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Secure Healthcare Data Aggregation and Transmission in IoT–A Survey

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ABSTRACT Internet of medical things (IoMT) is getting researchers' attention due to its wide applicability in healthcare. Smart healthcare sensors and IoT enabled medical devices exchange data and collaborate with other smart devices without human interaction to securely transmit collected sensitive healthcare data towards the server nodes. Alongside data communications, security and privacy is also quite challenging to securely aggregate and transmit healthcare data towards Fog and cloud servers. We explored the existing surveys to identify a gap in literature that a survey of fog-assisted secure healthcare data collection schemes is yet contributed in literature. This paper presents a survey of different data collection and secure transmission schemes where Fog computing based architectures are considered. A taxonomy is presented to categorize the schemes. Fog assisted smart city, smart vehicle and smart grids are also considered that achieve secure, efficient and reliable data collection with low computational cost and compression ratio. We present a summary of these scheme along with analytical discussion. Finally, a number of open research challenges are identified. Moreover, the schemes are explored to identify the challenges that are addressed in each scheme.

INDEX TERMS IoT, healthcare, smart medical devices, fog computing, data aggregation, security, compression.

I. INTRODUCTION

Internet of Things (IoT) comprise of smart devices to exchange information with each other [1]. Multiple intelligent sensory elements and wearable smart devices contribute to develop IoT [2] and play a vital role in fields like healthcare, mining, buildings, cities, agriculture, transportation, Industries and automated systems [3]. In healthcare, smart medical devices connect peoples and smart objects which makes life easy and simple [4]. Internet of Medical Things (IoMT) is becoming an essential element in healthcare. It provides smart services for healthcare by collecting various types of information and transmitting it to cloud repositories [5], [6]. IoMT joins everything in smart healthcare. Therefore, a green [7] solution is required to overcome the several challenging issues in recent strategies of IoT based smart healthcare [8]. Medical devices provide remote monitoring of patient to improve the quality and efficiency of patient medical treatment [9]. Patient sensor devices transmit health information to nearby smart collector devices or servers. Medical networks ensure patient safety, organize patient information and provide timely critical health information in emergency situations [10]. In the application of healthcare, many miniaturized devices are exploited for healthcare data collection. Hence, their secure transmissions should be also discussed. For example, [11] proposes secure transmission protocols in wearable devices. Reference [12] develops an effective authentication scheme for promising battery-free implanted devices on human bodies. In this Context, cyber physical systems (CPS) are also used in social services, especially in healthcare-based applications. It enhances the quality of medical care and extensively reduces the healthcare cost [13]. In health monitoring, patients' health related data is transmitted towards the cyber world to process and analyze huge amounts of data in real time [14]. In this situation, an improved computing frameworks are required to dynamically integrate both real and cyber aspects of medical cyber physical systems (MCPS) [15]. Real time monitoring

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