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Performance Analysis of Multiple Access Techniques for LTE system under Symbol Error Rate (SER) Calculation

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Abstract— *In the recent years, so many technologies in multiple access trends have influenced the field of Wireless Sensor Networks in significant ways. Various trends are readily available technology of ubiquitous wireless sensor networks as well as wireless communication networks and progress in the development of two multiple access techniques are compared in this scenario: the OFDMA and SC-FDMA. The OFDMA and SC-FDMA transceivers are modeled and simulated considering both the interleaved and localized subcarriers mapping schemes. WSNs have the potentiality to connect the physical world with the virtual world by forming a network of sensor nodes. To prolong the network's hop in terms of single and two hop using both techniques should be used in the sensor nodes. The minimization of computing and storage platforms as well as the development of novel micro sensors and sensor materials with high reliability force encourages technology in research on WSN. In this paper, we will proposed the field of multipath routing in wireless sensor networks, and mainly focus on the technology of SER of WSNs.*

Keywords— WSN, multithreading, communication between nodes, SC-FDMA, OFDMA, SER.

I. INTRODUCTION

Multipath routing is one of the promising schemes to improve availability. Recent advances in wireless communication technologies and the manufacture of inexpensive wireless devices have led to the introduction of low-power wireless sensor networks. The Internet takes an increasingly central role in our communication infrastructure. This model consists of a single user transmission scenario, in which the UE is directly connected to the BS as shown in Figure 1-1. Two multiple access techniques are compared in this scenario: the OFDMA and SC-FDMA. The OFDMA and SC-FDMA transceivers are modeled and simulated considering both the interleaved and localized subcarriers mapping schemes. Although WSNs have huge advantages over wired ones, in any critical scenarios like disaster, military attacks, flood and cyclone, earthquake etc, the sensor network infrastructure may breaks down. To overcome these limitations researchers are working on ad-hoc and WSNs. SER of Sensor nodes is an important parameter in WSNs; many routing strategies are applied in WSNs to overcome the Energy issue.

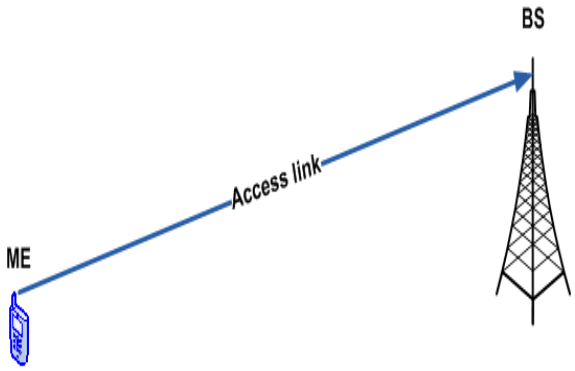

Fig.1.1: One Hop Model.

Relay Assisted Transmission Model (Two Hops Link): In this scenario a RN is introduced between the UE and the BS, which breaks the direct link between the UE and the BS into two high quality wireless links (two hops) as depicted in Figure 1-2.The RN operates in half duplex mode, in first time slot the RN receives the transmission from UE and in second slot the received data is transmitted/forwarded to the BS. The RN operates according to detect and forward strategy. Both the localized and interleaved subcarriers mapping schemes are studied for SC-FDMA and OFDMA techniques in the two hops scenario.

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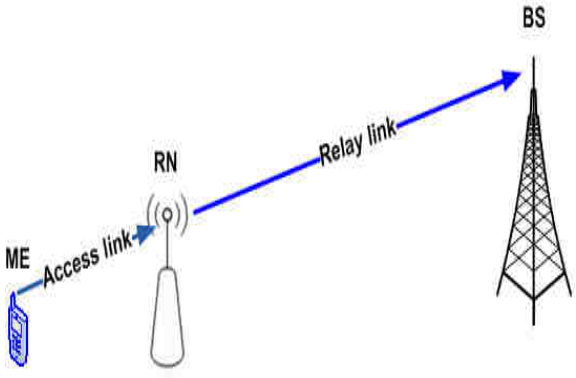

Fig.1.2: Two Hops Model.

II. TECHNIQUES & ALGORITHMS BRIEFING

A wireless sensor network (WSN) deployed for detection applications has the distinguishing feature that the sensors cooperate to perform the detection task. Therefore, the decoupled and maximum throughput design approaches typically used to design communication networks do not lead to the desired optimal detection performance. Recent work on decentralized detection has addressed the design of media access control (MAC) and routing protocols for detection applications by considering independently the quality of information (QoI), channel state information (CSI), and residual energy information (REI) for each sensor. However, little attention has been given to integrate the three quality measures (QoI, CSI, and REI) in the system design. In this work, they present a cross-layer approach to design a QoI, CSI, and REI-aware transmission control policy (XCP) that coordinates communication between local sensors and the fusion centre, in order to maximize the detection performance. They formulated and solved a constrained non-linear optimization problem to find the optimal XCP design variables, for both ALOHA and time-division multiple access (TDMA) sensor networks. They shown the detection performance gain compared to the typical decoupled and maximum throughput design approaches, without utilizing additional network resources. Also they compared ALOHA and TDMA MAC schemes and shown the conditions under which each transmission scheme outperforms. In this paper, they pursued a cross-layer, model-based approach to design a single-hop ALOHA and TDMA WSNs deployed for detection applications. They developed an integrated model for the detection system that includes the communication network, sensing, and energy models. They considered the QoI, CSI, and REI quality measures in the design process. They designed a complete transmission control policy that includes the transmission probabilities, communication rate, and energy allocation for each sensor. They have shown in their results that a significant performance increase over the decoupled and maximum throughput design approaches with equal energy allocation scheme, for both ALOHA and TDMA networks [3].

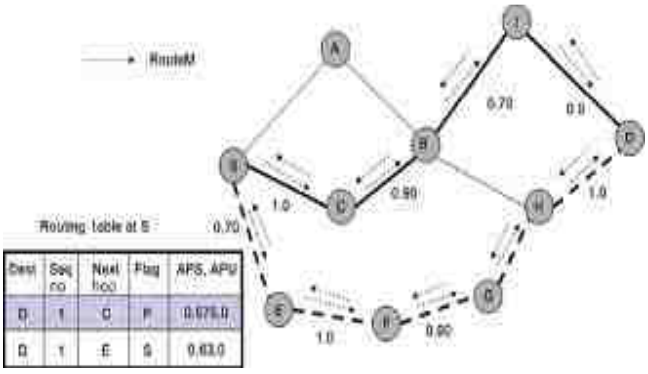

Fig.2.1: Routing table marking node table & time consumption with shortest path selection

Routing techniques involved in WSN that considers both static and mobile sensor nodes. They have thrown light not only on routing protocols which might vary based on the implementation and network architecture, but also on future directions of research on development of routing protocols for WSN. They explained in their research that WSN Protocol suggested which can be classified as Non-architecture based and Architecture based. Routing protocols without a specific architecture (DSR, PEGASIS) are more suitable for WSNs with small deployment areas since a Multi-hop routing mechanism is simply used to transmit data from sensor nodes to the sink. The architecture of clusters is one of the most well-known architectures which have been so far proved to be best in terms of energy conservation. Various protocols like - A) Low energy adaptive clustering Protocol (LEACH**),** B) LEACH-Centralized (LEACH-C), C) LEACH-H (Hybrid Cluster Head Selection LEACH), D) A Hybrid, Energy-Efficient Distributed Clustering Approach (HEED), E) Threshold sensitive Energy Efficient sensor Network Protocol (TEEN), F) Adaptive Periodic Threshold-sensitive Energy Efficient Sensor Network (APTEEN), G) Dynamic Source Routing (DSR), H) Power Efficient gathering in Sensor Information System (PEGASIS), I) Dynamic Static Clustering (DSC) Protocol, K) Low energy adaptive clustering Protocol-Mobile (LEACH-M), L) Low energy adaptive clustering Protocol - Mobile-Enhanced (LEACH-ME), M) Reliable location-aware routing protocol for mobile wireless sensor network (LFCP-MWSN), N) Cluster Based Routing Protocol for Mobile nodes (CBR-M), O) Mobile sink routing protocol (MSRP), P) Reliable Energy Aware Routing (REAR), Q) Graphical adaptive fidelity (GAF). They have summarized

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recent research results on routing in sensor networks and classified the approaches into several categories, namely routing with static nodes, routing with mobile nodes and location-based, power usage .etc. Few other protocols followed the traditional network flow and QoS modelling methodology [4].

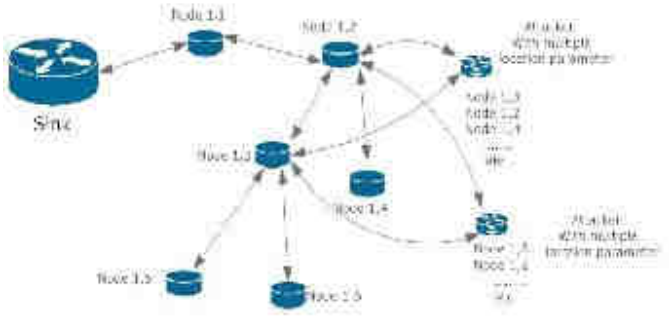

Fig. 2.2: Routing algorithm analysis using routers

Wireless multimedia sensor networks with sensing and processing abilities of multimedia data have recently emerged as one of the most important technologies for high quality monitoring. The routing scheme for multimedia data is an important research issue addressed in wireless multimedia sensor networks. In this paper, a disjointed multipath routing scheme for real-time data transmission in wireless multimedia sensor networks. This scheme uses a hybrid routing protocol based on Bluetooth and Zigbee in order to overcome the limitation of low bandwidth in conventional sensor networks. This scheme also performs disjointed multipath routing based on competition to alleviate the delay of routing path setup and they compare it with the existing scheme through performance evaluation. Their experimental results show that the proposed scheme reduces the end-to-end delay by about 30% and the routing path setup costs by about 22% over the existing scheme and also increases data reception rates by about 690% over the existing scheme on average. Various schemes to transmit data in the conventional sensor networks have been simulated. Representative schemes are tree-topology-based TAG, cluster-topology-based HEED, and greedy-forwarding-based GPSR. Though these schemes are suitable for sending scalar data from the conventional sensor networks and are designed on the basis of the low bandwidth of Zigbee, multimedia data has a large size which is different from conventional sensor networks that handle scalar data. Therefore, they are not suitable for transmitting mass multimedia data such as video and image [5].

III. ALGORITHM APPROACHES

Wireless sensor networks have grown enormously and become progressively attractive in wide variety of applications because of their low cost, low power, small in size, self-organizing behaviour in harsh environments. There are many routing protocols like: location based, multipath, data centric, mobility based, hierarchical routing, hybrid routing etc. Clustering is used to prolong the lifetime of the wireless sensor networks. Clustering is the process where sensing area is divided in groups to balance the energy level of sensor nodes known as clusters. An Optimal Clustering technique can reduce the energy consumption in WSN and increase the lifetime of the network. Energy is the main consideration when they analyze routing protocols for WSN. In this paper they study the different clustering based energy efficient routing protocols of wireless sensor networks and compared them on various parameters.

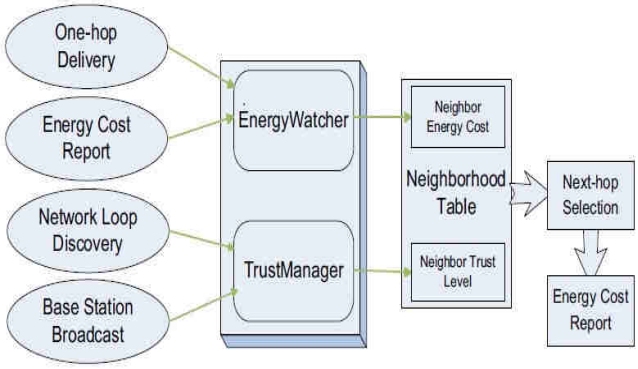

Fig.3.1: Routing Algorithm flow control mechanism

Homogeneous and Heterogeneous nodes are used in wireless sensor network where a wireless medium is used by the nodes to communicate with each other. A hundred to thousands of nodes can be deployed in the sensing region to sense the environment. These nodes work cooperatively and send sensed information to the sink. Wireless sensor network can be categorized into two types: **1) Unstructured WSN**- The nodes are densely deployed and also the nodes can be deployed in ad-hoc manner in the sensing area or region. **2) Structured WSN** – Sensor node developments of some or all nodes are preplanned. The nodes placement is also planned. So, the maintenance of structured WSN is much easy as compare to Unstructured WSN. Sensor nodes work cooperatively to monitor environment conditions such as temperature, sound, vehicular movement, pressure and pollutants. Energy conservation in wireless sensor networks has become one of the most important research areas The main objective behind the routing protocol design is to keep sensors alive as much as possible, thus prolonging the lifetime of network. For

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heterogeneous wireless sensor networks, many energy efficient clustering protocols are proposed which are based on residual energy, density etc. they also discussed *energy-efficient clustering protocols like:* Low energy adaptive clustering hierarchical (LEACH), Threshold-sensitive energy-efficient sensor network protocol (TEEN), Adaptive TEEN, Geographic adaptive fidelity (GAF), Constrained shortest path energy aware routing (CSPEA), Power-efficient gathering in sensor information system (PEGASIS), Stable election protocol (SEP), Hierarchical Geographic Multicast Routing (HGMR), Distributed energy-efficient clustering (DEEC), Distributed Weight-based Energy-efficient Hierarchical Clustering protocol (DWEHC), Improved and balanced LEACH (IBLEACH), Concentric Clustering Scheme (CCS), Energy-efficient cluster head election protocol (EECHE), Hybrid Energy-Efficient Distributed Clustering (HEED), Base-Station Controlled Dynamic Clustering Protocol (BCDCP) [6].

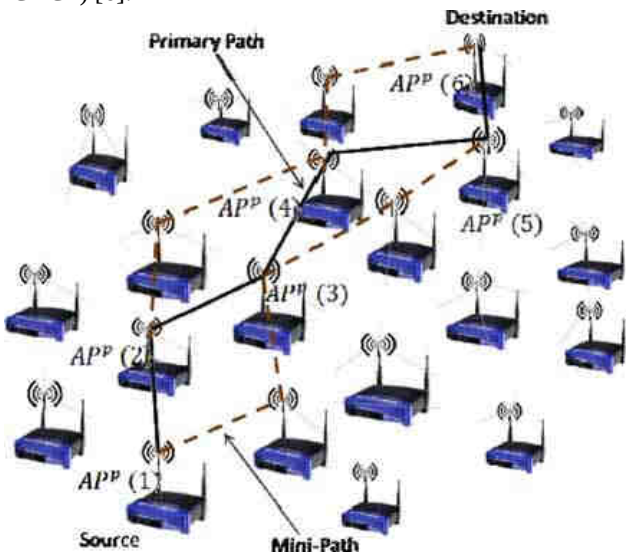

Fig.3.2: Nodes shortest path selection mechanism

Wireless sensor networks are networks having non wired infrastructure and dynamic topology. In OSI model each layer is prone to various attacks, which halts the performance of a network .In this paper several attacks on four layers of OSI model are discussed and security mechanism is described to prevent attack in network layer i.e wormhole attack. In Wormhole attack two or more malicious nodes makes a covert channel which attracts the traffic towards itself by depicting a low latency link and then start dropping and replaying packets in the multi-path route. This paper proposed promiscuous mode method to detect and isolate the malicious node during Wormhole attack by using Ad-hoc on demand distance vector routing protocol (AODV) with omnidirectional antenna. The methodology implemented notified that the nodes which are not participating in multi-path routing generates an alarm message during delay and then detects and isolate the malicious node from network. In this paper promiscuous mode methodology is implemented which works very efficiently in WSNs during wormhole attack. It not only prevents the degradation of the wireless network also helps in improving performance of wireless sensor networks. This methodology has not been proposed yet based on delay metrics. Analysis has been done through simulation to enhance performance of the proposed model in wireless multi hop network. The simulation results have shown that in the presence of malicious nodes in ad hoc network. The performance of wireless network with AODV provided extensions with promiscuous mode mechanism is better than wireless network with simple AODV routing protocol in terms of throughput and end to end delay. Furthermore, it can help in putting some constraints on the network topology to design a robust network for such attacks, and in the design of new and more powerful attack countermeasures. Comparatively this approach is analytical and systematic than previous theoretical approaches [8].

IV. RESULT TABULATION

Various techniques and algorithms used to make this process effective approach. Some tables and parameters are surveyed as follows:

Table.4.1: Node Parameter for Clustering

Parameters	Value
Network Filed	(0,0) ~ (500,500)
Number of nodes	100
Cluster radius R	30 m
Sensing radius r	10 m
Initial energy	10 J
Data packet size	1024 Bytes
$E_{threshold}$	0.01 J
E_{elec}	50 nJ/bit
E_{fs}	10 nJ/bit/m^2
Threshold distance	80 m
MAC layer	IEEE 802.11
Max buffer size	256 K-Bytes
Simulation time	1000 s

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Table.4.2: Clustered & Comm. Based parameters

Parameter Name	Comment
CID	UL-MAP IE, section 8.4.5.4, table 287 of IEEE Std. 802.16e-2005.
Serving BSID	Identifier for the serving BS
OFDMA symbol offset	UL-MAP IE, section 8.4.5.4, table 287 of IEEE Std. 802.16e-2005. UIUC, section 8.4.5.4.3 of IEEE Std. 802.16e-2005.
Subchannel offset	
No. OFDMA symbols	
No. subchannels	
Ranging method	
Dedicated ranging indicator	
CDMA_Allocation_IE	UL-MAP IE, section 8.4.5.4, table 287 of IEEE Std. 802.16e-2005. UIUC = 12, section 8.4.5.4.3 of IEEE Std. 802.16e-2005.
Fast_Ranging_IE	UL-MAP IE, UIUC = 15, Section 8.4.5.4.21 of IEEE Std. 802.16e-2005.
Permutation base (UL_PermBase)	Section 11.3.1, Table 353 of IEEE Std. 802.16e-2005.
Action time	Section 6.3.2.3.52, Table 109 of IEEE Std. 802.16e-2005.
Approximate ranging signal transmission time	This parameter may be derived from other parameters such as, but not limited to, approximate clock of the base station, allocation start time, duration of the allocation, etc. Section 10.3.4.1 and table 342 of IEEE Std. 802.16e-2005.

These parameters are according to location of routers, cells in geographical areas, basic techniques used in routing, IEEE standards details and connection less or connection oriented algorithms requirement.

V. CONCLUSION

In this paper, we surveyed about multipath routing protocol, ad hoc routing in WSN. Here we also see that various algorithms like clustering hierarchical (LEACH), Threshold-sensitive energy-efficient sensor network protocol (TEEN), Adaptive TEEN, Geographic adaptive fidelity (GAF), Constrained shortest path energy aware routing (CSPEA), Power-efficient gathering in sensor information system (PEGASIS), Stable election protocol (SEP), Hierarchical Geographic Multicast Routing (HGMR), Distributed energy-efficient clustering (DEEC), Distributed Weight-based Energy-efficient Hierarchical Clustering protocol (DWEHC), Improved and balanced LEACH (IBLEACH), Concentric Clustering Scheme (CCS), Energy-efficient cluster head election protocol (EECHE), Hybrid Energy-Efficient Distributed Clustering (HEED), Base-Station Controlled Dynamic Clustering Protocol (BCDCP) may use to develop a effective approach for IP versions and efficient content for internet services. Furthermore analysis and study will be on development of multipath routing algorithms and protocols design may design on various tools like NS2, OPNET, OMNET, TINYOS etc.

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