International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May -2017 www.irjet.net p-ISSN: 2395-0072

Impact fair and impact free packet scheme for under water acoustic localization

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Abstract - This substance considers the consolidated problem of packet timing and self-localization in an underwater audio sensor network with randomly divided nodes. In terms of packet timing, our aim is to reduce the localization time, and to do so we consider two packet transmission designs, namely a collision-free design (CFS), and a collision-tolerant design (CTS). The required localization time is formulated for these schemes, and through analytical results and numerical examples their performances are shown to be dependent on the circumstances. When the packet duration is short (as is the case for a localization packet), the operating area is large (above 3 km in at least one dimension), and the average possibility of packet-loss is not close to zero, the collision-tolerant scheme is found to require a shorter localization time. At the same time, its implementation complexity is lower than that of the collision-free scheme, because in CTS, the anchors work independently. CTS consume slightly more energy to make up for packet collisions, but it is shown to provide a better localization accuracy. An iterative Gauss-Newton algorithm is employed by each sensor node for self-localization, and the Cramér Rao lower bound is evaluated as a benchmark.

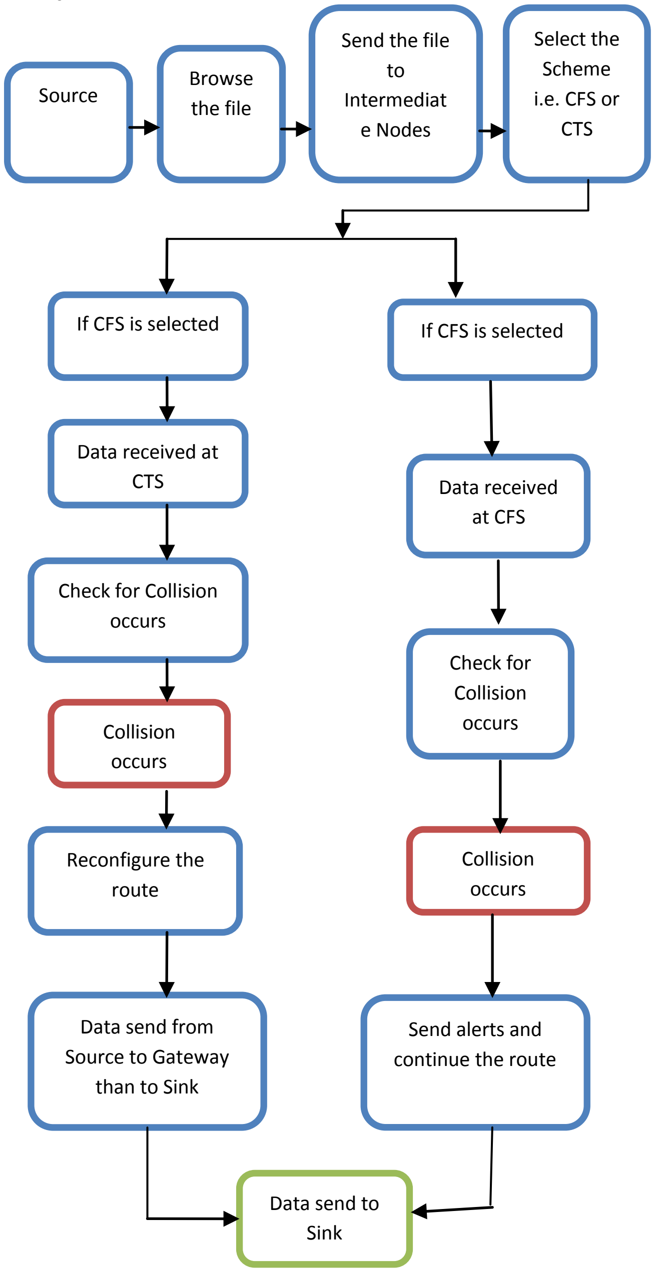
***Key Words*: Underwater acoustic networks, localization, packet scheduling, collision.**

1. INTRODUCTION

AFTER the emergence of autonomous underwater vehicles (AUVs) in the 70s, developments in computer systems and networking have been paving a way toward fully autonomous underwater acoustic sensor networks (UASNs)[1], [2]. Modern underwater networks are expected to handle many tasks automatically. To enable applications such as tsunami monitoring, oil field inspection, bathymetry mapping, or shoreline surveillance, the sensor nodes measure various environmental parameters, encode them into data packets, and exchange the packets with other sensor nodes or send them to a fusion center. In many underwater applications, the sensed data has to be specify with the time and the location of their origin to provide meaningful information. Therefore, sensor nodes that travel the environment and gather data have to know their position, and this makes localization an important task for the network. Due to the defiance of underwater aural communications such as low data rates and long propagation delays with variable sound speed[3], a variety of localization algorithms have been introduced and estimate in the article[4], [5]. In variance to underwater systems, sensor nodes in terrestrial wireless sensor networks (WSNs) can be set up with a GPS module to tap location. GPS signals (radio-frequency signals), however, cannot raise more than a few meters, and underwater acoustic signals are used rather. In addition, radio signals sense trivial propagation delays as compared to the sound (acoustic) waves. Applications in aqueous environments are an Underwater Acoustic Network (UAN). UANs make use of sensors, vehicles and other devices to cover large areas of a water environment for monitoring and data acquiring tasks. Additionally, gateway nodes are placed on the water surface to act as a mediator between the control center and sensor nodes in underwater. They can also be used to collect or route data. An example deployment can be seen in Figure. Potential applications of UANs include submarine detection, tsunami monitoring and offshore structural health monitoring. The devices and sensors used in UANs are networked together using acoustic communication channels.

2. PROPOSED WORKE

2.1 system architecture



1. Node Configuration

a. Source

Hear the source has to browse the file and choose the file in form of text (doc, txt etc.) and Get the IP address and select the Scheme and Destination Path.

b. Send Packets to Anchor Nodes

It sends the packets to the nearest node or Anchor node which has to again send it to neighbor anchor node.

Collision-Free Packet Scheduling

Collision Free Packet Scheduling is an completely-connected (single-hop) network, based on the known position of the anchors location. First the sensor node send request packet to Anchor node. This wakes up the anchors from their sleep mode puts them in the Active mode. Then Anchor node listening and Reply's to Sensor Node. The requested packet is used for a accurate estimation and calculating the location of the Sensor node. After the sensor node estimates its location by using an iterative Gauss-Newton self-localization algorithm, and senses the warning message and send to anchor node. In this paper, we assume that all the anchors have its ID, and All Anchor node been correctly send the warning messages to Gateway node.
Gateway node already knows the Position of all anchors. Anchors simply transmit their IP address and Port number. Each anchor has to
Transmit packet without delay after receiving the previous anchor’s packet. Each anchor is fully depends on its previous anchor node. Finally send the message to gateway. So transmission time more because anchor node waits until it receives the localization packet from previous anchor if the packet loss occurs in the previous node the present anchor does not know about the packet loss.

Collision-Tolerant Packet Scheduling

The Collision Tolerant Packet Scheduling is better than the Collision Free Packet Scheduling because in this all anchor nodes transmit packets independently to other anchor nodes. So the packet transmission time is reduced. When the packets transmitted from different anchor nodes to the sensor node if collision occurs at that time packet will not be received by sensor node. Sensor node sends packet to the gateway where sensor node knows its location. The CTPS consumes more energy for packet transmission due to packet transmission in different paths so collision is reduced. From this we get best accurate location of sensor node. The collision tolerant packet scheduling helps to control the probability of collision by the packet transmission rate therefore each sensor node can receive enough error free packets

C. sink

In this module, sink receives all the packets from the sender node.

[3]. Hear concerns the problem of scheduling the localization packets of the anchors in an underwater acoustic sensor network (UASN). Knowing the relative positions of the anchors and their maximum transmission range, we take advantage of the long propagation delay of underwater communication to minimize the duration of the localization task. First, we formulate the concept of collision-free packet transmission for localization, and we show how the optimum solution can be obtained. Furthermore, we propose two low-complexity algorithms, and through comprehensive

simulations we compare their performances with the optimal solution as well as other existing methods. Numerical results show that the proposed algorithms perform near optimum and better than alternative solutions.

[4]. Hear author present a novel technique for localizing an event of interest in an underwater environment. The network consists of randomly deployed identical sensor nodes. Instead of proactively localizing every single node in the network as all proposed techniques set out to do, we approach localization from a reactive angle. We reduce the localization problem to the problem of finding 4-Node Coverage, in which we form a subset of nodes such that every node in the original set is covered by four nodes belonging to this special subset – which we call the anchor nodes for simplicity. This subset of anchor nodes behaves like a backbone to the localization process. We show that in terms of energy consumption, this localization technique far surpasses others in terms of energy efficiency.

[5]. Hear they proposes a channel access protocol for ad-hoc underwater acoustic networks which are characterized by long propagation delays and unequal transmit/receive power requirements. The protocol saves transmission energy by avoiding collisions while maximizing throughput. It is based on minimizing the duration of a hand shake by taking advantage of the receiver's tolerance to interference when the two nodes
are closer than the maximal transmission range. Nodes do not need to be synchronized, can move, are half-duplex, and use the same transmission power. This protocol achieves a throughput several times higher than that of the Slotted FAMA, while offering similar savings in energy. Although carrier sensing ALOHA offers a higher throughput, it wastes much more power on collisions.

3. RELATED WORK

[1]. Hear they consider the issue of localization in the context of underwater sensor networks which contain anchor nodes with perfect knowledge of their position, but asynchronous clocks. By taking advantage of a sequential transmission protocol and the broadcasting nature of the acoustic underwater medium, the entire network can be localized simultaneously with small overhead. Additionally, it can be initiated by any node at any time. Through extensive simulation and derivation of the Cramer-Rao Lower Bound (CRLB), we first verify the utility and performance of the algorithm, demonstrating that both initiator and passive nodes can achieve low-error positioning. We then implement the algorithm on an existing modem, and through tests performed within a pool and lake we have determined the accuracy and effectiveness of the algorithm in a true underwater environment.

[2]. Hear considers the problem of packet scheduling for localization in an underwater acoustic sensor network where sensor nodes are distributed randomly in an operating area. Our goal is to minimize the localization time, and to do so we consider two packet transmission schemes, namely collision-free, and collision-tolerant. Through analytical results and numerical examples the performances of these schemes are shown to be comparable. In general, for small packet length (as is the case for a localization packet) and large operating area (above 3km in at least one dimension), the performances of the collision tolerant protocol is superior to its collision-free counterpart. At The same time, the anchors work independently of each other, and this feature simplifies the implementation process.

Algorithm

Localization Algorithm

After the anchors transmit their localization packets, each sensor node has Q measurements. Each measurement is contaminated by noise whose power is related to the distance between the sensor and the anchor from which the measurement has been obtained. The lth measurement obtained from the jth anchor is related to the sensor's position **x** (sensor index is omitted for simplicity) as

$$\hat{t}_l = f(\mathbf{x}) + n_l, \quad (1)$$

Where nl is the measurement noise (see (1)) and f (**x**) is

$$f(\mathbf{x}) = \frac{1}{c}\|\mathbf{x} - \mathbf{x}_j\|_2 \quad (2)$$

where **x**j is the jth anchor's position. Stacking all the measurements gives us a Q ×1 vectorˆ**t**. The number of measurements is given by

$$Q = \sum_{j=1}^{N} q_j, \quad (3)$$

where qj is the number of measurements which are obtained correctly from the jth anchor. In CFS, qj is a Bernoulli random variable with success probability P1j = P(qj = 1) = 1−pl(dj)

where dj is the distance between the sensor node and the jth anchor. In CTS qj is a Poisson random variable with distribution

$$P_j^n = P(q_j = n) = \frac{(p_s \lambda T_{\mathrm{T}})^n}{n!} e^{-\lambda T_{\mathrm{T}} p^j_{s|\mathbf{d}}}, \quad (4)$$

where pj s|d is the conditional probability that a sensor node correctly receives a packet from the jth anchor, knowing its distance from all anchors (elements of d). This pdf can be found from the conditional pdf of the received signal and the interference power.

Since the measurement errors are independent of each other, the maximum likelihood solution for x is given by

$$\hat{\mathbf{x}} = \arg\min_{\mathbf{x}} \|\hat{\mathbf{t}} - \mathbf{f}(\mathbf{x})\|_2 , \qquad (5)$$

which can be calculated using a method such as the Gauss-Newton algorithm specified in Algorithm 1. In this algorithm, η controls the convergence speed,

$$\nabla \mathbf{f}(\mathbf{x}^{(i)}) = [\frac{\partial f_1}{\partial \mathbf{x}}, \frac{\partial f_2}{\partial \mathbf{x}}, \ldots, \frac{\partial f_Q}{\partial \mathbf{x}}]^T_{\mathbf{x}=\mathbf{x}^{(i)}}$$

represents the gradient of the vector f w.r.t. the variable x at x(i), x(i) is the estimate in the ith iteration, and

$$\frac{\partial f_l}{\partial \mathbf{x}} = [\frac{\partial f_l}{\partial x}, \frac{\partial f_l}{\partial y}, \frac{\partial f_l}{\partial z}]^T$$

where l = 1, . . . ,Q . Here, I and ε are the user-defined limits on the stopping criterion. The initial guess is also an important factor and can be determined through triangulation.

Algorithm 1 Gauss-Newton Algorithm

Start with an initial location guess.
Set $i = 1$ and $E = \infty$.
while $i \leq I$ and $E \geq \varepsilon$ **do**
  Next state:
    $\mathbf{x}^{(i+1)} = \mathbf{x}^{(i)} -$
    $\eta(\nabla \mathbf{f}(\mathbf{x}^{(i)})^T \nabla \mathbf{f}(\mathbf{x}^{(i)}))^{-1} \nabla \mathbf{f}(\mathbf{x}^{(i)})^T (\mathbf{f}(\mathbf{x}^{(i)}) - \hat{\mathbf{t}})$
    $E = \|\mathbf{x}^{(i+1)} - \mathbf{x}^{(i)}\|$
    $i = i + 1$
end while
$\hat{\mathbf{x}} = \mathbf{x}^{(i)}$

4. RESULT

Hence we obtain our aim is secure data, and reduce the localization time to transmit the more packets from source to destination .In between if the collision occurs or if the packets are attacked by the attacker ,then those packets will be re configured and send to the destination. Hear using the two schemes namely collision free transmission and collision tolerant transmission. if the anchor nodes fails to send the packet then it will pump-up the message to re-transmit that packet then ,we can come to know which packets are collide or modified . Hence data is secure and error free transmission from source to destination. The bandwidth is reduced because of minimized by splitting the packets at the source node.

And also the performance can be analyzed by the total number of packets transmitted or attacked. The less the number of packets collides or attacked, the more the accurate data obtained at the destination.

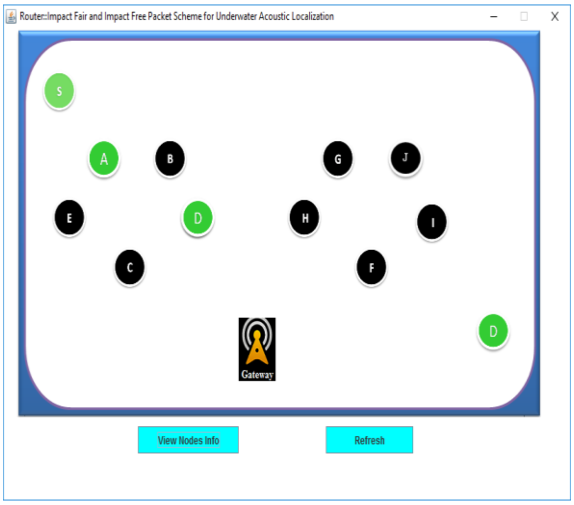


Fig1.Packet transmission from source to sink

GRAPH

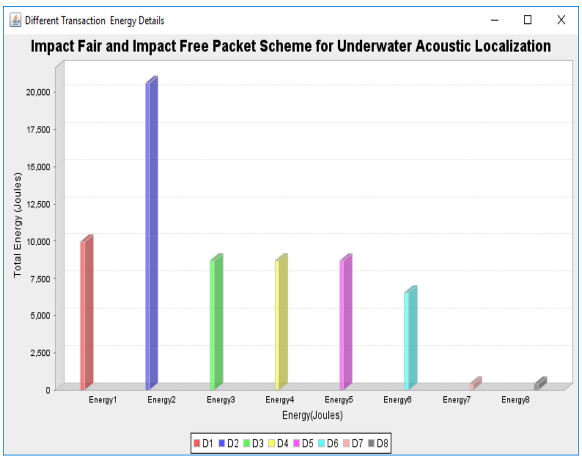


Fig1.2 Different transmission energy

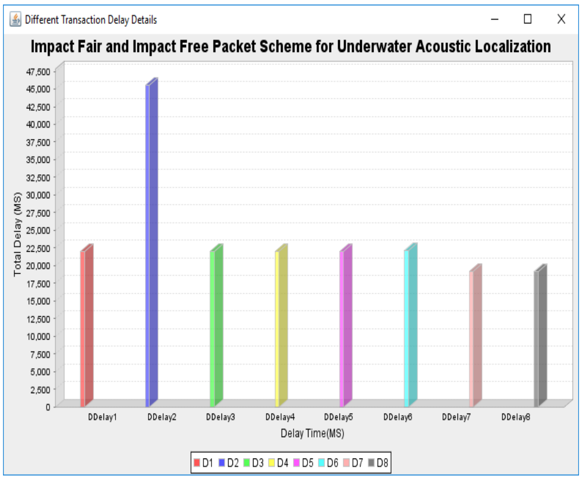


Fig1.3 Different transmission delay

5. CONCLUSION

Here we have considered two types of self-localization for packet scheduling scheme in underwater acoustic localization. They are Collision Free Packet Scheduling (CFPS) and Collision Tolerant Packet Scheduling (CTPS). CFPS works as there is no collision between sensor nodes because of packet transmission by one anchor to other anchor is dependent. Collision Tolerant algorithm design there may collision occurs but controlling the probability of collision for localization. We also used Gauss-Newton based localization algorithm for these schemes to have probability density of sensor nodes in particular area. In this article we are comparing these two algorithms in terms of the time required for localization.

In the future, we will extend our work to a multi-hop network where the communication range of the acoustic modems is much shorter than the size of the operating area.

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