# A prospective study on the emerging Blockchain with IoT

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***Abstract*— People using smartwatches, health devices and location trackers are not so futuristic or revolutionary anymore. This paper focuses on the evolving technologies such as Internet of things and Blockchain and how these influence especially the devices in order to provide the accurate data and statistical analysis.**

## I. INTRODUCTION TO BLOCKCHAIN:

Blockchain has commenced to take a significant influence in the Internet of Things (IoT) by improving security, empowering the incorporation of cumulative number of devices into the ecosystem. The enhancements in IoT device security facilitate faster adoption of this revolutionary innovation, and will open up a wide range of possibilities for enterprises in the years to come.

Blockchain can be defined as a shared peer-to-peer distributed ledger (distributed database). It is the technology that underlies bitcoin, a digital asset (crypto currency) and payment system which were introduced as open source software around 2009. It is a peer to- peer transaction management system without an intermediary. The transactions are verified by a network of nodes and recorded in a public distributed ledger called blockchain.

A blockchain database involves of two kinds of records: transactions and blocks. Blocks hold batches of valid transactions that are hashed and encoded into a Merkle tree. Each block includes the hash of the prior block in the blockchain, linking the two. The linked blocks form a chain. This iterative process confirms the integrity of the previous block, all the way back to the original genesis block. Some blockchains create a new block as frequently as every five seconds.

IoT solutions using blockchain can be built to maintain a continuously growing list of cryptographically secured data records protected against alteration and modification. It can set up trust, accountability, and transparency while streamlining business processes.

The progress of blockchain - a tamper-proof digital technology used to keep the record of transactions between business partners or to store data – is causing huge excitement in the engineering sector. It could deliver an effective means of controlling intellectual property, ensuring that inventors receive the financial rewards that they deserve. It could also lead to smarter supply chains, enabling firms to track the progress of materials and payments as goods make their way around the world. Blockchain could also play a vital role in the Internet of Things (IoT) by allowing the more effective monitoring of manufacturing facilities, ensuring that machine-to-machine payments are settled in real-time.

Blockchain can help reduce budget and volatility of working edge devices or connecting servers. Blockchain distributed ledger simplifies the expansion of cost-effective business systems where anything can be tracked and exchanged, without requiring an essential central control. The adoption of this rising innovation is indicating incredible promise in the IoT space and within the enterprise.

In simple terms, a blockchain is a distributed or "decentralized" database in which no one can modify or delete past entries. There are rules—known as the 'protocol'—for how new entries are made to the ledger. Each "block" is a snapshot of the transactions in the ledger, in the form of a database. The term "chain" refers to linking each successive block to the prior one in a linear, chronological order. Hence, "blockchain." The ledger is open to anyone for inspection. There are scenarios where access is controlled. These are known as private blockchains. For this paper, we focus primarily on public or open blockchains, for the same reason that Internet is bigger than Intranet. One critical component of blockchains is that the transfer of ownership of an asset can only be authorized by the entity that controls the corresponding private key. A second critical element is that security is provided by a decentralized network of computers instead of a centralized entity. Blockchains offer the potential for improved security and network resiliency while lowering transactional costs because of their distributed, peer-to-peer nature.

## II. IMPORTANCE OF BLOCKCHAIN WITH IOT

With the excessive amount of devices, one can collect huge datasets and analyses it in batch, real or near real-time. But the system should be process data and support acquisition, processing and storing such volume of data. Also system should provide safe access and association between all interested sides, if such association should be allowed. If we think in context of personalized healthcare we could attach some wearable devices on patients like smart bands, smart watches, or non-wearable like smart-phones, glucose level

monitoring etc., or even devices that are not necessarily wearable and connected to patients, like some blood pressure monitors, lung function monitor, or others devices that measure other condition that affect human health as well. These devices could measure environment also, that is important especially for patients with sensitive health. All of these devices should be connected to the internet, and provide constant monitoring of all parameters. Eg. In future, maps can alert asthma patient not to go in the area where the carbon index is high.

This approach could provide us an innovative insight into human health, or other factors that could affect human health, for specific patient and for the groups of patients. Benefit of this approach are numerous. Doctor can now see patient condition in real-time or near real-time depends on patient condition and severity of the disease, and track patient health, reduce costs of running basic tests and saving valuable time if already have insight in patient conditions. Because data is acquired constantly doctors now don't need to run all of the tests when patient come to hospital. In emergency cases this could save valuable time.

Electronic Health Records should provide double the 180 - degree patient view from healthcare perspective. This problem by itself is complicated. There are lot of tests, lot of different data types (numeric data, images, CT scans, textual prescriptions etc.). Another problem is centralized system that is hard for collaboration between institutions. On the other side, blockchain is great new technology with a lot of promise. It would be hard to store all the medical data to blockchain. Main problem would be expensive replication between nodes (images, text, prescriptions etc.). To solve this, we could use Big Data technologies that are proven for variety, velocity and volume, as a storage and processing mechanism. Or we could use combination of big data tools and blockchain like BlockchainDB. Having said that, Blockchain had already influenced the multiple strategic business units such as financial, insurance, retail and predominantly now into pharmaceuticals.

## III. BLOCKCHAIN POWERS IOT TO TECHNICALLY ACHIEVE THE EFFECTIVE DATA STORAGE

IoT blockchain empowers devices to involve in various dealings and communicational transactions as trusted sources. While device X may not know device Y, and may not believe it verifiably, the permanent record of communicational transactions and information from devices stored on the blockchain authorize and enable the vital trust for firms, individuals, and smart devices to collaborate.

It is remarkable for IoT edge devices to reduce processing overhead and eliminate the 'middle man' (IoT gateways) from the procedure. Communication, data exchanges, and device information or data are conducted on a peer-to-peer basis, removing any additional traditional protocol, hardware, or communication overhead costs.

Improved data exchanges as the 'middle man' (IoT gateway or any intermediate filtering device) is expelled from the process. Peer-to-peer device based contracts and ledgers (blockchain) decrease time required to complete device information exchange and processing time.

Decentralized technologies hold great promise for a system that needs to handle storing and retrieving information of millions—if not billions—of connected devices. These future systems have to provide low latency, high throughput, querying, permissions, and decentralized control.

Blockchain in IoT represents the biggest technological disruption since the integration of computing and transaction processing systems. Due to major progress in device innovation and software, it is now possible to bring transaction processing and intelligence to devices everywhere. There are critical adaptability experiments connected with distributed systems, as well as security, coordination, intellectual property management, identity, and privacy.

Many institutions and individuals are actively working on these issues and building an open source foundation for the proliferation of this technology. The blockchain has proven to be an excellent way of connecting the different parties involved in any supply chain environment due to the transparency and security-by-design of the technology. A blockchain-enabled supply chain is highly resilient to cyberattack – a copy of the essential shipping data is stored on each node on a decentralized network, meaning that even if one node is compromised, the data is safe nevertheless.

The presently available options could be a decent public database. The neighboring to the ideal are the NoSQL databases. The only thing they drawback is scheming fault tolerance. The Ties. Network Database is a deep modification of the Cassandra database and offers a preferable solution. It inherits the popular of features from the fundamental NoSQL databases and adds byzantine fault tolerance and incentives.

With these features it can convert a public database and enable feature-rich applications on blockchains with smart contracts. The database is writable by any user. But the users are identified by their public key and all the requests are signed. Once created, record remembers its creator who becomes an owner of the record. After that the record can be modified only by the owner. Everyone can read all records, because the database is public. All the permissions are checked on request and replication. Additional permissions can be managed via a smart contract.

## IV. SUMMARY AND FUTURE DIRECTIONS

In nutshell, this paper deals how the future of strategic business units can equip with the help of Internet of Things in combinations with Blockchain and Big Data. By joining Internet of Things and blockchain, hospitals and other firms can effortlessly collect various patient data from different IoT nodes, but also do real-time patient monitoring and store data securely.

Because of current lack of database features and characteristics in a blockchain technology, data could be

stored efficiently using big data tools, or newly designed tools like BlockchainDB and so on. In this way, it helps to decrease costs and increase association between health institutions using blockchain, and stop hackers and anti-social elements from stilling or modifying sensitive patient data. Blockchains give us resilient, distributed systems and the ability to interact with nodes in a trustless, auditable manner.

Blockchain provide as smart contracts as new way of interaction. Smart contracts allow us to automate complex multi-step processes. The devices in the IoT ecosystem are the points of contact with the physical world. For the future work, such system should be implemented and tested in real environment, collecting real data and storing it in public or private blockchain storage.

## V. About the Author

Maria Priya has the outstanding combination of expertise in computer engineering and management skills as she has the bachelor's degree in Information Technology and master's degree (MBA) in business administration with the specialization of Human Resources. Also, she is pursuing her doctorate (Ph.D.) in the field of HR. She has been in teaching profession for the last six years. She has presented and published research articles in various national and International conferences and journals.

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