



Smart City IoT System Network Level Routing Analysis and Blockchain Security Based Implementation

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Abstract

This paper demonstrates, network-level performance analysis and implementation of smart city Internet of Things (IoT) system with Infrastructure as a Service (IaaS) level cloud computing architecture. The smart city IoT network topology performance is analyzed at the simulation level using the NS3 simulator by extracting most of the performance-deciding parameters. The performance-enhanced smart city topology is practically implemented in IaaS level architecture. The intended smart city IoT system can monitor the principal parameters like video surveillance with a thermal camera (to identify the virus-like COVID-19 infected people), transport, water quality, solar radiation, sound pollution, air quality (O₃, NO₂, CO, Particles), parking zones, iconic places, E-suggestions, PRO information over low power wide area network in 61.88 km × 61.88 km range. Primarily we have addressed the IoT network-level routing and quality of service (QoS) challenges and implementation level security challenges. The simulation level network topology analysis is performed to improve the routing and QoS. Blockchain technology-based decentralization is adopted to enrich the IoT system performance in terms of security.

Keywords IoT technology · Smart applications · Network simulation · Blockchain technology

1 Introduction

Because of its impressive performance and great potential, the IoT technology's role in the design of smart systems is thrived in many fields like smart cities [1–3], medical [4–6], aquaculture [7–9], industry [10–12], and smart home [13]. Industry 4.0 is aimed at mass customization and cyber-physical cognitive systems, in that IoT technology proved its ability and significance. When compared with RFID and smart device technology IoT plays a vital role in exploring smart applications [14].

The IoT device users count is growing rapidly as shown in Fig. 1, and this is the major motivating point for many kinds of researchers to choose IoT as a major domain of research [15]. However, the major research challenges in the implementation of IoT systems are maintaining high throughput, less delay, low power consumption, low path loss, good packet receive rate, quality of service (QoS), congestion

control, reliability, heterogeneity, scalability, high security, and best network routing [16, 17]. The network-level IoT topology simulation helps to make the implementation cost-effective and the incorporation of blockchain technology in IoT will make the system more secure and sturdy [18].

The present-day civil people are using more and more IoT devices and there is a significant demand for smart IoT systems like the design of smart transport, smart building, smart home, smart business [19], and smart grids [20]. However, the development of smart city applications using IoT is one of the potential research areas. Nowadays IoT systems for smart cities monitor viruses (like COVID-19) spread which is very essential. The vital smart city parameters are video surveillance, transport, water quality, solar radiation, sound pollution, air quality (O₃, NO₂, CO, Particles), parking zones, iconic places, E-suggestions, and public relational officer (PRO) information as shown in Fig. 2.

The sensor, network, and implementation level challenges of a smart city-based IoT system as listed in Table 1. Identifying the best IoT routing topology for a smart city with good quality of services (QoS) is one of the network-level potential research challenges. Before the implementation,

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