IoT Driven with Big Data Analytics and Block Chain Application Scenarios

Pavan Manjunath [1], Prakruthi MK[2], Dr. Pritam Gajkumar Shah [3]
[1,2]*Ph.D. Scholar in Computer Science, Jain University, Bangalore*
[3]*Ph.D, Department of Computer Science, Jain University, Bangalore*

***Abstract*— The Big Data, Block chain and the Internet of Things (IoT) are the key names in the technology development of these eras. There are undoubtedly differences between the three technologies, but there are also firm relationships that increase the system operations, practicability, and adoptability. As the domain Block chain and the Internet of Things (IoT) are just infant domain and, still it's undergoing more and further development events, and the Internet of Things(IoT) is producing a larger set of the data and adopted across the different industries such as healthcare, smart cities development, retail, banking and public administration and real time application forecasting, the well-analyzed data is tremendously valuable the Big Data Analytics will suffice this needs, and on the other side the Block chain will provide more secured transaction of the data, and it provides contracts, and more other applications plus integration and Big Data Analytics can be integrated on top of it. In this paper will focus on the incorporation of the all three technologies or domain, such as Big Data Analytics, Block chain and the Internet of Things (IoT). We concluded that all the three technology Big Data Analytics, Block chain and the Internet of Things (IoT) would play a vital role in resolving each other constraints. Based on our analysis and case studies it will help for future work research.**

***Keywords*— Big Data Analytics; Block Chain; IoT architectures; IoT- Smart City; Security;**

I. INTRODUCTION

The first thing that arises to attention when speaking about Big Data Analytics, block chain and the Internet of Things (IoT) is the upsurge in the size of data that will increase the data storage of companies or industries[1], or millions of devices are connected to the Internet of Things (IoT). These systems or devices are generating a larger set amount of data. The transmission and processing of this data is a challenging task [2]. All this data needs to be securely saved and utilized for the present, and future analysis effectively managed and very day to day.

The Internet of Things (IoT) has the positive scope of providing a universal network of linked multiple devices and smart sensors for cities, education system, wearable devices, transportation system and tourism, the big data analytics has got good potentials to empower the Internet of Things (IoT) to real-time control preferred for smart and connected communities [3].

The upsurge of big data years on the Internet has steered to the massive growth of data size. However, trust concern and privacy have developed the main problem or issues of the big data; this has led to data safely circulated. The block chain domain delivers a new set of solution to this issues by merging non-altering, traceable features with smart contracts business codes that automatically executed by the default set of business instructions [4]

Let us take an example, where a conglomerate of 47 banks in Japanese signed up with a block chain startup called Ripple cryptocurrency to ease money transfers between bank accounts via block chain domain. The core aim of this is to perform real-time transfers at the lower cost. The reasons behind was the traditional real-time transfers were costlier and even susceptible to potential risk factors and with the help of block chain domain this risk can be avoided, and role of the big data analytics makes it promising to make out patterns in consumer spending and, risky transactions factors can be quickly identified and a precautionary measure can be taken in much faster way to avoid any losses to banks, and this analysis can be done in real time and also reduce the cost [5].

II. BLOCK CHAIN AND BIG DATA ANALYTICS AND IOT

An overview of Big Data Analytics, Block chain and the Internet of Things (IoT) technologies are discussed in general below for better understanding of each technology, as shown in the figure 1 the integration of all three set of technologies, were big data analytics acts as the top layer for both block chain and Internet of Things (IoT) for analysis's of the data, the block chain can also be integrated with Internet of Things (IoT) for performing secure transaction.

978-1-5386-5657-0/18/$31.00

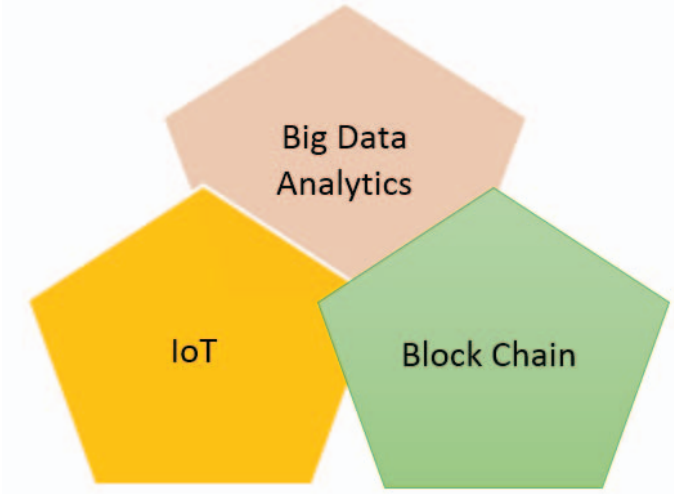

Figure 1: The block diagram of Big Data, Block chain and the Internet of Things (IoT) Integration [6].

A. Big Data Analytics, The big data analytics is a fast-trading, major practice and a vital enabler for the social business and other industries business analysis. In the social business model where the insights gained from the user-generated online contents and cooperation with customers is critical for success in the era of social media [7]. Big data analytics using Hadoop plays a key part in the execution of meaningful real-time analysis on the larger set of data and able to forecast the emergency situations before it occurs [8]. According to the Gartner IT Glossary, big data is high-velocity, high-volume, and high variation information resources that demand cost-effective, and it improves the decision making [9]. The list of a couple of Big data analytics reporting, analysis, integration, visualization, and development tools are MongoDB, Cassandra, Spark, Apache Hive, Tableau[10].

B. Block chain, Block chain is distributed ledger the set of transactions that are shared across a different set of computers systems, rather than being stored on a single computer or the central server. Basically there are two types of block chain one is private and other is public. The Public block chain, anyone can write into the ledger without needing any pre-approval, and such a block chain are highly prone to attackers. In a private block chain, only set of the group of users within an organization or group of companies are the only one to have access to the block chain, and such a block chain are more secured and trusted [11]. Figure 2 describes each block holds the hash of the earlier parent block [12].

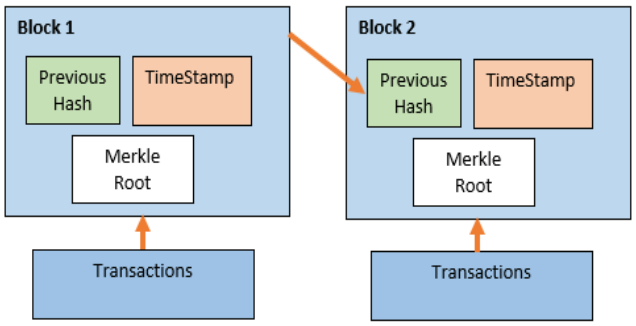

Figure 2: The block chain model

The time-stamp field denotes the period or the time when the block was created, the previous hash field is the hash function of the prior block header which connects each block to its parent block [12], and the field Merkle root or transaction root where every transaction has a hash linked with it and all of the transaction hashes in the block are themselves hashed [13].

C. Internet of Things (IoT), Internet of Things (IoT) is an environment of connected multiple systems that are accessible through the internet. Each device or system or physical object that have been allocated a unique IP address and can gather and transfer data over a network without any manual support or interference[14]. For example, car or any vehicle's that has built-in sensors to alert the driver when tire pressure is low [15].

III. IoT-Data Management

The scattered, unstructured and structured big data sets across several datacenters arise from the new type of Internet of Things (IoT) applications [16].The old-fashioned database management solutions are difficult to satisfying the high tech needs, and sophisticated application requirements of an IoT network that has a global-scale [17] and the storage is a very critical exploration direction of the data management of the Internet of Things. Massive and unstructured data of the Internet of Things brings the vast storage challenges [18]. The IoT includes many essential technologies such as man-to-devices and devices-to-devices communication, sensors, and networking. One of the key important of IoT is the data that flows under these technologies. The source of the data can be a different side, which is shown in figure 3.

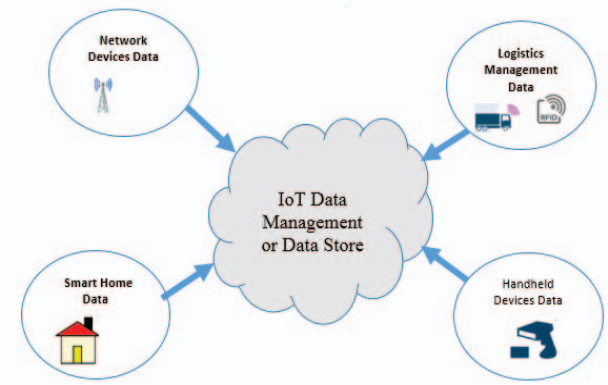

Figure 3: The block diagram of the Internet of the Things (IoT) data store.

IV. CASE STUDIES FOR SMART CITY SOLUTIONS

Day by day as year progress the growing population density in urban centers demands the satisfactory, good establishment of services, security surveillances, transportation, shopping complex, and infrastructure to meet the needs of humans. The usage of information data and communications technologies to achieve this objective presents a prospect for the development of smart cities, where city supervision or management team and citizens are given access to a wealth of real-time information about the urban atmosphere upon which to base decisions, actions, and upcoming planning can be taken [20].

The building of the smart city, has several advantages, such as waste management, air quality, noise monitoring, traffic congestion, city energy consumption, smart lighting, smart parking, smart homes or buildings, automation of public and government building [21].

The smart homes will be interconnected in the cities and the smart home there will be a lot of advantages such as comfort or easy control of all the home devices such as washing machine, televisions, and it helps the user in terms of security, and power utilization of the home can be controllable by sitting at the remote location [22].

An Investigational Study, PADOVA SMART CITY, The Smart city application activities are already being implemented out in Italy by city Padova. The technology used in collecting the environmental data and monitoring the street lighting and each lighting system is equipped with sensors, and it's connected to the Internet of Things (IoT) to pass on the data and also for collecting of environmental parameters, to monitor the air temperature, noise pollutions and humidity [23].

As shown in figure 4, basically two types of Big data analytics are performed first is live data streaming analytics and the historical data analytics, in the live data streaming analytics where the live data is directly processed, and the analysis reports are generated, or Streaming Analytics is the capability to always calculate statistical analytics while moving within the stream of data. Streaming Analytics permits real-time analytics of live streaming data and management, monitoring of live real-time data [24, 25].

In case of historical analytics, the data is stored in the storage data area for a couple of years for future use, such data can use for future references, and when the business required the old set of data needs to be analyzed, then the data can be analyzed for specific business requirements.

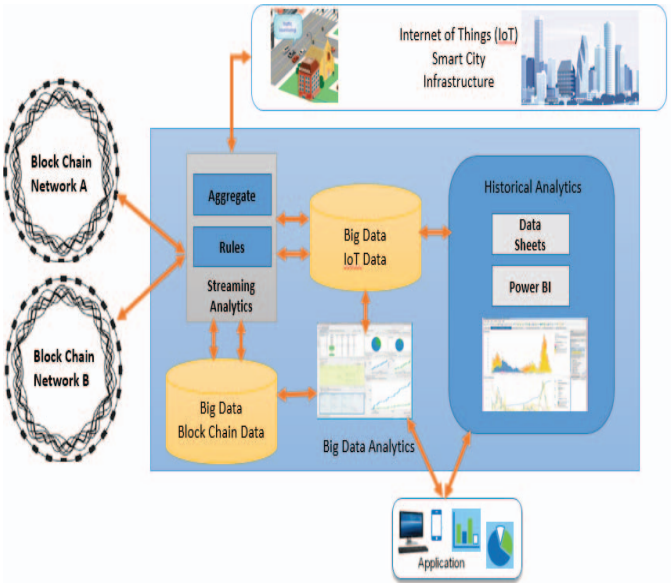

Figure 4: The block diagram of the integration of Internet of Things (IoT), Block chain and Big Data Analytics

V. CONCLUSION

Big data analytics is very vital and can be integrated very easily with Internet of Things (IoT) enabled applications and block chain database technology and the block chain database domain can resolve two of big data's unresolved challenges, such as how to trust or privacy of the data, and how to build a worldwide data exchange. The reports or analysis data generated via big data analytics tools will give a border angle to take a critical decision and monitor certain events in the smart cities infrastructure.

REFERENCES

[1] How Big Data is Powering the Internet of Things (IoT) Revolution,Avantika Monnappa,Last updated September 11, 2017,

[Online].Available:https://www.simplilearn.com/how-big-data-powering-internet-of-things-iot-revolution-article

[2] U.Ahsan and A. Bais, "A Review on Big Data Analysis and Internet of Things," 2016 IEEE 13th International Conference on Mobile Ad Hoc and Sensor Systems (MASS), Brasilia, 2016, pp. 325-330.doi: 10.1109/MASS.2016.048

[3] Y. Sun, H. Song, A. J. Jara and R. Bie, "Internet of Things and Big Data Analytics for Smart and Connected Communities," in *IEEE Access*, vol. 4, pp. 766-773, 2016. doi: 10.1109/ACCESS.2016.2529723

[4] L.Yue, H. Junqin, Q. Shengzhi and W. Ruijin, "Big Data Model of Security Sharing Based on Blockchain," 2017 3rd International Conference on Big Data Computing and Communications (BIGCOM), Chengdu, 2017, pp. 117-121.doi: 10.1109/BIGCOM.2017.31

[5] Home/Blog/Analytics/Introduction to Blockchains & What It Means to Big Data,Introduction to Blockchains & What It Means to Big Data,September 1, 2017 Posted by:Abhinav Venkat Category:Analytics, Big Data, Big Data Analytics, Cloud

[Online].Available: http://www.noahdatatech.com/introduction-blockchains-means-big-data/

[6] Home Analytics Making the connection between Big Data Analytics and the Internet of Things,

Making the connection between Big Data Analytics and the Internet of Things,ERPINNEWS,OCTOBER 31,2017,

[Online].Available: https://erpinnews.com/making-connection-big-data-analytics-internet-things

[7] S. Singh and N. Singh, "Big Data analytics," 2012 International Conference on Communication, Information & Computing Technology (ICCICT), Mumbai, 2012, pp. 1-4.doi: 10.1109/ICCICT.2012.6398180

[8] A Survey of Big Data Analytics in Healthcare and Government,Author links open overlay panelJ.ArchenaaaE.A. MaryAnitab,

[Online].Available: https://www.sciencedirect.com/science/article/pii/S1877050915005220

[9] Home/Big Data Analytics,What is Big Data Analytics,

[Online].Available: https://www.qubole.com/big-data-analytics/

[10] Data Visualization/Big Data Analysis/Data Mining/Data Analysis,What are good tools for big data analytics,

[Online].Available: https://www.quora.com/What-are-good-tools-for-big-data-analytics

[11] How Blockchain works, Venkatesh Narayanan,Mar 28, 2016,

[Online].Available: https://medium.com/@venkinarayanan/how-blockchain-works-b0a62ca2fca1

[12] Can someone explain how the Bitcoin Blockchain works,

[Online].Available: https://bitcoin.stackexchange.com/questions/12427/can-someone-explain-how-the-bitcoin-blockchain-works

[13] WHAT IS MERKLE TREE & MERKLE ROOT IN BLOCKCHAIN,

[Online].Available:https://www.blockchain-council.org/blockchain/what-is-merkel-tree-merkel-root-in-blockchain/

[14] The lifeline for a data-driven world,What is IoT,

[Online].Available:https://www.happiestminds.com/Insights/internet-of-things/

[15] Home,Strategy,Networking and communications,Internet of Things (IoT),

[Online].Available:https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT

[16] L.Wang and R. Ranjan,"Processing Distributed Internet of Things Data in Clouds," in IEEE Cloud Computing, vol. 2, no. 1, pp. 76-80, Jan.-Feb. 2015.

doi: 10.1109/MCC.2015.14

[17] Data Management for the Internet of Things: Design Primitives and Solution,sensors,ISSN 1424-8220,13, 15582-15612; doi:10.3390/s131115582

[18] T.Li,Y.Liu,Y.Tian,S. Shen and W. Mao,"A Storage Solution for Massive IoT Data Based on NoSQL," 2012 IEEE International Conference on Green Computing and Communications, Besancon, 2012, pp. 50-57.doi: 10.1109/GreenCom.2012.18

[19] Bosch ConnectedWorld Blog,The top 4 benefits of IoT data management,CHRISTOPH GROTZ,JAN 9,2018,

[Online].Available:https://blog.bosch-si.com/internetofthings/the-top-4-benefits-of-iot-data-management/

[20] J.Jin,J.Gubbi,S.Marusic and M.Palaniswami,"An Information Framework for Creating a Smart City Through Internet of Things," in IEEE Internet of Things Journal, vol. 1, no. 2, pp. 112-121, April 2014.doi: 10.1109/JIOT.2013.2296516

[21] Internet of Things (IoT) for Smart Cities, Guided By, Mr.Kiran V K, Asst. Professor, Dept. of CSE, NSS Colleage of Engineering. Slide number 10,

[Online].Available:https://www.slideshare.net/SaNaLKuMaR17/iot-for-smart-city-59762552%20Slide%20number%2010

[22] Smart home Environment using iot,parvathy s m, Student at College of Engineering,Perumon,Published on Mar 3,2017

[Online].Available:https://www.slideshare.net/parvathysm/smart-home-environment-using-iot

[23] Internet of Things for Smart Cities [1],An article review by Judith Sobotie,

[Online].Available:http://www.etcs.ipfw.edu/~lin/CPET581-InternetOfThings/1-Lectures/2-5-2016-PaperPPT-slides/IoTResearchDirection_JS.pdf

[24] Home/Cities/Smart City,Utopian or Real,Where Are We Heading,Smart City,January 12, 2015by Samudranil,

[Online].Available:https://www.mapsofindia.com/my-india/cities/smart-city-utopian-or-real-where-are-we-heading

[25] DATAVERSITY,Data Education for Business and IT Professionals,Sunday April 22nd, 2018,Analytics Translator vs. Citizen Data Scientist: What is the Difference,By Kartik Patel

[Online].Available:http://www.dataversity.net/streaming-analytics-101/