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Industry 4.0: Impact of Blockchain based IOT on Banking and Financial services

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Abstract. The first industrial revolution during the end of 18th and the beginning of 19th century, was marked by Mechanical production, driven by hydraulic and steam engines, mass production based on division of labor in the second, the third revolution was based on automated production supported by computer technologies, and today the world is witnessing industrial revolution 4 which is based on the virtualization and interconnection of technologies called Industry 4.0, the development of information technologies developed new instruments and products, the major players are, Big data, supply chain, IOT and AI. This paper is focused on application of IOT-Blockchain in Banking and financial services.

The origin of Blockchain Technology is crypto currencies, where initially this Technology was used as a public ledger to record the transactions of crypto currencies. This Technology is based on three pillars, as Decentralization, Immutability and Transparency.

Research objectives:

1.To understand about Industry 4.0.

2. IOT and Blockchain integration.

3. Application of IOT- Blockchain in banking and financial services.

Design/methodology/approach: This paper is designed as a conceptual paper, keeping this in view; a careful selection of relevant information is collected from secondary data from published reports.

Scope: This paper is confined to study impact of Blockchain based IOT on the banking and financial services in the Industry 4.0.

Keywords: “Industry.4.0”, “Blockchain Technology”,” IOT”, “Banking and Financial services”.

I Introduction

1.1 Industry 4.0

IR 4.0 symbolises drastic change to the technology, industry, society, due to technological developments, through increased inter connected computer networks, [1,

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2], as per the scientific research, [3] popularised by Klaus Schwab, the WEF founder, according to whom, the changes are not only confined to improvement in work efficiency but also to the significant shift in the industrial operations [4].A brief note on the four IR's [5].

The First Industrial Revolution

Invention of steam machines, mechanisation of manufacturing, the usage of water and steam power, emergence of steam engines, steam based mechanical production, machine loom in the process of textile production, development of transportation system, were the prominent developments in the first industrial revolution.

The Second Industrial Revolution

Emergence of electricity &machines based on electric power. First assembly line, electricity based mass production.is typically seen as the period where electricity and new manufacturing 'inventions' which it enabled, such as the assembly line, led to the area of mass production and to some extent to automation.

The Third Industrial Revolution

Computer revolution, the major developments in the third industrial revolution were emergence of first programmable controller, CAD(Computer aided design) CAM (Computer aided manufacture) controller based automation, manufacturing of computers (1960), Microprocessors & personal computers, computer networks (such as WAN, LAN, MAN,), and the use of robotics in manufacturing with more automation which resulted in reduction of processing time as well as cutting short of costs and with increased efficiency.

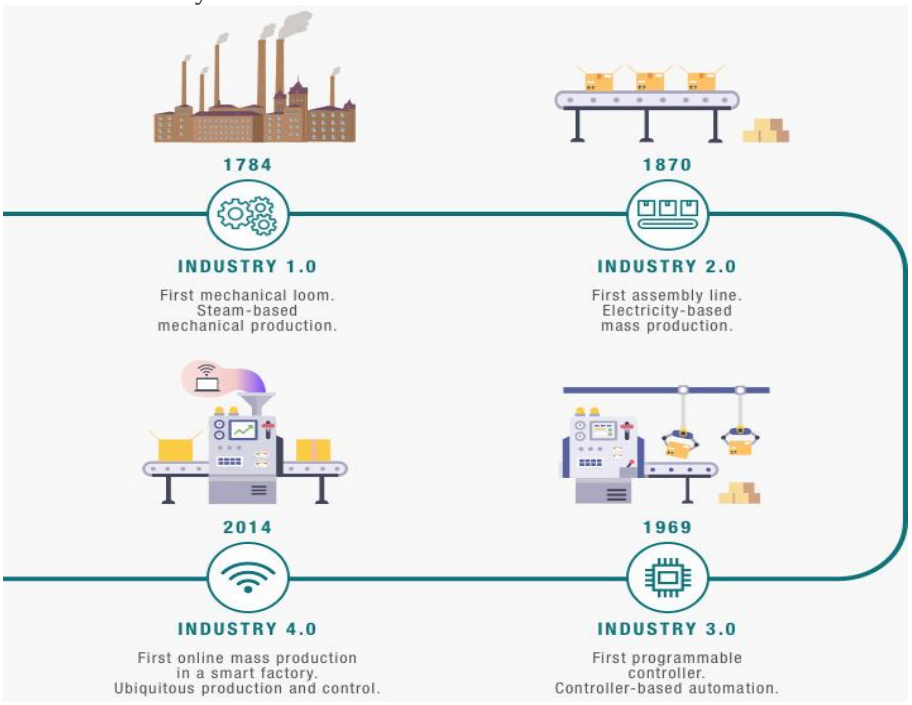

Figure:1: Developments of various industrial developments.

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In the fourth industrial revolution
Evolution of digital era, major technological developments to note are, First online mass production in a smart factory, ubiquitous production, Internet expansion, Blockchain, IOT, AI and Robotics. We move from 'just in time 'to the Internet and the client-server model bridging of digital and physical environments through the development of IT and IOT, which provide numerous opportunities to innovate and lead the industry to the next level.

Table 1: Technological changes marked by industrial revolution so far

Industrial Revolution	Duration	Technological Developments
Industry 1.0	1784 to 1870	Emergence of steam engines, steam based mechanical production. First machine loom, Development of transportation system.
Industry 2.0	1870 to 1960	Emergence of electricity &machines based on electric power. First assembly line, electricity based mass production.
Industry 3.0	1960 to 1995	Computer revolution, first programmable controller, controller based automation, manufacture of computers (1960), Microprocessors & personal computers.
Industry 4.0	1995 to first decade of 21st century	Evolution of digital era, First online mass production in a smart factory,ubiquitious production and control Internet expansion, virtual products, Blockchain, IOT, AI and Robotics.

II Review of Literature

Samaniego & Detas [6] asserts ,IOT suffers from network latency due to cloud based operations , to overcome this problem, they proposed a software defined IOT management ,known as virtual resource, decentralized Blockchain which has the potential to solve this problem on IOT implementation. M. A. Khan and K. Salah, [7] surveyed on few important IOT related issues and challenges and proposed the integration of Blockchain and IOT and also outlined the research issues can be addressed through IOT-Blockchain integration. Singh et.al [8] observed, the present technologies lack the capacity to solve IOT application from various cyber-attacks in the application for business and they suggested Blockchain with more reliable efficient secured application with IOT- Blockchain application. Pustišek and A. Kos,[9]in their

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study on the IOT- Blockchain integration, presented three different Blockchain architectures such as Hyper ledger , Hyper ledger fabric , Ethereum for security for IOT-Blockchain applications , according to the authors, among the three, Ethereum has enhanced security. Huh et.al,[10] proposed a new way to manage a few IOT devices by using Blockchain based architecture Ethereum, computer based platform, also suggested smart phones, smart contracts musing public keys, to track and save values. C.-F. Liao, S.-W. Bao, C.-J. Cheng, and K. Chen, [11] made study on design issues and architectural styles on IOT-Blockchain, suggested an architectural approach for Blockchain based IOT could solve the design issues of IOT for business. A. Reyna, C. Martín, J. Chen, E. Soler, and M. Díaz, made [12] a detailted study on Blockchain and its integration with IOT, listed out challenges of IOT such as scalability, storage capacity, consensus mechanism data privacy and anonymity and the authors identified potential benefits of Blockchain based IOT and they suggested different topologies for the Blockchain-IOT integration to enhance the performance and feasibility in the business applications.

III IOT and Block Chain Integration

IOT, can be defined as “A network of inter connected devices to enter, record and share data or information by communicating directly with each other through the collection, recording and distribution of data via the internet. Internet of Things (IoT), can be understood as various devices are connected through the internet to collect, record and share useful information via servers and sensors, for pre fixed tasks to perform specific tasks or actions in the external environment .The main purpose of IOT is to deliver the right information to the right person in the right time the data so collected can be used for effective decision making process.

The IOT- Blockchain based IOT solutions simplifies business workings, improves customer experience and reduces cost and improves work efficiencies .It can be said that IOT needs Block chain and vice-versa.

IOT and Block chain are two emerging technologies in business; IOT is a device, used for processing the information /data, helps in entering, recording and sharing the data/information while Blockchain is a distributed filing system, each file once created

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becomes a block and enters into the network of blocks which will be transmitted to the parties, which is tamper-proof, having time stamp on the block.

3.1 The Benefits of Using IOT Based Block chain:

There are mainly three key benefits for the banks and financial services, while using IOT based Blockchain.

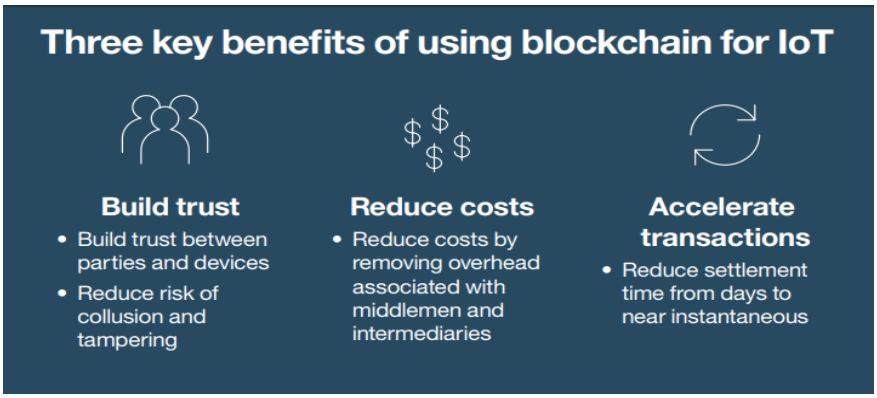

Fig 2: Three key benefits of using Block chain for IOT

Source: IBM.

Block chain based IoT provides three key benefits for transactions in Banking and financial services.

- Building trust: Block chain based IOT, helps to build trust between the parties and devices.
- Cost reduction: Block chain based IOT, reduces costs based on one of the basic characteristics, of providing peer to peer direct contact, which helps in reducing the overhead costs associated with middlemen and intermediaries.

Blockchain based IOT brings some notable benefits which can be enumerated as follows:

Security

IOT devices like 24/7 monitoring, CCTV cameras, smart alarm systems, which are connected with each other and remotely controlled, play vital role in providing security to the banks, once intrusion is detected, security team , quickly lockup or close the branch to take appropriate measures.

Real-time Monitoring

IOT devices have the capabilities of collection of real time data helpful in assessing customers' needs, Other benefits of IOT based Blockchain for Banks and Financial services:

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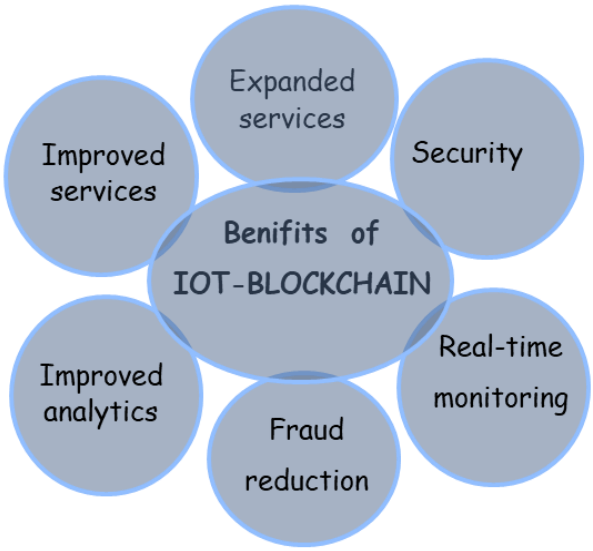

Fig: 3.Other benefits of IOT-Block chain

Fraud Detection
IOT devices provide secured transaction, minimizes fraud as all transactions are entered, recorded and transmitted through network of computers.

Improved analytics
IOT provides banks right information in the right time for investments which helps in effective decision making measure accurate ROI

Improved Customer Service
Block chain based IOT has the capability to generate data/ information from mobile application, websites which are recorded, banks can gather the information 24/7, and can make improvements/changes/modifications to the budgets or investment proposals.

Expanded Services
With the help of IOT devices banks gather information through android phones and watches, and attractive cash back offers to launch new products to the bank customers.Differences between IOT and blockchain :

The following table illustrates the differences between IOT and Blockchain.

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Table 2: Differences between Internet of things and Blockchain.

Point of difference	Internet of Things	Blockchain
1. Concept	Connecting everything to the internet in real time through sensors and collect data/information	Recording transactions across peer to peer network ,providing authenticated transactions.
2.Nature	A global network of physical objects called IOT connected to the internet.	A digital medium for value that ensures safety & security of transactions on line.
3.Objective	Gather data/ information from tiny sensors using internet.	Provide authenticated transactions.
4.Function	A technology , which supports integration ,exchange, analytics of data generated by smart devices.	An open decentralized data base that keeps record of every transaction involving monetary value.
3.Application	Real life applications,wearables, smart appliances, smart home appliances and smart security systems.	Payment process ,supply chain ,digital voting, medical records etc.,

IV Applications of IOT-Block Chain in the Banking and Financial Services

4.1 Examples of IOT in Banking

There are numerous IOT devices which are used in banking and financial services. A few mostly used in banking and financial services are; Stripe, Kontak.io, Dynamics.Inc. MasterCard, Metromile.

- **Stripe:** It is a programmable API, facilitates payments.
- **Kintak.io**: Helps to manage your devices & inform you about the health & records the information /data about your last/previous record.
- **Armis:** These are the control devices including Digital assistants, smart TVs, security camaras, Industrial control systems.
- **Dynamics.Inc**: Products used by bank for global operations, includes, global bank payments, networks, telecommunications, cordless payments, wallet card.
- **MasterCard:** It is an American multinational financial security issued in the form of debit card/credit card. The aim is to process payments in international business process.
- **Metromile:** It is a device with which one can access the proof of insurance for instance, the Metromile app.

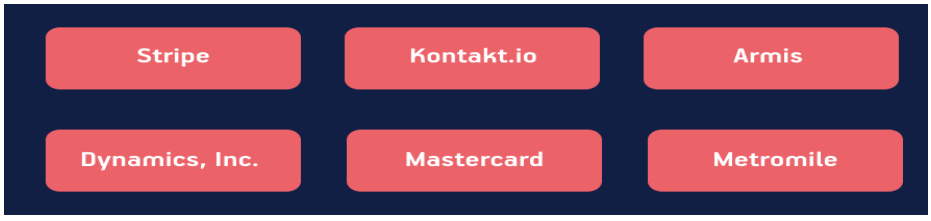

Fig: 4: IOT devices for banking and financial services

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Source:https://www.mobindustry.net/blog/iot-in-banking-and-fintech-benefits-examples-and-cases/

Tab Table: 3. A few popularly used IOT devices in banking and financial services

IOT Device	**Function**	**Application areas**
Stripe	Simplifies payments & organisation aspects for business using cloud infrastructure.	Revenue management, fraud prevention.
Kontakt.io	Manufactures lower energy Bluetooth beacons	Mobile payments replacing Point of sale (POS) technologies.
Armis	IOT security to business including banks	Automatic identification &disconnection of unmanaged devices.
Dynamics	Creates interactive battery powered payment cards connected to IOT.	Provide real time two way communication between customers and banks.
MasterCard	Creates products that simplify several daily tasks.	Contactless payments, Iot connected key chains with General Motors.
Metromile	Using trackers connected to Metromile.	Insurance plans based on mileage & driving behavior, simplifies the claim handling process by allowing drivers to file a full claim for their mobile phones.

Source: Prepared by the author.

4.2 The Use of IOT Devices in Banking and Financial Services

IOT in Retail banking
Iot devices are being used since more than a decade, ATM (Automatic Teller Machines) is one of the top IOT devices, helping banks to provide real time transactions, the usage of "Smart ATMS' is helping banks to reduce the number of employees thereby reducing the overheads, a new IOT device 'becons" helps banks to send SMS through smart phones about the new products launch by the banks.

Customer–Centricity
IOT devices help banks to collect digital customer experience, getting feedback or sending messages /information through mobile.

Chat Bots
IOT devices helps in providing un interrupted service through virtual assistants or chat bots providing 24/7 customer services without any human involvement with the help of which the operational costs could be reduced, as per the insider intelligence reports, the operational costs could be reduced up to $ 8 billion across global banks .Chat bots use natural language, and use machine learning process for customer interaction.

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Simplifying Operating Models
Iot helps in reduction of operating time in retail banking. Banks are able to operate more efficiently which allows slashing operating costs.

Wearable & Smart Speaker Technology
Banks are now providing services such as smart speakers, voice instructions a new device, compatible with google home speaker, and provides information about bank balance, last transaction, pending transaction and history of transaction. With the help of IOT wearable devices like android watches, smart watches,

Block chain Based Smart Contracts
Customers top concers is security privacy and safety, Banks adopt Blockchain based IOT for better customer service as the transactions once enters in blockchachain are authenticated, secured, saved and immutable.

Discussion
The combination of IOT-Block chain proves prominent benefits for the banks and financial services among all, four major benefits can be prominent. Firstly, Banks deals with huge volumes of data, getting generated from multiple organisation every day, with the IOT based blockchain, it would be possible to manage and process the gathered data. Secondly, with the specific feature of in blockchain is encryption, the distributed ledger records, with the help of IOT the recorded transaction will be secured, Thirdly, the execution of smart contract in blockchain facilitates the blockchain platform like Ethereum allow only when the conditions are met. Fourthly, Blockchain provides scope to improve the overall security of IOT environment.

V Conclusion

A considerable number of observations prove that Blockchain based IOT can be beneficial to the business operations. One major problem for IOT is that it depends on centralised platform which can be solved by integrating with Blockchain, the distributed transaction records data into nodes &enters into the network .Blockchain based IOT records every transaction made in IOT which cannot be altered, changed & provides a permanent record. An important study on Integration of Blockchain and IOT was carried on by K. Christidis, M. Devetsikiotis, [13] who demonstrated the Blockchain-IOT applications observed, Block chains distributed to interact peer-to peer system, has the ability to interact with peers, ,smart contracts allow to automate the entire process and IOT devices are the points of contact with the physical world, when these two are combined we can experience new and unique ways of work flows along with cryptographic verifiability which can result in reduction of operational cost and also time. The distributed wireless sensor networks, in spite of their drawbacks [14, 15] are the pillars of technological and human developments the combination of Blockchain –IOT architecture may enhance the operational efficiency of IoT by minimising its deficiencies [16,17,18,19,20]. One can trust the Integration of Blockchain –IOT brings desired changes in the industries and the combination of different models, innovations will lead to enhanced performance and leading to rapid economic development.

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