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IPV6 PACKET DELIVERY SCHEME USING TRUST ROUTING G.9959 PROTOCOL FOR WIRELESS SENSOR NETWORK (WSN) BASED INTERNET OF THINGS

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Abstract:

Wireless Sensor Network (WSN) has received a lot of attention over the past few years both in the research and industrial frontier. It combines multiple applications that include military use, disaster management smart cities, habitat monitoring and healthcare, among others. It employs terms like Internet of Things (IoT) for a variety of products and services. Also, when the network is associated with the industrial revolution, it's typically referred to in the context of the Industrial Internet of Things (IIoT). By using IPv6 is a way to provide an extremely high degree of scalability based on the power of Internet users. It is crucial to ensure the efficacy of the protocols and modules. This will determine the battery's life time when it is utilized together with battery's temporary drain. Based on this assumption , a variety of protocols are evaluated the use of IIoT within WSN. In this article, we have chosen G.9959 as the most preferred protocol. The analysis is made using G.9959 and IPv6 rates of delivery of packets. Test results show that the proposed protocol is more effective in comparison to other protocols.

Keywords - IPV6, Protocol, IoT, G.9959

1 INTRODUCTION:

Wireless Sensor Networks (WSNs) are technologies in which computing, communication and control are tightly linked[1They are tightly connected to communications, computing, and control. WSNs comprise numerous sensor nodes that receive data and respond to commands and send changes to the other sensors

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within the network. They are employed for military surveillance as well as environmental science, health care as well as smart metering and home automation. The usage of WSNs is growing due to the fact that they expand communications ranges with low cost, low power and low-complexity[2.3].

The prediction and aggregation of data are a topic that is often discussed both in academic and commercial circles. WSN constraints, characteristics and monitoring data are all factors that influence the selection of data prediction schema. The prediction schema must be accurate and take into consideration the WSN objectives, sensed phenomena, user requirements, and the architecture used to make the predictions. There are currently no tools that can be used to analyze and determine the characteristics of the data before deciding on the best prediction method. Only a comparison of different works can be used to help choose the right prediction scheme. Future work will require a method to assess the data reduction efficiency of prediction techniques. This approach should not be limited to financial considerations such as communication costs, but also the selection of the prediction method and its location (i.e. determining where the predictions are made: gateway, sensor node or both. Also consider the implied
costs in their calculation.

Cloud computing services may allow us to predict whether WSN information will meet future quality standards. We respond by updating prediction models and adopting new prediction schemes to prevent a decrease of quality. This is a serious question. Because decisions made at this level can result in extra transmissions and processing cost to modify the operation of sensor nodes, it is not trivial. This may have benefits that are not apparent in the current state of the art in terms of energy savings and medium access to information. This could lead to new mechanisms that don't just extend the WSNs lifespan but also provide more information to users. This is something that has never been considered in the context of prediction.

Low power consumption is one of the main constraints for sensor nodes. The power source for sensor nodes is usually limited and irreplaceable. While traditional networks strive to provide high QoS provisions, protocols for sensor networks must be focused on power conservation. They should have built-in trade-off mechanisms that allow the end user to prolong network lifetime at the expense of reduced throughput or increased transmission delay.

WSNs are subject to additional problems than the basic concerns. Many researchers have noticed these issues. WSN issues that are of major concern include power consumption and network speed. WSN communication faces a serious problem in terms of energy consumption. Energy efficiency has a significant impact on the network's performance and can help extend its life span. WSN routing protocol efficiency can be assessed by examining the energy level (EL). WSN routing cost functions should include energy consumption, residual energies, and other important metrics.

Routing has been an integral part of every communication system. Since ancient times, academics have struggled to find cost-effective, secure and affordable ways to send packets to the intended recipients. Because of the limitations in sensor resources, such as low energy, limited processing and a short communication range, researchers face a challenging task when creating routing algorithms. Many attempts have been made to find the best solution. Clustering can be used to balance load and other factors such as scalability and lifetime maximisation. It is also a great way to save energy. This is an efficient and effective way to prolong the life of WSNs, while also modifying the overall performance of the network.

The G.9959 protocol can support data rates that are composed of three channels namely R1,R2 and of 9.6 10 kbit/s, 40 Kbit/s or 100 kbit/s. Additionally, it allows segments and reassembly of payloads that can reach 1350 Octets. This is accomplished by a gateway that acts as an intermediate node between the WSN and IP network [8]. . The 6LoWPAN payload is based on the encapsulation header stack. Each header within the header stack has the header type, that is followed by one or more header fields. A IPv6 header stack could include in the order listed below address, hop-by hop options routing fragmentation, destination choices and, lastly payload.

2 PROBLEM FORMULATION:

In IoT the various devices are used within WSN. The devices are fully controlled by employees or users of the company and the control is carried out through the making use of commands enclosed into IPv6 packets. If packets are received at the gateway node, in accordance to MTU , the fragmentation of the packet occurs. After that, it forwards pieces of the packet until it has reached the destination. In this process of forwarding, the sensors is unable to send its own sensed data at the same time, along with the intermediate fragments of forwarding. This can lead to delays and waste of resources regards to energy. Since the amount of fragments created by 6LoWPAN is higher in comparison with G.9959 protocols, This could result in a higher quantity of transmissions. The 6LoWPAN protocol, the sensors are responsible for receiving and forwarding an increased quantity of fragmented chunks and this could result in the burning out in their power. In addition, the sensors are unable to transmit their own sensor data in a timely manner to the base station, and is a detriment to the critical deadline applications through the use of the high delay. The sensor nodes send the data they sense to the clusterhead node. The data is transmitted to the base station to

be processed further.

2.1 CONTRIBUTIONS:

To address the problems, a reliable and efficient scheme for packet delivery is suggested to address the issues, a novel and an efficient and efficient method of packet delivery has been suggested to support IIoT specifically WSN. The work's contributions can be summarized as follows:

Our inputs can be summarized as follows:

Utilizing network coding, we offer a unique protocol for delivering packets to WSN

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Utilizing G.9959, a new method of channel allocating is created and .the utilization to use a MAC layer is eliminated.

The bandwidth of the channels is determined by the rate of data and the size needed.

The relationship between the bandwidth that is utilized as well as energy production is established.

3 PROPOSED WORK:

3.1 Channel Allocation

The energy consumption directly correlates to bandwidth, and could affect the performance measurements. In the protocols of the past, prior to G.9959, i.e. IEEE 802, bandwidth was allocated to only one channel. Its metrics were based upon standards MAC requests. So, if the rates of data are excessive for the channel this could lead to improper use of resources to transfer packets in fragments or smaller size.

Because of this the amount of bandwidth used was discovered to be excessive , and it was a waste of bandwidth. To address these issues, we've suggested the use of G.9959 as a replacement for that of the IEEE 802 standard. This protocol was created to support three channels of bandwidth that are identified by the name R1, R2 and refers to their bandwidth rates of 9.6 Kbits/s, 40 kbits/s and 100 kbits/s. The bandwidth of R3 is used to transmit IPv6 chunks of packets . The other two bandwidths are used to transmit the sensor's data.

3.2 Routing

IEEE 802.15.4 networks can be based on the multihop model. To enable connectivity to networks in this topology 6LoWPAN provides two different routing options: mesh-under where routing takes place under IP (thus multihop paths appears as one connection to IP) as well as route-over that relies upon IP routing (thus every physical hop is considered an IP hop). In the lattercase, intermediary forwarders function as IP routers, also known as 6LoWPAN Routers (6LRs). In both cases the router connecting the 6LoWPAN network to an IP network is known as a 6LoWPAN Border Router (6LBR). The majority of 6Lo technology defines topologies for networks

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where there is one physical connection between the hosts as well as the 6LBR. In these cases, routing protocols are not necessary. However the ITU-T G.9959 as well as IEEE 1901.2 allow mesh networks. The 6Lo adapter layers that support both of these technologies are based on 6LoWPAN route-over capabilities (in both instances) as well as mesh-under (only in the first).

3.3 Addressing

In 6LoWPAN, like other traditional networking scenarios like Ethernet, IPv6 address generation generally relies on embedding the link layer's address into the Interface Identifier (IID) for autoconfiguration of stateless addresses. In 6LoWPAN this method can be used for both total and partial compression of addresses to support IPv6 header compression. The same reason is why the 6Lo adapter layers all initially relied on the same method to generate IID generation. .

3.4 Packet Delivery Scheme:

The gateway is the node of an normal IP network, IPv6 packets are initially broken up in accordance with MAC requirement to be able to fit into to the MAC layer. Each packet within the fragments are broken down into smaller pieces so how they fit in to the MAC frame. In general the IPv6 packet can be divided into downward and upward packets. The downward packets are packets that are accepted by Nodes's externe IP networks, while the upward packets refer to the packets that are transmitted by sensors nodes to establish connections to external networks. The upwards packets do not require dispersal because their size is smaller and they can be included in the identical IP packet. However, the packets that are delivered to the network through different IP networks must be separated. The letters N G represent gateways. All other Nodes of the WSN can be represented as The numbers are $N_{1,}$, N_2, N_3,...N_n. The packets are sent via an algorithm based on trust . The packets are transmitted by the trust-based routing protocol that

$$T_f\ (P_i\ ) \propto No.\ of\ \ packets\ \ transmitted$$

In order to ensure equal transmission rates of various sizes of packets There should be an upper limit on the amount of bandwidth consumed. Therefore, there should be an intelligent system that allocates the bandwidth of packets allocated to channels according to the size of the data packets and transmitting rates. In the event that y(t) represents the data and the energy E can be expressed as follows:

$$E_y = \int_{\infty}^{-\infty} y(t)^2 dt$$

In further discussion it could be expressed with:

$$E_x = \frac{1}{2\pi} \int_{-\infty}^{\infty} Y(B)Y(-B)dB$$

in which Pi represents the path, and where$T_f(P_i)$ is the factor of trust that governs the route. This can be calculated like this:

$$T_f(P_i) = P_{avg} / D_{avg}$$

P_{avg} = No of Successful packets transmitted / Total packets transmitted

D_{avg} = Delay over the path / Sum of Delay over the path

The following steps are executed in this proposed work:

Step 1: The dimension of the packet is evaluated against the size of an IPv6 packet. If it is greater than that the size, step 3 will be carried out, and it will be set to 1. is fixed to 1.

Step 2: If it is determined that the IPv6 package size exceeds larger than then N, 0 will break up this received data into chunks of S_0.

Step 3: The chunks that are broken up are encoded using a network code scheme.

Step 4: By using channel capacity the speed of data D_0 can be calculated to send the packet. Based on this, the channel is chosen for transmission of the fragmented frames is determined.

Step 5: The intermediate node is responsible for forwarding this frame onto the following node until the frame gets to the destination.

We recommend using trust factor-based routing to identify the most efficient route to take the packet to get it there. The other WSN nodes act as relays in this process. So the packet is sent efficiently thanks to multicast support.

5 SIMULATION RESULTS:

The lifespan that the sensor network has is tied to the energy used to process. So, if there's higher efficiency in length of the network it leads to an increase in the efficiency of sensor networks. However, the terms lifetime of the network as well as energy, and sensors are closely related to one another. In order to get higher performance, we've suggested a strategy that can give fair bandwidth and energy. The sensor's performance evaluates longevity of the network for different strategies and we find that the strategy proposed achieves an endurance that is greater than other strategies that have been studied.

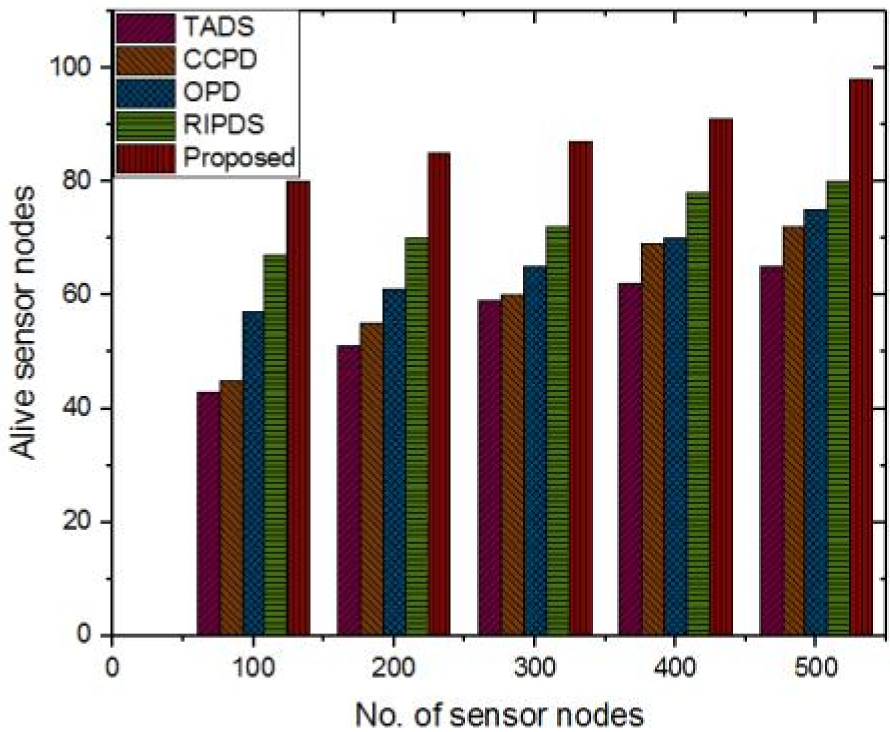

Figure 1 : Performance of proposed scheme by utilizing no. of sensor nodes that are alive

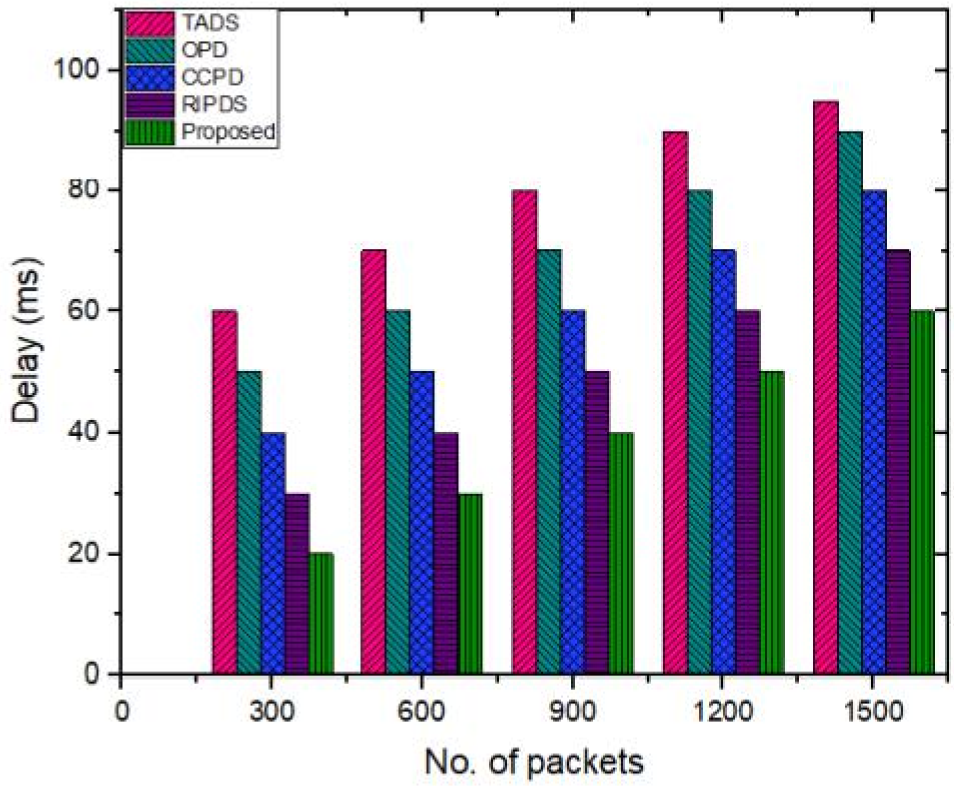

Figure 2 : End-to end delay Performance

The performance metric, referred to as end-to end delay is analyzed to determine the effectiveness of the new scheme as part of comparison to other packet delivery methods. In the graph, it is evident that the proposed plan outperforms when compared to other schemes for packet delivery. The proposed strategy is expected to achieve 68.61 milliseconds of delay in the event that 100 packets are involved. The strategy is able to maintain the least delay for the packets' ranges are between 1 to 300. If the simulation reaches its maximum amount of data packets i.e. 500, then the predicted strategy achieves 66.9973 milliseconds of delay from end to end.

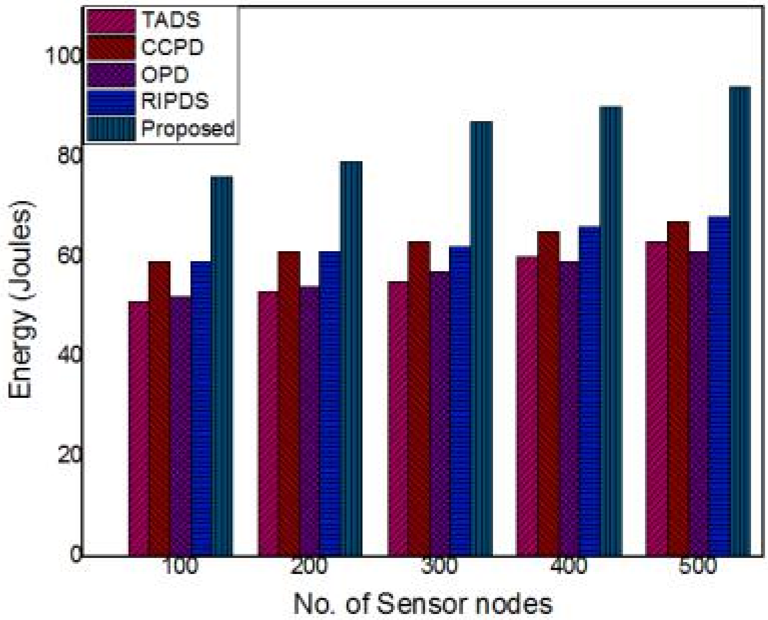

Figure 3: Performance in terms of energy

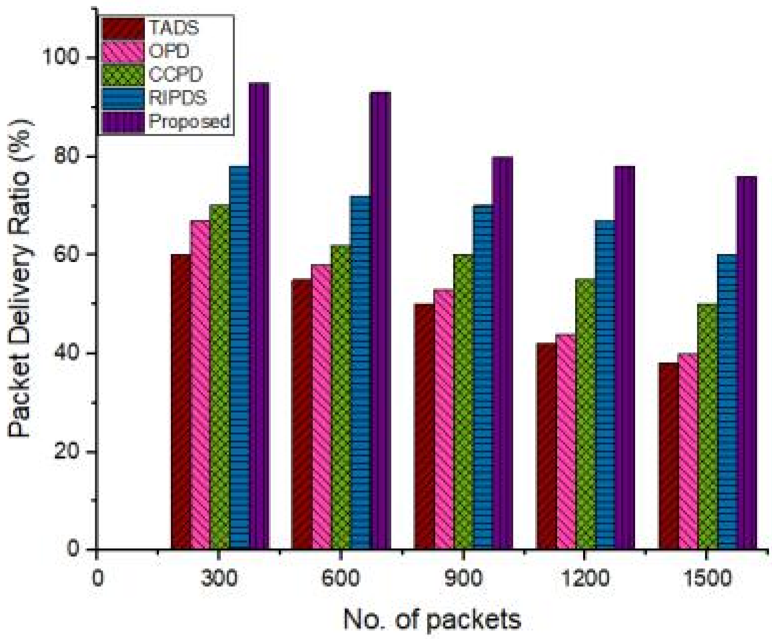

Figure 4: Performance in terms of PDR

The performance metric that is referred to as the ratio of packet delivery (PDR) can be seen by using the simulation environment set-up.

5 CONCLUSION:

As technology advancements in IoT and WSN advances rapidly this has led to a more efficient way of communicating for everyday life, making use of smart devices. They maintain a level of transparency with other users , while remaining connected to the internet to allow remote access. If a wireless medium is employed as a medium to communicate, the packet drop rate can be high. Furthermore, the means to transmit sensing information is not included in the scheme for delivering packets. To overcome these issues we've proposed the use of the G.9959 protocol for the delivery of packets. It is a more secure method to send the data sensed through encoding and decoding according to the path or channel which is chosen. The efficiency of the proposed method is evaluated by energy consumption, the ratio of packet delivery overhead, and life. The results show that the proposed method is superior to other methods that are employed. In the course of further research, we could develop an application that puts the system into action in live in real time.

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