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Smart Contracts - An Overview of Ethereum

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Abstract:
Smart contracts have been a paradigm shift in the realm of business.In the present epoch,smart contracts are a hot potato.Their influence is escalating by leaps and bounds and it is desideratum for the development also.There is paroxysm of interest in cryptocurrency and smart contracts run on ethereum in every nook and corner and it is snowballing on quotidian basis.Firstly,in this research paper,smart contracts and rationale for trusting them is thrashed out.Secondly,this paper expounds the etherum and its cryptocurrency ether.This digital currency has made a leap from an academic concept to virtual reality and is inspiring legion of followers.It has become a de-facto.Thirdly, smart contracts have brobdingnagian gamut of potential application scenarios including both financial as well as non-financial services.Penultimately,this paper delineates the benefits of smart contracts.Lastly,it explicates the challenges thwarting adoption of smart contracts and current scenario of smart contracts in India.This research paper is targeted at providing direction for further research and also,it will serve as a reference for future research papers.

Keywords:- Smart contracts, Ethereum, Ether.

INTRODUCTION

Smart contract is a computerized transaction protocol that executes the terms of a contract.Some of the highlighted aspects of smart contracts are:-

1)Programmability-A smart contract self-executes on the basis of programmed logic.

2)Multisig authentication-Multisig is of crucial importance in case of multi party contracts.It permits all the parties to the contract to approve the execution of a transaction independently.

3)Escrow capability-It makes certain that funds get locked with a mediator(e.g.a bank or an online market)that can only be unlocked if the contracting parties provide their assent.

If A & B are unknown to each other and do not have faith in each other,then they require a third party that can be relied upon to serve as a mediator to enforce the contract between them.But smart contracts are the solution to this complication.

e.g:-1. If A wanted to purchase a car from B using a smart contract on the blockchain,then the transaction would be scrutinized by each and every node in the blockchain network to make sure that B is the owner of the car and A has sufficient funds to compensate B.

On the off chance, if the network concurs that the terms are met,A automatically gets the access code to the smart lock for the garage.A is registered as the new proprietor of the car on the blockchain.B's account gets credited with $ 40,000 and A's account gets debited with $ 40,000.The money is

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paid in the equivalent ether.Hence,in the entire procedure,no intermediary is needed.

Rationale for trusting smart contracts-

Under smart contracts,each computer executing the blockchain protocol can inspect whether an individual is the true owner of car or not.They give smart keys which provide the access control.

e.g.-C purloins the car and makes claim of being the owner of car.But each transaction is recorded on the public ethereum,so anyone can check that the owner of the unique car ID with the particular blockchain address is A and not C.

I. Smart Contracts – In Relation to Ethereum-

A. Ethereum-It is a blockchain which keeps an account of each and every executed code and stores them as transactions.

Ethereum is a decentralized platform on which smart contracts run.These smart contracts are applications which run totally as programmed without any chance of downtime censorship , fraud or involvement of third party.

B. Ether-Ether is a cryptocurrency which is the core of the Ethereum blockchain.It is a elementary token for the functioning of Ethereum and thus,provides a public distributed ledger for execution of transactions.It is listed under the code ETH and traded on cryptocurrency exchanges.

C. Working of Smart Contracts on Ethereum-

The programmers compose the code of smart contract by utilizing the local language of Ethereum referred to as "Solidity".These codes can be of substantial forms,such as the exchange of cash if some conditions are met,or the trading of merchandise between parties.After the code is composed ,it is transferred to the Ethereum Virtual Machine,which is a runtime compiler or browser to trigger off the code of smart contract.

e.g.:-2. Suvreen rents a flat from Gunjan.She makes the payment in cryptocurrency ether.After making the payment,she receives a receipt which is kept in virtual smart contract.A digital entry key is given by Gunjan which reaches Suvreen on a particular date.Refund is released by the ethereum block chain if the key does not arrive to Suvreen on time.If the digital entry key is sent by Gunjan before the arrival of rental date,then it is kept by the function until the date arrives.On the arrival of rental date,the function provides both the fees and the digital entry key to Gunjan and Suvreen respectively.

The functioning of ethereum blockchain is based on the concept of if-then.Its operations are observed by millions of individuals simultaneously.So,there is no chance of any fault.

II. Benefits of Smart Contracts-

1.Accuracy-Smart contracts circumvent the snag of manually filling out stack of forms.

2.Storage and backup-These contracts record indispensable aspects of every transaction.In the case of loss of information,these aspects are easily retrievable.

3.Speed and Efficiency-Smart contracts do not hinge on the people for their execution.After the trigger event occurs,smart contract self-executes.A trigger event can be a date,time,or any action started off by a participant to the contract such as transfer of some units of digital money i.e. cryptocurrency from the wallet of client to that of the enterprise.On the happening of trigger event,the contract starts self-execution.This results in swift contract execution.

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4.Paper-free-The "go-green"movement is empowered due to these contracts.This is because they dwell and furthermore,suspire in virtual world.

5.Security-Smart contracts utilise public and private keys for perusing and executing the transactions.Thus,they thwart pernicious activities.

6.Cost Reduction-The execution of smart contracts cuts the requirement for a intermediary such as legitimate personnel.This,in turn,aids in reducing overall organisational costs.

7.Transparency-The conditions of the contract are unequivocally noticeable to all the participants on the ethereum; ergo,smart contracts provide transparency.

III. Applications of Smart Contracts in Financial Services Industry-

A. Commercial and Retail Banking-

1)Trade Finance- Supply Chain

In present era,freight and logistics industry has paramount importance as business entities are becoming progressively reliant on supply chains.Currently,the industry is reigned by cargo merchants who encourage transfer of cargo from shippers to carriers by adding some margin.Because of this,there is a surge in expenses of the carriers which results in high downstream prices to the consumers.The customary supply chains were dependent on physical transfer of paper documents which took a very long time for a solitary transaction.So,smart contracts help to dispose off the job of intermediaries and cuts the need of paper.

e.g-When smart contracts are used in supply chains,automatic payment is done after goods are delivered to the party.

Apart from above advantages,companies can also transfer and share the necessary information on the ethereum blockchain such as level of inventory,sales data,data of demand forecast by industry and order and shipment information.This can help them to eradicate information delays and uncertainty that leads to **"bullwhip effect"**.

2)Crowdfunding for startups-

Crowdfunding is the process by which an entrepreneur subsidizes his project by raising teeny-weeny amount of money from a horde of investors, via the Internet for a creative idea.

e.g.-An entrepreneur wants to develop a new product and funds are required to make it happen on an enormous scale.Smart contracts will encircle following scenarios if crowdfunding campaign is run through them:-

(a) The contract will accept funds and issue tokens to the financiers.(e.g.-100 tokens per ETH.)

(b) Tokens can be utilised to purchase merchandise from the entrepreneur or even exchanged among clients i.e. individuals can offer it to other people at various prices.

(c) Funds will be transferred to the campaign starter provided the target is reached.(Suppose,the goal is 500 ETH.)

(d) If the campaign is not able to accumulate 500 ETH until certain date,all funds would be claimed back by financiers.

B. Insurance-

1)Peer to peer insurance-

In P2P insurance system,P2P insurers structure a covey of individuals with identical insurance needs.After the formation of assemblage, each person provides some amount to get protection against the probable occurrence of financial loss.Once the premium has been decided,the

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individuals place the amount into an escrow account.If the claim event happens,then the money is paid to the claimant after assent is given by the other members through voting mechanism.Any remnant of money is redistributed to the members or transferred to a philanthropy.

The P2P insurers get their income by way of charging a fixed percentage of the premium or the claim amount.Therefore, they are not demotivated to payout claim amount.

Since the whole course of action is overseen by the peer group and automated with the aid of technology,the cost is reduced which means lower premiums.The transparency originates from the voting mechanism wherein the individuals of peer group accept or reject the claim amount.

C. Capital Markets and Investment Banking-

1)Derivative Processing-

Financial derivatives are those financial instruments whose value depends on the value of their underlying asset.Whenever there is change in the price of the underlying asset ,it results in the change of value of derivative.

e.g.-The value of a gold futures contract comes from the value of underlying asset i.e.gold.

The types of derivatives are forwards,futures,options and swaps.

Here is an example of how smart Contracts help in options contract.Two entities,Openlaw and Rhombus, together made the execution of options contract possible in integration with smart contracts.

Openlaw is a commercial operating system.Multifarious ways are provided by Rhombus,an oracle provider,to transfer external world data into a smart contract.Openlaw and Rhombus tied up.With their tie-up,they are able create,implement and settle a derivative by making use of ethereum technology.A standard call option contract was created by Openlaw.It combined this standard call option contract with a custom Rhombus oracle which functions on the basis of current price of ether to gold.Rhombus provided its oracle agreement and thereafter,a smart contract was written by Openlaw which can study the information.Openlaw cryptographically glued the data to the underlying agreement.The whole project was linked up with the help of their oracle interface.

In order to buy a ether/gold option,a client is basically required to see the ETH to Gold price.This is the trigger event and on viewing the conversion price,it automatically creates a standard option contract on Openlaw.After the creation of option contract,it can be executed by the clients within seconds.**For instance**,If the current price shown by oracle is 25 ETH to Troy Ounce,then the client can create an option contract and he/she is entitled to buy one Troy Ounce for 30 ETH,48 hours from the present time.

If the ETH/Gold price is higher than 30 ETH on passing of 48 hours,then the client has the option to finish the purchase.If,finally,the client takes the decision to finish the purchase,then transfer of 30 units of ether is made and the client gets a token which amounts to 1 ounce of gold.

Moreover,an Openlaw user has the prerogative of a conventional licit contract which is enforceable in the court of law.

Hence,smart contracts assist in dealing in derivatives with the click of a button.

D. Taxation-

If tax collection authorities adopt smart contracts for the collection of taxes in the future,then these contracts can simplify the procedure of tax collection.When tax payments are collected by automation technology,then this discourages

individuals and legitimate authorities from committing the heinous crime of tax evasion.The storage of all the necessary data related to tax on the ethereum platform will ensure transparency.Due to this,tax evasion would become next to impossible.

E.Miscellaneous-

1) Prediction Markets-

Prediction markets empower the individuals to give their conjectures about the denouement of the occasions like auctions,sports matches,election campaigns,etc.On the basis of these conjectures,corporations can decide if they should launch a new good in the market.They get an idea whether their product will be profitable..Hence,these prediction markets help to make a lot of important decisions.

Smart contracts store the prognosis of large no. of participants to get more precise conjectures.Participants get rewards if they make accurate conjectures.The payment of these rewards can be automated with the aid of smart contracts.Smart contracts offer transparency while recording participant's conjectures.These contracts also provide accuracy and greater accessibility in the field of prediction markets.Therefore,the use of smart contracts in prediction markets is worthwhile.

Augur and Gnosis are renowned ethereum based prediction market platforms.

IV. Applications of Smart Contracts in Non-Financial Services Industry

A.Midasium smart contracts for real estate-

Midasium smart contracts are tailor- made for real estate agreements.They are legally binding because they can be converted into a conventional legal contract.Under these contracts,use of cryptocurrency is not made for managing payments..These contracts collaborate directly with banking systems to exchange payments for transactions in real fiat currencies (USD,EUR,GBP).

B.Intellectual Property Rights-

The creators like virtuoso,authors etc. can place their innovative piece of art or any other creative work on the ethereum and can have absolute control over their piece of work.Smart contracts help the creators in collecting royalties and other fees directly without the inclusion of intermediaries.

C. Transparent NGO and CSR financing-

An organisation who wants to support an NGO or run a CSR program is confronting transparency challenges:how efficacious is the expenditure of funds?On what is the endowment spent?Smart contracts can succour ventures to obtain a pellucid image of what occurs with their assets.

An undertaking can deliver a white label token,supported by collateral,like fiat,to maintain a strategic distance from unpredictability or exchange demand issues.After this,the endowment parameters are set by them and once this task is complete,they make the funds accessible to the supported program.As the tokens are being spent by the NGO,the NGO workers can demand the collateral commensurate to the tokens.Everything up to this point happens on the blockchain.This makes the entire procedure completely limpid for the NGO and the sponsoring enterprise.

D.Internet of Things (IOT)-

The interlinkage of everyday physical devices and the internet is known as internet of things.These

devices are given unique identifiers (UIDs).They have the capability to convey data and other important information over a network without the need of human to human or human to machine interaction.

Package of an individual can go astray in the post.But in a world which is associated with the internet of things,this doesn't happen.There are sensors placed at each step along the path and a completely automated system makes sure that the package doesn't go astray.

Every sensor establishes a node of its own on the ethereum blockchain.After this,the "possession"of the gadget to each lone sensor (and ensuing location) is recorded and stored by the smart contract.A barcode,near field communication (NFC)chip or any other device which can be used for tracking fitted on the parcel will be perused at each and every sensor while in transit to the destination.Every time it is perused by a new sensor,its area or location is communicated to all the IoT members on the ethereum blockchain.

This is the most secured framework for tracing the parcel because the parcel's location is recorded at each step and then,enciphered into the ethereum blockchain in a particular manner.The "possession" is taken into account by the smart contract from soup to nuts; ergo,cementing the faith of the individuals in the integration of smart contracts and internet of things.They know where the parcel can be discovered.

V. Challenges Thwarting Adoption of Smart Contracts-

A. Common Challenges-

1)Immutability-If the clients to the contract provide their assent,then modification can be made in real world contracts.On the contrary,smart contracts are inflexible.

2)Contract Secrecy and Security Needs- All the network players can view the transactions taking place on the ethereum.In such a case,banks will resist to collaborate if privacy is not given the utmost importance.The management of cryptographic key is a pivotal factor in the process of concealing transaction details from unidentified individuals.

B. Organisational Challenges-

1)Paucity of talent pool-There is dearth of talent in companies for using smart contracts.Companies are required to set up prowess development programs.

e.g.-Companies should appoint "coder-lawyers"-a very uncommon blend of abilities that integrates a concrete comprehension of both law and computer programming.

2)Governance-The financial institutions that gather to work on a common smart contract platform should possess clearly defined jobs and make certain that all rules regarding creation,implementation and abrogation of smart contracts are decided.The aspects of information access should be decided.

C. Technological Challenges-

1)Interoperability with macro environment- Smart contracts require macro environment data i.e.
shipments,weather,temperature,customs,prices,etc .This outer world information is provided to smart contracts by the programs referred to as oracles.In order to manage the acquired information,a smart contract network requires oracles that can connect these contracts with unimpeachable sources of information.Immense challenges are there for linking with these oracles in a secured manner.

2)Scalability of transactions-As there are small no. of network players to the consensus in transactions such as syndicated loans ,smart

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contracts work perfectly.But when the transactions escalate,consensus algorithms becomes a challenge for smart contracts.

D. Legal Challenges-

Smart contracts are immutable and secrecy of contract execution is not maintained.Moreover,they do not possess a licit status in India.

VI. The DAO Incident

On 17 June ,2016,a smart contract on ethereum public permissionless blockchain was hacked and $50 million money was transferred to a sub-contract which was owned by the hacker.Because of the checks built into the contract,hacker was unable to use funds to his advantage for 27 days,providing the community abundant time to act and countermand the attack.This incident stressed on the significance of strong governance.

After this incident,the Ethereum was divided into two different blockchains:-the new version is "Ethereum"(ETH) under which the theft was rolled back and the old one is referred to as "Ethereum Classic"(ETC) and it continued its journey.

VII. Current Scenario of Smart Contracts in India-

1.The picture of smart contract and cryptocurrency is obscure until now.The rationale behind this is that cryptocurrency is not perceived as licit tender and also,smart contracts do not possess legitimate status in India.FEMA,RBI Act or Coinage Act do not contain explicit definition of cryptocurrency.

2.A long standing ambivalence persists regarding how cryptocurrency will be taxed.That's why smart contracts are not fully acknowledged in India.

3.Bank underpin has been pulled back by RBI from virtual currency exchanges.Furthermore,it has issued numerous caveats expressing that it will not be in charge of deceits related to cryptocurrencies and the ones who transact through the equivalent will be in charge of their own risks.This gives rise to wariness within the psyches of individuals,who desire to transact via the same.

4.There are no laws to regulate smart contracts.They will be directed by the Indian Contract Act,1872,the IT Act,2000 and the Indian Evidence Act,1872.

5.The IT Act permits contracts to get ratified by making use of digital signatures.Sec 35 of the act states that the government has the whole and sole authority to approve the digital signature.This becomes a stumbling block in the path of smart contracts as ethereum produced hash key is utilized as unique identifier and authenticator to ratify a smart contract.

6.There is a question mark on the evidentiary value of smart contracts according to the Evidence Act,1872 owing to the fact that only those digital records are acceptable whose validation is done by a legitimate digital signature acquired in consonance with the IT Act.

VIII. Research Methodology-

The type of research is descriptive in this research paper.I undertook exhaustive web based research of smart contracts.The data is taken from multitudinous web pages,journals and articles.

IX. Conclusion-

Bitcoin is primary application on the blockchain.On the other hand, ethereum and smart contracts are the cutting edge applications on the blockchain. Just like the invention of the internet

has metamorphosed the world, smart contracts have the potential to change our lives in incredible ways.

The conduits of unmatched development have been opened with the formation of the "Enterprise Ethereum Alliance".The Enterprise Ethereum Alliance joins Fortune 500 enterprises(like Accenture,Microsoft,Intel,Wipro,etc.) and startups with people who have adroitness in ethereum subject matter.

With this congregation of minds,it's highly plausible that ether is going to be the next big cryptocurrency.

Moving to smart contracts,they are swift,provides transparency,saves cost by removing intermediaries and offers other prodigious benefits.They have their pertinence in financial as well as non-financial services.But simultaneously,they have some challenges too like immutability,scalability,etc.

I personally ponder that in a nation like India,it is arduous to recognise a smart contract as individuals are accustomed and disposed towards the utilization of verbal language and personal promises.A contract sans such desires makes its execution onerous.It will take a long time for people to accept the notion that a verbatim relationship is not a prerequisite for a contractual transaction.It is yet an cock and bull reality for people to shift from customary to smart contracts.We can hanker for it to occur in the near future.Undeniably so,it would lead to a higher prospects of successful contract implementation and curtail the burden of judiciary.

The legal and regulatory aspects in relation to smart contracts needs to be looked upon before acknowledging smart contracts as a valid substitute for traditional contracts.This is because cryptocurrency is not recognised as licit tender in India and smart contracts do not have a legitimate status in India.

I propound that to make other smart contracts like midasium smart contracts,some efforts should be made as the latter are legally enforceable because they are not immutable.They can be converted to conventional contracts and they deal in real fiat currency instead of cryptocurrency.

I conclude that inspite of astronomical amount of advantages of smart contracts and considering the scale of digital upheaval,smart contracts technology is still in its nascent stage and it will take time to enter mainstream.

X. Recapitulation of the conclusion-

1.Ethereum and smart contracts are the cutting edge applications on the blockchain.The formation of Ethereum Enterprise Alliance will definitely carve a path for the progress and acceptance of ethereum and smart contracts.The day is not far when ether will be the biggest cryptocurrency and smart contracts will dominate the world.

2.People are accustomed to the use of verbatim relationship.So,it will take a long time for them to accept ethereum-based smart contracts as they are fully computerized.

3.Cryptocurrency is not acknowledged as legitimate tender in India and also,smart contracts do not possess licit status in India.Therefore,smart contracts cannot be recognised as valid substitute for conventional contracts for the time being.

4.To make other smart contracts like midasium smart contracts,some efforts should be taken as the latter are enforceable in the court of law due to their ability of being converted into customary contracts.

5.Despite myriad of merits,smart contracts will take time to enter mainstream as this technology is hitherto in its infancy.

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