Chapter 18

Future Perspective of Quantum Cryptography for Smart Cities of the 21st Century

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ABSTRACT

Maintaining security in smart cities and various smart applications has become a most challenging research domain to provide secure access to the society. Exposure of digital data to intruders can easily happen through different smart gadgets knowingly or unknowingly. To ensure security, the role of quantum cryptography is essential in this regard. Quantum cryptography is achieved by utilizing the polarization property of photon and quantum key distribution (QKD). In contrast to a classical computer, quantum computers achieve exponential speedup through reversible operations with the intention to provide security without compromising processing speed in smart applications. In this chapter, concepts, features, and technologies of smart cities are presented. Next, the important role of quantum computing in security with quantum key distribution protocols are explained. This chapter presents an algorithm of encryption and secret key to give the insights of QKD protocol. The chapter concludes with future directives of QKD in smart cities.

INTRODUCTION

Information and communication technology (ICT) is used in smart cities to increase operational effectiveness, share information with the public, and improve the quality of public services and citizen welfare (Anuj Tiwari & Kamal Jain, 2014). Technology is used by smart cities to offer services to their residents. Data collection involves the use of numerous technological techniques and sensors. The insights gained from the data obtained aid in operationally improving waste disposal, utility delivery,

traffic flow, environmental management, and social service management. City officials can monitor the city in real-time and communicate easily with the population thanks to the usage of information and communication technology.

A well-developed and smart infrastructure with quality housing, education, and healthcare are given the highest priority in the smart city. A smart city must provide better habitation and provide better employment options to boost the economic growth of society. It should look forward to providing reliable and cost-effective measures with increased critical services. The resources of a smart city must be managed effectively to prevent depletion. Lastly, a smart city must have an improved transit network connectivity with the internet and proper use of cutting-edge technologies to serve community needs. These characteristics set smart cities apart from ordinary cities to serve as models for other towns looking to upgrade their infrastructure and spur urban economic growth. In India five cities, New Delhi, Hyderabad, Pune, Bhubaneshwar and Coimbatore are already identified with a few features. A brief discussion about these is presented in the following.

i.   *New Delhi:* In the Nation's capital, the Smart city welfare society exists to meet a city's needs for smartness. Roadways and metro rail offer better connectivity between different parts of the city. Along with government agencies, many private Information Technology (IT) and non-IT businesses also provide employment opportunities. There are numerous schools, colleges, hospitals, recreational clubs, and offices within 5 miles of the city center. Living in the city is made comfortable by the well-developed infrastructure (The Smart Cities Mission in Delhi, n.d). New Delhi's improved sanitization, energy distribution, and water delivery system have raised the value of living there.

ii. *Hyderabad:* Hyderabad has emerged as one of the nation's IT centers in recent years. It was regarded as the country's second smartest city. It serves as the state of Telangana's capital. Hyderabad has gained popularity in recent years due to the affordable and availability of land. Jobs, education, hospitality, medical facilities, and other industries have all developed quickly. These factors combine to make Hyderabad the ideal city for comfortable living (IT, Electronics and Communications Department, n.d).

iii. *Pune:* Pune is quickly rising to the top of the list of preferred cities for both residential and commercial purposes because to advancements in the IT sector, increased connectivity, and public transit. In and around Baner, Pune, there are more than 500 IT and non-IT businesses. Popular neighbourhoods in the city include Dhayari-Narhe-Ambegaon BK, Hadapsar, Wakad, Dhanori-Lohegaon, Pimple Saudagar, and Wagholi. The retail spaces and apartment developments cater to homebuyers with a middle-class and modest income (What makes Pune a Smart City, n.d). The future Metro train in Pune as well as buses from Pune Mahanagar Parivahan Mahamandal Limited (PMPML) are planned as part of the city's smart city initiative.

iv. *Bhubaneshwar:* It serves as the state of Odisha's capital. It is listed as a Smart City in the "Social" category. The school system in socially astute Bhubaneshwar is well run. A single city portal is very effective at controlling the city and solving problems in the neighborhood. For managing the traffic, there is a functional traffic control center and adaptive traffic light system. The local children's Sensory Park and Splash Park are now open for business (Bhubaneshwar Smart City Limited, n.d).

v.   *Coimbatore:* One of the smartest cities in the nation is Coimbatore, well known as the energy city of India. This city is the ideal place to live to its amenities. As a result, energy resources are managed sustainably. The project for this city's "smart cities" falls under broad headings such as

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