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An Artificial Intellegence Based Relay Node Tree Formation Network(AIBRTN) for Secure Data Transformation To Enhance The Life Of Wireless Senser Netwoks

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Abstract

This research article proposes a noval approach for enchancing life of wireless senser networks and secure data transformation from source node(node closes to environment) to sink node(root of Wireless Senser Network) by introducing a tree formation with artifical intellegence based decision making at relay node side in Wireless Senser Network. This research article induces a balanced algorithm that manage the performance and quality of tasks performed at each node are as following:1)number of source node directly connected to Intermidiate node (2)energy of each source node and relay node before and after data transformation (3) calculation of shortest path for data taransformation between senser node (4)Artificatical intellegence basesd shifting load(number of source node directly connected to relay node) from one relay node to other relay nodes to overcome queinng delays at relay node or if energy of one relay node is dying and its load can easily be managed by other relay node with proper updation messege to all relay and source node to overcome minimum life due less energy in WSN.The simulations is performed with applying above mentioned approach to find the (1)energy efficiency at each node of network, (2)queuing delays(3)maximum throughput of network without data aggregation and result showed that proposed technique has better results than Tree Based Data Aggregration method(TDAM) and balanced tree for data transfmission(BDTML) as mentioned in litrature[1,3].

Keywords*: *Wireless Sensor Network, BDTML, AIBRTN, Sink Node and Source Node.

1. INTRODUCTION

Modern day life the technologies or modified techniques (improvement in already existing technologies) are introduced and experimented to ease the way of life .The current trend in industry for secure and easy managing of system (such as power plants managements, to calculate temperature, pressure of boilers, humidity in air effecting products, spy applications, surveillance etc.) is being done by the implementation of Wireless Sensor Network.

The WSN system have some issues related to less power for data transformation, less memory and limited energy life(life of system).It consists of large number of source nodes and one or more sink node depending on network or the system to be managed. Source node gets the required information from the environment to which it is dedicated and send to sink node .The base station is at the sink node side and delivers the data to the users through internet.

Normally there are four important component in the source node (a) sensor (depend on the application for which source node is used). (b) processor (c) transceiver (d) battery [4].Now a days there are also sensor with data backup faculty to back up the data so that if energy failure is done data is not lost [1].Different architecture are

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Formulated to maximize the data and life of WSN as mentioned in research article [1-4] each time the node is sensing the data or transceiver portion of node works its energy get used and due to which we say the WSN has limited energy resources.

Normally in tree based technique for data transmission from environment end to user in WSN, nodes are arranged at different hierarchies to form a tree. The sink node is called the main root of tree and is directly connected to user or a base station. Relay nodes are the stem of the tree .The source node are the leaves of the tree and land is the user, water is consider as instructions from user and nutrition from water is transferred to stem (relay node) and from stem to leaves (source node) and required fruit (fruit is the task required by the user in WSN) is produced [3, 4].

In this research article the artificial intelligence based decision is done on relay node by the sink node under the instructions of user to avoid the queuing delay which could leads to packet transmission failure and shifting of load (number of source node) from one relay node to another relay node by constant calculating the minimum energy level required for data transformation by each node. If the system is large to be managed there is another sink node for load sharing and backup purpose. The main theme of this novel approach is enhanced the idea in presented research article [3] by obtaining maximum throughput in limited energy resources with proper energy harvesting on each node. This can lead to extend in life of the WSN.This means to work/sense for longer period as compared to other approaches mentioned in search articles [1-4].

This research article is organized in further five sections which are as following: **(section-II)** includes Literature review (related work and identification of problem).

(Section-III) includes proposed approach methodology **(section-IV)** includes the Formulation (parameters and formulas to extract the results for comparison between TDAM and BDTML approach). **(Section-V)** includes the results and comparisons.

2-LITERATURE REVIEW

This section include the identification of key parameters from different approaches used by different researches and problem related to the approach and need of proposed approach (AIBRTN).

In research article [6] the tree formation in WSN is done with source node directly connected to sink node. Once a source node is connected to sink node its position (connectivity) cannot be changed. There is no relay node in the network .To save the energy the transceiver portion of the node is kept off and can be operated manually if needed to save energy and in some cases can be kept in standby mode if there is any disturbance the sensing portion sense and send to sink node if during this time if sink node transceiver is off the data packet is lost.

In research article [7] the tree formation in WSN is done with major emphasis on the distance from the sink node .The node which is closer to sink node is selected as parent node by the source nodes, without referring the number of source node already connected to sink node with reference to this node. If the energy of that parent nodes ends the data transmission is stopped.

In research article [8] the tree formation in WSN is done by considering the node having shorter distance to maximum parent nodes and source nodes is selected as sink node. So during this methodology all the load is on that sink node and there is also no backup all the system leads to unbalanced energy harvesting.

In research article [9] the tree formation in WSN is done by selecting the sink node with maximum energy .But as the systems runs all the load is on that single node due to maximum energy and whole system degrades quickly.

In research article [3] the problem existed in above techniques is somewhat solved by using a check sum at the relay node but not managed by sink node to schedule the traffic as proposed in this research paper technique.

In research paper [1] the node close to the root and with shortest distance is selected as relay node. With this there comes a time when a one node will be sharing maximum number of load of system and queuing delays for packet transmission start to form with approach.

All the problem mentioned above are solved by proposed technique, in which a balanced algorithm is applied that manage the performance and quality of tasks performed at each node are as following:1)number of source node directly connected to Intermidiate node and is controlled by the repetitive controller applied at sink node so that the tally of load on one relay node not exceed the safe limit. (2)energy of each source node and relay node before and after data transformation (3) calculation

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of shortest path for data transformation from source node to sink node,so that by repetitive controller the source node data packet can be routed by any other path which require less time and energy to maximize the life and reduce the queuing delays for packet transmission.(4)Artificatical intellegence basesd shifting load(number of source node directly connected to relay node) from one relay node to other relay nodes to overcome queinng delays at relay node or if energy of one relay node is dying and its load can easily be managed by other relay node with proper updation messege to all relay and source node to overcome minimum life due less energy in WSN.

3-PROPOSED APPROACH METHODLOGY

This section is further sub divided into three section which is as following: **A.Working of Proposed technique:**

The block diagram of (AIBRTN) based network is shown in figure (1).The proposed network can have one or more sink node depending upon the load on the system or the sink node can be used for data backup. Once sink node is selected the root of tree by broadcast messages to other neighbouring node. These neighbouring nodes are the relay node and acting as a bridge between source node and sink. The relay nodes responds with uni-cast message and select sink node as their parent node. Now sink node have x-y coordinate position of all relay node in the network. The relay node further send the broad message to their neighbouring nodes (source node) so to be selected as parent nodes for that source node send the data packet in response. The repetitive controller is design at the sink node side that all the time calculate the exact number of load on each relay node for proper scheduling of load and to have maximum throughput.

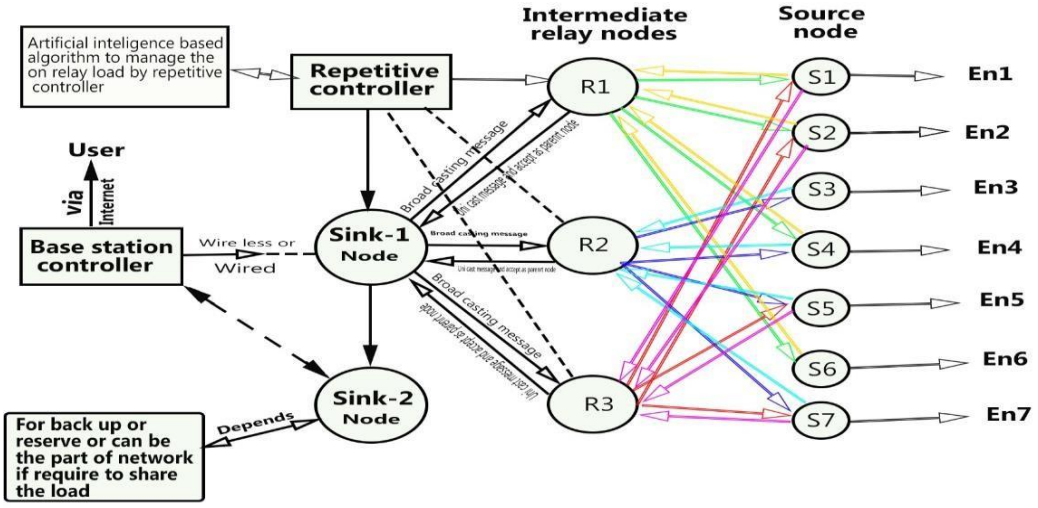

Figure 1: block diagram of proposed (AIBRTN) technique

Figure 1: block diagram of proposed (AIBRTN) technique

B.Assumption made for implementation of proposed Technique:

The emphasis of this approach is to have load balancing at the relay node side so that maximum through is achieved and less energy is utilized for packet transmission and reception by avoiding queuing delay which used to keep sensor node on for longer period of time. For the implementation of proposed technique, there are following assumptions:

- All the sensor nodes inside (AIBRTN) based network are considered static.
- Each node known its location(X-Y coordinate position) for its proper identification. Once the tree formation process is completed all the relay node selected as stem of tree along with root node contain information about x-y coordinate position of all sensor nodes.
- All the sensor node possess the same amount of energy. The energy is used only during data packet transmission and reception.

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- All the data packets are routed from source node to sink node with proper energy harvesting at the relay node side.
- No energy is utilized at standby mode
- Each sensor node has equal ability to generator the data packets in this proposed network.

C.Step in term of flow diagrams for construction of (AIBRTN) based proposed network The step by step procedure of above mentioned technique with flow chart is as following:

Step #1:
The AIBRTN based tree formation is started with selecting the number of sink nodes required in the system. If the load on the system is greater than two or more sink nodes can be used .Normally one sink node is used and the other can be deployed for data backup purposes as shown in figure (2).

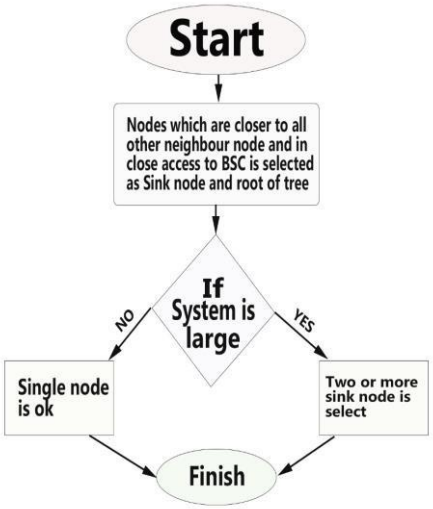

Figure 2: Procedural diagram of step # 1

Step #2:
In this step the sink node as a root sends message to the other nearby node and the node that directly receive message from sink node are at first contact to each other and are called intermediate or relay node. The relay node acknowledge the message in the unicast form and providing x-y coordinate location.

Step #3:
In this step, the relay nodes further send the broadcast message to all other neighbouring node .The message includes the distance from the sink node and already source node connected to the corresponding relay node .The source node responded to message in unicast form and select the corresponding relay node as its parent node that have more energy and less load and having provided with shortest path from the source node to the sink node. The above mentioned concept is shown in flow diagram (figure 3).

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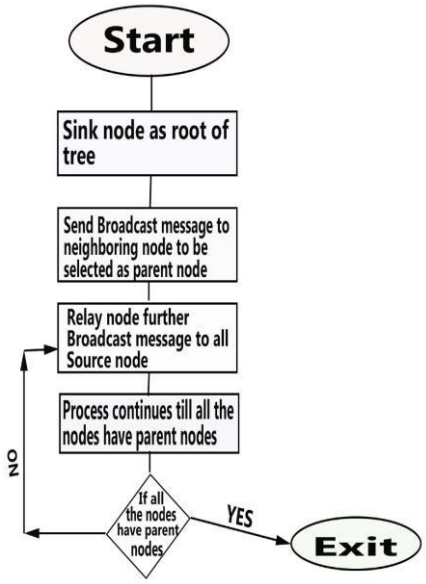

Figure 3: Procedural diagram of step #2 and 3 (selecting the relay node as parent node by the source node)

Step #4:

The step #4 is divided into the two cases and shown in figure (4) and its explanation is as following:
Case1: the source node that has previously accepted a corresponding relay node as parent node now gets another broadcast message by another relay node and founded having less load and providing shortest distance between source and destination the new relay node is selected as parent node and information is updated to the sink node being run under repetitive control algorithm.
Case2: the source node that has previously accepted a corresponding relay node as parent node now gets another broadcast message by another relay node and founded that this relay node is already loaded and providing queuing delay so in that case the previous status is maintained thus message is discarded.

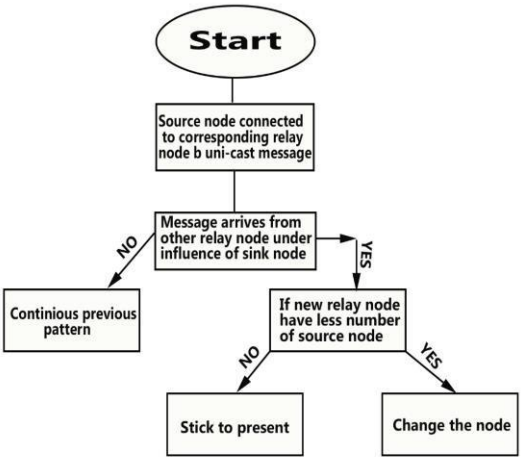

Figure 4: Procedural diagram of step #4 (selecting the relay node as parent node depending on repetitive controlled algorithm)

Step #5:

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In this step, the sink node detect the overload condition with repetitive controlled algorithm and shift the load of one relay other relay node if that relay node have more residual energy and have less load(source node connected),This concept is explained in figure(5)

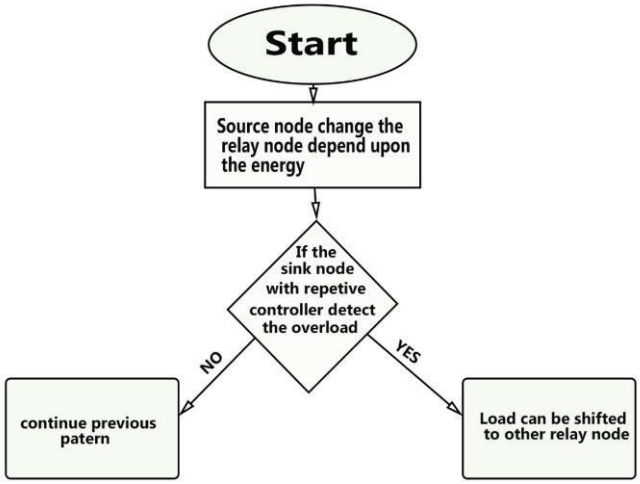

Figure 5: Procedural diagram of step5 (energy harvesting to maximize the throughput of the network)

Step #6:
The sink node always calculate the minimum with-stood energy level of each relay node. If the relay node is busy in packet sharing and other relay are not loaded so the load can be shift by proper message to source node by avoiding more energy lost in queuing process.

4. FORMULATIONS AND PARAMETERS TO CALCULATE THE PERFORMANCE OF PROPOSED SYSTEM

A. Simulation parameters:

Every node in the network have equal energy at the start of simulation. Energy is consumed as mentioned in table (1) during process of data transection, consider zero energy loss at standby mode. The different parameters along with their values used in simulation in network simulator tool is shown in table (1).

Table 1
Parameters used in simulation of proposed technique (AIBRTN).

Channel used for transformation of packets	Wireless
Area to be covered	900*300 meters
Nodes	22
Source nodes	7
Power required for transmission	2 watts
Power required for reception	1 watts
Initial energy	100 J
Simulation time	40s
No of source nodes	7
Radio propagation model	duplex

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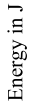
B. Formulation of performance parameters:

The different parameters to evaluate the over performance of system is as following:

1- Energy Constrains:

The formulas to calculate the remaining energy value of node at the send of simulation and for better comparison with BDTL is given as

Energy= power* time (1)



Transmission power is given by P_T, Received power is given by P_R, Energy of node during transmission is E_T and energy of node during receiving is E_R, where T_t and T_R is time taken in transmitting and receiving data packet respectively.

$E_T = P_T * T_t$ (2)

$E_R = P_R * T_R$ (3)

The time for the data packet is calculated by the following formula

$$\text{Time} = \frac{\text{Packet Size} * 8}{\text{Bit rate}} \quad (4)$$

Every node start with equal amount of initial energy and during transmission and reception of data packet is energy is reduced every time. The current value of energy after every transmission and reception is given by $Node_{cv}$.At the end of simulation the value of $Node_{cv}$ indicate the amount of energy left and can be used for comparison.

$Node_{cv} = Node_{cv} - E_T$ (5)

$Nodecv = Nodecv - E_R$ (6)

2- Queuing delay:

It's the total time required by the packet to reach to the destination from the source it is given by

$$\text{Q-delay} = \frac{\sum (\text{delay of data packets}}{\sum \text{total data packets received}} \quad (7)$$

3- Maximum Throughput of the network:

It's the total number of packet received by the total number of packet transmitted.

$$\text{Throughput} = \frac{\sum \text{data packets received}}{\sum \text{total data packets transmitted}} \quad (8)$$

Simulation Results and Comparison

A-Comparison of Energy Constrains in AIBRTN and BDTML:

The figure # 5 shows the comparison of energy constrains in J on y-axis and simulation time in s on xaxis. It can be seen from the figure that at the end of simulation time the energy remaining in the AIBRTN (blue colour line) is far greater than BDTML (red colour line).

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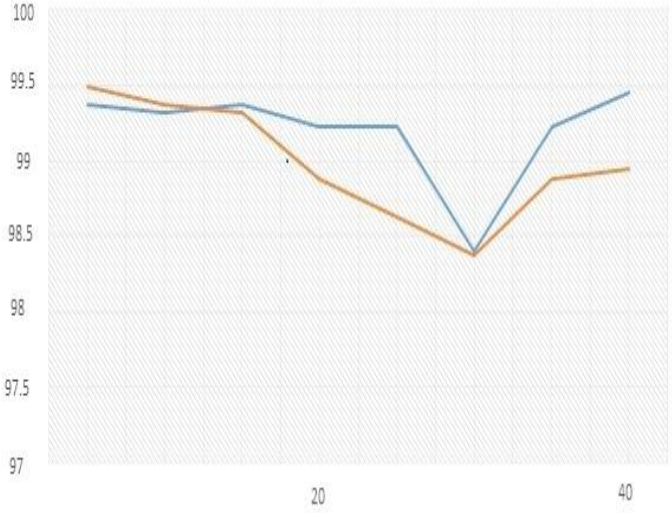

Figure 5: Comparison of AIBRTN with BDTML in term of Energy constrains

B-Energy constrains with number of Node in the network:

The figure # 6 shows the comparison between remaining energy of the node and number of node and represent that time the energy remaining in the AIBRTN (blue colour) is far greater than BDTML (red colour).

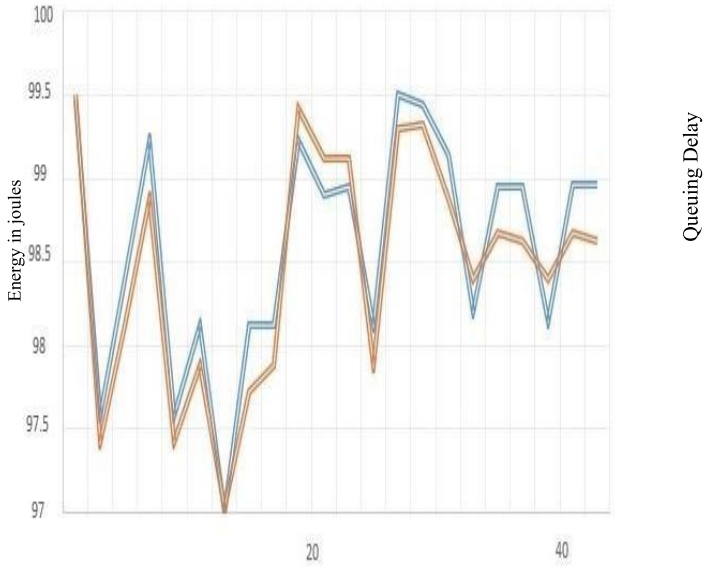

Figure 6: Comparison of AIBRTN with BDTML in term of Residual Vs Node in network).

C- Queuing delay:

The figure # 8 shows the comparison of queuing delay with and shows AIBRTN is having less delay than BDTML. By using formula given in equation#7 the queuing delay in AIBRTN is 16.75 and that in BDTML is 24.56 as shown in figure #7

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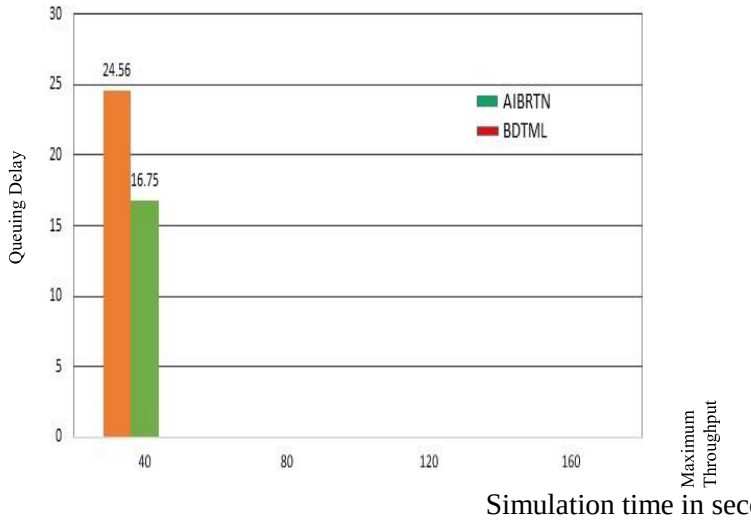

Figure 7: Comparison of AIBRTN with BDTML in term of Queuing Delay

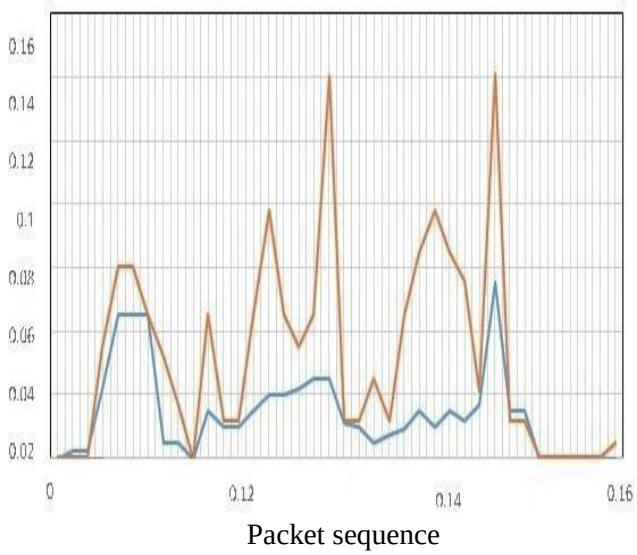

Figure 5: Comparison of AIBRTN with BDTML in term of Queuing delay in term of packet sequence.

D-Throughput:
The figure # 9 shows AIBRTN shows the maximum efficiency and throughput as compared to BDTML system.

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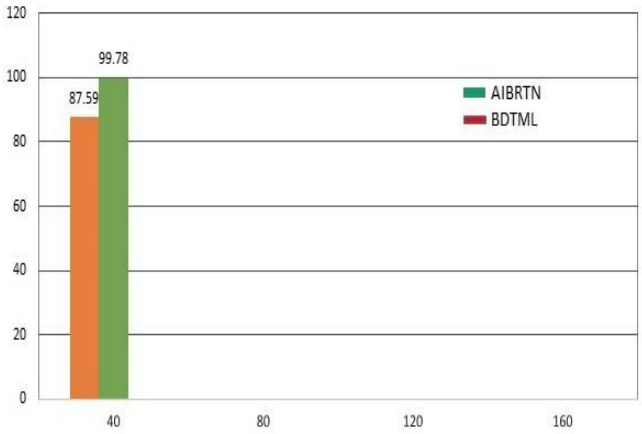

Figure 9: Comparison of AIBRTN with BDTML in term of Throughput.

CONCLUSION:

The method proposed in this research article paper is implemented satisfactory result are obtained .The AIBRTN performed better while comprising with other research technique in [1-3].The proposed system showed better performance in term of residual energy, less queuing delay and maximization of throughput of the WSN.

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