Energy Efficiency by Utilizing Link Quality and Loop Breaking In WSN

Sridevi P.M, Jitendranath Mungara, K. Sundeep Kumar, Manoj Challa

Abstract—Energy is a major critical resource in wireless sensor network. Most of routing protocol forward message along with minimum energy to the sink to minimize the consumption of energy, which causes imbalance of residual energy and link unreliability among all sensor nodes. In this paper, with the help of the potential classes, we are going to design the energy balanced routing protocol with link quality by creating mixed potential field in terms of energy density, residual energy, depth and link quality. The goal of paper is to forwarding packets towards to sink through dense energy and protect the nodes from low residual energy. The link quality mechanisms rely on aggregation of the high quality links to maintain network connectivity for long time, which avoids unwanted transient topology break down. Our results show that improvements in balancing energy, network throughput and network lifetime in wireless sensor network.

Index Terms: WSN, balanced energy consumption, potential field, required power, energy efficient routing and link quality.

I. INTRODUCTION

Wireless sensor network (WSN) has recently energized as a platform for various applications such as environment all monitoring, disaster recovery and battle surveillance. It plays important role in network to sense the physical world [2]. To extend the network lifetime, energy, efficiency is one of the major problem in the WSN protocol design. To overcome the problem, energy available at sensor nodes are more efficiently routing protocol attempts to find minimum energy path to the sink and also to optimize the energy at particular nodes. The imbalance of energy consumption is undesirable for the long-term of the network lifetime.

By causing uneven energy imbalance the network partition reduces (or) decreases the network connectivity, a number of protocols have been introduced to minimize the energy consumption. This article proposes a novel routing scheme that solves the energy imbalance of previous existing routing algorithms and also we demonstrate the useful of balanced energy consumption across a network. The energy imbalance in distribution is due to a topology limits the number of paths along which forward the data packets can flow initial deployment. Application themselves identifies the location and rate where generate the data by nodes. The path, along data forwarding with more packets and generating more data suffers faster energy depletion.

The three main reasons which causes imbalance in distribution of energy:

1. Topology: The number of paths along the data packets can flow. For example, if there is only one path to the destination, nodes along the path deplete their energy.
2. Applications: Application represents the location and rate at which nodes generate data. if area generating more data and forward packets which suffers more energy.
3. Routing: Routing which causes imbalance and always choose static path to reduce energy consumption which give energy at node on path is depleted.

In this paper we develop a EBQL and loop breaking through energy efficient in WSN using the concept of virtual potential field with energy balanced link quality. The 3 independent virtual potential fields in the terms of depth , energy density and low residual energy where it establishes a routing to make packets move towards the sink, along the high energy areas and residual energy filed protects the node with low energy and also link quality finds the correct link path in potential gradient.

It also addresses the routing problem by introducing queue buffer while tracing the path.

II. RELATED WORK

In existing system EBRP[1] delivers the packets from source to destination when event occur through dense energy and protect the nodes from dying. While tracing the route, routing loops can be detected and eliminated.

Existing EBRP, with the absence of link quality transient topology break down takes place and also while tracing the route the loops detection consumes time and energy more and it is difficult to balance the energy.

III. ENERGY BALANCED WITH LINK QUALITY

The paper works on balancing energy consumption and avoiding the routing loops occur during the forward packets to the sink. We are adapting the potential field in classical physics i.e, energy balanced link quality with the terms of depth, energy density, residual energy and link quality. The field routes the path to the sink:

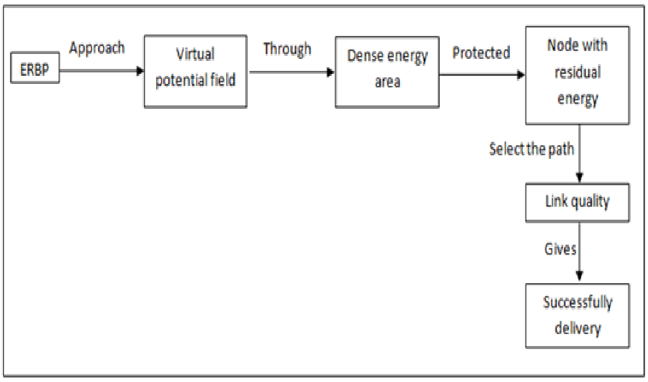

Fig 1: Process of EBLQ .

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Depth: The number of hops with the shortest path from the sink to node. The depth of the field of potential field is given by

$$V_d(d) = 1/d+1 \quad \text{-------- (1)}$$

where d is the depth of node i.

Energy Density: By adding up all energy value of its entire neighbor node through data exchanged among nodes with area of the radio coverage disk.

$$V_{ed}\ (i, t) = ED\ (i, t) \text{ ---------- (2)}$$

where V_{ed} (i, t) energy density on the position of node i at time t.

Residual Energy: To protect the node with low energy, where ever node become weak (or) sustain.

$$V_e(i,t) = E(\ i,t) \text{ ------------ (3)}$$

Where Ve(i,t) is the energy potential of node i at time t, and E(i,t) is the residual energy of node i at time t.

Link quality: The processes rely on the aggregation of high quality links to maintain robust network connectivity.
(RSSI strength of signal from Ni/RSSI strength of signal from Nmax)*100 ----------- (4)

IV. ROUTING ALGORITHM

Initially depth of all nodes is set to be some value, but default depth of sink is 0. The sink sends first update message to the nodes, if the nodes away from the sink with one hop than it will get their own depth value by adding 1 to update message. By using battery model [3], the value of residual energy sent through message, thus each and every node comes to know the residual energy of its entire neighbor node and which records into routing table. By using the signal attenuation mechanism Received Signal Strength Indicator (RSSI) we can calculate the distance between two neighbor nodes. The link quality is first translated at every node to index and checks the quality of link by using highest RSSI strength.

Process of update message: When a node receives update message from one of its neighbors, it will refresh its routing table and reselects a next-hop node according to the

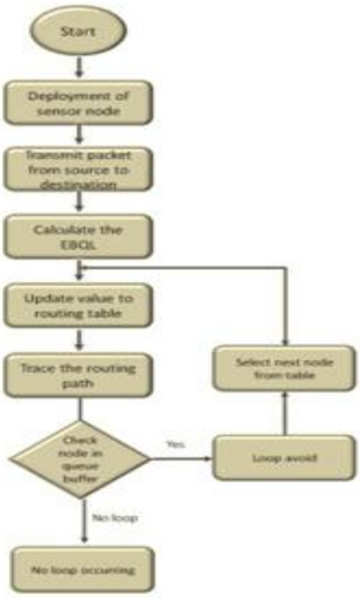

Fig 2: Data flow of EBLQ with loop breaking

It chooses the next node according to maximum depth energy density and residual energy with maximum and minimum depth of neighbors & minimum cost of links.

Pseudo codes of EBLQ Routing Algorithm:

1.Local_Energy_Density=calculateLocalEnergyDensity().
2. fd = (Local_Depth + 1) / (u_Msg.Depth + 1).
3.fed=u_Msg.Energy_Density/Local_Energy_Density.
4. fe = u_Msg.Energy / Local_Energy
5. LQ = (RSSI strength of signal from Ni/RSSI strength of signal from Nmax)*100.
6. COST = Distance (neighbor_ID).
7. D = Um / COST.
8. updateRoutingTable(neighbor_ID).
9. Select the Lowest Depth from the routing table as LD.
10. If(Local_Depth > LD + 1 then
11. setLocalDepth(LD + 1)
12. end if
13. Select Parent according to max-D, max- Um, max-Ued, max-Ue,max-Ued, max-Ue, min-u_Msg.DEPTH, min_ COST,Random.

V. LOOP BREAKING

A routing loop can be seen as a circular trace of routing update information which returns to the same parent sensor node either directly from the neighboring node or via a loop topology. To prevent routing loops due to they consume a large amount of bandwidth and impact the end-to-end performance of the network.

By tracing path and monitoring events occurs in network. We find routing loops caused by ERBP into 3 types.

One -hop-Loop: Loop occurs between local node and its parent,

Origin-Loop: Its consists of one (or) more sampling nodes, and it is back to back loop,

Queue-Loop: Here in queue loop, node transfers a packet will check if the length of local node is greater than threshold set if so queue has been detected a CLP packet is sent else the packet is forwarded to the next hop node.

To overcome the three type of routing loop ,we are using queue buffer for tracing the route where node is updated or stored in buffer and which avoids the looping by checking every time in buffer during process from node to neighbor node.

```
if(LOOP_DETECT)
 {
if((i!=node)&&(NEXTHOP_INDEX[i]>nhi_max)&&(CON
NECTIVITY[node][i])&&(NotInQL(i)))
  {
   nexthop = i;
   nhi_max = NEXTHOP_INDEX[i];
     }
   }
 else
 {

if((i!=node)&&(NEXTHOP_INDEX[i]>NEXTHOP_INDE
X[nexthop])&&(CONNECTIVITY[node][i]) )
     nexthop = i;
   }
```

VI. SIMULATION RESULTS:

The simulation experiments in WSN are conducted and evaluate to get performance of our EBQL and are compared with EBRP. The simulation is proposed. As initial step to implementation of energy routing protocol and queue buffer. We have evaluated the network lifetime with queue buffer and also the energy consumption.

The following parameters are taken to show our simulation.

Parameters	Values
Channel	Wireless
Deployment area ,type	Radius=500,homogeneous
No of nodes	15
Sink	(0,0)m
Node	Total energy 1000,range 20m
Sampling rate	0.1 packet/s
Datapacket size	512

The figure 3 shows the network lifetime the no of sampling nodes requires to be alive and amount of time that is task should carried out perfectly. The comparisons between EBRP and EBLQ shown in fig 3.

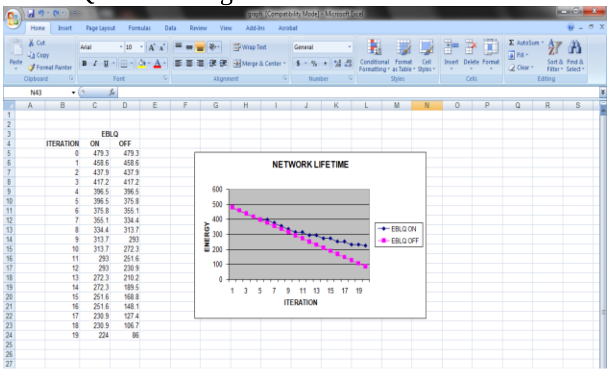

Fig 3: Network lifetime

The fig 4 show power utilizes among the nodes is compared with EBRP.

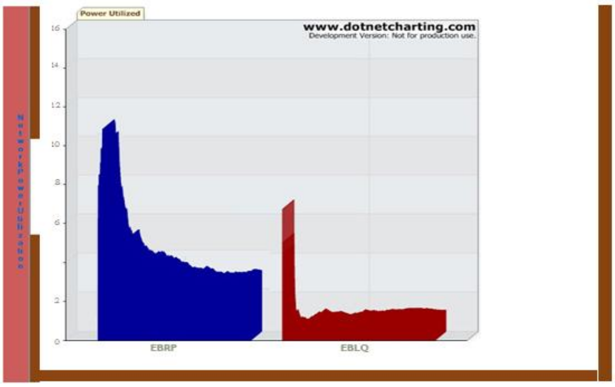

Fig 4: Power utilizes

VI. CONCLUSION

In this paper, we are propose by the help of potential, we are going design an EBQL by constructing a potential field in terms of depth, energy density, residual energy and link quality. The packet move towards to the sink through dense energy area move towards to the sink and also to protect nodes with low residual energy. The link quality gives the best path link. To solve the routing loop problem by the help of queue buffer index we complete eliminate the loops occur during the process.

Finally, the performance of routing algorithm is done and our results show that significantly increases in energy balance, network connectivity, and lifetime also through put in WSN.

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