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Real-Time Secure Communication for Smart City in High-Speed Big Data Environment

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Abstract— The recent development in the technology brings the concept of Smart City that is achieved through real-time city related intelligent decisions by analyzing the data harvested from various smart systems in the city using millions of sensors and devices connected over the Internet, termed as Internet of Things (IoT). These devices generate the overwhelming volume of high-speed streaming data, termed as Big Data. However, the generation of city data at a remote location and then transmitting it to central city servers for analysis purpose raises the concerns of security and privacy. On the other hand, providing security to such Big Data streaming requires a high-speed security system that can work in a real-time environment without providing any delay that may slow down the overall performance of the Smart City System. To overthrown these challenges, in this paper, we proposed an efficient and real-time Smart City security system by providing strong intrusion detection at intelligent city building (ICB) and also a security protocol to protect the communication between the remote smart system(RSS)/User and the city analysis building, i.e., ICB. The proposed communication security protocol consists of various phases, i.e., registration phase, session key exchange phase, session key revocation phase, and data transmission phases from RSS to ICB as well as from User to ICB. Vast security analyses are performed to evaluate the credibility of the system. The proposed system is also evaluated on efficiency in terms of computation cost and throughput of overall functions used in the system. The system's evaluation and the comparative study with existing system show that the prosed system is secure, more efficient, and able to work in a real-time, high-speed Smart City environment.

Index Terms— Smart City, Big Data, Internet of Things (IoT), Communication Security, Cyber Security.

1. INTRODUCTION

With the advancement in IoT technology, smart systems, and Big Data analytics, the world is evolving to be smarter. The modern era is now turning from smart systems to Smart City. Urban planning [1] and development Smart City applications have a major impact on the life of citizens [2, 3]. It includes the effect on the citizen regarding health and safety, disaster management, pollution control, and so on so forth. Smart City provides the environment where people are facilitated anytime and anywhere for anything; people are more secure and safe from theft, robbery, assaults and other crimes as well as from external environments, such as pollution. Smart City has a neat and clean environment, good sanitation system, a lot of parking areas at proper places, parking and cycling tracks, and much more. Resultantly, people living in the Smart City are intelligent and have good health. Industries, roads, houses; all are constructed in an ideal way at proper locations with suitable structures. Number and location of roads and parking space fulfill the present and future demands of the citizens. The city has no scarcity of resources. All resources needed, such as energy, water, etc., are pre-measured and managed beforehand. The Smart City also has safety from natural disasters, such as floods, tsunami, thunderstorms, heavy rains, earthquakes, etc. Even though we cannot escape from such disasters, however, if any disaster happens, the city has the technology to detect them in advance (in some cases) and take precautionary measures to save the citizens' life.

All of the Smart City services mentioned above can be achieved through real-time analyses of city data. The city data is harvested by millions of interconnected devices, sensors services, and smart systems [4] over the Internet, which generate terabytes of high-speed streaming data, termed as Big Data. A similar concept is followed using the IoT paradigm and the Big Data for urban planning. Thus, providing real-time city-information to citizens as well authorities and analyzing such amount of high-speed streaming data to make intelligent decisions is a major challenge solved by the Smart City System.

Irrespectively of all the benefits provided by a Smart City to all the public, the legal and social aspects of a citizen's ''right to privacy'' are entangled with the challenge of cyber security. If all the city information including the people information, their mobility, living style and behavior, as well as the city assets information are public over the Internet without any security measure, it will create a disastrous security threat to the people and the country as overall. E.g., the vehicular movement is also monitored by Smart City, which can predict