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# Blockchain based Hybrid Network Architecture for the Smart City

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**Abstract:** Recently, the concept of "Smart Cities" has developed considerably with the rise and development of the Internet of Things as new form of sustainable development. Smart cities are based on autonomous and distributed infrastructure that includes intelligent information processing and control systems, heterogeneous network infrastructure, and ubiquitous sensing involving millions of information sources. Due to the continued growth of data volume and number of connected IoT devices, however, issues such as high latency, bandwidth bottlenecks, security and privacy, and scalability arise in the current smart city network architecture. Designing an efficient, secure, and scalable distributed architecture by bringing computational and storage resources closer to endpoints is needed to address the limitations of today's smart city network. In this paper, we propose a novel hybrid network architecture for the smart city by leveraging the strength of emerging Software Defined Networking and blockchain technologies. To achieve efficiency and address the current limitations, our architecture is divided into two parts: core network and edge network. Through the design of a hybrid architecture, our proposed architecture inherits the strength of both centralized and distributed network architectures. We also propose a Proof-of-Work scheme in our model to ensure security and privacy. To evaluate the feasibility and performance of our proposed model, we simulate our model and evaluate it based on various performance metrics. The result of the evaluation shows the effectiveness of our proposed model.

**Keywords-** Internet of Things, Smart City, Blockchain, Software Defined Networking

## 1. Introduction

The Internet of Things (IoT) envisions and offers a promising future for traditional Internet industries and societies, and the realization of smart cities is tightly bound to the IoT outlook. By deploying low-cost sensors and various types of smart objects to collect data in public infrastructure, a smart city increases operational efficiency, shares information with the public, and improves the quality of life, cost of living, and government services as well as the environment [1] [2] [3]. Nowadays, the biggest wave of urbanization around the world and people are moving toward cities because of economy growth and social transformation. Recently, the United Nations has predicted that 86% of developed countries and 64% of the developing countries will be urbanized by 2050 [4]. Gartner's report forecast that 30% of smart cities' healthcare applications will have robotics and smart machines, and 10% of smart cities will use streetlamps as the backbone for a network of smart cities by 2020 [5]. Such implies that billions of devices and systems will be integrated in the future, ranging from end-user devices to smart transportation, healthcare, industry, buildings, and environments. Thus, the de facto expectation for a network of smart cities is to analyze a huge volume of data generated by IoT devices, increase security and privacy, realize optimal use of network bandwidth to avoid congestion, support real-time applications, etc.

Recently, blockchain technology has attracted the attention of many stakeholders in many industries such as agriculture, cryptocurrency, supply chain, etc. IoT technology and blockchain technology are felt throughout our daily lives. The Gartner report predicts that \$ 3.1 trillion in business value will be added by 2030 [6]. By taking advantage of the blockchain technique in the IoT network, we can offer new ways to automate business processes without the need for costly and complex centralized IT infrastructure. This will help us build trust between devices and users, reduce the risk of falsification and cost, eliminate middlemen, and shorten the transaction settlement time. To simplify business processes, realize significant cost savings, and improve the user experience, blockchain-based IoT solutions are ideally suited. On the other hand, Software Defined Networking (SDN) is gaining prominence among technologies for its disruptive quality. As an emerging network architecture, it decouples control of the

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