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Underwater Wireless Sensor Networks

M.ChinnaDurai, S.MohanKumar, Dr.S. Sharmila
Diploma in Information Technology, PSG Polytechnic College, Coimbatore
Head, Department of Information Technology, PSG Polytechnic College, Coimbatore

Abstract: The applications of underwater sensor network are oceanographic data collection, pollution monitoring, offshore exploration, disaster prevention, assisted navigation and tactical surveillance applications. The routing protocol designed for specific roles, leads to issues in the network. The major issues for development of routing protocol for underwater sensor network are harsh deployment environment, low bandwidth, high propagation delay, requires high battery energy, Temporary losses, Fouling and corrosion and High bit error rates. In this project the certain issues to be rectified are low bandwidth, energy efficiency and data delivery.

I.INTRODUCTION

More than 70% of the earth surface is covered with water. New technologies have brought us new ways to explore this vast unexplored aquatic environment. These technologies provided us with a number of applications for scientific, environmental, commercial, and military purposes including pollution monitoring, disasters prevention in terms of tsunami warnings, assisted navigation, offshore exploration, oil/gas spills monitoring, tactical surveillance, and so forth. However, due to unique characteristics such as large propagation delay, low communication bandwidth, node mobility, high error rate, and harsh underwater environment, existing solutions of terrestrial sensor networks cannot be applied directly to underwater sensor networks.

II.BENEFITS OF WSN

The role of a Wireless Sensor Network (WSN) as a collection of miniature computers designed for an extremely resource constrained environment. They must satisfy the following characteristics: 1. small size in order to be unobtrusive or hidden and not clutter up the landscape , 2.very cheap so they can be affordably deployed in large numbers , 3. extremely power efficient. Power efficiency extends battery life or allows energy scavenging from the environment. The sensors could even suggest the fastest route to the emergency area.

In WSNs, the mechanism to create and manage node identities is usually naive and is not well protected. When compared to computer terminals in LANs, wireless sensors must operate on very low capacity batteries to minimize their size to about that of a quarter. The nodes use slow processing units to conserve battery power. Sensors could be deployed from the safety of a plane above the cloud.

III.CHALLENGES TO WSN

Compensation for non-deterministic message latency, synchronization protocols designed for wireless sensor networks should be sensitive to the requirements and limited resources of sensor network applications. However since there are often trade-offs between requirements (e.g. component cost, energy efficiency or scalability) a single synchronization scheme may not satisfy these altogether. They define these requirements as:

Energy efficiency: As with all protocols designed for sensor networks, time synchronization techniques should consider the limited energy resources available to sensor nodes. With this in mind, a well-designed synchronization technique should achieve its goal with the minimum number of transmissions.

Scalability: Many sensor network applications require a large number of sensor nodes to be deployed. Synchronization schemes should scale well with increased network size and/or density.

Robustness: Since sensor networks are often left unattended for long periods of time in possibly hostile environments, synchronization schemes should be robust against link and node failures.

Cost and Size: Therefore attaching relatively large and expensive hardware such as GPS receivers or temperature compensated clocks to sensor nodes may not be an acceptable solution to the synchronization problem.

IV MAJOR CHALLENGES

Battery power is limited and usually batteries cannot be recharged, also because solar energy cannot be exploited.

- The available bandwidth is severely limited.
- Channel characteristics, including long and variable propagation delays, multi-path and fading problems.
- High bit error rates.
- Underwater sensors are prone to failures because of fouling, corrosion, etc.

V. RELATED WORK

QoS-based routing protocols allow sensor nodes to balance energy consumption and certain predetermined QoS metrics before they deliver data to the sink node. For example, the end-to-end delay remains within an acceptable range, the link bandwidth pertains to the tolerable compression ratio, the jitter is satisfactory, and there is a low packet loss rate. Providing QoS guarantees in wireless sensor networks consists of a very challenging problem, but several approaches have been proposed in the literature for QoS support. Those all are satisfying in some form of QoS guarantees only. They won't provide full-fledged QoS guarantying routing.

PROPOSED ALGORITHM

A.CALCULATIONS

In propose algorithm, Validity time is calculated. Validity time indicates a time limit, which states and specifies the time for packet to be transferred and delivered at the destination end. The destination node always specified with the certain time limit for receiving data,

VT = C * (1 + a/16) * 2^b

Where, C is the scaling factor for the "validity time" calculation. A is the higher order bit. B is the lower order bit. As validity time decreases, sender needs to process the packet very quickly with the help of priority, so that the performance can be increased. The MPFR protocol does the job here.

The packet Deliver Ratio (PDR) states number of packets delivered successfully at the receiver which is transmitted from the sender

$$\text{PDF} = \frac{\text{Number of received packets}}{\text{Number of sent packets}}$$

The above formula is used to find the packet drop in the network. A high value of Packet Delivery Fraction indicates that most of the packets are being delivered to the higher layers and is a good indicator of the algorithm performance. This is defined as the average time taken by the data packets to reach the intended destinations. This include delay occurred due to different reasons like queuing delay, propagation delay, processing delay etc.

$$\text{AED} = \frac{\Sigma\,(\text{time received} - \text{time sent})}{\text{Total data packets received}}$$

The link stability metric rather than path stability metric is considered. This is due to the protocol scalability properties that we tried to offer to the routing scheme. A node with the best tradeoff between link stability and energy consumption is adopted through a local forwarding criterion. Before explaining the method adopted to estimate the link stability grade, the definition of link stability is provided

By following the strategy outlined in the proposed mathematical model, the expected residual lifetime Ri;j(ai;j) of a link (I; j) of age aij is determined from the collected statistical data as follows:

$$R_{i,j}(a_{i,j}) = \frac{\sum_{a=a_{ij}}^{A_{\max}} a \cdot d[a]}{\sum_{a=a_{ij}}^{A_{\max}} d[a]} - a_{i,j}\ \forall (i,j) \in A,$$

It is assumed that each wireless node has the capability of forwarding an incoming packet to one of its neighboring nodes and to receive information from a transmitting node. In addition, each node is able to identify all its neighbors through protocol messages. It is assumed that each node does not enter in standby mode and each node can overhear the packet inside its transmission range and it is not addressed to itself. The energy needed to transmit a packet p from node I is: (p,i) = I.v. Joules, where I is the current (in Ampere), v the voltage (in Volt), and tb the time taken to transmit the packet p (in seconds).n The energy E(p, i) spent to transmit a packet from node into node j is given by

E (p,i) = (p,i)+(p,j)

Where Etx and Erx denote, respectively, the amount of energy spent to transmit the packet from node I to node j and to receive the packet at node j; to the energy spent to overhear the packet has been avoided.

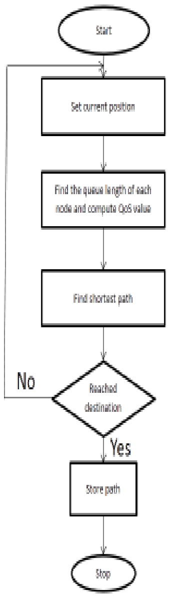
VI. PROPOSED SYSTEM

The biggest challenge in wireless sensor network is to find most efficient routing to increase QOS routing and to reduce the energy consumption. It has been found that Ant Colony Optimization (ACO) is a special kind of optimization technique having characterization of Swarm Intelligence (SI) which is highly suitable for finding the adaptive routing for such type of volatile network. ACO routing algorithms use simple agents called artificial ants. ACO is used because they are more robust, reliable, and scalable than other conventional routing algorithms. ACO routing algorithm uses position information also as routing metric to improve the performance of the network. Typical routing protocol has fixed transmission power irrespective of the distance between the nodes. Limiting factors like small size, limited computation power and energy source, the possible solution excludes use of GPS for identifying the distance between nodes. The distance between the nodes can be determined by using received signal strength indication (RSSI) measurements.

With respect to the distance, an energy efficient swarm intelligent protocol (EESIP) is proposed to adaptively to increase QOS routing. By determining the QOS value and queue length an energy efficient routing is achieved. Through our proposed routing results in reducing the transmission power enough to cover the node, energy expenditure would be reduced thus prolonging the lifetime of battery, which increases the network life time.
Here, we implemented a new protocol EESIP which is based on Ant Colony Optimization algorithm (ACO) for finding out effective routes for WSN. EESIP are more robust, reliable, and scalable than other conventional routing algorithms because of its combination of ant colony optimization. And the path found by using EESIP will be an energy efficient shortest path which is based on

QUEUE LENGTH. The position of the nodes can be found by using Received Signal Strength Index (RSSI) measurement. By considering the position information also the search region can be reduced, here by EESIP can obtain lower convergence rate. Also for optimizing the transmission power, distance between the nodes will find out by using (RSSI). At last to discover the performance of our proposed protocol QOS value is estimated for every transmission from each sensor node to sink node, and also delay is calculated on each sensor routing to sink, through this parameter analysis we can prove our proposed EESIP is more reliable than existing protocols.

VII.FLOWCHART



VIII.NETWORK SIMULATION

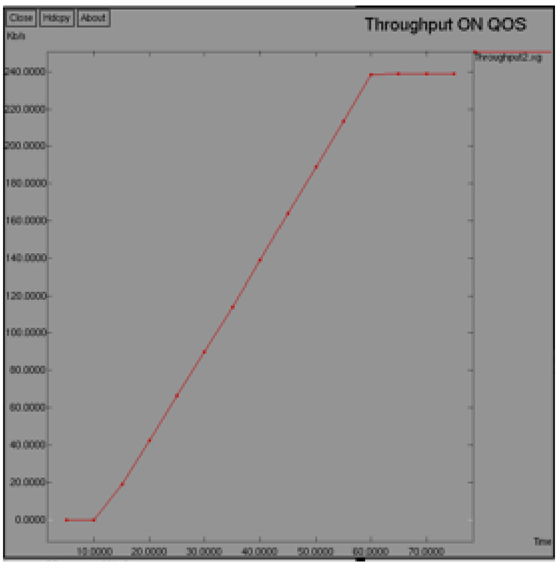


Fig 1.The graph is simulated in Network Simulator which describes about the Throughput of Proposed algorithm

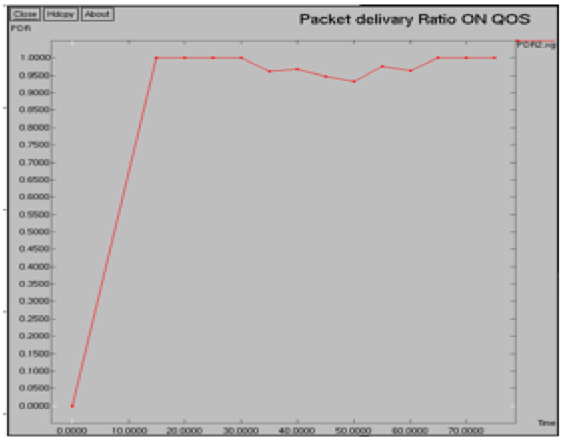


Fig 2.The graph is simulated in Network Simulator which describes about the Packet Delivery Ratio of Proposed algorithm

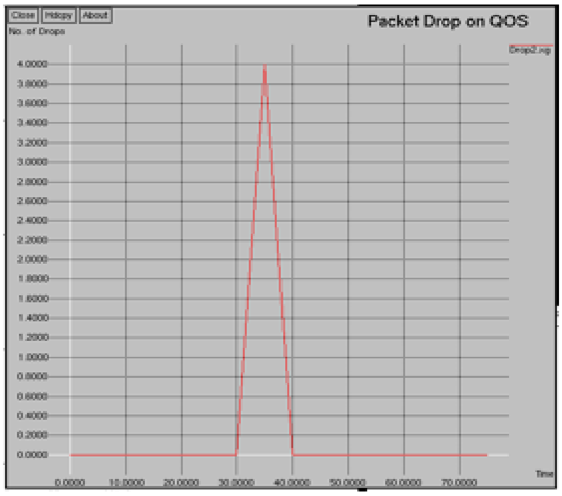


Fig 3.The graph is simulated in Network Simulator which describes about the Packet Drop in the Proposed algorithm

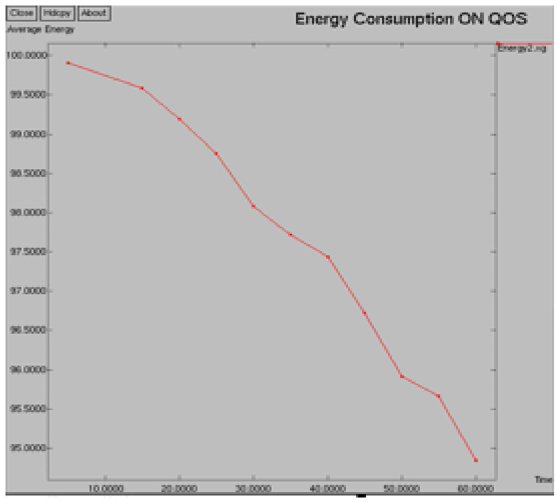


Fig 4.The graph is simulated in Network Simulator which describes about the Energy Consumption of the Proposed algorithm

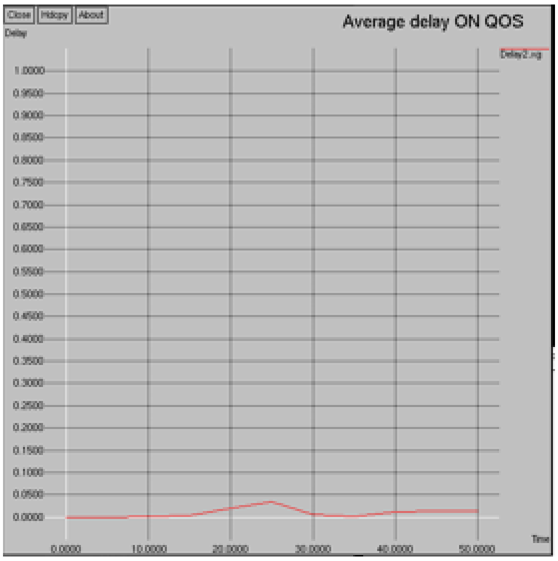


Fig 1.The graph is simulated in Network Simulator which describes about the Average Delay on the Proposed algorithm

D.CONCLUSION

A new protocol for UWSN is proposed and simulated based on an existing protocol named Signal Stability Based Adaptive Routing protocol. By implementing it in underwater wireless sensor, the no of Packet Drop can be reduced

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