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DESIGN AND DEVELOPMENT OF A VEHICLE SAFETY DETECTION AND ALARM SYSTEM

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ABSTRACT

A smart city is one that uses digital technologies and other means to improve the quality of life of its citizens and reduce the cost of municipal services. Smart cities primarily use IoT to collect and analyze data to interact directly with the city's infrastructure and monitor city assets and community developments in real time to improve operational efficiency and proactively respond to potential problems and challenges. Today, cybersecurity is considered one of the main challenges facing smart cities. Over the past few years, the cybersecurity research community has devoted a great deal of attention to this challenge. Among the various technologies being considered to meet this challenge, Blockchain is emerging as a solution offering the data security and confidentiality essential for strengthening the security of smart cities. In this paper, we propose a comprehensive framework and architecture based on Blockchain, big data and artificial intelligence to improve smart cities cybersecurity. To illustrate the proposed framework in detail, we present simulation results accompanied by analyses and tests. These simulations were carried out on a smart grid dataset from the UCI Machine Learning Repository. The results convincingly demonstrate the potential and effectiveness of the proposed framework for addressing cybersecurity challenges in smart cities. These results reinforce the relevance and applicability of the framework in a real-world context.

Introduction

In the digital age, everything is connected as part of the growing and accelerating digital transformation of modern societies, which involves all kinds of sectors and human activities such as education, healthcare, economy, energy, etc. Urban communities, and even some villages, are benefiting from the technologies and solutions available through digital transformation to engage in all kinds of smart city initiatives to put them at the service of sustainable, resilient and inclusive socio-economic development. The smart city achieves efficiencies, promotes sustainability, and improves the quality of life for its residents through the integration of technology. Planning for a smart city is essentially about bringing the Internet of Things (IoT) to scale. The Internet of Things (IoT) is the network of physical terminals, objects, incorporating software, connectivity, sensors, etc., to connect to other systems on the internet and exchange data to provide proper management and monitoring of city infrastructure and operations. Driven by the growing urban population, IoT and ICT are the main pillars of smart cities to improve their efficiency as well as the lives of their citizens [1], [2]. A smart city needs technological efficiency in areas as diverse as transportation and mobility, services, communication, security, citizen relations, etc. The implementation of IoT-based applications within cities allows for the optimization of: energy control, building performance, street furniture management, waste disposal, mobility,

etc. The beneficiaries are citizens, consumers, private companies and local authorities [3]. By offering increasingly digitized services, smart cities are becoming ever more connected but also more exposed to cyber risks and cyber-attacks. Data collection is essential in IoT-based applications and services that are considered key assets for monitoring and operating smart cities. Therefore, managing data across the smart city infrastructure is a big challenge given all the connected devices involved and their different architectures and urban data must be protected throughout its lifecycle. However, the main challenge is to protect IoT infrastructures throughout their deployment [4]. In this case, an important question arises, namely: how to transfer all data quickly, securely and without third-party intermediaries? The use of the Blockchain within Smart Cities would allow a more controlled governance by reappropriating personal data that would no longer be controlled by intermediaries. It offers the possibility of encrypting and securing the information transmitted while ensuring its traceability and maintaining its anonymity. In addition, it optimizes the interconnection of all the services offered in the city but also provides real-time information on mobility (e.g., vehicles used, routes taken, etc.), energy, waste management, etc., [5], [6]. The blockchain is a distributed system based on a sequence of blocks allowing the storage and transmission of information. One of the advantages of blockchain technology is the traceability of all transactions, as well as its operation without a central controlling authority, which makes it decentralized, secure and transparent. Cryptography helps users to validate information, thus ensuring its authenticity [7]. The members chosen in the blockchain to manage the technical structure of the implementation are paid for their role in checking, verifying and validating the consistency with other information in the blockchain. Once verified and validated the block is time-stamped and added to the blockchain. Everyone can then view and access this information, but not modify it. In case of an error, it will be corrected by a new transaction [8]. Smart contracts present a computer equivalent of the paper contract, they are usually deployed on a blockchain and refer to irrevocable computer programs that execute specific instructions that must be followed. During the execution of the smart contract, all verification steps are recorded in the blockchain used, a process that prevents modification or deletion after the fact, thus protecting and securing all data [9]. Artificial intelligence (AI) enables machines to replicate human cognitive abilities such as reasoning, language, perception, etc. It also refers to the ability of computers and robots to perform intelligent tasks without requiring human intervention. With machine learning (ML) methods, AI analyzes data to organize information and learn to solve problems, but in rule-based or logic-based systems, problem solving is programmed by humans. Both AI and blockchain are being leveraged to build smart cities based on dataintensive applications. As a result, they can help smart cities achieve ‘‘data sovereignty’’ and improve data security, with traceable and secure transactions, preventing situations such as misuse cases and data leakage [10]. Among the ML libraries, Spark’s Mllib has succeeded in making ML simple and scalable. It is a machine learning library that enables high-speed, high-quality analysis of algorithms. The various tools it provides are: ML algorithms that include classic machine learning algorithms such as regression, classification, collaborative filtering and clustering. Characterization which includes feature extraction, transformation, dimensionality reduction and feature selection. Pipelines, which allows for the evaluation, construction and tuning of ML pipelines. Persistence, which offers saving, loading of algorithms, models and pipelines to reduce time and effort. Also, utilities such as data processing, statistics, linear algebra, etc. Smart cities IoT

platforms collect, process and distribute data in large quantities. Such massive data streams require another level of computing power to be analyzed and processed in real time. Today, the focus should be on making better use of existing infrastructure and data. The massive volume of data generated by smart cities requires that it be collected, managed, and analyzed to provide useful information, functionality and insight. This presents cities with a new challenge: controlling, moving, and restoring their data anytime, anywhere [11], [12]. Moreover, there are thousands of IoT devices in smart cities which interact with each other and implement complex applications [13]. However, the use of Big Data could improve the services they provide in different areas. AI algorithms such as machine learning play an important role in Big Data analysis and present accurate analysis of realtime data. However, designing and implementing AI and ML-based Big Data analytics has inherent challenges in terms of data security, privacy and centralized architecture. Integrating blockchain technology into smart cities is essential to overcome these challenges. Hence, by integrating these technologies, we could overcome these challenges and provide an effective solution for cyber-secure smart cities. Therefore, the proposed research mainly presents a blockchain-based cybersecurity approach for smart cities while covering other topics on how data collected by IoT devices should be managed using big data and AI techniques and approaches

Literature survey

M. Shen, X. Tang, L. Zhu, X. Du, and M. Guizani, "Privacy-preserving support vector machine training over blockchain-based encrypted IoT data in smart cities," IEEE Internet Things J., vol. 6, no. 5, pp. 7702–7712, Oct. 2019.

Machine learning algorithms based on deep Neural Networks (NN) have achieved remarkable results and are being extensively used in different domains. On the other hand, with increasing growth of cloud services, several Machine Learning as a Service (MLaaS) are offered where training and deploying machine learning models are performed on cloud providers' infrastruture. However, machine learning algorithms require access to the raw data which is often privacy sensitive and can create potential security and privacy risks. To address this issue, we present CryptoDL, a framework that develops new techniques to provide solutions for applying deep neural network algorithms to encrypted data. In this paper, we provide the theoretical foundation for implementing deep neural network algorithms in encrypted domain and develop techniques to adopt neural networks within practical limitations of current homomorphic encryption schemes. We show that it is feasible and practical to train neural networks using encrypted data and to make encrypted predictions, and also return the predictions in an encrypted form. We demonstrate applicability of the proposed CryptoDL using a large number of datasets and evaluate its performance. The empirical results show that it provides accurate privacy-preserving training and classification. Machine learning algorithms based on deep Neural Networks (NN) have attracted attention as a breakthrough in the advance of artificial intelligence (AI) and are the mainstream in current AI research. These techniques are achieving remarkable results and are extensively used for analyzing big data in a variety of domains such as spam detection, traffic analysis, intrusion detection, medical or genomics predictions, face recognition, and financial predictions [9, 10, 24, 27, 32, 38, 44, 54]. However, training the models requires access to the raw data which is often privacy sensitive and can create potential privacy risks. Furthermore, with increasing growth of cloud services, machine learning algorithms can be run on the cloud providers' infrastructure where training and deploying machine learning models are

performed on cloud servers. Once the models are deployed, users can use these models to make predictions without having to worry about maintaining the models and the service. In a nutshell, this is Machine Learning as a Service (MLaaS), and several such services are currently offered including Microsoft Azure Machine Learning [33], Google Prediction API [16], GraphLab [18], and Ersatz Labs [12].

A.Sharma, E. Podoplelova, G. Shapovalov, A. Tselykh, and A. Tselykh, "Sustainable smart cities: Convergence of artificial intelligence and blockchain," Sustainability, vol. 13, no. 23, p. 13076, Nov. 2021,

Smart cities are boosting sustainability. It is an urgent and global trend. The study addressed the Smart Sustainable Cities (SSCs) considering the recent local and global constraints. It focused on the Egyptian context as a scope because of the absence of this trend in it, despite its potential opportunities. The paper was divided into two sections; the first was a theoretical approach to the SSCs definitions and concepts. It also framed the SSCs skeleton. Then, the SSCs planning and management's guidance followed this approach. Moreover, the paper pointed out to some experiences in the developing countries and the Arabic context. The second section was the applied study. It aimed to develop a road-map about embarking the SSCs in the Egyptian scope, as a step to transfer the vision to reality. Then, it identified the local challenges and opportunities, followed by the key pillars needed for that transformation. Finally, the paper extracted the actions required to transforming the Egyptian cities to be smart and sustainable in the reality. Nowadays, smart cities are emerging in many countries to handle urban sustainability issues. It tries to solve many essential problems like traffic, pollution, crowding, energy, water, and poverty by using Information and Communication Technology (ICT). The pressure on resources and the size of the challenges that cities face needs to evolve solutions to boost the city's livability. It needs a citywide secure, smart, and flexible transformation. Adopting ICT transformation is a key choice that states should rely on. That mitigates many of the risks and challenges they are facing. So, government leaders should build up a road-map for building smart cities. It harnesses the capabilities of the integrated ICT. It extends to not only create real social, economic, environmental opportunities, and save lives, but to achieve sustainability. So, SSCs choice is no longer just an option but essential . In Egypt, SSCs as a notion is still new. So, this paper is not set for technical people specifically. However, it meant the governmental chiefs and policymakers at the highest level in general, and in urban development specifically. It aims to clear the Egyptian SSCs vision by giving guidelines for their leaders about the shifting. Then, it should set a strategic plan for the future of urban development to the smart cities age. The smart city's technical definition is a physical space in which ICT is widespread and supports a new growth. In addition, it depends on the virtualization in the new dimensions of modern, sustainable, and smart planning; where it aims to drive cities towards compatibility with the resources and sustainability needs to reduce urban entropy. Thus, a smart city offers aspiration to mend environmental, social, and economic levels. These form the main pillars of sustainability. Thus, it boosts sustainable urbanism.

O. S. Neffati, S. Sengan, K. D. Thangavelu, S. D. Kumar, R. Setiawan, M. Elangovan, D. Mani, and P. Velayutham, "Migrating from traditional grid to smart grid in smart cities promoted in developing country," Sustain. Energy Technol. Assessments, vol. 45, Jun. 2021, Art. no. 101125.

customers' steadily increasing usage of power equipment causes a mismatch among requirements and supply, which presents a growing issue for power generation. Energy management is an essential tool in minimizing large supply-side shortages and boosting power effectiveness. The present practice in energy systems emphasizes lowering the total price of electricity without restricting use by deciding to decrease electricity usage during peak timings. The aforementioned problem calls for the creation and advancement of an adaptable & moveable technology that serves a broad range of clients and maintains the overall energy balance. The goal of the Intelligent Electricity Management Solution seems to be to compensate for an energy loss of electricity in a territory with managed part-load reduction that caters to consumption habits. The execution of experiments conducted is demonstrated under the assumptions of a power storage occurrence, the maximum demand restriction using various scenarios, and adjusting the preference allocated to each equipment. In Intelligent Power Management System (IPMS), there are price-optimization techniques depending on the duration of use and flexibility using detector information elements. A home location network with efficient ZigBee connectivity has been constructed, and an IoT framework has been created for predictive analytics and archiving. In a popular era, electrical energy has become an important concern. By 2041, it is anticipated that the present worldwide proportion of electric power in the overall power consumption would rise to between 22 and 28 percent.

BUZZERS

In common parlance a Buzzer is a signaling device that is not a loudspeaker. It can be mechanical, electromechanical, or electronic (a piezo transducer). BeStar produces Buzzers in every available configuration for a wide variety of applications. A Piezo transducer can produce the sound for panel mount buzzers, household goods, medical devices and even very loud sirens. When a lower frequency is required an electromagnetic buzzer can fill the need. These are very common in automotive chimes and higher end clinical diagnostic devices. The BeStar buzzer range includes self drive units with their own drive circuitry (indicators), or external drive units, which

allow the designer the flexibility to create their own sound patterns.

CONCLUSION

In this paper, we present a comprehensive and efficient approach for strengthening smart cities cybersecurity. Using blockchain, big data and artificial intelligence algorithms, this approach offers a robust and a reliable framework for smart cities data security and privacy. This framework was illustrated using a real dataset on smart grid, demonstrating its efficiency and reliability. By focusing on data confidentiality, integrity and availability, our approach allows to guarantee a secure environment for smart cities, their infrastructures and services while improving their resilience to cyber-attacks. In addition, this approach fosters mutual trust among the smart cities stakeholders and strengthens citizens confidence and engagement in smart cities applications and services.

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