Smart E-Business Model based on Block Chain (BC) and Internet of Things (IoT) Technologies

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Abstract: - Blockchain (BC) is a de-centralized, digitized, public ledger of all crypto-currency transactions. BC attempts to create and share all the online transactions as a data structure on a computers network where it validates the transactions using peer-to-peer network of computers. It also allows users to make and verify transactions immediately without the need for a central authority. BC which works on Bitvoin Protocol is a transaction database and ledger technology which contains information covering all the transactions ever executed in the past. On the other side, Internet of Things (IoT) is becoming a new platform for smart E-business activities. In this paper, we present a smart E-business model based on BC and IoT technologies where this model may be seen as a combination of the four used intelligent approaches in data Mining, knowledge computing, machine learning, and transactions testing. In addition, we re-design many elements in traditional E-business models. The results of our analysis show that, within appropriate E-business paradigms, BC technology can play an efficient role in facilitating active tasks for all activities over the architecture of IOT in many domains. We also experiment our design and make a comprehensive discussions.

Key-Words: - Blockchain (BC), Data Mining, E-business, Managerial Decision-Maker, Machine Learning Internet of Things (IoT), Computational Intelligence

1 Introduction

E-business which is a complex term, encompasses the deployment of recent Information and Communication Technologies (ICT) across organizational departments considering the links to partners, intermediaries, supplies, and customers, and including many processes such as buying and selling goods and services, processing payments, servicing customers and interacting with business partners, Chaffey [1]. Wallace [2] concentrates on the participants in E-business, including governments and nonprofit organizations. To sum up, E-business covers the operations of: buying, selling, marketing, paying, delivering, and servicing of products and services as well as sharing information through networks that link business organizations with their customers, allies, suppliers, partners, prospects, agents, and competitors.

On the other side, the BC, which was originally implemented for the virtual crypto currency, Bitcoin, is a novel peer-to-peer approach which links together a sequence of events or transactions in a way that makes them immutable [3]. BC is a transaction database which works on Bitcoin protocol, contains information about all the transactions ever executed in the past. It creates a digital ledger of transactions and allows all the participants on the network to edit the ledger in a secured way which is shared over a distributed network of the computers [4]. According to a recent report, the amount of data in our world is rapidly increasing where it is estimated that 20% of the world's Data has been collected in the past couple of years. Facebook, which is the largest online social network, collected 300 peta bytes of personal Data since its inception. MIT Media Lab provided a mechanism called ''De-centralizing Privacy'' which can protect personal Data. A BC is something like a ledger in which all transactions have been recorded, and shared by the participants of a Bitcoin network [5].

Recently, Internet of Things (IoT), has become a smart tool in almost every industry and business tasks. Those institutions that can use I0T correctly and effectively play a pivotal role in disrupting the status quo in a leadership position. But other institutions that don't keep up with IoT technology generally do not survive. The authors of [6] have identified the BC technology as a catalyst for emerging use cases in the financial and nonfinancial industries such as industrial manufacturing and supply chain. Nowadays, the development of traditional business models becomes more and more mature as people use them to guide various types of E-business activities. However, old business models could hardly fit for the E-business on the IoT [7].

Overall, we observed that only limited applications of knowledge engineering paradigms in the field of e-business are related to modeling e-business [8]. Osterwalder and Pigneur [8] use, for example, as a base for representing the-business domain several main aspects such as: product innovation, customer relationship, infrastructure management, and finances, with the main goal of describing technology used for creating value in on-line business [9]. The benefits of using formalized e-business models can be seen in the possibility for managers to easily communicate with each other; share their views with other stakeholders [10]; simulate and learn about e-businesses without the risk of the experiment threatening the organization [11]; favor changes if needed[12], etc. Section 2 of this paper presents a brief overview of E-business aspects. Section 3 presents the BC's technical architecture and characteristics.. Section 4 presents the advantages and disadvantages of BC Technology. Section 5 presents our proposed model for smart E-business activities based on BC and IoT technologies. Section 6 discusses the research results and section 7 presents the research conclusions.

2 E-Business Aspects

E-business involves all aspects of business, which are based on the use of intelligent informatics approaches, internet of things (I0T) and computer networks. Overall, most researchers emphasize that e-business is a somewhat a broader concept compared with E-commerce where E-business refers to servicing customers, discovering knowledge, performing e-transactions within an organization, e-government, collaborating with business partners, social networks, and many more activities.[13,14]. Moreover, some researchers are ready “to use the broadest meaning of digital commerce, which is basically equivalent to the broadest definition of e-business, and these terms can be used interchangeably” [14]. E-business links value chains across businesses where this involves efficient paradigms in the value chain, costs reduction, and improving business efficiency.

E-business has a variety of complex framework involving: many tasks, organizational units, and technological issues [14]. Many authors focus on different important approaches and aspects related to both e-commerce and e-business. Some authors (Turban et al [14] view a wide range of applications in the area of e-business including e-purchasing, e-government, e-learning, online advertising, e-marketing, social commerce, m-commerce, collaborative commerce, e-health, online publishing, etc. Other authors (Parusheva et al)[15], Joshi [16] distinguish a special group of applications in the area of e-finance. Central e-finance applications include electronic trading, and e-insurance, electronic banking and e-payments. In turn, electronic banking has the following range of applications: PC banking, mobile banking, phone banking, internet banking, TV banking, as well as, most recently, wearable banking and social media banking. In order to perform these applications, organizations and companies need appropriate infrastructure and support areas. Turban et al.[14] offers five support areas, which include people, marketing & advertising, support services, public policy, and business partnerships.

All published research in the field of e-business pay attention to e-business participants. Laudon and Traver[17] examines in details only the major participants that is Business-to-Business and Business-to-Consumer. The first type includes participants like e-distributors, exchanges, e-procurement, and industry consortia. The second type has many representatives such as e-tailors, portals, content providers, community providers etc. Rainer et al.[13] consider many more types of participants: Business-to-Business, Consumer-to-Consumer, Business-to-Employee, Business-to-consumer, and e-government, which in turn includes Government - to - Customer, Government-to Government, Government-to-Business, etc.

The new developments, maturation, and growth of e-business continue to expand where the pre-requisites for this growth are the relentless evolution in ICT and the commercial approaches, which exploit this evolution [6]. The recent trends and directions in e-business are related to the phenomenal growth of social media, especially of social networks such as Facebook, Twitter and Google+, and conducting e-business via smart mobile devices[14],[17].

3 Architecture and Characteristics of Blockchain (BC) Technology

3.1 The Architecture of BC

The architecture as shown in Figures (1 and 2) contains two major parts: ULE (sensors and network) and the cloud platform based on the internet. The system is composed of connected devices and sensors, and the collector that collect data. In order to transfer data securely to the

Ubiquitous IoT platform for analysis, and processing, these elements are connected to the internet where this allows the groups of students to access the services, securely, via the integrated cloud platform based on the internet. In the internet network, students use a consensus protocol to approve the ledger content. The crypto-graphic hashes are cluster computing used to confirm the reliability of transactions. The consensus protocol eliminates the risk of unsecured transactions and verifies that the shared ledgers are duplicated. Obviously, the collected data from devices are integrated with the private BC ledgers which in turn ensure shared transactions efficiently. The distributed architecture eliminates the requirement for centrally stored data, and allows for the decentralization way.

Transaction data should not be trusted in the hands of third-parties, as they are susceptible for stealing and misuse. Instead, users should own and control their own data without compromising security or limiting authorities and companies' ability to provide encrypted transactions. Our platform enables this security compromization by combining a BC with a Holomorphic encryption solution. Users who are not required to trust any third-party are always aware of the data that is being collected about them and how they are used. In addition, the BC recognizes the users as the owners of their encrypted data. Companies, in turn, can focus on utilizing data without being overly concerned about the properly securing and the compartmentalizing issues [18].

Following the recent research on [18], authors illustrated a novel approach of personal document management using BC technology Personal Archive Service System (PASS) where this smart system well exploits the BC features. Whenever a subject likes to make a trace of achievement or new characteristics, the subject can archive it right away rather than waiting for an inquisitor later on where the opportunity for such application is pervasive. The (PASS) can be used in online applications as well as in other applications like promotion and employment where this eliminates a third party from completely keeping its anonymity and accountability [19].

From the technical point of view, BC is essentially a distributed database of records, or a public ledger of all digital events or transactions or digital events that have been executed and shared among participating parties ,

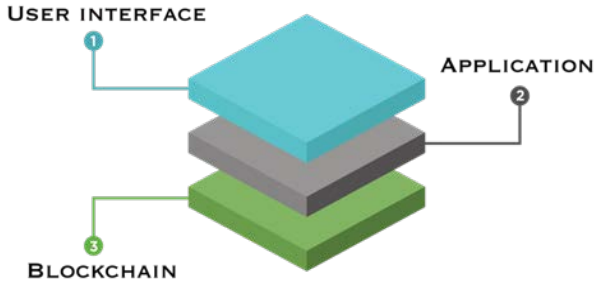

Figure (1): The BC System Relays Transactions

The consensuses of the majority of the participants in the system verify each transaction in the public ledger. Once the transactions are entered, information can never be erased. The BC contains a certain and verifiable record of every single transaction ever made. The BC can be used in smart contracts, currency, cloud storage area, record keeping, IOT systems, storage and many other areas [20].

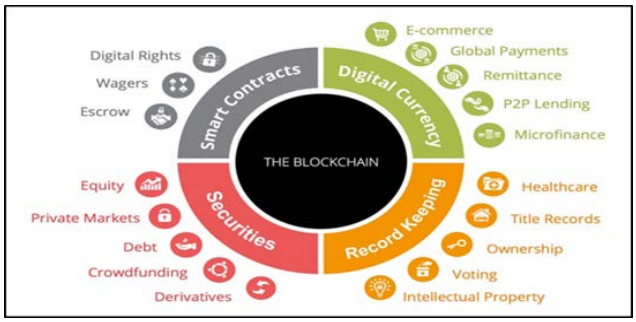

Figure (2): The Architecture of IoT E-business

BC technologies can be divided into three main types, namely; (a) Public BCs, (b) Consortium BCs and (c) Private BCs.

(a) Public BC: Where everyone can check the transaction and verifies it, and can also participate in the process of getting consensus (Bitcoin and Ethereal are good examples).

(b) Consortium BC: This means that the node that had authority can be chosen in advance; it usually has partnerships like business to business where the data in BC can be open or private and can be seen as Partly Decentralized. Both Hyper ledger and R3CEV is consortium BCs where Figure (2) shows consortium BCs.

(c) Private BC Node will be restricted where not every node can participate this Blockchain. It has a strict authority management on data access.

From the scientific point of view, no matter what type of BC, it both has advantages. Sometimes we need public BC because its convenience, but other sometimes we may need private control like consortium BC or private BC, depending on what type of service we offer or what place we use it [21].

3.2 Characteristics of Blockchain(BC)

(a) Trust' is the most important issue of the BC. The interactions between the nodes within the network ensure that trust is achieved. To facilitate transactions, the participants of a BC network rely on the BC network itself rather than relying on trusted third-party organizations. The following five properties (immutability, non-repudiation, transparency, equal rights and integrity) are the main properties which are supported in existing BCs [22].
(b) Security and Reliability: ‘‘Software Security Guidelines span every phase of the Software Development Lifecycle’’ and the ‘‘Software Reliability Engineered Testing" is a testing method encompassing the whole development process’’ [23].
(c) To ensure that the BC based systems are trustworthy, the BC must guarantee 'data integrity' and 'uniqueness' which, in the case of BOS, that of security-critical systems. In particular, there is a need for testing suites for BOS as these suites should include: Smart Contract Testing (SCT), namely specific tests for checking that smart contracts: (i) satisfies the contractors’ specifications, (ii) complies with the laws of the legal systems involved, and (iii) does not include unfair contract terms.
(d) Blockchain Transaction Testing (BTT), such as tests against double spending and to ensure status integrity [23].
(e) BC is simply a cryptographically verifiable list of Data. One of the reasons for the enthusiasm surrounding the BC is that Databases do not have any cryptographic guarantees of integrity that is guaranteed which are necessary for any database operating in an adversarial environment [24].

4 Advantages and Disadvantages of Blockchain(BC) Technology

4.1 Advantages of BC

(a) Disintermediation the core value of a BCs which enables a database to be directly shared without a central “Data Mining” instructor. The BC transactions have their own proof of validity and authorization to enforce the constraints rather than having some centralized application logic.
(b) Empowered users are in control of all their information and their transactions [25].
(c) Durability, reliability and longevity due to the decentralized networks where BC does not have a centralized point of failure and is better able to withstand malicious attacks as shown in Figure (3).
(d) The process integrity where users can trust that transactions will be executed exactly as per the protocol commands and thus removing the need for a trusted third party [26].
(e) Transparency and immutability changes to public BCs are publically viewable by all parties creating transparency; and all transactions cannot be altered or deleted and hence they are immutable.
(f) The clutter and complications of multiple ledgers are reduced by eco-system simplification with all transactions being added to a single public ledger.[27].

4.2 Disadvantages of BC

(a) Performance: BCs are always slower than centralized databases because of their nature. When a BC processes a transaction it does the same things just like a regular database does, but it carries three additional burdens as well [28].
(b) Challenges such as transaction speed, the verification process, and data limits which will be crucial in making BC widely applicable, resolves Nascent technology [29].
(c) Control, privacy and security while solutions exist, including private or permissioned BCs and strong encryption, there are still cyber security concerning the need to be addressed before the general public, will entrust their personal data to a BC solution [30].
(d) Integration concerning BC applications offer Solutions that require significant changes to, or complete replacements of, existing systems are offered by integration concerning BC applications. Companies must strategize the transaction so as to make the switch [31].
(e) A complete shift to a decentralized network which requires the buy in of its users and operators is represented by a cultural adoption of BC.
(f) Cost BC offers tremendous savings in transaction costs and time but the high initial capital cost could be limited [32].

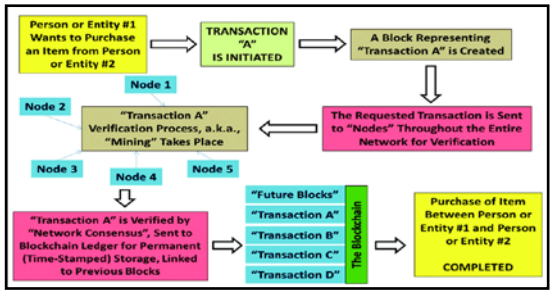

Figure (3): General Model of Blockchain

5 A Proposed Model

We have developed a framework that is a General Model of Blockchain Works for IoT “SBM IoT” (Smart E-Business Model based on Block Chain for IoT); we apply evaluation and verification Empower where users are in control of all their information and transactions tests for evaluating the Ecosystem simplification with all transactions being added to a single public ledger which reduces the clutter and complications of multiple ledgers.

From the above mentioned studies and based on the several advantages of Data Mining approaches and “transactions testing" for E-Business intrusion detection, we suggest that a combination of both approaches can help in developing a new generation of high performance IoT. In comparison with the traditional IoT, IoT based on DM “Data Mining” and "Transactions testing" is generally more precise and requires far less manual processing and input from human experts. Figure (4) shows the proposed "IoT" model based on "DM “DATA MINING”" and "transactions test ". The system is composed of the units shown in Figure (4). The proposed IoT model based on DM “Data Mining” and transactions testing

1 Computer Network Sensors: These sensors collect audit Data and network traffic events and transmit these Data to IoT units.

2 DM “DATA MINING”-IoT unit: This Unit contains different modules that employ various DM “DATA MINING” algorithms and techniques (e.g., Frequencies, hierarchy clustering model for entity Block chain for IOT etc.). Each module works independently Block chain to in the network traffic Data.

3 Transactions Test Unit: This unit deploys transactions test to detect Transaction in the network audit Data.

4 Collect detected Transaction unit: This transaction unit collects detected Transaction from DM “DATA MINING” and transactions testing units.

5 Virtualization Unit: This unit helps in monitoring and visualizing the results of transactions test units.

6 Managerial Decision-Maker: This decision-maker analyzes intrusion results, checks for negatives and positive results, takes decisions on the detected Transaction, evaluates system performance, controls system operation, checks for negatives and positive results, generates a performance report and decides if there is the need for changes/updates.

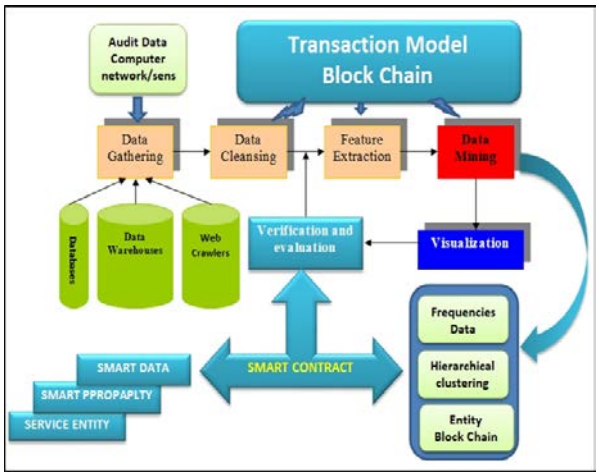

Figure 4: Proposed Model - SBM IOT “Smart E-Business Model based on Block Chain”

6 Discussions and Challenges

The Blockchain should only be deployed if it is applicable and if it provides security with better opportunities for obtaining increased revenue and reductions in cost. A Blockchain is a Data Structure used to create and share distributed ledger of transactions among a network of computers where it allows users to make and verify transactions immediately without a central authority. BC technologies contain many disciplines, e.g. Cryptography, intelligent algorithm, mathematics, and economic model, combining peer-to-peer networks and using distributed consensus algorithm to solve the traditional distributed Database synchronize problem, which is an integrated multi field infrastructure construction. The BC technologies are composed of six key elements, namely; Decentralized, Open Source, Transparent, immutable, Autonomy and Anonymity. BC technologies can be divided into three types: Public Blockchain, Private Blockchains, and Consortium Blockchain. Advantages of Blockchain Technology are: Disintermediation, Empowered users, durability, High quality Data, longevity and reliability, Process integrity, Transparency and immutability, Efficiency, Ecosystem simplification, Auditability, Transparency, Traceability, lower transaction costs, faster transactions. Nascent technology resolves challenges such as transaction speed and main benefits of Cluster Computing are queued and processed in a single location.

On the other hand, the combination of Ubiquitous Intelligent Computing (UIC), IoT and BC can be effective where BC provides a resilient distributed P2P system considering the possibility to interact with peers in an effective manner. The connected devices in ULE ecosystem are the

elements of contact with students and teacher. Indeed, we believe that the continuation of BC integration using UIC and IoT will present a substantial transformation of current ecosystems because it enhances the next generation of IoT applications considering the features of security, cryptographic, and decentralized model that can completely change the organization of our scientific and economic activities.

Unfortunately, BC is not mature enough for large-scale business deployment yet in terms of general public education and technology. Before BC can be fully adopted as a mainstream technology for real-world business solutions many barriers need to be overcome. Aside from the issues inside the BC technology such as: Lack of standards, the need for off-chain development of open system interfaces, and having intermediaries who currently profit from controlling the data to interface with BCs, are all impediments to the adoption of a BC system. Most people understand and realize the hard problems in current healthcare industry. However, BC is no elixir. To power BC applications, we need to continuously improve low-level BC protocols that are equivalent to the backbone of current internet services such as TCP/IP and HTTP. We also need to improve decision-making and trust processes in BC so that the system is more scalable with higher transactions throughput without sacrificing the security. One used way to expedite the computation of the block, is that the BC network could assign more weight into trusted nodes.

7 Conclusions and Future Work

Blockchain promises a secured distributed framework to facilitate exchanging, sharing, and the integration of information across all users and third parties as it is important for the planners and decision makers to analyze the Blackchain in depth for its suitability in their business and industry applications. The potential of Building Information Modeling methodology (BIM) to support a transformation of the processes of design and construction has been evident in the construction industry. A current topic that requires attention is the integration of Blockchain and the internet of things technologies with computational intelligence techniques where the user visualizes a virtual world through either interactive devices or a total immersion. Moreover, combining intelligent computing and machine learning and knowledge engineering paradigms with IoT where the BIM solution can address retrieving and presenting information and increasing efficiency on communication and problem-solving in interactive and collaborative E-business projects. On the other hand, Blockchain has its own issues and challenges but it is a promising technology to provide an open and secured access to all E-activities and services over IoT.

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