5G Environment based CLB-AODV Multicast Routing for the Zigbee on Wireless Sensor Heterogeneous Network

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***Abstract*: A communication load balanced dynamic topology management algorithm (CLB-AODV) is proposed to extend the Wireless Sensor Network (WSN) lifetime via managing the participation in communication process among all nodes in the network. The idea is that, each time there is a failure in the network topology, the topology is adjusted only on-demand by choosing the best path according to paths weights between source and destination nodes. The path weight reflects the nodes participation in communication process through the lifetime of the nodes. Our algorithm is based on the routing protocol AODV instead of using a separate protocol for dynamic topology control in order to reduce the routing load among nodes. Simulation results show that CLB-AODV can prolong the lifetime of the network, increase the number of alive nodes and reduce the average routing load when compared with some of the most powerful recent algorithms. The integration of WSN, new generation networks or 5G, TCP/IPv6 protocols with the Internet of Things (IoT) that aims to exchange information, applying security, QoS (Quality of Service) and configuration are the aspects in the construction of a network in which confidentiality, integrity, availability, authentication, reconfiguration of topology, improvement, high quality of service, addressing, infrastructure, network and node construction for M2M (Machine to Machine) or end to end communication. 5G cellular networks, in particular, are attractive technologies to provide internet connectivity to equipment (UE). Moreover, an additional routing information collecting method is developed to further improve the routing performance.**

***Keywords*: CLB-AODV, Wireless Sensor Network, Multicast Routing**

Introduction

A Wireless sensor network can be defined as a network of devices that can communicate the information gathered from a monitored field through wireless links. The data is forwarded through multiple nodes, and with a gateway, the data is connected to other networks like wireless Ethernet. Terrestrial WSNs are capable of communicating base stations efficiently, and consist of hundreds to thousands of wireless sensor nodes deployed either in unstructured (ad hoc) or structured (Preplanned) manner. In an unstructured mode, the sensor nodes are randomly distributed within the target area that is dropped from a fixed plane. The preplanned or structured mode considers optimal placement, grid placement, and 2D, 3D placement models. In this WSN, the battery power is limited; however, the battery is equipped with solar cells as a secondary power source. The Energy conservation of these WSNs is achieved by using low duty cycle operations, minimizing delays, and optimal routing, and so on. A large amount of research activities have been carried out to explore and solve various design and application issues, and significant advances have been made in the development and deployment of WSNs. It is envisioned that in the near future WSNs will be widely used in various civilian and military fields, and revolutionize the way we live, work, and interact with the physical world. Autonomous underwater vehicles are used for gathering data from these sensor nodes. The challenges with the multimedia WSN include high energy consumption, high bandwidth requirements, data processing and compressing techniques. Zigbee wireless technology is specially designed for sensors and control devices that employ low cost connectivity and widely used for several applications. Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection.

Figure 1: Zigbee Architecture

The AODV protocol builds routes between nodes only if they are requested by source nodes. AODV is therefore considered an on-demand algorithm and does not create any extra traffic for communication along links. The routes are maintained as long as they are required by the sources. They also form trees to connect multicast group members. AODV makes use of sequence numbers to ensure route freshness. They are self-starting and loop-free besides scaling to numerous mobile nodes. In AODV, networks are silent until connections are established. Network nodes that need connections broadcast a request for connection. The remaining AODV nodes forward the message and record the node that requested a connection. Thus, they create a series of temporary routes back to the requesting node.

Literature Survey/Prior Work

The existing multi-hop effective capacity model from the continuous-time domain into the discrete-time domain. Mathematical formulae including tail probabilities of delay, delay mean and jitter over multi-hop wireless paths were derived. Furthermore, we used these formulae to develop a simple algorithm for predicting end to-end delay based on the sampling method. End-to-end delay performance is an important QoS metric in 5G communication systems and WSNs. Recently, a multi-hop effective capacity model was proposed to provide accurate characterization of end-to-end delay performance in wireless multi-hop environments. However, this model was developed in the continuous-time domain, which accounts for a discrepancy in digital/discrete-time systems Furthermore, propose a simple algorithm for end-to-end delay performance prediction based on the sampling method. By using publicly-available real traces from a wireless sensor network, we recreate these field experiments in a simulation platform to validate the algorithm. In this work, Data move from source to destination in shortest path in dynamic networks compared to static ones. As future work, more investigation on extra factors can be evaluated in the WSN of 5G area contributed to provide a simulation-based analysis of the energy efficiency, accuracy and path length of static and dynamic wireless sensor networks for 5G environment. Results are analyzed and discussed to show the difference between these two types of sensor networks. The tasks of WSNs are functionally influenced by the power source constrains. Minimizing power consumption is very important issue in these networks. In this study, the antecedents that integrate new technologies that integrated with the IoT has a good development, next step is to understand the logic of the architectures and finally based on the network traffic model Gauss-Markov studied the variables as S (Speed), D (address), L (length), W (width), d_c (certainty/uncertainty) due to obtain an error approaching zero in a 4G network that improves for 5G in budget packet delays in Very small times.

This paper a design for implementing network-based virtual Ethernet switches (NVESs) on top of a physical substrate consisting of a software-defined networking (SDN) network. An NVES has the same capability as a real Ethernet switch. A user makes a request to provision an NVES by specifying the number of ports and the maximum bandwidth for each port. The substrate network considered in this study is an Open Flow network. The entire network is controlled by an Open Flow controller. The controller is responsible for performing admission control, resource allocation, routing, address learning, and spanning tree protocol. QoS and configuration, these three aspects are the problems in the construction of a network in which confidentiality, integrity, availability, authentication, reconfiguration of topology, improvement, high quality of service, addressing, infrastructure, Network and node construction, for M2M communication or end to end. Because 5G cellular networks, in particular, are attractive technologies to provide Internet connectivity to equipment.

Problem Statement

The AODV routing protocol is designed for the ad hoc networks, it has a trustworthy performance in various environments. The on demand routing discovery may bring the global shortest path in any time, but the routing overheads and the bandwidth occupation caused by the flooding are the disadvantages. A feasibility analysis of the Zigbee protocol for the wireless dynamic sensor networks (WDSN) applications feasibility of adopting Zigbee in the WDSN is proved and the advantages and limitations are well discussed. It is shown that as the node mobility increases, the Z-AODV routing plays a more and more important role in the data transmission design a multiple feedback policy by processing key messages during route discovery for the AODV routing protocol in the Zigbee specification.

Different from the original algorithm in which the link is decided by the destination node, the sending device would choose the best link based on the multiple replies from each potential path. Although the proposed method may not directly improve the routing, it inspires us to collect the routing information and make other nodes decide the optimal path a compliant new model in OPNET simulator is proposed to resolve the node mobility issue in the Zigbee networks.

An improved routing architecture is developed. The cluster information and network addresses are used to control the transmission range and direction in Z-AODV. Though the routing performance is improved, the routing cost and bandwidth occupation of the algorithm not well considered.

The nodes are classified into l-sensors and H-sensor according to their hardware capacities separately, and the algorithm establishes different logical topologies upon the same physical topology to balance the link numbers of H-sensors. It is shown that the Rout has a higher diversity and reliability in the HSNs. The architecture in the Rout is quite like ours, in which the AGs are the H-sensors and the Zigbee nodes are the l-sensor, but it does not fully fit for our work. It is partially because the uniform deployment required by the parallel links. Moreover, the AGs have a much higher mobility which may leads to continual topology changes a fair cooperative routing strategy for overlapped heterogeneous networks to maximum energy efficiency. A shared energy pool is built to manage the transmission cost; it works as a broker to fairly allocate the resources.

The Proposed Model

Our problem is to identify the dead nodes and to choose another suitable path so that the data transmission becomes smoother and less energy gets conserved. In order to resolve these issues, we propose directional transmission-based energy aware routing protocol named PDORP. The proposed protocol PDORP has the characteristics of both power efficient gathering sensor information system and DSR routing protocols. In addition, hybridization of genetic algorithm and bacterial foraging optimization is applied to proposed routing protocol to identify energy efficient optimal paths. The performance analysis, comparison through a hybridization approach of the proposed routing protocol, gives better result comprising less bit error rate, less delay, less energy consumption, and better throughput, which leads to better QoS and prolong the lifetime of the network. Moreover, the computation model is adopted to evaluate and compare the performance of the both routing protocols using soft computing techniques should address application security issues such as reliability, authentication.

The improved Z-ADOV routing method using the associated gateways in the 5G environment in detail, including the routing request flooding, determining the optimum path and the additional routing information mining procedures. In the AODV routing, when a sending node cannot find a corresponding entry in the routing table, it may initial a routing discovery procedure by flooding a routing request (RREQ). The command frame includes the command option, route request identifier (RRID), destination address and the path cost.

In this work, we simply measure the path cost by the hop counts, thus the path cost is equal to the hops from the source to the current device. Based on the scheme in the last sub-section, the RREQ is forwarded to the destination by flooding. Because the destination replies every RREQ it receives, the source may get multiple RREPs with different routing costs from different reversed paths within a pre-set waiting duration. Afterwards, it determines the optimum path in the original Z-AODV. Meanwhile, a routing table entry which is identified by the destination address and the path cost is also activated. In order to adapt to the hardware sources especially energy source restrictions of 6LoWPAN, we propose S-AODV (Sink Routing Table over AODV) routing, a new AODV implementation designed to provide benefits in terms of traffic reduction, power consumption and networks lifetime extension, for WPAN in this work. In S-AODV, traffic of route discovery in original AODV is reduced by using SRT (Sink Routing Table). By the new mechanism, the delay and energy consumption of the connection between each internal common node and the sink are reduced.

1. The Improved Z-AODV Routing

In this method using the associated gateways (ZAG) for the Zigbee networks in the 5G environment. In ZAG, when the exotic 5G terminals opportunistically move into the coverage of the Zigbee networks, they take part in the existing network to improve the data communication. Each joining AG is assigned a unique AG identifier (AGID) by the ZC for recognizing each other. Because the AGs are connected by IP links, it is rational to consider that the communication between them does not introduce any cost to regular Zigbee nodes. Thus we introduce a one bit field, IsAG, in the neighbor table to indicate whether a device is an AG (1 for yes and 0 for not). Consequently, the Zigbee device is capable of recognizing an AG in its neighbourhood. For a lucid explanation, the network shown in Figure 2 is an example to illustrate the node behaviours.

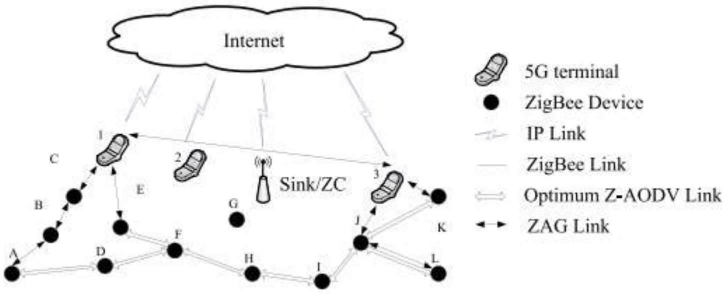

Figure 2: An example of the Zigbee

2. Routing Request Flooding

In the AODV routing, when a sending node cannot find a corresponding entry in the routing table, it may initial a routing discovery procedure by flooding a routing request (RREQ). In this work, we simply measure the path cost by the hop counts, thus the path cost is equal to the hops from the source to the current device. Upon receipt of a route request, each regular Zigbee device (including the destination) functions the same way as in the Z-AODV. On the other hand, when an AG receives a RREQ, beside the compatibility of the marking behaviour, there are 3 reserved bits in the command option filed of the original RREQ, what we need is a one bit Boolean indicator. In the ZAG, we make the Bit 7 (8th bit) to be the Passed AG tag. The default False (0) value means only the Zigbee nodes are included in the path.

When an AG receives a RREQ from another one via internet, it sets the value True (1) and rebroadcast the RREQ. Afterwards, if another AG receives this RREQ, it discards this frame since the packet has already passes through AGs. In other words, in the ZAG, when receiving a RREQ, an AG may teleport it only if the PassedAG filed is False. For instance, the Passed AG is set True by AG 2 and 3 before their rebroadcasting. Afterwards the RREQ will be abandoned if it is received by an AG. By the above scheme, the duplications and the loop paths are controlled. To manage the routing discovery, all the AGs which are connected in the IP networks are required to maintain a shared routing discovery table (SRDT). Besides the fields which the regular routing discovery table entry has, such as RRID, source address, sender address, forward cost, residual cost, and expiration time, a SRDT entry has four more fields. Different from identifying an ordinary routing discovery table entry by RRID, a combination of Incoming AGID, RRID, and Outgoing AGID determines a unique SRDT entry. Owing to the sufficient resources in the AG (especially the ZC), the size of the SRDT (number of entries) can be considered infinite.

Experimental Study

In this section, we evaluate the effectiveness of our proposed method, The proposed algorithm is evaluated based on simulation results. It is shown that our routing method outperforms the existing ones by higher picketer deliver ratio, shorter path length, lower latency, fewer packets sent per Zigbee node and lower routing overhead.Figure 4.2 shows node in a sensor network that is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. This result shows a simple Network configuration on 5G network which consists of 34 nodes as shown in the above figure. A node in NS is Network work real-time object made of address and port classifiers. This shows that current network is ready to transfer data between each.

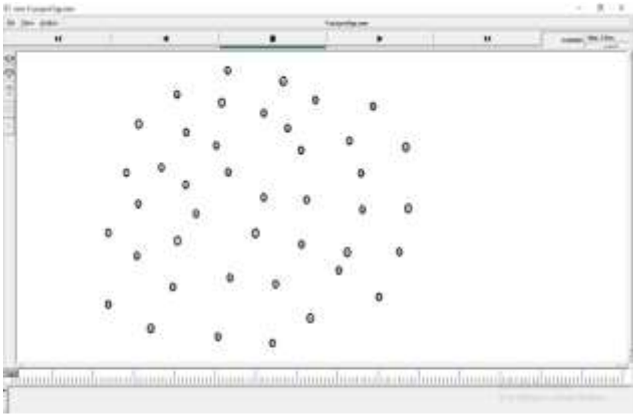

Figure 3: Node Creation

Figure 3 shows node Synchronization in wireless networks is the first most important for basic communication, but it also provides the ability to detect movement, location, and proximity. Here all 34 nodes are synchronized for data transfer and make to participate correctly in routing function.

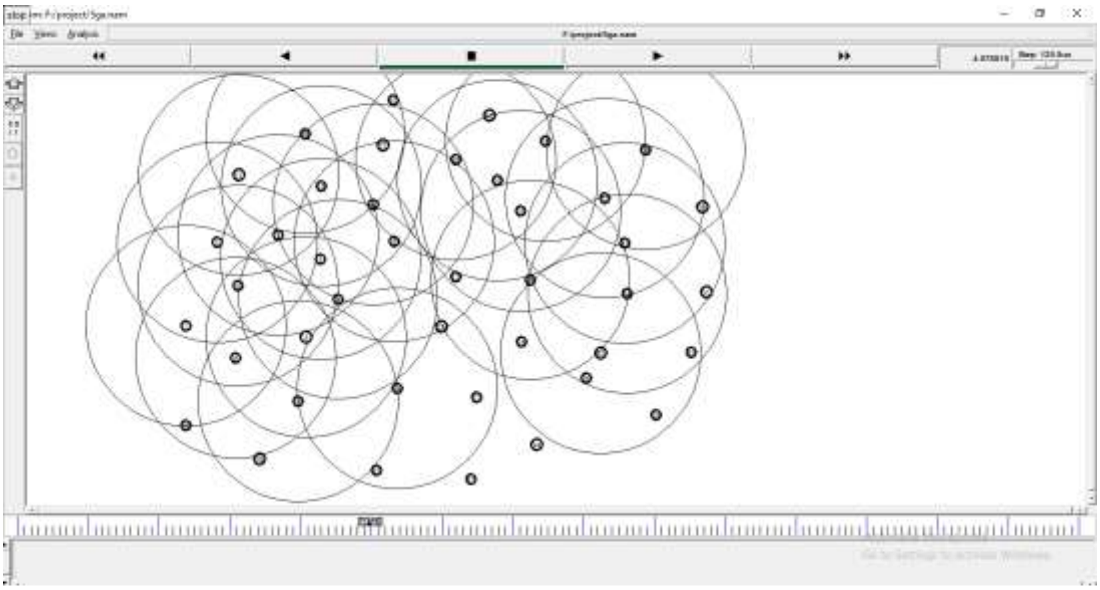

Figure 4 : Node Synchronization

Figure 4 shows routing is established using AODV protocol, based on the protocol function the node started to transmit the packet, with packet delivery ratio (PDR) of 98.3% while transmitting, also get throughput of 48,000 packets/sec.

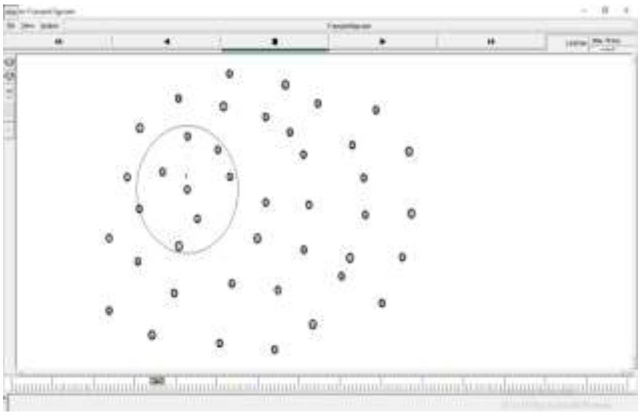

Figure 5 : Packet Transformation

Figure 6 shows PDR for different simulation time .In this the PDR is increased with respect to simulation time. Figure 7 shows throughput for different simulation time. Where the throughput is increase with respect to simulation time. Figure 8 shows the end to end delay for different simulation time. In this the end to end delay is decrease with respect to simulation time is evaluated. Figure 9 shows the overall delay for different simulation time whereas the overall delay is decrease with respect to simulation time.

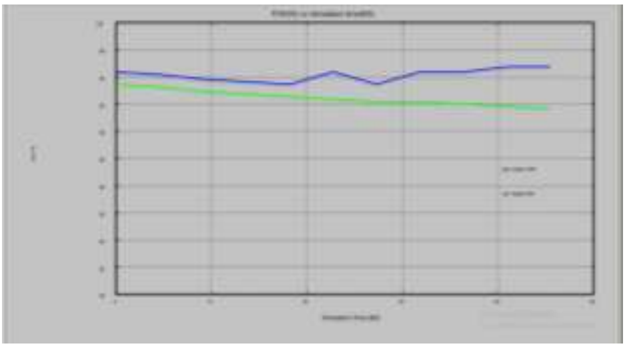

Figure 6: PDR vs simulation time

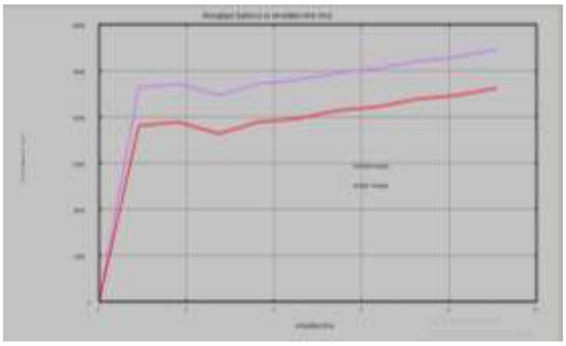

Figure 7: Throughput vs simulation time

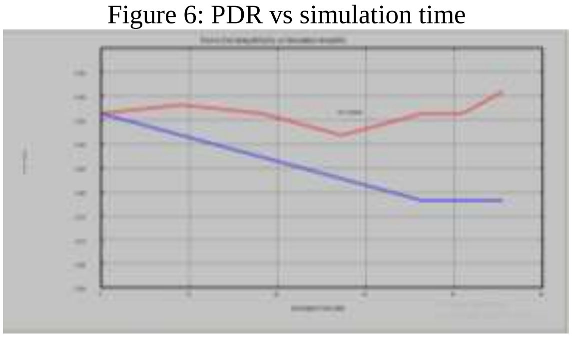

Figure 8: End to End Delay vs Simulation Time

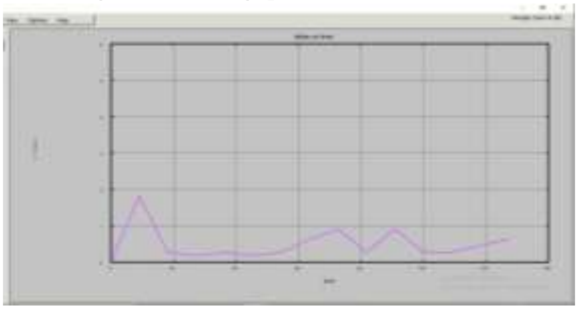

Figure 9: Overall Delay vs Simulation Time

Conclusion and Future Enhancement

The system investigated the routing information in routing discovery, a mining scheme is also discussed to find the segmented optimum paths which can be used in further routing discovery. The simulations show that ZAG achieves better performances with higher packet delivery ratio, less hop counts from Zigbee devices and lower end-to-end delay. Moreover, its overheads are reduced as well, each Zigbee device sends less packet and the normalized routing overheads are also decreased. The on demand routing improvement for Zigbee networks in 5G environments in WSN. We plan to extend the metric to the residual energy, network congestion and other parameters which need to be paid attention to in the real world, reliability should be increase in future, fault tolerance should be avoided to minimizing end-to-end latency, cost of communication will be further decreased in future.

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