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# A SURVEY A HYBRID MODEL FOR CENTRAL BANK DIGITAL CURRENCY BASED ON BLOCKCHAIN

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## ABSTRACT

With the development of blockchain technology, research on digital currency is gaining popularity, especially Central Bank Digital Currency (CBDC), which is essential to the growth of a nation's economy. However, CBDC requires a more complicated system than other crypto currencies do. a stronger focus on supervision and controllable decentralization Therefore, the technical foundation that is in accordance with economic ecology, efficient consensus methods, and network architecture that conserves computer resources are essential elements of CBDC. In this study, we propose a modularity network-enabled hybrid blockchain system for CBDC. Common digital currencies are recorded using the account system, especially for numerous small payment transactions, whereas digital assets and smart contracts with major value fluctuations and low liquidity are recorded using the Unspent Transaction Output (UTXO) scheme. To boost the concurrency of this structured network, a sliced data storage solution is developed, and a modular blockchain design is recommended. The DPOS-BFT technique is enhanced based on the block chain's CBDC supervision mode, which condenses the original algorithm's two rounds of consensus into a single round. The effectiveness of this approach in speeding up consensus and transaction processing is shown in three simulated studies on scheme, network, and consensus.

**KEYWORDS:** Blockchain,Central Bank Digital Currency,Prototype System

## 1. INTRODUCTION

### 1.1 BLOCKCHAIN

Blockchain is a decentralized, unchangeable database that makes it easier to track assets and record transactions in a corporate network. An asset may be physical (such as a home, car, money, or land) or intangible (intellectual property, patents, copyrights, branding). On a blockchain network, practically anything of value may be recorded and sold, lowering risk and increasing efficiency for all parties. Information is essential to business. It is best if it is received quickly and is correct. Blockchain is the best technology for delivering such information because it offers real-time, shareable, and entirely transparent data that is kept on an immutable ledger and accessible exclusively to members of a permission network. Among other things, a blockchain network can monitor orders, payments, accounts, and production. Additionally, because everyone has access to the same version of the truth, you can see every aspect of a transaction from beginning to end, increasing your confidence and opening up new prospects.

### 1.2 CENTRAL BANK DIGITAL CURRENCY

Bank of America Digital currencies are digital tokens that are issued by a central bank and resemble crypto currencies. They are linked to the value of the fiat money used in that nation. CBDCs are being developed by several nations, and some have even put them into practice. Understanding digital currencies and what they signify for society is crucial since so many nations are looking at how to make the shift. A government-issued currency known as fiat money is one that is not backed by a tangible commodity like gold or silver. It is regarded as a type of accepted legal money for the exchange of goods and services. Banknotes and coins served as the traditional forms of fiat money, but technological advancements have made it possible for governments and financial institutions to

replace the physical form of fiat money with a credit-based system in which balances and transactions are recorded digitally.

### **1.3 PROTOTYPE SYSTEM**

Efficiency and security have grown to be crucial concerns as the long-range (LoRa) infrastructure for Internet-of-Things (IoT) applications has been developed. The LoRa system's centralized working model, in which all packages are processed and stored in the central cloud, makes it difficult to fully utilize the resources of LoRa gateways and leaves it open to security threats like data loss or falsification. On the other hand, the blockchain has the ability to provide the LoRa system a secure, decentralized architecture. Deploying blockchain at LoRa gateways with limited edge computing capabilities, however, presents considerable hurdles. In this article, a concept and implementation of the Hyper Lora, an open-source hyper ledger Fabric-based LoRa system with edge computing, are proposed.

## **2.LITERATURE SURVEY**

### **2.1 USING BLOCKCHAIN TO ENABLE AN E-KYC SYSTEM THAT PRESERVES PRIVACY AND TRUST**

The electronic know your customer (e-KYC) system, which SOMCHART FUGKEAW et.al. have suggested in this work, allows banks or identity providers to: between trusting parties, develop a mechanism for customer identification data verification. Most banks use cloud computing to create their e-KYC system because of its effective resource usage and high level of accessibility and availability. Essentially, the most important concern is the security and privacy of e-KYC-related documents that are kept in the cloud. To satisfy their security and privacy requirements, existing e-KYC platforms often rely on robust authentication and use conventional encryption. According to this paradigm, the owner of the KYC system encrypts the file using the host's key before uploading it to the cloud. This approach results in overheads for key management, communication, and encryption. In this work, we provide an innovative blockchain-based e-KYC scheme dubbed e-KYC Trust Block, which binds the client consent enforcement with the cipher text policy attribute-based encryption (CP-ABE) technique to deliver trust, security, and privacy compliance.

### **2.2 SCAVENGER HUNT: USING BLOCKCHAIN AND IOT TO CREATE A LOCATION-BASED GAME**

AHSAN MANZOOR et al., has proposed in this paper Distributed Ledger Technology, which has received a lot of attention in areas other than crypto currency. DLTs are already being used in industries such as energy, transportation, and healthcare. into their business operations Recent advancements and the growing popularity of Internet of Things (IoT) technologies, on the other hand, are enabling new and exciting ways of interaction and sensing for mobile device users. Another prominent industry that can benefit from technological advancements and has the potential to create business opportunities is mobile gaming. In this paper, we investigate the applications of Distributed Ledger Technology in mobile gaming. To that end, we have taken a location-based IoT mobile gaming use case and proposed new gaming features for the players by incorporating the DLT. Using low-power BLE beacons, we propose a platform for creating and playing scavenger hunt games. It enables smart phones to interact with predefined real-world locations, and players can observe their surroundings for "clues" in the game.

### **2.3 A SYSTEMATIC MAPPING STUDY OF BLOCKCHAIN APPLICATION FOR CENTRAL BANKS**

In this paper, NATALIA DASHKEVICH et al. propose that Blockchain is a novel technology capturing the attention of Central Banks and a technology with significant disruptive potential. However, a research effort gap between practitioners and academics appears to have emerged. This paper examines and maps that gap by examining trends in peer-reviewed research contributions via thematic categorization of academic literature on Distributed Ledger Technology (DLT) use-cases for central bank services, operations, and functions. Furthermore, this paper summarizes the opportunities and challenges for central banks arising from blockchain adaptation to each of those

use-cases. We use a Systematic Mapping Study approach to accomplish this goal. The paper provides an in-depth assessment of statistical and thematic analysis of research maturity and researcher types, with a focus on the types of central bank use-cases considered for blockchain adaptation.

#### **2.4 A DELAY-TOLERANT PAYMENT SCHEME BASED ON THE ETHEREUM BLOCKCHAIN**

YINING HU et al. proposed in this paper that digital banking as an essential service can be difficult to access in remote, rural areas where The network connection is unavailable or intermittent. Payment processors such as Visa and MasterCard It is frequently difficult to reach these remote, rural areas. Although short message service or unstructured supplementary service data messages have enabled micro-banking in some places, their security flaws and session-based nature prevent their widespread adoption. Global-level crypto currencies enable low-cost, secure, and widespread money transfer among distributed peers, but they are still limited in their ability to reach people in remote communities. We propose a blockchain-based digital payment scheme that can provide reliable services on top of unreliable networks in remote areas. We consider a scenario in which a community-run base station provides reliable local network connectivity while intermittently connecting to the larger Internet.

#### **2.5 A BLOCKCHAIN-BASED HYBRID MODEL FOR CENTRAL BANK DIGITAL CURRENCY**

JINNAN ZHANG et al. proposed in this paper the development of blockchain technology is attracting interest in digital currency research. more and more attention, particularly Central Bank Digital Currency (CBDC), which plays an important role in national economic construction. However, when compared to other crypto currencies, CBDC requires more controllable decentralization and more emphasis on supervision. As a result, the network architecture that saves computing resources, the technical scheme that is compatible with economic ecology, and efficient consensus algorithms are critical components of CBDC. In this paper, we propose a hybrid blockchain system with a modularity network for CBDC.

#### **2.6 THE NOTARIAL OFFICE IN E-GOVERNMENT: A BLOCKCHAIN-BASED SOLUTION**

In this paper, YING GAO et al. propose that the Notarial Office (NO), which works on providing various essential certificates, still relies on manual handling and requires paper materials from other government departments That brings a lot of inconvenience. The Notarial Office rejects non-local paper materials due to their lower credibility in the local market. and thus unable to provide cross-border services. It can also easily lead to sensitive information leakage. Paper copies have been saved. Because of its benefits, a blockchain-based system is appropriate for addressing challenges in this scenario (e.g, decentralized, immutability, transparency, audit ability). We built this system on top of the Hyper ledger Fabric. Furthermore, we replace manual operations with smart contracts, create extra ledgers to offload different types of transactions, and provide encryption for private information when necessary. Finally, we get the expected outcome. That is, in experiments, the modified network outperformed the unmodified network.

#### **2.7 NUTBAAS IS A BLOCKCHAIN-AS-A-SERVICE PLATFORM.**

NutBaaS: A Blockchain-as-a-Service Platform et al., has proposed in this paper Blockchain, which evolved from the Bit coin system, has piqued the interest of academics. Because of its decentralization, persistence, anonymity, and audit ability Over the last decade, blockchain technology has evolved and become viable for a wide range of applications outside of finance. However, due to the complexity of blockchain technology, it is typically difficult and costly for most developers or teams to build, maintain, and monitor a blockchain network that supports their applications. Most common developers or teams are unable to ensure the reliability and security of the blockchain system, which has an impact on the quality of their applications.

## **2.8 A FRAMEWORK FOR MAKING THE VOTING SYSTEM TRANSPARENT USING BLOCKCHAIN TECHNOLOGY**

In this paper, MUHAMMAD SHOAIB FAROOQ et al. Because of widespread distrust in the traditional voting system, democratic voting in any country is very important. People have seen their fundamental rights violated. Other types of digital voting Due to a lack of transparency, systems have been called into question. Most voting systems are not transparent enough. This makes it extremely difficult for the government to gain the trust of voters. The traditional and current digital voting systems fail because they are easily exploited. The primary goal is to resolve problems with the traditional and digital voting systems, which include any type of mishap or injustice during the voting process. Blockchain technology can be used in the voting system to ensure a fair election and reduce injustice. Physical voting systems have many flaws, and digital voting systems are not perfect enough to be implemented on a large scale. This assesses the need for a solution to ensure people's democratic rights. This article introduces a platform based on modern blockchain technology that provides maximum transparency and system reliability in order to foster trust between voters and election authorities. The proposed platform provides a framework that can be used to conduct voting activity digitally via blockchain without the use of physical polling stations. By utilizing flexible consensus algorithms, our proposed framework facilitates a scalable blockchain. The Chain Security Algorithm used in the voting system makes the voting transaction more secure. While executing a transaction in the chain, smart contracts establish a secure connection between the user and the network. The security of the blockchain-based voting system has also been discussed. Additionally, encryption of transactions using cryptographic hashes and 51% attack prevention on the blockchain has been developed. Furthermore, using Blockchain, the methodology for carrying out blockchain transactions during the voting process has been developed. Finally, the proposed system's performance evaluation demonstrates that it can be implemented on a large scale population.

## **2.9 ANALYSIS FOR THE EVALUATION AND SECURITY MANAGEMENT OF A DATABASE IN A PUBLIC ORGANIZATION TO PREVENT CYBER ATTACKS**

According to SEGUNDO MOISÉS TOAPANTA et al., in data handling, security and privacy are essential for database administrators and users. own their data For databases, information about security models or architectures was examined. Reduce cyber-attacks The issue is that security models used in public-sector databases are ineffective. suffer from computer attacks due to flaws in their security management systems Data providers frequently publish information for research purposes; however, publishing compromises the privacy of the data of users registered in the entities. There are many database security techniques based on data encryption processes in transactions; however, the techniques discovered compromise information. The document was created using the deductive method and an exploratory research technique, which allows us to study the information in the articles presented. In this document, we proposed a Security Model Assessment Prototype for Databases, a Prototype of Security Management Architecture in Blockchain for a Database, a Database Security Algorithm, a Logical Structure of the Management System in Blockchain, and a Prototype to mitigate cyber attacks.

## **2.10 BLOCKCHAIN AS A CYBER DEFENSE TOOL: OPPORTUNITIES, APPLICATIONS, AND CHALLENGES**

In this paper, SUHYEON LEE et al. propose that targets of cybercrime are not limited to the private sector. Successful cyber attacks on nation-states have demonstrated that cyber threats can jeopardize vital national interests. In response, Nation-states have begun to address cyber threats at the national defense level, dubbed "cyber defense." Because cyber defense is linked to national security, it necessitates strong security technology. In contrast to traditional systems, blockchain provides strong security properties without a centralized control entity, and as such, its application in the cyber defense field is receiving attention. In this paper, we discuss the opportunities blockchain provides for cyber defense, research and national projects, and limitations. From 2016 to 2021, we conducted a survey of government documents, interviews, related news, technical reports, and research papers.

As a result, our research contributes to closing the gap in blockchain for cyber defense by conducting systematic research and analysis.

### **2.11 A BLOCKCHAIN-BASED SOLUTION TO REDUCE OVERPRODUCTION AND UNDERCONSUMPTION OF MEDICAL SUPPLIES**

DIANA HAWASHIN et al. have proposed in this paper that billions of dollars have been lost over the last decade due to overproduction and waste. Underuse of medical supplies Overproduction and under consumption are usually caused by the Current healthcare supply chain systems lack accountability, transparency, traceability, audit, assessment, security, and trust. It is necessary to ensure that everyone receives an equitable share of medical supplies while avoiding unnecessary waste. In this paper, we propose a blockchain-based solution that ensures the commitment and accountability of all participants, preventing them from producing unnecessary waste. To perform the waste assessment accurately and fairly, we use five phases: registration, commitment, production, delivery, and consumption. We create four smart contracts that automatically record all actions on an immutable ledger while ensuring data provenance, transparency, security, and accountability. To address the large data problem, we use off chain decentralized storage. We present five algorithms and discuss each phase of the proposed solution, including full implementation, testing, and validation details. We conduct security audits to ensure that our smart contracts are secure and free of vulnerabilities and flaws. The smart contract code is publicly available on GitHub.

### **2.12 A BLOCKCHAIN-BASED TRUSTED UPLOAD SCHEME FOR INTERNET OF THINGS NODES**

Yulei Jiao et al. proposed in this paper In recent years, the theory and method of swarm intelligence based on the Internet have emerged as the primary research field of the new millennium. Internet of Things (IoT) generation (IoT). Both play a fundamental and supporting role in other IoT research fields. With the spread of popularity Massive swarm intelligence data, as well as the development of crowd network systems, have posed unprecedented challenges to traditional centralized data management. The most prominent is the issue of privacy and security. Given the ease with which source data can be tampered with and stolen, as well as the lack of a credit guarantee mechanism in information sharing, a blockchain-based trusted uploading scheme of IoT nodes is proposed. It performs trusted design from three dimensions of node hardware, transmission link, and platform and provides relevant references for similar designs. As a result, swarm intelligence research can not only advance AI theory and technology, but also serve as a driving force for the entire information society's application, management, system, and business innovations.

### **2.13 UNCOVERING THE DARK WEB WITH MULTILAYER BITCOIN ADDRESS CLUSTERING**

MINJAE KIM et al. propose in this paper that Bit coin is the most widely used crypto currency for illegal trade in current dark net markets. Even though transaction flows are globally visible due to the anonymity of its addresses, Bit coin. Clustering is still one of the most difficult and open problems in illegal Bit coin transaction analysis. To address this issue, we propose a novel multi-layer heuristic algorithm for Bit coin clustering that takes advantage of both on-chain transactions and off-chain application data in the real world. To accomplish this, we first investigated the distinctive characteristics of dark net market ecosystems, including their trading systems. We discovered that some dark net market review data disclosed transactions containing Bit coin value and item delivery information after conducting an in-depth analysis of the data manually collected for 11 months.

### **2.14 A TRUST-BASED HIERARCHICAL CONSENSUS MECHANISM FOR CONSORTIUM BLOCKCHAIN IN SMART GRID**

In this paper, Xingguo Jiang et al. proposed As the smart grid evolves, an increasing number of connected devices provide a variety of trading data. This raises higher standards for secure and efficient data storage Traditional centralized data management does not work. Meet the prerequisites listed above currently; smart grid with traditional consortium blockchain can solve the aforementioned issues. However, when faced with a large number of nodes, existing consensus algorithms frequently perform poorly in terms of efficiency and throughput. In this paper, we propose

a trust-based hierarchical consensus mechanism (THCM) to address this issue. First, we create a hierarchical mechanism to improve efficiency and throughput. Then, intra-layer nodes use an improved Raft consensus algorithm, while inter-layer nodes use the Byzantine Fault Tolerance algorithm. Third, we propose a trust evaluation method to improve the Raft election process. Finally, we build a prototype system to test the performance of THCM. The results show that consensus efficiency is improved by 19.8%, throughput is improved by 12.34%, and storage is reduced by 37.9%.

### **2.15 PROOF OF DELIVERY SMART CONTRACT FOR PERFORMANCE METRICS**

YASH MADHWAL et al. proposed in this paper The expansion of enterprise blockchain research supporting supply chain management calls for investigating their impact and being mindful of their design, use cases, and pilots This paper contributes to learning about performance measurement and the transaction costs implications during the development and application of smart contracts by using a blockchain design for Proof of Delivery (Pod) process management. An experimental design science approach is used to create an open-source blockchain to investigate ways to make delivery processes more efficient, proof of delivery more reliable, and performance measurements more accurate. The Transaction Costs Theory is used to assess the cost implications of using smart contracts in Pod management. The findings show that smart contracts improve delivery processes and make proof of delivery more reliable. However, the methods and metrics are too complex and qualitative, limiting the smart contract's ability to measure performance. Our findings point to the possibility of lowering transaction costs by implementing a blockchain-based performance measurement system.

### **2.16 SELF-RENEWAL CONSORTIUM BLOCKCHAIN BASED ON PROOF OF REST AND STRONG SMART CONTRACTS**

Wenyu Shen et al. proposed in this paper this paper proposes a new consensus method for the business alliance scenario in blockchain. Proof of rest (PoR) mechanisms and strong smart contracts the block structure and logic of PoR consensus are described In addition, a consortium blockchain system that supports strong smart contracts is being developed. We modify the difficulty value algorithm based on proof of work (PoW) and add adjustable parameters. The longer a node rests after creating a block, the easier it is to create another new block, hence the term PoR. The penalty for slack nodes, the joining and quitting of nodes, and the adjustment of the expected block creation time can all be accomplished using strong smart contracts, allowing the consortium blockchain to self-renew. Block chains' core technology consists primarily of cryptographic algorithms and consensus mechanisms. The rudiments of these technologies appeared as early as the last century and are gradually maturing. This paper focuses on consortium blockchain and proposes a new consensus mechanism called proof of rest (PoR), which has specific authorization and access conditions. When a little competition is introduced, blocks can be quickly created. Furthermore, the system throughput is high, and the network requirement for reaching a consensus is low, so it has some advantages in the business alliance scenario.

### **2.17 OVERVIEW OF BLOCKCHAIN DATA ANALYSIS FROM THE PERSPECTIVE OF COMPLEX NETWORKS**

Wanshui Song et al. proposed in this paper Crypto currency based on blockchain technology has gradually become a popular investment option, and many users have contributed to the collection of massive transaction data. Researchers can mine and analyze data in blockchain because of the complete transaction records and openness of data. Network modeling and analysis of crypto currency transaction records are common methods in blockchain data analysis. The analysis of attribute graphs can provide insights into various economic indicators, illegal activities, and general Internet security, among other things. As a result, the purpose of this article is to summarize and analyze the literature on crypto currency transaction data from the perspective of complex networks. To provide systematic guidance for researchers, we proposed a blockchain data analysis framework based on an introduction to the relevant background and reviewed the work from five perspectives: blockchain data model, data acquisition on blockchain, existing analysis tools, available insights, and common analysis methods. For each aspect, we introduce the research problems, summarize the methods, and discuss

the results and findings. Finally, we discuss future research directions and open questions in the study of crypto currency transaction networks.

### **2.18 BLOCKCHAIN FOR DISTRIBUTED ENERGY RESOURCE MANAGEMENT AND INTEGRATION**

SERGIO CANTILLO-LUNA et al. proposed in this paper that power grids all over the world are transitioning to a decentralized structure. Given its security, integrity, decentralized nature, and required infrastructure, blockchain technology is emerging as a potential solution for technical, deployment, and decentralization issues. Furthermore, blockchain technology provides excellent features such as non-repudiation and immutability, making it a promising application for DER integration and management of reliability factors. This paper presents a comprehensive review of blockchain applications for DER management and integration. First, a blockchain-based literature review of research activities in the DER integration area and related tasks, including entrepreneurial efforts, is conducted. Following that, the various opportunities and challenges of DER integration and management in power grids, such as centralization, regulatory support, and development costs, are discussed. Finally, some key research challenges and opportunities for applying blockchain technology to DER integration and management issues are presented.

### **2.19 SEARCHABLE ENCRYPTION SCHEME WITH PRIVACY PROTECTION BASED ON PUBLIC AND PRIVATE BLOCKCHAINS**

Ruizhong Du et al. proposed in this paper while users benefit from the convenience of cloud data outsourcing, they also face the risks of data modification and private information leakage. Searchable encryption technology can perform keyword searches over encrypted data while protecting their privacy and ensuring the data's integrity by verifying the search results. However, some related issues remain, such as low verification efficiency and uncontrollable query results. As a result, this paper proposes a Privacy-Preserving Searchable Encryption (PPSE) scheme based on public and private block chains. First, we store an encrypted index in a private blockchain while outsourcing corresponding encrypted documents to a public blockchain. The encrypted index is used to find the encrypted documents. This method can reduce blockchain storage overhead while also improving transaction execution efficiency and data security. Furthermore, we use a smart contract to implement a secondary verification access control mechanism and restrict data users' access to the private blockchain via authorization to ensure data privacy and the correctness of access control verification. Finally, the security analysis and experimental results show that, when compared to existing schemes, the proposed scheme not only improves the security of encrypted data but also guarantees query efficiency.

### **2.20 BLOCKCHAIN ORACLES: STATE-OF-THE-ART AND FUTURE RESEARCH DIRECTIONS**

In this paper, SHAHINAZ KAMAL EZZAT et al. propose that blockchain interoperability is an innovative feature of blockchain technology that is rapidly evolving, gaining traction in various fields. Enterprise block chains have not yet seen widespread adoption. Achieved because blockchain networks are isolated islands that cannot connect or exchange assets and/or information. Furthermore, because of the lack of connectivity between the block chains, smart contract execution is limited to on-chain executions only. This paper aims to conduct a comprehensive and thorough literature review on blockchain interoperability, with a special emphasis on blockchain Oracles as state-of-the-art. Oracles have demonstrated potential as an emerging technology that has revolutionized the blockchain ecosystem by acting as agents that fetch external information into the blockchain ecosystem. A detailed comparative discussion of various blockchain interoperability techniques is presented, highlighting the strengths and weaknesses of each technique. The shortcomings of these techniques in comparison to Oracles are identified, as well as how Oracles have succeeded in overcoming many of these limitations. Furthermore, the literature lacks a focus on the most recent market solutions that use blockchain Oracles, and only a few studies have examined them in depth. This gap has been filled through an in-depth examination of the most

recent market solutions that have used Oracles in recent years. Finally, design issues attempting to achieve Oracle best practices, future directions.

Imrus Salehin et al., have suggested in this study An Artificial Intelligence Based Rainfall Prediction Using LSTM and Neural Network [21] The most challenging problem of meteorology is to forecast rainfall. In this work, we suggested a model for predicting the amount of rainfall that can be easily computed utilising artificial intelligence and LSTM approaches. This is a sophisticated method for calculating rainfall. The deep learning strategy is particularly beneficial for this sort of method implementation, as seen by its accuracy. A long short-term memory technique is used to assess memory sequence data, compute prior data quickly, and generate the best forecast. Because the majority of the population in this country rely on agriculture, this forecast method is critical. A timely rainfall assessment will boost crop yields and lower agricultural expenditures. Taking all of these elements into account, we developed our model, which will assist us in determining the quantity of rainfall. To do this, we gathered data from six different areas. We used six factors to forecast (temperature, dew point, humidity, wind pressure, wind speed, and wind direction). We achieved 76% accuracy in our job after examining all of our data. For the best results, we also use a large dataset of long-term weather data.

Anomaly Detection on IoT Network Intrusion Using Machine Learning [22] Zhipeng Liu et al., have argued in this research that improving the security of IoT networks is one of the most pressing concerns confronting the information technology sector. With significant numbers of IoT devices being created and deployed, it is difficult for these devices to interact securely without sacrificing performance. The limitations occur because most IoT devices are power restricted, limiting their processing performance. As a result, using encryption and authentication to protect against harmful cyber-attacks is problematic. The intrusion detection system (IDS) logically rises to the top of the security food chain. Anomaly-based network intrusion detection is critical in protecting networks from various hostile activity. In this study, we use several machine learning techniques to detect abnormalities in the IoT Network Intrusion Dataset. The findings are encouraging, as we were able to reach 99%-100% accuracy while being very efficient.

Prashant Mhaskar et al. proposed in this paper Fault-Tolerant Control of Nonlinear Processes: Performance-Based Reconfiguration and Robustness [23]. This work considers the problem of control system/actuator failures in nonlinear processes subject to input constraints and presents two approaches for fault tolerant control that focus on incorporating performance and robustness considerations, respectively. In both techniques, a family of possible control configurations for the process under evaluation is defined initially, characterised by various controlled inputs. The construction of a Lyapunov-based predictive controller that guarantees closed-loop stability from an explicitly described set of beginning circumstances is used to integrate performance considerations initially (computed using an auxiliary Lyapunov-based nonlinear controller). A hierarchical switching policy is developed that uses stability considerations (evaluated by the presence of a state in a control configuration's stability region) to determine the suitability of a candidate backup configuration, and then performance considerations are used to choose between the suitable backup configurations. Following that, we look at the challenge of applying fault-tolerant control to nonlinear systems that include input limitations and uncertainty. To that purpose, for each possible control configuration, we first construct a robust hybrid predictive controller that assures stability from an explicitly specified set of beginning circumstances, subject to uncertainty and limitations. The activation/deactivation of the constituent control configurations is then orchestrated using a switching policy.

In the dynamic and competitive world, technology has transformed the speed of all industries. Artificial intelligence is a technology that allows the industry to expand at a quicker rate while also effectively completing their task. This technology has spread to different areas such as finance, human resources, marketing, and manufacturing. The AI system has helped the company to improve its current performance and conduct activities more effectively on a daily basis. People working at various managerial levels are currently working under pressure and realising the necessity for



artificial intelligence at the workplace owing to the dynamic and competitive environment. The authors conducted the study using quantitative research, and the data was analysed using regression methods. AI as a technology plays a part in several HR processes, beginning with talent acquisition and progressing through analysing people's performance at work. This research will investigate the relationship between artificial intelligence and HR functions, as well as the many activities done by the HR department. The goal is to comprehend factors like as innovativeness and how HR operations are used.

Salvatore Gaglio et al. suggested a method for detecting human behaviours using information detected by an RGB-D camera, notably the Microsoft Kinect, in this study. Our approach is based on the estimation of some relevant human body joints using the Kinect; three different machine learning techniques, namely K-means clustering, support vector machines, and hidden Markov models, are combined to detect the postures involved in an activity, classify them, and model each activity as a spatiotemporal evolution of known postures. Experiments were carried out on the Kinect Activity Recognition Dataset, a novel dataset, as well as the CAD-60, a publicly available dataset. Our technique outperforms four related research based on RGB-D image fusion, hierarchical Maximum Entropy Markov Model, Markov Random Fields, and Eigenjoints, in that order. The results we obtained, i.e., precision/recall of 77.3% and 76.7%, and the capacity to distinguish actions in real time, indicate promise for practical use.

### 3. COMPARATIVE ANALYSIS

Title	Techniques & Mechanisms	Parameter Analysis	Future Work
Enabling Trust and Privacy-Preserving e-KYC System Using Blockchain	In our scheme, the privacy of both customers' identity documents stored in the cloud is guaranteed by the symmetric key and public key encryption while the sensitive transaction data stored in the blockchain is encrypted by symmetric key encryption and CP-ABE	Our proposed scheme delivers secure and decentralized authentication and verification of the e-KYC process with the user's consent enforcement feature	. For future works, we will test a larger sample of data in the real cloud environment and measure the throughput of the system in accommodating high number of e-KYC registration and verification requests.
Scavenger Hunt: Utilization of Blockchain and IoT for a Location-Based Game	A locationbased game that utilizes IoT beacons and DLT was developed for exploratory purposes, its architecture was described and the smart contract algorithms utilized in it were described.	y Hyper ledger Fabric's write frequency. In addition, the performance of BLE beacons was evaluated, and it was concluded that their slow and irregular detection latency posed an impediment to player experience	In the future, we plan to address the issues and challenges identified. We plan to extend the proposed system with an implementation on a different blockchain platform e.g. EOSIO blockchain

Blockchain Application for Central Banks: A Systematic Mapping Study	A critical discussion point in this review is the understanding of which exact areas and functionality of the central banking business is under the academic lens of interest.	The purpose of this mapping study was to examine existing peer-reviewed publications concerning the influence of blockchain technology on the business of central banks.	Signaling a knowledge gap for future exploration by researchers and practitioners.
A Delay-Tolerant Payment Scheme Based on the Ethereum Blockchain	We then validated the proposed system through prototype implementation on a private Ethereum tested and demonstrated the practicality of system design using off-the-shelf laptops and mobile devices.	We proposed a blockchain-based payment scheme for intermittently connected regions	A Delay-Tolerant Payment Scheme Based on the Ethereum Blockchain
A Hybrid Model for Central Bank Digital Currency Based on Blockchain	The nodes on the POW network compete for ledger writing via complex and meaningless calculations.	To solve the problem of block forks, the period of producing each block cannot be too short. But this can cause a decrease in transaction processing speed.	Therefore, performance, compatibility, and security may become hidden issues in the future.
The Notarial Office in E-government: A Blockchain-Based Solution	proposes an electronic certificates sharing system based on consortium blockchain to address the challenges of cross-border government services, especially in terms of audit ability, efficiency, and privacy.	proposes an electronic certificates sharing system based on consortium blockchain to address the challenges of cross-border government services, especially in terms of audit ability, efficiency, and privacy.	our future work is communication on inter-blockchain. It can help to improve the efficiency and saving the space of storing transactions.
NutBaaS: A Blockchain-as-a-Service Platform	Blockchain has received more and more attention because of its potential to decentralize, disintermediate, and enable 'trustless' interactions	We also introduce some more advanced technical services, such as IdentityChain technology and smart contracts security vulnerability detection.	In the future, our work can be extended in different aspects: Transparency of blockchain deployment and runtime
A Framework to Make Voting System Transparent Using Blockchain Technology	The Chain Security Algorithm is also added, which automatically verifies the validity of the chain each time a new block is added to it.	The proposed framework has a promising output based on the performance evaluation of blockchain technology in VMS.	The proposed framework has a promising output based on the performance evaluation of blockchain technology in VMS.

Analysis for the Evaluation and Security Management of a Database in a Public Organization to Mitigate Cyber Attacks	The security assessment prototype provides public organizations with better management of system resources	prototype of the proposed architecture on a hybrid blockchain model provides an optimal security system for public organizations	In the future, we proposed the application of database security systems for countries with high rates of cyber attacks in public organizations in Latin America.
Blockchain as a Cyber Defense: Opportunities, Applications, and Challenges	Blockchain technology is one of the emerging technologies for security in defense. It has a decentralized nature, so a blockchain ensures data processing integrity.	We provided a scope of cyber defense and reviewed blockchain research and development trends under the defined cyber defense.	Therefore, it is a significant future work to obtain evaluated data from blockchain in defense environments.
A Blockchain-Based Solution for Mitigating Overproduction and Under consumption of Medical Supplies	we proposed a blockchain-based solution to mitigate the medical supplies waste caused by their overproduction and under consumption in a manner that is decentralized, accountable, auditable, traceable, secure, and trustworthy	Each phase of the proposed solution is discussed in detail, including implementation details, testing, and validation	In the future, we aim to deploy and test our proposed solution on the real Ethereum network and build an end-to-end DApp.
A Blockchain-Based Trusted Upload Scheme for the Internet of Things Nodes	Based on the scheme, the risk of access from illegal equipments to the data platform is effectively curbed, ensuring the legitimacy of IoTs data source.	Compared to traditional centralized data storages, the blockchain-based data platform greatly reduces the risk of privacy disclosure and deliberate tampering, solves the bandwidth bottleneck, and greatly improves the scalability of data storage.	Finally, the trusted design in three dimensions effectively prevents malicious users from taking illegal means to obtain the raw data, thus improving the credibility of users' access to the data, and protecting the native value of the data.
Get off of Chain: Unveiling Dark Web Using Multilayer Bit coin Address Clustering	we propose a multi-layer Bit coin address clustering method using both blockchain-layer and application-layer information to resolve the false-negative problem associated with existing heuristics.	We propose a multi-layer Bit coin address clustering method using both blockchain-layer and application-layer information to resolve the false-negative problem associated with existing heuristics.	Our method achieved 100% precision and 89.2% recall rates without producing any false positives, demonstrating its potential efficacy in the real world.

<p>A Trust-Based Hierarchical Consensus Mechanism for Consortium Blockchain in Smart Grid</p>	<p>In the proposed approach, the nodes in the network are layered, and different algorithms are applied between layers and within layers, respectively.</p>	<p>In the proposed approach, the nodes in the network are layered, and different algorithms are applied between layers and within layers, respectively.</p>	<p>In the future, we intend to test the THCM in realistic In the future, we intend to test the THCM in realistic</p>
<p>Proof of Delivery Smart Contract for Performance Measurements</p>	<p>Blockchain, distributed ledger technologies, and smart contracts applied to SCM are in the early stages of technological maturation and adoption.</p>	<p>The DLT capabilities include the management of delivery processes, delivery performance measurement, automated payoffs, and dispute resolutions.</p>	<p>Future developments might include using private keys to encrypt information instead of relying on a trusted third party as a funded escrow arbitrator</p>
<p>Self-Renewal Consortium Blockchain Based on Proof of Rest and Strong Smart Contracts</p>	<p>We used Alibaba Cloud and Tencent Cloud to build the consortium blockchain</p>	<p>The system can automatically punish the slack nodes, update the parameters, and increase or decrease the number of nodes, which achieves the self-renewal of the consortium blockchain.</p>	<p>We used Alibaba Cloud and Tencent Cloud to build the consortium blockchain</p>
<p>Blockchain Data Analysis from the Perspective of Complex Networks: Overview</p>	<p>crypto currency transaction network and, based on the effective analysis and mining of the transaction network, propose more deanonymization and entity detection methods.</p>	<p>we also propose a blockchain data analysis framework and present a detailed process for acquiring</p>	<p>Future work can further explore the dynamic characteristics and evolutionary laws of the crypto currency transaction network</p>
<p>Blockchain for Distributed Energy Resources Management and Integration</p>	<p>The issues associated with security, privacy and resilience, derive from the P2P energy trading on the grid as an alternative for managing and integrating DER, even under unexpected disruptive events</p>	<p>Overall, the blockchain research revealed a greater scope in DER integration and management processes</p>	<p>future path of its development, where scalability, standardization of mechanisms, support at the policy level, and development costs are the main issues, where a joint effort at the level of regulation and technological progress is needed.</p>
<p>Privacy-Preserving Searchable Encryption Scheme Based on Public and Private Block chains</p>	<p>Traditional privacy-preserving SE schemes rely on cloud servers to complete search operations.</p>	<p>Using the blockchain itself to store data can obtain correct and immutable results.</p>	<p>The Future results obtained concerning our prototype demonstrate the practicability of our scheme.</p>

Blockchain Oracles: State-of-the-Art and Research Directions	This will ensure that one avoids the major drawbacks of attempting to implement one's own Oracles, such as long delays, increased costs, and possibly serious security issues.	They ensured that every node across the entire network had the same ledger copy. The proof of work and proof of stake were the earliest consensus algorithms proposed for block chains.	Finally, design issues trying to achieve the best practices of Oracles, future directions, and identified research gaps are highlighted
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### 5. CONCLUSION

The proposal is for a hybrid blockchain system for CBDC that is revolutionary on three levels: technological scheme, network design, and consensus mechanism. The method for the issue, circulation, and return of CBDC is described below. This plan is fully designed. When compared to UTXO, this hybrid model of UTXO and account improves processing rate by 16.4%. The network architecture also improves transaction processing performance by 26.3%. The consensus algorithm has been Updated, increasing the consensus speed by more than 51.8%. There are still some issues to work out. For example, due to experimental circumstances and staffing limits, the implementation of smart contracts and related experiments has not been carried out. As a result, further tests must validate the optimization impact of smart contracts theory. Furthermore, we did not investigate how the system may be used for currency control and investment at the national policy level. Despite the fact that it is not a technological issue, it is one of the study areas focusing on digital money systems.

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