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Performance Evaluation Of Wireless Sensor Network (WSN) In 5g Infrastructure: A Review

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Abstract – In *the coming decades Wireless Sensor Network (WSN) becomes very significant part of our daily lives **,** Today sensors are everywhere. The major limitations of WSN are resource insufficiency in terms of bandwidth, and energy, coverage and rout optimality [**10**]. Under this background, 5G emerges to introduce advanced key technologies aiming at achieving around 1000 times the system capacity, 10 times the SE, EE and transmission data rate . When 5G will finally realized, the problem will become more complex than that in traditional simplified WSNs. [1]. Many researchers has been gradually investigated the issue of energy and security approaches in 5G including WSNs and remains an open are for research and improvement [2]*

Keywords- *WSN , 5G, SE, EE.*

INTRODUCTION

WSN has very important application in various fields like environment and habitat monitoring, building automation, disaster and waste management, infrastructure monitoring etc. Today sensors are everywhere. There are sensors in our vehicles, in our smart phones, in factories and even in the ground monitoring soil conditions etc. The research on wireless sensor networks (WSNs) started back in the 1980s, and it is two decades that WSNs generated an increased interest from different prospective like industrial and research . This is due to the availability of less expensive, low powered small scale components like processors, radios energy and sensors that were often integrated on a single chip [**11].** WSN consist of hundreds to thousands of low-power sensor nodes, operating in an unattended environment, with limited resources. These sensor nodes have the ability to communicate either among each other or directly to a base station.[4**] .** The sensor nodes are usually scattered in a sensor field, as shown in Figure 2 (Akyildis et al., 2002). All the sensor nodes has capabilities to collect the data and route the data towards a sink node. Routing is obtained by a multihop infrastructure-less architecture through the sink. The sink may communicate with the task manager node via Internet or satellite. So, the data can be accessed by the users The major limitations of WSN are resource insufficiency in terms of bandwidth, and energy, coverage and rout optimality [**10**]. According to the current studies for WSNs either in homogeneous or low level heterogeneous networks, they are not able to function in highly dynamic IoT systems with a large range of user scenarios. With the popularization of smart devices and rapid development of internet services, it has been predicted that the traffic flow of mobile data traffic will increase a thousand-fold till the year of 2020. As video and audio services are becoming more and more popularized nowadays, the high definition and bigger volume characteristics of graphic and voice services needs higher data transmission rate. And, even with substantially higher transmission rate and traffic flow, perfect user experience are expected to be achieved as the same level with fixed internet service to meet the real-time demands. The rapid increasing trend of mobile data services and traffic flow motivates new technologies bringing higher spectrum efficiency (SE), higher energy efficiency (EE) and denser cell deployment. Under this background, 5G emerges to introduce advanced key technologies aiming at achieving around 1000 times the system capacity, 10 times the SE, EE and transmission data rate. In the future, 5G will evolve into a new ultra dense distributed cooperating and self-organized network, with joint radio resource allocation technologies employed by different heterogeneous systems for the purpose of improving resource utilization and system performance. This new network architecture and consequent key technologies carry new challenges to system-level simulation methodologies and frameworks for 5G systems adaption. Firstly, from the perspective of internal storage demand and simulation speed, more complex parameter configuration, larger temporal data storage demand, enormous interacting information of users, more diverse performance evaluation metrics require the application of large scale antennas [2]. Secondly, updation in traditional network architecture is needed for reducing the interference distribution situation,. Thirdly, the distributed coordination and self-organized network make the modification of 4G simulation tools like resource scheduling and beam forming necessary[5]. When 5G will finally realized, the problem will become more complex than that in traditional simplified WSNs. [1]. Many researchers has been gradually investigated the issue of energy and security approaches in 5G including WSNs and remains an open are for research and improvement [2]

RELATED WORK:

1) In the paper title "Security Comparison Between Dynamic & Static WSN for 5G Networks" authors proposed that Static and Dynamic WSNs are rated in terms of energy consumption, accuracy and routing path length. TRMSim-WSN used for implement and simulates static and dynamic WSNs. This job experiments consisted of 100 WSNs whose nodes were randomly distributed over an area of 100 square units. Of the nodes, requesting 100 times a certain service and applying a specific trust and/or reputation. Number of sensors used in the simulation is 50 and simulated for 100 executions. Another assumption in this simulation, every node only knows its neighbours within its RF range. Simulation parameters and default values used in the experiments are Number of executions 100 Number of networks 100, Minimum number of sensors 50, Maximum number of sensors 50, Clients (%) Variable, Malicious nodes (%) 20, Plane (units) 100 , delay between simulated networks 0 Radio range 12, Security threats used Collusion and oscillating and Number of executions 100. Results prove that dynamic networks are consumes less energy than static networks. However, static networks more accurate than dynamic networks. Data move from source to destination in shortest path in dynamic networks compared to static ones

2) In the paper titled "A Survey of Clustering Techniques in WSNs and Consideration of the Challenges of Applying Such to 5G IoT Scenarios" authors proposed that a general-to-specific review of clustering algorithms in WSNs was conducted. The services provided by existing algorithms were analyzed from four QoS angles: network lifetime, transmission reliability, network latency, and the QoE awareness perspective. Upon this analysis and the comparison, several findings have been revealed. 1) Limited work concerns network coverage when evaluating network lifetime. 2) Latency awareness and transmission reliability are not well supported in clustering. 3) User scenario/profile awareness has drawn little attention in current clustering research. 4) Limited work shows interest for clustering in heterogeneous networks with high degree of diversities.

3) A separate network architecture for indoor and outdoor communication system have proposed. Some of the major technologies such as Massive MIMO and visible light communication are also discussed. An article in communication magazine has described the impact and potential of five technologies and they are device centric architecture, millimeter wave, massive MIMO, smart device and M2M communication that could bring a revolutionary impact on design and concept of 5G

4) A HAP system for WSN application in 3G cellular network has researched, where the HAP system was used to replace the sink node. The proposed two HAP-WSN system configurations for different applications, as follows:

a. Sensor nodes in the HAP cell transmit directly to HAP .**b.** Sensor nodes in HAP cells are arranged in a cluster, where one node with a higher level energy compared to other nodes is appointed the cluster head. The sensor nodes acting as cluster members will collect and send information to the cluster head, which will subsequently send all the data to HAP. Both scenarios were simulated, and their performances were evaluated. The performance indicators evaluated was the ratio of energy bit to noise spectral density ratio (Eb/N0). From the simulation result and performance evaluation (Yang and Mohammed, 2008), it appears that Eb/N0 on HAP-WSN single-cell scenario is larger than the one on HAP-WSN multiple-cells scenario. According to the implementation of HAP-WSN system to replace the sink nodes in a WSN has the following advantages:

a. Reduced complexity of multihop transmission and high energy efficiency

b. Low cost

5) Based on a WSN, a new coverage detection technology of a 5G mobile communication network was proposed. Because the sensor nodes can collect information in real time, the purpose of network coverage detection can be achieved anytime and anywhere, and it can satisfy the needs of network multiple coverage detection in the test and trial phase of a 5G mobile communication network. The proposed algorithm simultaneously performs estimations based on RSSIs received by sensor nodes; thus, the requirements of the base station antenna are low. For a conventional omnidirectional antenna or a smart antenna with a narrow beam of adjustable direction, the algorithm has good applicability. To ensure the completeness of 5G wireless coverage area detection, the coverage detection technology applies Kriging interpolation to realize the network coverage detection in the target area. The algorithm is primarily composed of three modules: data collection and processing, Kriging interpolation, and network coverage performance generation. Data collection and processing primarily includes performing the target area division, interpolation points selection, RSSI data collection, and data preprocessing. Kriging interpolation primarily includes calculating the variation function values of the sample data set and performing the variation function curve fitting and the interpolation points RSSIs estimation. Network coverage performance generation primarily includes combining the data that were collected by the sensor nodes and estimated by the interpolation points to generate the signal contour line of a 5G mobile communication network. The signal contour line is similar to the contour line in geography. This article defines this line as a closed curve of each point on a topographic map, where the signal strengths are equal. The map can intuitively display the coverage performance of a 5G mobile communication network.

6) Simulation of Smart Home Networks with Cognitive Radio Wireless Propagation Mode Cognitive Radio Pre-coding and Modulation Model. At the basic, technical level it has been illustrated that deploying CRs in smart homes offer ways to handle the smart homes key challenges which are interferences and wall penetration losses for a limited power budget. Simulations have been performed to answer the questions raised in the introduction about what power performance can be achieved with a CR solution under different conditions. These simulations compare a commonly used SHN with a 5G based on CRs with OFDM pre-coding. It has been found that the CR approach provides considerable power savings compared to the commonly used SHN approach.

7) The by using. By using Clustering algorithm , Enhanced Energy Efficient Multipath Routing (EEEMR) Protocol is implemented to improve the quality of service parameters like Throughput, Packet Delivery Ratio, Delay, Overhead and Energy of wireless sensor networks . After comparing with existing system the Throughput is increased around 35%, Packet Delivery Ratio is increased around 13%, Delay is decreased around 40%, Overhead is decreased around 40% and Energy consumption is decreased around 13%. The network life time of wireless sensor network is increases based up on Quality of Service parameters.

8) The possibility of integrating WSN with IoT through the use of LTE / 5G capabilities. In order to do this, the characteristics of WSN traffic and compare this with the regular traffic that is normally supported in LTE networks was studied. A network model for the purposes of our evaluation was presented. Based on Gauss - Markov network traffic model, in this case variables S (speed), D (direction), length (L), width (W), certainty of uncertainty was studied. With this is generated graphic to compare packages vs nodes, packages vs time of sensing and Bytes by unit of time (1s) and consolidate in a table the parameters: rate of loss of errors of packages, budget of delay of the package (ms), priority in range of (1-9) exchanging the order and type of resource (GBR and Non-GBR). The results are compared for the priority of the package The simulation results show that the boss of traffic generated from a WSN differs significantly the one that rests regularly for LTE. This difference in the

boss of traffic illustrates the need of a new design technology of programming LTE to provide the QoS needed for the traffic WSN.The mobile networks of new generation or 5G that migrate 4G/LTE. They would have speeds of 10.000 Mbps which serious 10 times faster than the LTE.

9) The existing empirical foliage attenuation models with the acquired attenuation values in a forest site for 5G WSN planning and deployment in forest areas was compared . The early Weissberger models show very poor accuracy in these environments. The reasons could be low antenna height, climatic factors like humidity, oxygen and also low transmitting power 16 dBm considering the benchmarks of WSN applications. The expected 5G frequencies (15GHz,28GHz, and 38GHz) radio wave propagation in forest environments have been investigated. Results showed that the NZG showed good accuracy for prediction of attenuation at 15GHz (for both in-leaf and out-ofleaf) and FITU-R for the remaining frequencies. The highly desirable prediction models that are needed are the models, which do not require complex computation and specific site geometry details. FITU-R model showed satisfactory accuracy for the higher frequencies. Our contributions in this work towards attenuation due to foliage in forest environments will be very valuable to WSN planners for high date rate applications at 5G frequencies which are going to flourish in next few years.

CONCLUSION

In order to integrate WSN with IoT through the use of 5G capabilities we studied different related work and will try to optimize the problems of existing technology by replacing it with 5G infrastructure.

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