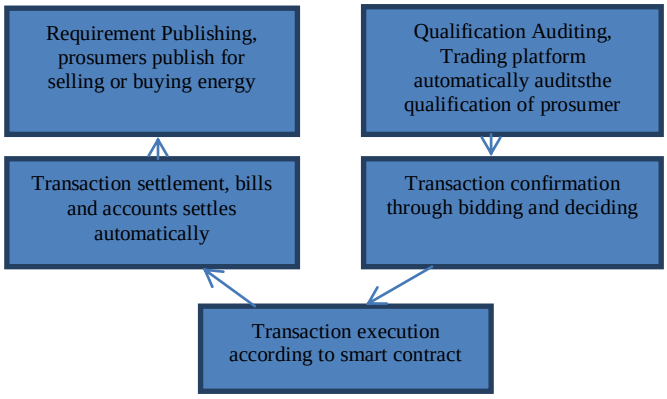

Fig 2. Distributed energy Transaction Flow

B Implementing a Microservices System

Microservices system is a software engineering concept in which microservices allow teams to slice existing information systems into small and independent services that can be developed independently by different teams[2].they have discussed on the basis of similarities found between the properties of smart contract in Blockchain which are distributed and immutability and of Micro service architectureproperties such as cloud based ,IDEALproperties(Isolation of state, Distribution, Elasticity, Automated management and Loose Coupling)[2].this paper discusses the technical implementation of smartcontract using solidity language on etherium virtual machine,it also represented a use case of doctor, patient,diagnosis microservices and executed their code of smart contract.

Microservices-based systems are usually built with three layers. The graphical user interface, the API-Gateway and the microservices,any device can be connected to the system through the API-Gateway. Similarly to the common microservice architecture, the corresponding smart contracts architecture is built on two layers , The first layer is the interface between external applications and the blockchain, Itprovides theApplicationBinaryInterface(ABI)tointeractwitht hesmart contracts and the User Interface in which ABI are embedded(Fig 3).

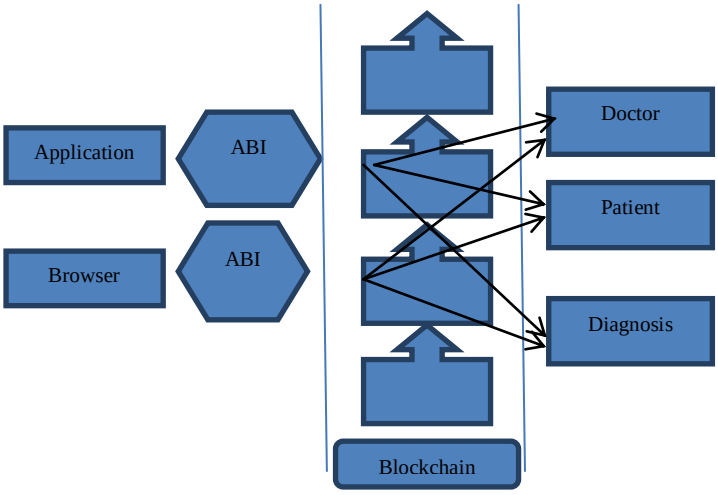

Fig 3.Blockchain based Architecture of the system

The comparison between the two approaches-

Clearly stated that using blockchain as a backbonein microservicessystem gives the feasibility of implementing micro service system on blockchain network with smart contract written in solidity Language. Main challenge in this is that the cost and complexity measureshas not been analysed and would come underconsideration for Block chain oriented softwareengineering field.

C .Secure Electric Vehicles Charging in Smart Community

Yuntao Wanget et al[3] proposes a framework for the electric chargeable vehicles smart community, they done it by introducing an energy blockchain which is a permissioned type blockchain integrated with RES, means that only verified users can be a part of the network and transaction are to be validated by only the participating parties, in this the pre-selected Electric vehicles can publicly audit and publish their transaction information without intervention of third party,they used delegated byzantine fault tolerance algorithm for consensus,in DBFT algorithm based Network there are three types of nodes, 1.General user node,2.Delegate nodes(who can approve the nodes)and 3.speaker node who proposes the next block.this network system shows 100 % finality in confirming the transaction. After that based on the contract theory the optimal contracts are analysed and designed by the monopolistic operator to meet EVs' individual energy demands while maximizing its utility. Fig 4 [4] shows the system model of smart community.

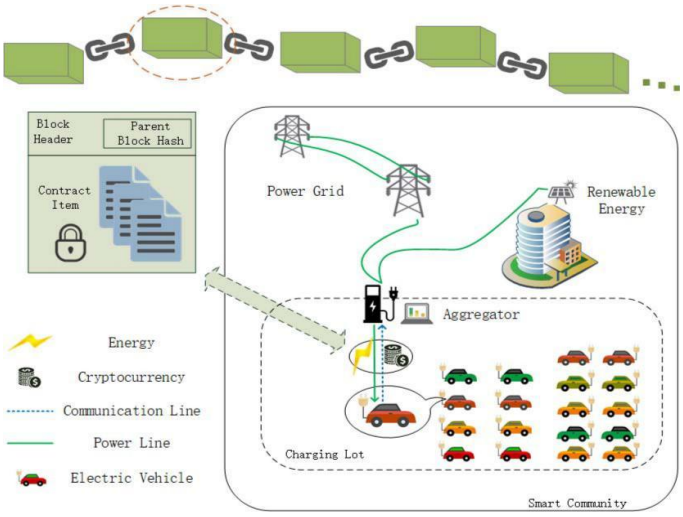

Fig 4.System Model of Smart community

Paper also gives the simulation results which shows high optimality over conventional schemes. Research gap is - they have not considered RES's limited and unstable characteristics.

D. Discovery Process ofStock Value Information

This paper [4] discusses the use of smart contract in stock value information,currently there are three steps for calculating stock value of any enterprise,

1. Value generation
2. Value record
3. Value evaluation

It proposes use of blockchain in value record phase,as Blockchain is distributed,immutable, and trusless environment where transaction information is stored in shared distributed ledger,if the value record system have distributed storage where activities of enterprise which add value to that enterprise stock becomes the transaction then it will help to investors and stock market supervisor a real time analysis on stock value of that enterprise.Fig 5 shows the decentralized storage structure of value record.

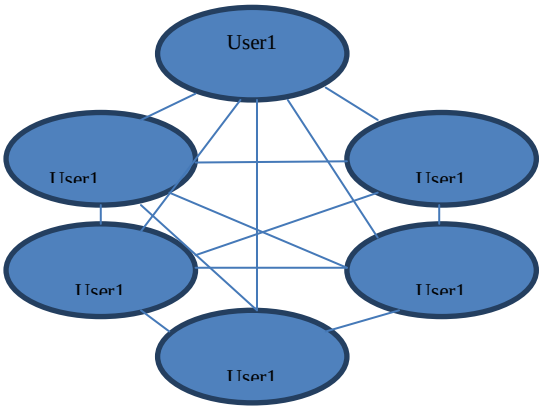

Fig5. Decentralized storage structure of Blockchain

The main limitation or research gap we found on the technical ground as they only provide the listing of transactions on company's information in real time where the stock market supervisors can see the stock price by analysing its information ,as we know that company listed there profit and net worth after a certain period, so if automatic discovery of stock value has to be added in terms of transaction on blockchain, and if there could be validators nodes to validate the final stock value of the enterprise the stock market supervisors or investors could also see the stock value in real time instead of predicting on the basis of transactions listed.

III Challenges in Implementing Smart contract

1) Irreversibility: The very nature of Blockchain transactions are irreversibility, if something has to be corrected in smart contract then it has to be done via another transaction which also has to be stored in blockchain,sometimes it requires to reverse the contract under some legal policies.

2) Digital intelligence: Oracles as a service provide a platform which runs on the blockchain technology for e.g.YouTube would be based on blockchain can inform you about the YouTubestorage and security of your account like "yourYouTube account balance is 3400$", your smart contract advocate might inform you but this will also enable the involvement of third party which makes communication between end user and the blockchain and alter the specification of no Third party involvement.

3) Legal Issues: smart contracts are of two types1.weak smart contract (legal policies has not followed correctly) and 2.Strong smart contract (legal policies has followed correctly) so that smart contract should be compatible with all legal policies and standards of their respective countries where they are executing.

4)Language of Smart Contract:mostly smart contracts are written in Solidity language which is Turing complete, but solidity is not flexible in terms of ontological expressiveness of business contracts and legal perspective of smart contract execution, so a more verifiable language is needed for implementing smart contracts.

IV Conclusion

This review paper tries to find out how smart contract has been implemented on various applications and what will be the major limitation of that implementation; it also states major challenges of implementing smart contracts.

V Future Scope

This review can be further extended to more blockchain applications, ItsTechnological platforms and programming languages used to implementthem,also the cost of implementing smart contracts may be reviewed on different parameters.

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