Block chain: A Chain to Stiffen the Modern Education System

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***Abstract*- Blockchain is the central technology used to create the crypto currencies, like bit coin, brought out the competence and propensity. As we have seen the industrial revolution, due to invention of steam engine, power, and records generation. Will industry 4.0 will be marked with blockchain? Already it has begun and has been successfully implemented in finance, judiciary, and trade. The current paper centered on its capacity on academic packages and explored how blockchain can be used to solve few major education system troubles. This article first addresses on the capabilities and abilities of blockchain and subsequently article exploring the current number of applications of the blockchain for education. Opportunities of open applications that can cut across the education system by linking all the education entities and bodies with a single chain of blockchain technology has been proposed, and the benefits and challenges of using blockchain technology for improving education system were made available for further study.**

***Index Terms*- Technology, Blockchain, Indian Education System, Educational evaluation, Management &Instructional design, Open Learning.**

INTRODUCTION

Blockchain is voicing technology at each point application. A lot generally confused with Bitcoin, blockchains are the keystones of Bitcoin. Blockchain is a database which records a series of ledger entries and also maintains it unceasingly budding list of data transactions or records. Disruptive nature of Blockchain is its ability to transform almost any process for validating, defrayal, settling, tracing and mining the records on the authentication of ownership an asset or transaction as they are operated. Already there cases of application of Blockchain in established financial institutions, where they are interested in bank-to-bank transfers, and there are the greatest opportunities of Blockchain can come handy for the automation of inefficient back-office processes through basic documentation, to settling complex contracts.

Every time have probably heard of Bitcoin, a peer-to-peer, non-governmental currency. Bitcoin is the first money that is its own payment system. That is, no bank, money transmitter or intermediary of any kind is required to clear and settle its transactions, which complete in mere seconds. The technology upon which Bitcoin is built ensures this work is done in a decentralized manner. This technology, called "blockchain technology," "distributed ledger technology," or simply "DLT," is just as good at clearing and settling transactions in other assets as for bitcoins. Indeed, it might be even better. What other assets? Securities, commodities, deeds to property, ownership of artwork, even medical records. The potential of this technology has been widely recognized.

So what is blockchain and how does it do that?

Simply speaking, blockchain allows one to change the age-old process of maintaining a ledger that can be accessed only by one party. Blockchain puts in place a distributed ledger that allows a participatory model.

Since blockchain is a decentralized ledger, it means all system members can access stored information. Verification by an intermediary is not needed.

A new disruptive force of digital technology is changing the business models and increasingly becoming a crucial factor around the world. The promotion and adaptation of digital technology

Blockchains are immutable digital ledger systems implemented in a distributed fashion (i.e., without a central repository) and usually without a central authority. At its most basic level, they enable a community of users to record transactions in a ledger public to that community such that no transaction can

be changed once published (NIST Blockchain Technology Overview Draft NISTIR8202, January 23, 2018)

Blockchain, mostly known as the backbone technology behind Bitcoin, is one of the emerging technologies currently in the market attracting lot of attentions from enterprises, start-ups and media. Blockchain has the potential to transform multiple industries and make processes more democratic, secure, transparent, and efficient.

This is generating significant interest across world and wide-ranging industries in India also. As the arena of applications for Blockchain growing, industry leaders are customizing and tailoring the technology to fit multiple use cases.

Though many financial and non-financial players are excited about the potential of this technology, the question that plagues the mind of the industry leaders is how to identify a good business case for Blockchain?

Financial players are the first movers to capitalize on this technology even though it is still in a nascent stage. A study by the World Economic Forum1 predicts banks and regulators around the world are poised to experiment multiple Blockchain prototypes in 2017. With 90+ central banks engaged in Blockchain discussion globally, 2500+ patents filed over the last three years and 80% of the banks predicted to initiate Blockchain and distributed ledger technology (DLT) projects by 2017, the Blockchain technology is on its course to become the new normal in the world of financial services. Many companies, from a plethora of nonfinancial services industries like telecom, healthcare and life sciences, travel and hospitality, and energy, are also keeping a close watch on the potential Blockchain use cases to positively disrupt their traditional business models.

Blockchain and its features:

Companies in multiple industries are exploring and experimenting new ways to:

- Execute transactions quicker for an enhanced customer service,
- Ensure cost efficiency in its operations, and
- Assure transparency to customers and regulators.

With huge volumes of data getting generated every day owing to digitization of records, it becomes important for every organizations to effectively manage the security threats and achieve significant cost efficiencies. This is where Blockchain, with its promises of decentralized ownership, immutability and cryptographic security of data, is catching the attention of the C-suite executives. Multiple use cases are also getting explored across industries as everyone has started realising the disruptive potential of this technology.

Blockchain vs Bitcoin

A *blockchain* is not a currency at all. Rather, it is a system for validating, clearing, settling, tracking and recording the ownership of assets as they are traded. The Bitcoin blockchain is just one of those systems. Currently, the Bitcoin Blockchain is the most widespread use of Blockchain Technology, but other blockchains exist as well and are being widely used for other purposes.

Blockchain Technology involves a ledger of transactions that are maintained on a network of servers called “nodes.” Each node maintains a ledger reflecting the ownership of assets. The ledger is “distributed” because it is maintained simultaneously on all of the nodes in the network. The ledger contains a continuous and complete record of all transactions dating back to the origination of the ledger (the “chain”). Validated transactions are added to the ledger in groups or “blocks” using cryptographic methods to ensure the integrity of the transactions. It is this recording of transactions in blocks to the chain of transactions reflected in the ledger that is the source of the term “blockchain.”

In the case of the Bitcoin blockchain, the distributed ledger reflects the current ownership of bitcoins at any given time, as well as all prior Bitcoin transactions going back to the creation of the Bitcoin blockchain. Thus, when a party transfers Bitcoins, the transaction is published to the network, which confirms with a very high degree of confidence that the transferring party owns the Bitcoins and hasn’t, for example, already transferred the Bitcoins to someone else. Transactions that are not validated across the network are rejected. In other words, the network establishes trust in the transaction without the involvement of a typical intermediary, such as a bank.

Transactions in the Bitcoin Blockchain are secure because the network employs sophisticated security algorithms, and because the transaction ledger is

distributed across a network of unrelated computers. To compromise the security of the Bitcoin Blockchain, a hacker would need more computing power than half the nodes in the Bitcoin Blockchain. Due to the size of the Bitcoin Blockchain, this is difficult to do.

Other so-called "public" blockchains are secured not by mining (known as "proof-of-work") but by demonstrating control over some of the assets native to the ledger (known as "proof-of-stake"). A blockchain need not be public, though. The blockchains that have captured the imaginations (and budgets) of many financial institutions are known as "private" blockchains because only certain pre-approved participants may join them. These blockchains use a variety of means to ensure the identity of parties to a transaction and to achieve consensus as to the validity of transactions.

How Blockchain Technology Will Revolutionize Transactions

Blockchain Technology is adaptable to a wide range of transactions including:

- Effectuating transfers of digital assets;
- Transactions in securities and derivatives;
- Recording sales of physical assets, such as tangible personal property and real property.

Blockchain also makes possible the use of so-called "smart contracts," *i.e.,* contracts embedded in computer code that can implement themselves automatically upon the occurrence of discrete events. Examples of smart contracts include:

- Automating rent payments in leases where rent is a function of revenue;
- Automatic coupon payments based on the calendar day;
- Automating royalty payments when payments are based on the number of seats currently in use for a software license; or
- Automating advertising payments for web clicks.

Blockchain Technology promises to automate many of the existing labor-intensive processes required to settle financial transactions, thereby increasing the speed at which such transactions can be conducted and lowering transaction costs. For example, manual processes of recording transactions in databases may be replaced with automated recording of transactions in the Blockchain ledger.

As applied to real property transactions, it is expected that Blockchain Technology will reduce deficiencies in current systems for tracking ownership of real property, including claims on real property such as easements and mineral rights. Accordingly, Blockchain Technology should allow for quicker settlements of real property sales and lease, and should also substantially reduce title insurance costs.

Blockchain is the central technology used to create the cryptocurrencies, like bitcoin, brought out the competence and propensity future by Satoshi Nakamoto in 2008 (Nakamoto 2008). Bitcoin, via the maintenance of immutable disbursed ledgers in lots of nodes proposed by Satoshi Nakamoto in 2008 (Nakamoto 2008). it's been considered as a part of the fourth industrial revolution for the reason that invention of steam engine, strength, and records era (Chung and Kim 2016; Schwab 2017). This disruptive technology can have a big effect on country wide governance, institutional capabilities, enterprise operations, schooling, and our each day lives inside the 21st century. It has the capability to transform the present day net from "The internet of records Sharing" to "The internet of value exchange." Blockchain era is anticipated to revolutionize the operating modes of commerce, industry, and training, in addition to to sell the speedy improvement of expertise-primarily based financial system on a global scale. due to its immutability, transparency, and trustworthiness for all transactions executed in a blockchain community, this innovative generation has many ability applications (Underwood 2016). all through the initial tiers of its appearance, blockchain generation become now not able to draw plenty of attention. however, as Bitcoin continues to run safely and gradually over the years, the society has when you consider that grow to be aware about the massive ability of the underlying generation of this invention in its software to no longer most effective cryptocurrency but also in lots of other areas (Collins 2016). Blockchain generation has turn out to be a hot subject matter for more and more nations, institutions, establishments, and researchers.

Presently, blockchain era has been applied in diverse fields inclusive of cryptocurrencies within the economic area, which incorporates Bitcoin,

Ethereum, and Zcash (Zerocash), and many others. Bitcoin is the primary peer-to-peer payment network of digital cash based totally on the blockchain era. one of the critical functions of blockchain generation is how many nodes in a disbursed blockchain network maintain consensus and the Bitcoin blockchain network adopts a hash-based proof-of-work (PoW) dispensed consensus set of rules (Nakamoto 2008). Ethereum is an open-source, public, blockchain-based dispensed computing platform providing clever contract capability using proof-of-stake consensus set of rules (Beck et al. 2016). Zcash is a decentralized and open-source cryptocurrency like Bitcoin. however, it offers a better privacy and selective transparency of transactions by way of the usage of proof-of-0-knowledge consensus set of rules. Zcash payments are posted on a public blockchain, however the sender, recipient, and amount of a transaction remain private (percent 2016). besides, a few agencies and firms are also looking to expand decentralized systems based totally on blockchain era. as an example Arcade metropolis, so-known as "Uber Killer," is a ride-sharing enterprise that has incorporated its version in Ethereum, consisting of identification and recognition structures (Zheng et al. 2017). Ubitquity is a virtual assets management organisation that gives secure recording and tracking data built on a blockchain platform.

Swan (2015) indicated that the improvement of blockchain packages may be divided into three ranges; Blockchain 1.0, 2.0, and three.zero. Blockchain 1.0 is the deployment of cryptocurrencies as a peer-to-peer cash payment gadget. Blockchain 2.zero is the substantial blockchain programs than easy cash transactions, along with stocks, bonds, loans, clever belongings, and clever contacts. Blockchain three.0 is growing blockchain packages beyond foreign money, finance, and markets, consisting of inside the regions of government, fitness, technology, literacy, lifestyle, and artwork.

according to the formerly stated principle, the modern applications of blockchain is still inside the 1.0 and 2.zero tiers. the majority do now not understand approximately the time period "blockchain," now not to say the capacity packages of the usage of blockchain era. even though researchers mentioned using blockchain within the commercial vicinity (Swan 2015), numerous research focused on how blockchain generation may be carried out in education (Devine 2015; Sharples and Domingue 2016).

The the rest of this article will talk the critical terminologies of blockchain technology consisting of "dispensed ledger," "block and chain," and "the verification mechanism." In section three, the modern-day programs of blockchain era in schooling is reviewed. Following on to the 4 innovative applications of the usage of blockchain era in schooling and the blessings are presented.

LITERATURE REVIEW

What is blockchain?

Blockchain generation is also referred to as distributed ledger era. It lets in members to relaxed the settlement of transactions, attain the transaction, and switch of property at a low-cost (Tschorsch and Scheuermann 2016). A sample glide of cryptocurrency blockchain transaction may be visible as follows. user A initiates a transaction to person B through a peer-to-peer blockchain community. A cryptographic evidence of identification (a pair of public key and private) is used to the network to pick out consumer A and user B uniquely. The transaction will then be broadcasted to the memory pool of the blockchain community awaiting transaction verification & validation. the brand new block is generated by way of obtaining a positive variety of accredited nodes; that is referred to as accomplishing consensus. After attaining consensus, new "block" at the complete blockchain community is formed, and every node updates its respective reproduction of the blockchain ledger. This block consists of all the transactions that befell at some point of this time. it is "connected" to the authentic block within the network via the digital signature (Yli-Huumo et al. 2016). The consensus degree is accomplished via the usage of a consensus set of rules. This technique is referred to as mining. particularly, Peer-to-Peer community reaches consensus on the current country of the disbursed ledger (Kraft 2016). each node can vote through its CPU power to accept legitimate blocks with the aid of taking extensions or reject invalid blocks through denying expansions. Any required policies and incentives may be carried out thru this consensus mechanism (Nakamoto 2008). each transaction in a block is tagged by using a

particular timestamp. the two blocks also are related by using a timestamp. therefore, the facts on the blockchain has a assets of time, and the duration of the chain is continuously developing. It manner that blockchain is a allotted variation that implements the timestamp service (Haber and Stornetta 1991). Blockchain makes use of specialized hardware to assemble considerable cryptographic statistics chain, and SHA-256 hash function is used to save you the tampering of information of third-birthday party users (Tschorsch and Scheuermann 2016). Any try and exchange even just a piece of statistics will destroy the prevailing chains. In short, blockchain is a decentralized and trustworthy digital public ledger. It makes use of distributed techniques and consensus algorithms that had been maintained via all individuals.

Blockchain is not simplest a brand new kind of internet infrastructure based totally on disbursed packages but also a brand new type of deliver chain community. essentially, blockchain is a distributed community of computers (nodes) used to hold the supply of records sharing. each node continues the safety and accuracy of the statistics with the aid of retaining a complete set of ledgers of past transactions. while a brand new block is being created by means of a miner, who is the first one to validate all of the transactions inside the block and clear up the mathematical problem by way of producing a digital signature for the block which meets a pre-described rule the use of the hash characteristic. The newly created block might be broadcasting to the whole blockchain network, allowing all nodes to keep the equal entire ledger (Tschorsch and Scheuermann 2016).

Consensus mechanism is performed via three most important verification mechanisms. Bitcoin makes use of a verification mechanism known as evidence of work (Nakamoto 2008). The miners are nodes operating in a blockchain peer-to-peer network. Their project is to validate all transactions covered in one block and remedy the mathematical trouble of the virtual signature the usage of a hash function. The miners compete with every different, and once someone solves the problem, the solution could be shared with other mining nodes. The triumphing miner receives additional bitcoins as rewards. other miners take delivery of the evidence of work, and the brand new block might be brought to the blockchain community (Fanning and centers 2016). Ethereum has 4 development degrees, together with Frontier, dwelling house, town, and Serenity. the first three ranges use the verification mechanism of proof of work, and the fourth level makes use of proof of Stake. The proof of Stake calls for the certifier to reveal the ownership of a positive quantity of cryptocurrency (Sharples and Domingue 2016). “evidence of zero understanding” is the consensus mechanism used in Zcash that can offer higher privateness to its users. as compared with different verification mechanisms, proof of 0 information has stepped forward both concerning capability and performance (Tschorsch and Scheuermann 2016).

Understanding the concept:

“A Blockchain is a digital, immutable, distributed ledger that chronologically records transactions in near real time. The prerequisite for each subsequent transaction to be added to the ledger is the respective consensus of the network participants (called nodes), thereby creating a continuous mechanism of control regarding manipulation, errors, and data quality.”2

In Simple words, Blockchain is a protocol for trading value communicated/exchanged using the internet without an intermediary.

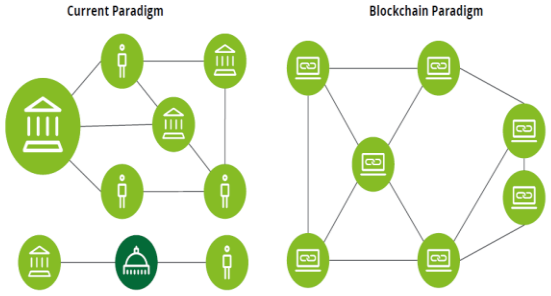

Figure 1: Traditional database vs. Blockchain base distributed ledger

- Central authoriteis will transfer actual value between two entities
- Multiple intermediaries required to facilitate of assets and create trust Current Paradigm
- Distributed nodes that maintain a shared source of information
- Trust enabled by cryptographic algorithm Blockchain Paradigm

The immutability of a Blockchain makes it nearly impossible for changes to be made once established, which increases confidence in data integrity and

reduces opportunities for fraud. The immutability and irreversibility feature of a Blockchain comes from the underlying data structure which is called a Merkle tree or Hash tree.

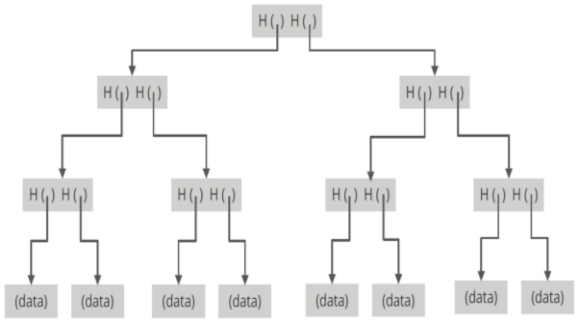

Figure 2:Merkle tree structure3

Merkle Tree is at the heart of the Blockchain Technology

The cryptographic security in Blockchain comes from a binary data structure with hash pointers. Merkle tree, or hash tree, as it is called, is a distributed data structure where data blocks are grouped in pairs and the hash of each of these blocks is stored in a parent node. This grouping of hash codes continue till the root node. This gives rise to the immutability of a Blockchain as tampering of any block will lead to tampering of all the preceding hashes till the root node which is tamper proof.

The other advantage of Merkle tree is the proof of membership/ownership as knowing the root member is enough to know all the members in the tree. As a result hash tree provides faster processing of data as compared to traditional binary tree.

Types of Blockchain

All Blockchain can be classified into three categories: Public, Permissioned, and Private. A public Blockchain is one where anyone can read or write on the platform, provided they can show proof of work. A permissioned Blockchain offers selective transparency where only selected nodes have the rights to access and provide consensus on that transaction. The third

Blockchain type is a private Blockchain where only chosen players have the rights to join the network which creates a closed loop environment.

Different types of Blockchain

Public Blockchain

Fully decentralized and Transparent - Anyone can read, send transactions & participate in the consensus process

Permissioned Blockchain

Quasi decentralized where consensus is controlled by preselected set of nodes and Read permission is restricted to participants

Private Blockchain

Centralized–requires 'high trust' entity where Write permissions are centralized to one entity and Read to all participants

Features of blockchain

From the technical factor of view, blockchain technology has four functions: decentralization, traceability, immutability, and foreign money properties.

Decentralization refers to the procedures of information verification, storage, protection, and transmission on blockchain that are based on a disbursed device shape. on this shape, the accept as true with among disbursed nodes is constructed through mathematical techniques in place of the centralized corporations.

Traceability means that every one transactions on blockchain are arranged in chronological order, and a block is hooked up with adjoining blocks with the aid of the cryptographic hash characteristic. therefore, each transaction is trackable by analyzing the block data linked via hash keys.

There are two motives that blockchain technology is immutable. On the one hand, all transactions are saved in blocks with one hash key linking from the preceding block and one hash key pointing to the subsequent block. Tampering with any transaction would result in different hash values and would accordingly be detected by all the different nodes strolling precisely the equal validation algorithm. alternatively, blockchain is a shareable public ledger stored on heaps of node, and all ledgers retain to sync in actual time. successful tampering would want to exchange over fifty one% of the ledgers stored within the community (Tschorsch and Scheuermann 2016).

Blockchain generation and cryptocurrency are inseparable, this is to mention, any blockchain network has a shape cryptocurrency belongings. The

essence of blockchain technology is point-to-factor transactions, no 1/3 celebration is concerned, which means that that all transactions do no longer require the participation of third parties. move of virtual foreign money primarily based on blockchain era is fixed. mainly, in Bitcoin, the foreign money base is ready at 21 million caps, so the generation of virtual currency is created by means of the usage of a specific mining algorithm and is bounded through a pre-defined formula. thus there gained't be the hassle of inflation, collapse and so on. In Blockchain 2.0 and 3.zero packages, the mixture of other sports together with government activities, instructional activities, and economic sports can make these non-monetary activities have the assets of forex.

Sanctifications of blockchain

Derived from the above referred to 4 technical capabilities, a few benefits in their software the usage of blockchain generation are defined as follows.

Reliability: the decentralized nature of a blockchain community changes the databases of the entire transaction records from closed and centralized ledgers maintained via only a few permitted institutions to open allotted ledgers maintained by using tens of thousands of nodes. The failure of a single node does now not have an effect on the operation of the complete community. This avoids the unmarried factor of failure and ensures the high reliability of the applications which constructed on the blockchain technology.

Consider: blockchain community makes the trust decentralized too. unlike the centralized agree with we take as a right, together with vital governments issuing currencies and commercial banks, blockchain community acts as new agree with bearers with decentralized ledgers. those ledgers are shared amongst a community of tamper-proofed nodes (Underwood 2016).

Protection: blockchain network makes use of the only-way hash characteristic which is a mathematical feature that takes a variable-period enter string and converts it into a set-duration binary series. The output bears no apparent relationship to the input. The process is difficult to reverse because, given simply the output, the input is not possible to decide (Yli-Huumo et al. 2016). moreover, the newly generated block is precisely following the linear collection of time.

Efficiency: all data are automatically run through pre-set tactics. therefore, blockchain generation can't most effective significantly reduce the cost of exertions however also enhance efficiency. For the virtual foreign money of Blockchain 1.zero, the automation of allotted ledger is mainly the automation of settlement. Blockchain generation ought to pace the clearing and settlement of sure financial transactions by way of decreasing the number of intermediaries involved, and by means of making the reconciliation system faster and greater green (Wang et al. 2016).

APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN EDUCATION

Nowadays, a few universities and institutes have carried out blockchain era into training, and maximum of them use it to assist academic diploma control and summative evaluation for gaining knowledge of consequences (Sharples and Domingue 2016; Skiba 2017).

Blockchain generation can formulate the entire transcript. in the formal gaining knowledge of context, this includes getting to know contents and results in addition to students' achievements and educational certificate. in the end, inside the casual getting to know context, facts about research experience, abilities, on line mastering revel in in addition to man or woman pastimes are covered. these facts may be effectively saved and accessed on a blockchain network in suitable methods. The college of Nicosia is the primary college which uses blockchain generation to manipulate college students' certificates obtained from MOOC structures (Sharples and Domingue 2016). Sony global training also used the blockchain generation to create a global evaluation platform to offer services for storing and dealing with degree records (Hoy 2017). moreover, Massachusetts Institute of technology (MIT) and the getting to know system agency cooperated to design a virtual badge for on line gaining knowledge of based totally on blockchain generation. college students who have attended the initiatives of MIT Media Lab and surpassed the assessment will get

hold of a certification as a way to be saved on a blockchain network (Skiba 2017). What's extra, Holberton college is the primary institute making use of blockchain technology to shop tiers and has claimed that they might share this statistics from 2017. The blockchain ledger can suit all kinds of educational statistics with the person's unique id. It includes mastering behavior in class, micro academic undertaking enjoy, and macro instructional historical past, and so forth.

moreover, blockchain generation contributes to decreasing diploma fraud. within the beyond, there had been numerous instances of degree fraud. but, it is able to be avoided by using blockchain in granting and handling scholar's diploma now. The statistics matched with users' identity and saved in blockchain are checked, validated, and maintained through the miners from everywhere in the world. Blockchain disbursed ledger is immutable and straightforward. as a result, the reliability and authority are both ensured, so one can significantly lessen diploma fraud.

additionally, blockchain can be used as a "capacity-foreign money transformation bank." especially, blockchain getting to know ledger records distinctive records approximately the customers' mastering experience and follows the improvement of their knowledge and abilties. they all may be transformed right into a form of digital forex and stored on a blockchain community according to a chain of comprehensive standards. students will benefit rewards thru their efforts on research, that's called "gaining knowledge of is incomes" (Sharples and Domingue 2016). a few schools have additionally started the application with this idea, for example, Sharples and Domingue (2016) claimed a form of training popularity foreign money named Kudos. it is able to be used to measure studying effects and stored in a virtual pockets.

Future revolutionary academic programs using blockchain technology

Blockchain era can be carried out to training in lots of innovative methods past just diploma management and achievements evaluation. For both newcomers and instructors, blockchain technology has a top notch capacity for broader utility potentialities on formative assessment, studying sports layout and implementation, and keep tracking the whole getting to know approaches. a few progressive applications of the usage of blockchain generation within the subject of schooling are proposed as follows.

A smart settlement walking on the Ethernum blockchain network is largely a laptop protocol that simulates a actual contract (consisting of economic transactions, employment, and many others.) (Kosba et al. 2016). it could facilitate settlement negotiation, simplify agreement phrases, put into effect settlement execution, and verify contract achievement kingdom. It marks the particular and precise identification of parties in a transaction (settlement topics) via a digital manner and stipulates the rights and obligations of both facets (settlement phrases) via code. The smart contract no longer simplest reduces "third celebration costs" in traditional transactions however also dramatically guarantees the transaction security and reliability. as an instance, in the context of automobile-installment, the purchaser negotiates with the seller directly as opposed to loans from the financial institution, saving any additional processing costs. If customer breaks the policies, the code may be done, and the smart contract may be terminated. The clever agreement greatly improves govt power and equity than the conventional one. consequently, if teachers and students perform teaching and mastering activities based on a clever settlement, some of the instructional issues would be solved.

From the perspective of students, there are still some bad subjective or goal factors causing terrible mastering outcomes, inclusive of the lack of motivation and financial pressure. due to the trait of currency property, blockchain may be used to encourage college students by way of enforcing "studying is incomes" (Sharples and Domingue 2016). The clever contract among teachers and students may be applied to the instructional state of affairs. Actual-time awards may be given to students via some simple clicks via the teachers. college students will get a sure number of virtual foreign money in step with clever contract as rewards. This sort of cash can be stored within the schooling pockets, used as training, even exchanged with actual currencies.

Assessment is likewise a difficult issue in the education machine. Formative assessment has been encouraged for a long term, and yet it's far nevertheless not ripe because it isn't clean to song every detail of teaching and getting to know. applying blockchain and smart settlement can cope

up with this task. significantly, the immutability, traceability, and reliability of blockchain mean that the information recorded on blockchain are greater unique, real, and anti-robbery. Take the "collaborative studying" for example, that's appeared as an fantastic way to carry out constructivism guidance and domesticate students' ability to work with others. however, it's miles frequently accompanied by using the trouble of unfastened-using hindering honest evaluation. Blockchain era can mitigate this phenomenon. each student submits his/her work to the studying platform via his/her precise account, the smart agreement walking on it will assessment scholar's performance, and the effects will be recorded into blocks. All behaviors at some stage in collaboration can be stored into blocks as evidence for evaluation as well. furthermore, public blockchain has the trait of decentralization. It method that the dispensed ledger guarantees the consistency of most nodes. accordingly, as nodes in blockchain network, college students' evaluations could be considered when assessing them. in this context, blockchain guarantees the fairness of the evaluation.

From the angle of instructors, the training is sophisticated and artistic in order that it is hard to evaluate. The traditional technique based totally on college students' comments has a tendency to be one-sidedness, missing subjectivity and is rarely useful for teachers' development. a new evaluation device can be built based totally on blockchain community and smart agreement. First, teachers need to publish preplanned academic sports as a smart agreement to the colleges. for the duration of the coaching process, all coaching sports may be recorded in the blockchain network. The clever settlement will affirm the consistency of the coaching design and exercise, which is going to be an important preparation assessment indicator. What's extra, a clever settlement between instructors and colleges, as well as the only among teachers and college students may be confirmed and supplemented with each other. instructors who meet the requirements will get virtual forex as a reward. It serves as both an appreciation and encouragement for teachers' coaching abilities.

From the attitude of pupil development, supervisor or instructional advisor is without delay responsible for the supervision of the student's application. they have got the obligations of supporting the scholar in making plans study programs and staying knowledgeable of student's studies activities and progress. however, in exercise, those troubles are not checked and supervised, so it will likely be controversial to differentiate the duties if something negative occurs inside the future. this example might be changed if clever settlement and blockchain generation is used in this region. All details ought to be monitored through clever contract platform and recorded into blockchain ledger. which includes how frequently has the supervisor discussed with students within the beyond semester? How commonly has the supervisor reviewed the thesis each in draft and final shape? whether they provide appropriate steering to the scholars in route selection and studies design? way to the traceability and immutability of blockchain technology, both college students and supervisors' behaviors will be recorded inside the blockchain ledger. This innovative application can shield the interests of both events.

basic, blockchain may be used to assemble a stability to measure gaining knowledge of process and outcomes. it is a reliable and an equal evidence of fee for anybody. Theoretically, blockchain can resolve the troubles of statistics asymmetry and accept as true with amongst strangers due to its decentralization and immutability. It ensures the authenticity due to the fact the information and fee are posted and maintained collectively. It affords a truthful way for talent investment. The user with extra training on digital currencies has a lot threat to win the appreciation and investment. Blockchain ledger tracks the whole thing you've ever discovered. Employers can use this records to provide you a process that matches your capabilities. on the other hand, the user who wishes an fantastic employee also can hotel to the blockchain ledger. it's going to substantially decrease the risk of investment bias and failure. In a phrase, blockchain maximizes the pursuits of both events.

Issues – pertaining to applying blockchain technology in education

it's far simple that there are capability drawbacks of making use of blockchain generation in education.

As a complex gadget, some learning behaviors and getting to know consequences need to be reviewed through the instructors subjectively together with essays and study room presentations. it's far pretty

hard to assess this sort of mastering activities by way of the pre-programmed clever agreement without human intervention.

If an educational blockchain system has been placed into use in faculties, all students' educational information could be integrated into blockchain ledgers. The immutability characteristic of blockchain era would act as a double-edged sword. It eliminates the opportunity of enhancing instructional document for valid motives for a few college students.

Moreover, many technical troubles or limitations are not addressed for the blockchain for use in training. as an instance, the classic evidence of work consensus mechanism wastes power and has a poor performance in terms of range of transactions in line with second (Vukolić 2015), which could cost an extra cost, and prevent its application in faculties.

CONCLUSION

Blockchain is essentially a distributed ledger technology, which uses the cryptograph techniques and disbursed consensus algorithms to create the functions of decentralization, traceability, immutability, and forex houses. It's forex properties has the ability to trigger many revolutionary packages for education. for example, by way of figuring out "getting to know is earning," blockchain generation can foster students' gaining knowledge of motivation. it could shop a whole, trustworthy set of file of instructional sports together with the techniques and outcomes in formal as well as casual studying environments. it is able to additionally report instructors' coaching behaviors and performance hence imparting a reference for teaching evaluation. In a word, for each novices and teachers, blockchain has great ability packages in academic design, behaviors recording, and evaluation as well as formative assessment. on the same time, it brings challenges and opportunities to researchers, developers, and educators.

For researchers, blockchain has fantastic capacity to be extensively carried out in education. but, very few researches had been performed. it'd be difficult to observe greater closely on subjects like, what possibilities can it offer for schooling revolution? a way to higher utilising the digital forex assets to decorate studying motivations and achievements?

For builders, those creative ideas are just the first steps of applying blockchain into education. it is also an crucial part to expand academic platforms and software, which brings demanding situations for developers. how to build a blockchain platform that meets customers' customized needs? how to integrate hardware with blockchain to create an environment for information acquisition and recording? how to maintain a big quantity of educational transaction information and combine blockchain technology into the prevailing educational equipment and structures?

For educators, a number of the advantages of adopting blockchain generation to layout smart touch-based totally mastering sports are smart settlement-based learning sports may be verifiable, robust, and traceable. This transparency characteristic is a sturdy protection for instructors who have executed a very good task. moreover, the school management concerning the evaluation of teaching overall performance need to also be modified to embrace this new generation.

The conclusion of twenty first century's security, privacy, accept as true with, and equality may be applied through blockchain era. safety refers to the protection of precious residences and records. nowadays a few human beings have belongings but can not prove ownership, which includes highbrow assets disputes. it may cause struggle with others. Blockchain generation can be used by checking the statistics in the database to show the residences. a few enterprise data, which include layout drawings, corporate planning, can be stolen via industrial spies. Blockchain generation can be used to shield these valuables commercial enterprise via recording information in a blockchain network. Blockchain era protects instructors' instructional design from usurpation, therefore enhancing the security of shielding intellectual homes.

Privateness means every node save the whole ledger, inclusive of all of the facts except for the real identification. For the sake of privacy, customers' identifications are all offered by using id numbers. It manner that blockchain technology protects the privateness of the trader, as no person else might have the personal key. in the education state of affairs, all of the statistics approximately gaining knowledge of enjoy recorded on blockchain can simplest be won by way of its unique user's private key. Others are not available, because of this

blockchain customers' privacy may be nicely guaranteed.

As for accept as true with, blockchain generation can remodel human beings's approaches of building believe from building it by using the third-birthday party institution to building it by means of technology. teachers' and college students' behaviors are each recorded and monitored whilst smart settlement and blockchain are carried out. The believe between the topics is primarily based on the generation itself, now not the 0.33-party.

Equality refers to the same rights and possibilities that everyone has on a blockchain network. The openness, without boundary lines and permissionless natures of blockchain era can offer all and sundry equal access to the era and the network built with it. every person can apply for an digital pockets on blockchain community. Blockchain generation does not set any limits for the users. All colleges, instructors, and students can apply it to daily, consequently keeping off authority-bias.

REFERENCES

[1] R Beck, JS Czepluch, N Lollike, S Malone, Blockchain – The Gateway to Trust-Free Cryptographic Transactions. InResearch Papers from ECIS2016, (Istanbul, 2016)

[2] M Chung, J Kim, The internet information and technology research directions based on the fourth industrial revolution.KSII Trans. Internet Inf. Syst. 10(3), 1311–1320 (2016)

[3] R Collins, Blockchain: A new architecture for digital content. EContent 39(8), 22–23 (2016)

[4] P Devine, Blockchain learning: can crypto-currency methods be appropriated to enhance online learning? Presented atthe ALT Online Winter Conference 2015, Online, (United Kingdom, 2015)

[5] K Fanning, DP Centers, Blockchain and its coming impact on financial services. J. Corp. Account. Finance 27(5), 53–57(2016) https://doi.org/10.1002/jcaf.22179

[6] S Haber, WS Stornetta, How to time-stamp a digital document. J. Cryptol. 3(2), 99–111 (1991) https://doi.org/10.1007/BF00196791

[7] MB Hoy, An introduction to the Blockchain and its implications for libraries and medicine. Med. Ref. Serv. Q. 36(3), 273–279(2017) https://doi.org/10.1080/02763869.2017.1332261

[8] A Kosba, A Miller, E Shi, Z Wen, C Papamanthou, in 2016 IEEE Symposium on Security and Privacy (SP). Hawk: The Blockchain

[9] Model of Cryptography and Privacy-Preserving Smart Contracts (2016), pp. 839–858 https://doi.org/10.1109/SP.2016.55

[10] D Kraft, Difficulty control for blockchain-based consensus systems. Peer Peer Netw. Appl. 9(2), 397–413 (2016)https://doi.org/10.1007/s12083-015-0347-x

[11] S Nakamoto, Bitcoin: A peer-to-peer electronic cash system. (2008) Retrieved from https://bitcoin.org/bitcoin.pdf

[12] M Peck, A blockchain currency that beat s bitcoin on privacy. IEEE Spectr. 53(12), 11–13 (2016)

[13] https://doi.org/10.1109/MSPEC.2016.7761864

[14] K Schwab, The Fourth Industrial Revolution (The Crown Publishing Group, New York City, NY, 2017)

[15] M Sharples, J Domingue, in The Blockchain and Kudos: A Distributed System for Educational Record, Reputation and Reward.

[16] Adaptive and adaptable learning (Springer, Cham, 2016), pp. 490–496 https://doi.org/10.1007/978-3-319-45153-4_48

[17] DJ Skiba, The potential of Blockchain in education and health care. Nurs. Educ. Perspect. 38(4), 220–221 (2017)https://doi.org/10.1097/01.NEP.0000000000000190

[18] M Swan, Blockchain: Blueprint for a New Economy, 1st edn. (O'Reilly Media, Sebastopol, CA, 2015)

[19] F Tschorsch, B Scheuermann, Bitcoin and beyond: A technical survey on decentralized digital currencies. IEEE Commun.

[20] Surv. Tutorials 18(3), 2084–2123 (2016) https://doi.org/10.1109/COMST.2016.2535718

[21] S Underwood, Blockchain beyond Bitcoin. Commun. ACM 59(11), 15–17 (2016) https://doi.org/10.1145/2994581

[22] M Vukolić, in The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication. Open problems in networksecurity

(Springer, Cham, 2015), pp. 112–125 https://doi.org/10.1007/978-3-319-39028-4_9
[23] H Wang, K Chen, D Xu, A maturity model for blockchain adoption. Financ. Innov. 2(1), 12 (2016) https://doi.org/10.1186/s40854-016-0031-z
[24] J Yli-Huumo, D Ko, S Choi, S Park, K Smolander, Where is current research on Blockchain technology?—A systematicreview. PLoS One 11(10), e0163477 (2016) https://doi.org/10.1371/journal.pone.0163477
[25] Z Zheng, S Xie, H Dai, X Chen, H Wang, in 2017 IEEE International Congress on Big Data (BigData Congress). An Overviewof Blockchain Technology: Architecture, Consensus, and Future Trends (2017), pp. 557–564 https://doi.org/10.1109/BigDataCongress.2017.85
[26] Guang Chen, Bing Xu, Manli Luand Nian-Shing Chen in 2018 Chen et al. Smart Learning Environments (2018) 5:1Exploring blockchain technology and itspotential applications for educationDOI 10.1186/s40561-017-0050-x
[27] The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services (2017) https://www.weforum.org/reports/the-future-of-financial-infrastructure-an-ambitious-look-at-how-blockchain-can-reshape-financial-services
[28] Princeton University report on "Bitcoin and Cryptocurrency Technologies" by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder
[29] RBI warns those investing in virtual currencies like Bitcoins are exposing themselves to potential financial, legal and security related risks (2017) http://www.livemint.com/Industry/xma89nytKOwcDu4hBT30RO/RBI-says-it-hasnt-authorised-use-of-Bitcoins-flags-risks.html
[30] World Economic Forum report on "The future of financial infrastructure" (2017)
[31] "Tech Trends 2016" by Deloitte University Press (2017)
[32] https://www.icicibank.com/aboutus/article.page?identifier=news-icici-bank-executes-indias-first-banking-transactions-on-blockchain-in-partnership-withemiratesnbd-20161210162515562
[33] http://www.mahindra.com/news-room/press-release/Mahindra-and-IBM-to-Develop-Blockchain-Solution-for-Supply-Chain-Finance http://www.livemint.com/Companies/BcqXQgey9fieFps9xVZxrK/How-Bajaj-Electricals-usesblockchain-to-pay-suppliers.html
[34] http://computer.expressbpd.com/news/nse-looking-at-blockchain-for-ensuring-settlement-guarantees/18956/
[35] http://www.ibtimes.co.uk/stellar-connects-icici-bank-offers-cross-border-payments-india-africa-philippines-1595052
[36] http://www.livemint.com/Industry/loztj0R98Ea6m58Ng8jUzM/Blockchain-technology-catches-Axis-Kotak-Mahindras-fancy.html
[37] Swan M. Blockchain: Blueprint for a New Economy. ª O'Reilly Media, Inc.º; 2015.
[38] Kitchenham B, Charters S. Guidelines for performing Systematic Literature Reviews in Software Engineering;2007.
[39] Coinmarketcap, Crypto-Currency Market Capitalizations; 2016. Accessed: 24/3/2016. https://coinmarketcap.com/.
[40] Nakamoto S. Bitcoin: A peer-to-peer electronic cash system. Consulted. 2008; 1(2012):28.
[41] Kondor D, PoÂsfai M, Csabai I, Vattay G. Do the rich get richer? An empirical analysis of the Bitcoin transactionnetwork. PloS one. 2014; 9(2):e86197. doi: 10.1371/journal.pone.0086197 PMID: 24505257
[42] Herrera-Joancomart J. Research and Challenges on Bitcoin Anonymity. In: Garcia-Alfaro J, Herrera-
[43] Joancomart J, Lupu E, Posegga J, Aldini A, Martinelli F, et al., editors. Data Privacy Management,
[44] Autonomous Spontaneous Security, and Security Assurance. vol. 8872 of Lecture Notes in Computer
[45] Science. Springer International Publishing; 2015. p. 3±16. Available from: http://dx.doi.org/10.1007/
[46] 978-3-319-17016-9_1.
[47] Bitcoincharts; 2016. Accessed: 24/3/2016. https://bitcoincharts.com.
[48] Housley R. In: Public Key Infrastructure (PKI). John Wiley & Sons, Inc.; 2004. Available from: http://dx.doi.org/10.1002/047148296X.tie149.

[49] Double-spending; 2016. Accessed: 24/3/2016. https://en.bitcoin.it/wiki/Double-spending.

[50] Bitcoinwiki; 2015. Accessed: 24/3/2016. https://en.bitcoin.it.

[51] Antonopoulos AM. Mastering Bitcoin: unlocking digital cryptocurrencies. ª O'Reilly Media, Inc.º; 2014.

[52] Proof-of-Stake; 2016. Accessed: 24/3/2016. https://en.bitcoin.it/wiki/Proof_of_Stake.

[53] Petersen K, Feldt R, Mujtaba S, Mattsson M. Systematic Mapping Studies in Software Engineering. In:Proceedings of the 12th International Conference on Evaluation and Assessment in Software Engineering.EASE'08. Swinton, UK, UK: British Computer Society; 2008. p. 68±77. Available from: http://dl.acm.org/citation.cfm?id=2227115.2227123.

[54] Dybå T, Dingsøyr T. Empirical studies of agile software development: A systematic review. Informationand Software Technology. 2008; 50(910):833±859. http://dx.doi.org/10.1016/j.infsof.2008.01.006.

[55] Anish Dev J. Bitcoin mining acceleration and performance quantification. In: Electrical and ComputerEngineering (CCECE), 2014 IEEE 27th Canadian Conference on; 2014. p. 1±6.

[56] Paul G, Sarkar P, Mukherjee S. Towards a More Democratic Mining in Bitcoins. In: Prakash A, ShyamasundarR, editors. Information Systems Security. vol. 8880 of Lecture Notes in Computer Science.Springer International Publishing; 2014. p. 185±203. Available from: http://dx.doi.org/10.1007/978-3-319-13841-1_11.

[57] Mann C, Loebenberger D. Two-Factor Authentication for the Bitcoin Protocol. In: Foresti S, editor.Security and Trust Management. vol. 9331 of Lecture Notes in Computer Science. Springer InternationalPublishing; 2015. p. 155±171. Available from: http://dx.doi.org/10.1007/978-3-319-24858-5_10.

[58] Bamert T, Decker C, Wattenhofer R, Welten S. BlueWallet: The Secure Bitcoin Wallet. In: Mauw S,Jensen C, editors. Security and Trust Management. vol. 8743 of Lecture Notes in Computer Science.Springer International Publishing; 2014. p. 65±80. Available from: http://dx.doi.org/10.1007/978-3-319-11851-2_5.

[59] Ateniese G, Faonio A, Magri B, de Medeiros B. Certified Bitcoins. In: Boureanu I, Owesarski P, VaudenayS, editors. Applied Cryptography and Network Security. vol. 8479 of Lecture Notes in ComputerScience. Springer International Publishing; 2014. p. 80±96. Available from: http://dx.doi.org/10.1007/978-3-319-07536-5_6.

[60] Beikverdi A, Song J. Trend of centralization in Bitcoin's distributed network. In: Software Engineering,Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD), 2015 16th IEEE/ACISInternational Conference on; 2015. p. 1±6.

[61] Wang L, Liu Y. Exploring Miner Evolution in Bitcoin Network. In: Mirkovic J, Liu Y, editors. Passive andActive Measurement. vol. 8995 of Lecture Notes in Computer Science. Springer International Publishing;2015. p. 290±302. Available from: http://dx.doi.org/10.1007/978-3-319-15509-8_22.

[62] Zhang Y, Wen J. An IoT electric business model based on the protocol of bitcoin. In: Intelligence inNext Generation Networks (ICIN), 2015 18th International Conference on; 2015. p. 184±191.

[63] Spagnuolo M, Maggi F, Zanero S. BitIodine: Extracting Intelligence from the Bitcoin Network. In: ChristinN, Safavi-Naini R, editors. Financial Cryptography and Data Security. vol. 8437 of Lecture Notes inComputer Science. Springer Berlin Heidelberg; 2014. p. 457±468. Available from: http://dx.doi.org/10.1007/978-3-662-45472-5_29.

[64] Valenta L, Rowan B. Blindcoin: Blinded, Accountable Mixes for Bitcoin. In: Brenner M, Christin N,Johnson B, Rohloff K, editors. Financial Cryptography and Data Security. vol. 8976 of Lecture Notes inComputer Science. Springer Berlin Heidelberg; 2015. p. 112±126. Available from: http://dx.doi.org/10.1007/978-3-662-48051-9_9.

[65] Vandervort D. Challenges and Opportunities Associated with a Bitcoin-Based Transaction Rating System.In: Bhme R, Brenner M, Moore T, Smith M, editors. Financial Cryptography and Data Security.vol. 8438 of Lecture Notes in Computer Science. Springer Berlin Heidelberg;

2014. p. 33±42. Availablefrom: http://dx.doi.org/10.1007/978-3-662-44774-1_3.

[66] Bos JW, Halderman JA, Heninger N, Moore J, Naehrig M, Wustrow E. Elliptic Curve Cryptography inPractice. In: Financial Cryptography and Data SecurityÐ18th International Conference, FC 2014,Christ Church, Barbados, March 3±7, 2014, Revised Selected Papers; 2014. p. 157±175. Availablefrom: http://dx.doi.org/10.1007/978-3-662-45472-5_11.