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SENSOR NODE FAILURE ROUTE RECTIFICATION USING CHECK POINT RECOVERY ALGORITHM IN WIRELESS SENSOR NETWORKS

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ABSTRACT

In Wireless Sensor Networks (WSN), working with sensors helps in analyzing many fields such as home security, surveillance, industrial monitoring, hospitals, environmental monitoring and military operations and hence reduces human effort. Data and secure transmission of data is also important in today's world. For transmitting this data, we use a lot of different kind of network system. Among this the most widely used medium is the wireless sensor network. But due to the high-end traffic of the transmission of this data, some failure takes place. Detecting this wireless sensor networks node failure is very important. For detecting node failure, round trip delay and path algorithm in wireless sensor network has been proposed. But due to the use of large numbers of portable sensor nodes in WSN, probability of sensor node failure gets increased. The fault detection analysis time will increase exponentially with increase of sensor node in WSNs. The objective of executing this project is to resolve these vulnerability present in these sensor nodes. Here we are trying to detect the malicious node so that the data are not transferred to those nodes in order to reduce the data loss, thus enhancing the throughput. The throughput is also enhanced by reducing the number of transmission nodes. By doing this, we can analysis the faulty nodes in a faster manner and can rectify them for better and efficient data transmission. This paper proposed link failure route repair is an important problem in routing protocol, which is needed for minimizing flooding and also implement AODV protocol for multipath communication purpose in this protocol. The main advantage of this route discovery process always better performance in wireless sensor network. The research paper going to overcome the wireless network communication link failure route recovery using check point route recovery algorithm (CPRRA) node energy low, node monitoring and node blocking this kind of process to measure for optimal establishing network.

Keywords: WSN, AODV, Link failure, Check Point Route Recovery Algorithm (CPRRA), NS2, malicious nodes, throughput.

1. INTRODUCTION

Wireless Sensor Networks (WSN) is now-a-days used everywhere for varied applications. Working with sensors helps in analysing many fields such as home security, surveillance, industrial monitoring, hospitals, environmental monitoring and military operations and hence reduces human effort. Using large number of sensors in any application increases the Quality of service (QoS). Rapid growth of electronics fabrication has made it possible to manufacture sensors at low cost. On the other-hand using large no of sensors also leads to failure hence affecting the QoS. Sensor Node failure can happen due to many reasons such as failure of battery, environmental effects, hardware or software disorder.

For enhancing QoS it is important to detect the failure node and transfer the data associated with that sensor node. Existing system uses Round Trip Delay (RTD) time for selecting the failure node. RTD is the time taken to receive the packet at receiver's end and getting back the acknowledgement to the sender. If the RTD is exceeding its general value then it is expected that the node has failed. This method does not lead to the failure detection at appropriate time. Hence, it can cause data loss in the network.

To overcome this limitation, in this paper the Check Point recovery algorithm (CPRA) is used for fault detection. The CPRA calculates the energy level of each sensor node. Atsome time interval all the nodes

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will send a heartbeat which will lead to know that the node is working properly. When the energy level of the node will decrease it will not send any heartbeat to the checkpoint which will let us know that the node is about to fail. So, the data associated with the node can be transferred to some other node which will lead to an increase in the reliability of the system. For the verification of the scalability of this concept, WSNs with large numbers of sensor nodes are implemented and simulated in network simulator NS2.

The rest of the paper is organized as follows. Related work is discussed in Section 2. The detailed framework of the proposed system is discussed in Section 3. The experimental discussion and evaluation is discussed in Section 4. Section 5 concludes the proposed work and Future work.

II. RELATED WORKS

This section addresses the existing related literatures on sensor failure node detection. Ravindra et al. [1] has presented a framework in which the Round Trip Delay (RTD) time of discrete round trip paths are used for the detection of faulty nodes and are compared with threshold value. The limitation of this scheme is that the detection of nodes happen after the expected RTD exceeds. By that time the node already use to be in failed state. Hence, the data associated with that node cannot be retrieved again which leads to packet loss.

Kewei Sha et al. [2] has proposed a state-of-the-art survey of existing multipath routing protocols for WSNs, which are classified into three categories, non-infrastructure based, coding based and infrastructure based, based on the special techniques used in building multiple paths and delivering sensing data.

Peng Jiang [3] has proposed a system in which an improved distributed fault detection (DFD) scheme is proposed by defining new detection criteria. In DFD scheme the failed nodes are checked out by the exchanging data and mutual testing among neighbor nodes in this network. But the fault detection accuracy of a DFD scheme decreases rapidly when there are small number of neighbor nodes to be diagnosed and the ratio for node's failure is high.

Feilong et al. [4] has proposed a routing protocols and technologies of communication on those wireless areas are enormously applied to sensor networks in order to improve the quality of service and communication. The schemes in [5] to [9] addresses the sensor node failure detection but all the existing schemes has increased data loss.

III. PROPOSED SYSTEM FRAMEWORK

a. Check Point Route Recovery Algorithm

The Check Point Route Recovery Algorithm (CPRRA) is used to detect the energy drain in a node, before the energy of that node is completely drained. The Static sensor node monitors each and every actor node and if there is energy loss in any node then it intimates the Dynamic sensor node. The dynamic sensor node finds the nearest node whose energy level is high and has the lowest number of links. This actor node then replaces the failure node using the CPRRA. The links of the node which replaces the failure node is maintained with the help of NTM.

Check Point Route Recovery Algorithm calculates the energy level of each node by sending Heart beat messages. Actors will periodically send heartbeat messages to their neighbours to ensure that they are functional, and also report changes to the one-hop neighbours. Missing heartbeat messages or Misbehavior route messages [10] can be used to detect the failure of actors. Once a failure is detected in the neighbor node, the one-hop neighbours of the failed actor would determine the impact, which is whether the failed node is critical to network connectivity. This can be done by executing Check point recovery algorithm. Basically, a cut vertex F has to be on the shortest path between at least two neighbours of F. The CPRRA serves the shortest path of all nodes. As mentioned, the study come up with a new method for link failure handling and it will be obtained through prediction of signal strength of an active route and divert the date by the current Node into a new path, more details refer System Architecture.

The system architecture shows the method or algorithm used in them in order to implement the module in the system- AODV route Discovery uses AODV routing protocol, Failure Detection implemented using CPRRA,

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selection of node for replacement is also done using CPRRA, Node replacement done by NTM. The architecture of the proposed system is shown in Fig.1.

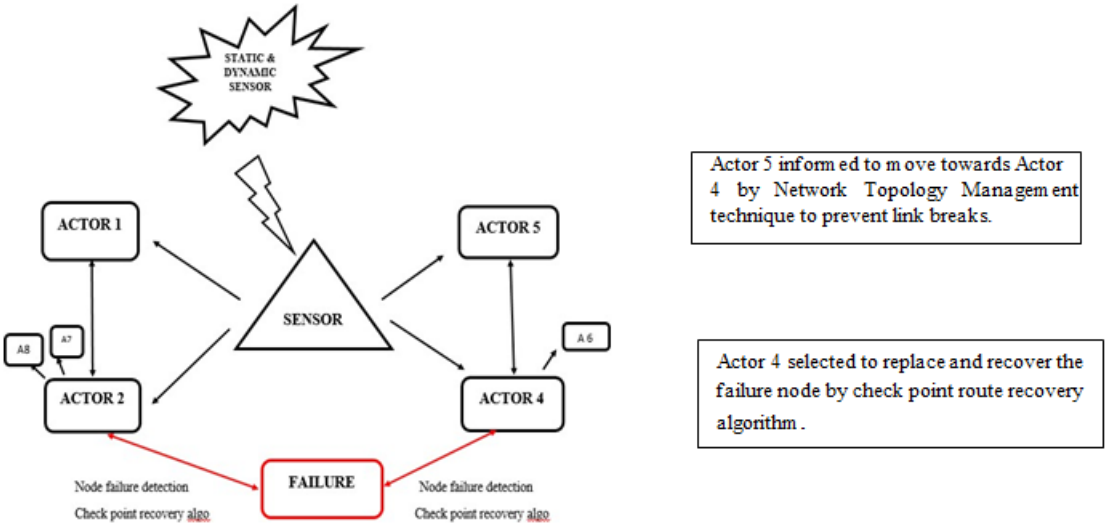

Fig.1 System architecture of Prevention of node failure

b. Failure Node Detection

Once there is a delay in heart beat messages or missing of heart beat messages, then the Static nodes detects the energy drain in that particular node which drops or delays the heart beat messages. The Static node after detecting the energy drop in a particular node intimates the dynamic node. The Dynamic node which is in mobility searches for a node which is nearest to the failure node. The Dynamic node finds a node whose energy delay [11] is high and who has lesser links when compared to other nodes. When the dynamic node replaces the failure node with another node, that node takes all the back up from the failure node. It also helps in the functioning of static and dynamic sensor nodes. The main functionality of static node is to detect energy loss in a particular node and to intimate it to the dynamic node. The Dynamic node selects a node whose energy is high and who has lesser links. The Dynamic node replaces the node with the failure node after taking backup.

c. Selection Of Node for Replacement

A node is selected for replacement only if that node is nearest to the failure node. The node which is selected for replacement should have high energy and should be nearest to the failure node. The selected node for replacement should have lesser links. The Static node monitors whose energy is about to drain. If the static node detects energy loss in a particular node then it informs the dynamic node that a particular nodes energy is about to drain. The static node intimates the dynamic node using signals. The Dynamic node after receiving the information searches for a node which is nearest to the failure node and whose energy is high. The dynamic node selects a node for replacement based on priority [12]. The dynamic node replaces this node with the failure node. The node which replaces the failure node gets back up from that node. The node which took back up will do all the functionalities of the failure node until the failure node has retained energy. After the failure node has regained all its energy it will come back to its position. The energy loss of each node is detected by the static node. The static node and the dynamic node are the main functionalities done with the help of check point route recovery algorithm.

d. Network Topology Management (NTM)

The node replacement is done by Network Topology Management (NTM). The Network Topology Management helps maintain the link between the nodes. It maintains the link between the nodes when energy loss is detected in a node. During replacement there are possibilities for direct links between nodes to break NTM helps maintain the link. It maintains the link between the nodes without affecting the packet transmission. The selection of the node for replacement is based on priority which has less number of links

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connected to it with higher energy level. Based on this the nodes are replaced and back up is taken. The failure node selects a node which has lesser links connected to it. Once it regains its energy it returns back to its normal position. This process takes place continuously.

e. Check Point Recovery Algorithm

The Check Point Recovery Algorithm is given asfollows:

1. Select any Sensor node SNY from WSN with Msensor nodes,
2. The value of Y=1, 2, 3……M.
3. Calculate the energy of the node SNY using (2).
4. If energy of SNY is high then,
5. Failure=false;
6. Else
7. Failure=True;
8. If Failure==false then
9. Collecting data from normal nodes
10. Else
11. Check pointing in backup nodes
12. Go to (1).
13. After selection of the new node SNX, broadcast theID of the node SNX to its normal nodes.
14. Stop.

IV. EXPERIMENTAL DISCUSSION AND EVALUATION

In WSNs, the node failure deteriorates the quality of wireless links. Malicious node leads to loss of data. To evaluate our Check Point Recovery algorithm, we developed a simulation system, which is built on the NS2 simulator. Here, we present our simulation results to evaluate our CPRA. First, we describe the simulation system setting. We then demonstrate the performance of our CPRA by comparing it with related proposals.

The performance is evaluated based on the following parameters:

1. Packet Delivery Ratio (PDR)

The ratio of the data packets delivered to the destinations to those generated by the constant bit rate sources. It describes the loss rate that will be seen by the transport protocols, which in turn, affect the maximum throughput that the network can support.

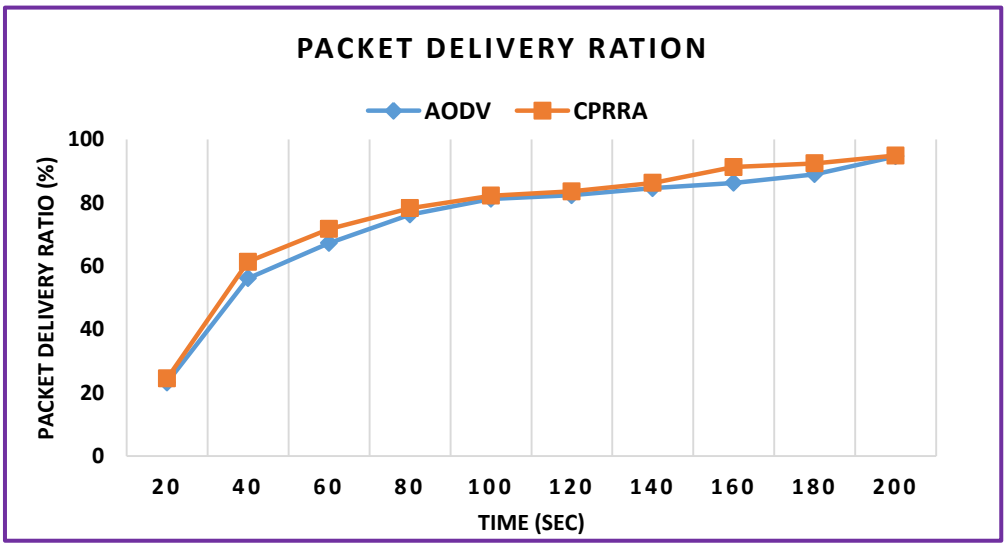

Figure 1: Packet Delivery Ratio

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2. End to End Delay

The delay experienced by packet from the time it was sent by a source till the time it reaches the destination.

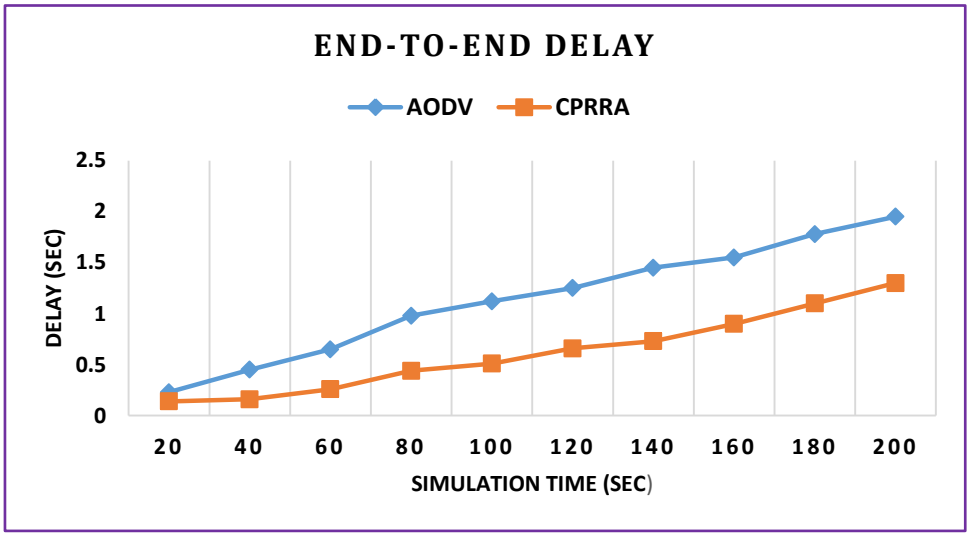

Figure 2: End- to-End Delay

3. Throughput

It is the average number of messages successfully delivered per unit time. Throughput performance is calculated to be the number of data packets delivered to the destination nodes.

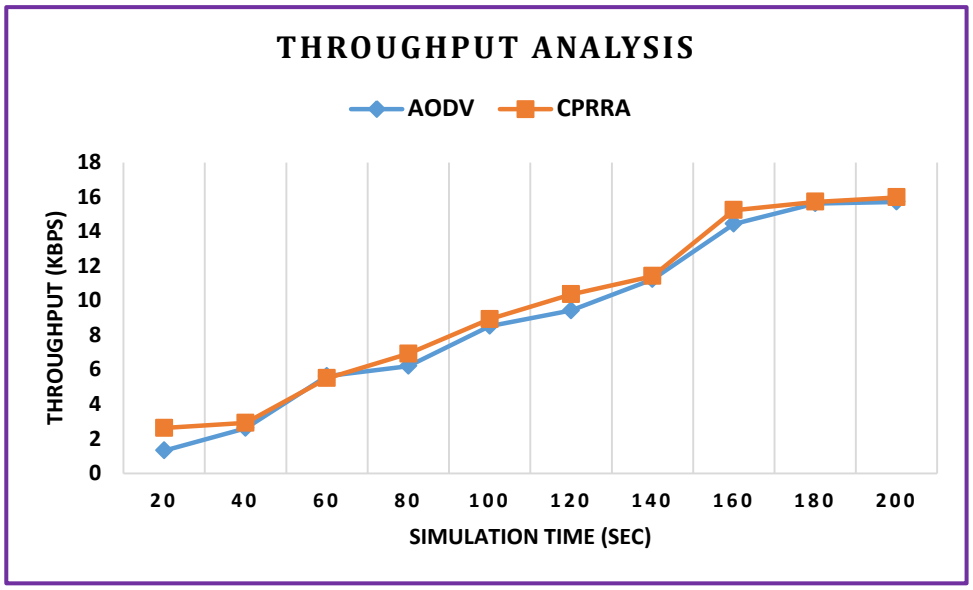

Figure 3: Throughput Analysis

4. Energy Consumption

Energy consumption calculates the present energy of all nodes are subtracted from initial energy of all nodes. This calculates the total energy consumed by the node with respect to time.

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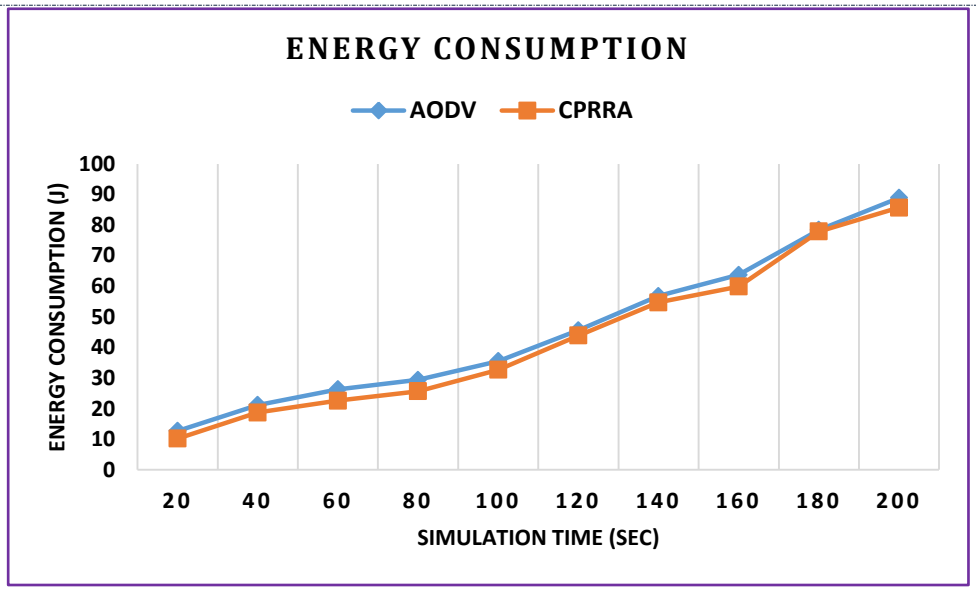

Figure 4: Energy Consumption

5. Energy Drain Rate

The draining rate of energy for different sensor nodes like actor, static and dynamic nodes are calculated.

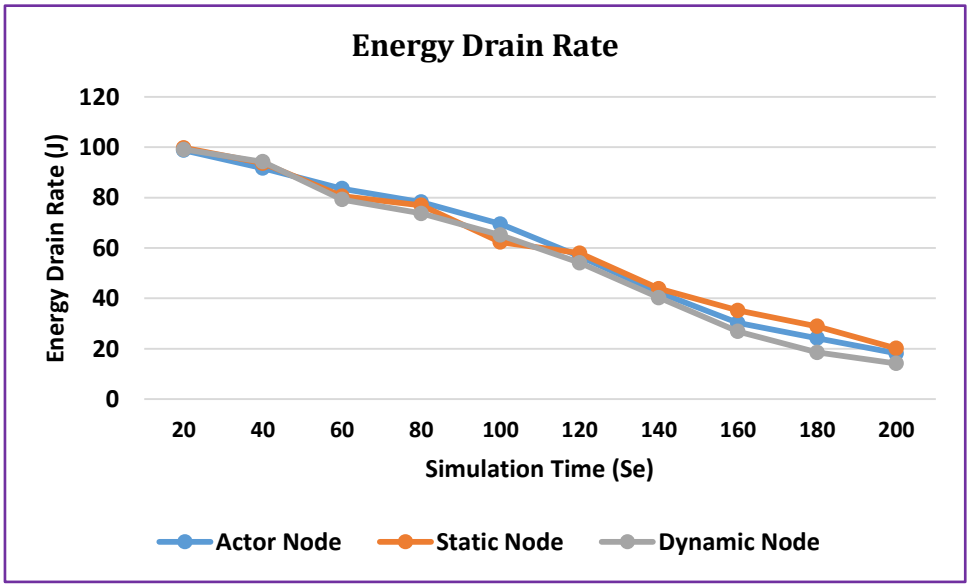

Figure: Energy Drain Rate

6. Route Detection Time

Route detection time is the time it takes to find an optimal route with respect to number of nodes.

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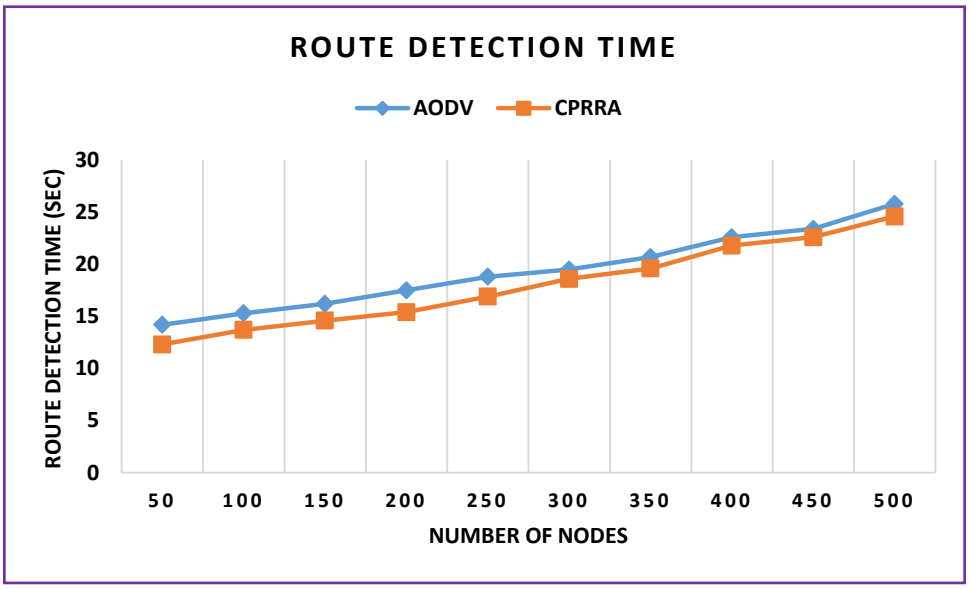

Figure: Route Detection Time

V. CONCLUSION AND FUTURE WORK

In this paper, prevention of node failure is done using AODV routing protocol, Check Point Recovery algorithm and Network Topology Management. These three methods are combined together to find the best route for packet transmission without much energy loss and to detect the node whose energy level is about to drain using a Static node which intimate the Dynamic node about the energy drop in a particular node. The Dynamic node searches for the nearest node whose energy level is high and also has a smaller number of links. The failure node is replaced with the node whose energylevel is high. This is done with the help of CPRRA. NTMmaintains the path between the nodes without breaking for better communication between the nodes; the link is established even after the replacement of the node without affecting the packet transmission. Thus, this results in a Reliable, Robust and energy-efficient communication betweenthe nodes. In future, there is a possibility of producing better results while combining check Point Recovery Algorithm with other existing routing protocol such as AOMDV, and also other algorithm such as Ant colony algorithm. There is a scope for improving in finding the best path and energy efficiency of the node.

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