Conflict Lenient and Conflict Open Packet Forecast for Flooded Sound Localization

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Abstract: **This article considers the matter of packet planning for localization in associate underwater acoustic sensing element network wherever sensing element nodes are distributed haphazardly in associate in operation space. Our goal is to attenuate the localization time, and to try and do therefore we have a tendency to think about 2 packet transmission schemes, specifically collision-free, and collision-tolerant. Through analytical results and numerical examples the performances of those schemes are shown to be comparable. In general, for tiny packet length (as is that the case for a localization packet) and huge in operation space (above 3km in a minimum of one dimension), the performances of the collision tolerant protocol is superior to its collision-free counterpart. At identical time, the anchors work severally of every alternative, and this feature simplifies the implementation method. The anchors are roughly synchronized with each other; however, the sensor nodes may not be synchronized with the anchors. This is a reasonable assumption because anchors are usually located on the surface and can be equipped with a GPS. It should be noted that no synchronization is needed when anchors use an on-demand packet transmission protocol, i.e., when an underwater node initiates the localization protocol, and the anchors are notified after reception of the transmitted packet. Anchors and sensor nodes are equipped with half-duplex acoustic modems, meaning they cannot transmit and receive simultaneously.**

I. INTRODUCTION

A **wireless sensor network** (WSN) is a computer network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations. The development of wireless sensor networks was originally motivated by military applications such as battlefield surveillance. However, wireless sensor networks are now used in many civilian application areas, including environment and habitat monitoring, healthcare applications, home automation, and traffic control. In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. The size a single sensor node can vary from shoebox-sized nodes down to devices the size of grain of dust. The cost of sensor nodes is similarly variable, ranging from hundreds of dollars to a few cents, depending on the size of the sensor network and the complexity required of individual sensor nodes.

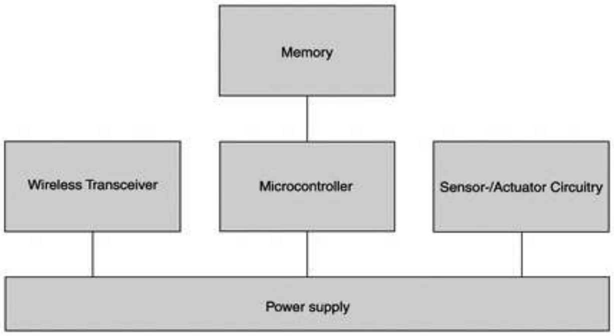


Figure 1: Simple architecture of WSN

Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and bandwidth. In computer science, wireless sensor networks are an active research area with numerous workshops and conferences arranged each year.

II. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques.

A methodology does not set out to provide solutions it is, therefore, not the same as a method. Instead, a methodology offers the theoretical underpinning for understanding which method, set of methods, or so-called “best practices” can be applied to specific case, for example, to calculating a specific result.

It has been defined also as follows:

1. "The analysis of the principles of methods, rules, and postulates employed by a discipline";
2. "The systematic study of methods that are, can be, or have been applied within a discipline";
3. "The study or description of methods".

- System Model
- Collision-Free Packet Scheduling
- Collision-Tolerant Packet Scheduling
- Self-Localization Process
- Performance Evaluation

A. SYSTEM MODEL

In the First module, we develop the System Model. We consider a UASN consisting of M sensor nodes and N anchors. The anchor index starts from 1, whereas the sensor node index starts from N + 1. Each anchor in the network encapsulates its ID, its location, time of packet transmission, and a predetermined training sequence for the time of flight estimation. The so-obtained localization packet is broadcast to the network based on a given protocol, e.g., periodically, or upon the reception of a request from a sensor node.

The system structure is specified as : Anchors and sensor nodes are equipped with half-duplex acoustic modems, i.e., they cannot transmit and receive simultaneously. Anchors are placed randomly on the surface, and have the ability to move within the operating area. The anchors are equipped with GPS and can determine their positions which will be broadcast to the sensor nodes. We consider a single-hop network where all the nodes are within the communication range of each other. The received signal strength (which is influenced by pathloss, fading and shadowing) is a function of transmission distance. Consequently, the probability of a packet loss is a function of distance between any pair of nodes in the network.

B. COLLISION-FREE PACKET SCHEDULING

In this module, we develop the Collision-free localization packet transmission module, where it is shown that in a fully-connected (singlehop) network, based on a given sequence of the anchors’ indices, each anchor has to transmit immediately after receiving the previous anchor’s packet. Furthermore, it is shown that there exists an optimal ordering sequence which minimizes the localization time.

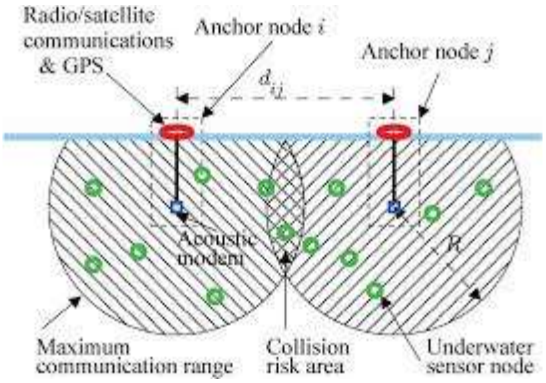


Figure 2 : Collision-free packet scheduling

However, to obtain that sequence, a fusion center is required to know the positions of all the anchors. In a situation where this information is not available, we may assume that anchors simply transmit in order of their ID numbers. In the event of a packet loss, a subsequent anchor will not know when to transmit. If an anchor does not receive a packet from a previous anchor, it waits for a predefined time (counting from the starting time of the localization process), and then transmits its packet.

C. COLISION TOLERANT PACKET SCHEDULING

In this module we develop the Collision-Tolerant Packet Scheduling. To avoid the need for coordination among anchor nodes, in a collision-tolerant packet scheduling, anchors work independently of each other. During a localization period or upon receiving a request from a sensor node, they transmit randomly, e.g., according to a Poisson distribution with an average transmission rate of λ packets per second. Packets transmitted from different anchors may now collide at a sensor node, and the question arises as to what is the probability of successful reception.

The average received signal strength is thus different for different links (this signal strength, along with a given fading model, determines the probability of packet loss).

D. SELF-LOCALIZATION PROCESS

In this module we develop the Self-Localization process. We have seen that a sensor node requires at least K distinct packets (or time-of-flight measurements) to determine its location. However, it may receive more than K different packets, as well as some replicas, i.e., qj packets from anchor j, where j = 1, . . . ,N. In this case, a sensor uses all of this information for self-localization. Note that in the collision-free scheme, qj is either zero or one; however, in the collision-tolerant scheme qj can be more than 1.

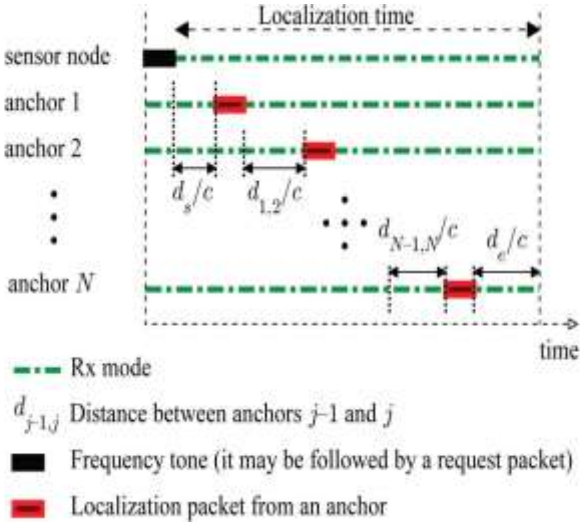


Figure 3 : Self-Localization Process

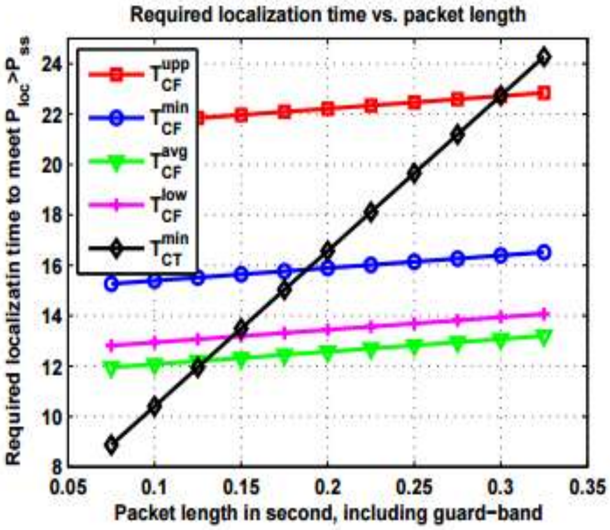
Packets received from the jth anchor can be used to estimate the sensor node’s distance to that anchor, and the redundant packets add diversity (or reduce measurement noise) for this estimate.

In the next two subsections, we show how all of the correctly received packets can be used in a localization algorithm, and how the CRB of the location estimate can be obtained for the proposed scheduling schemes. 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.

Figure 4 : Effect of packet length on the minimum required time for localization

E. PERFORMANCE EVALUATION

For a given number of anchors, the performance of the collision-free algorithm is constant over a range of pl , but that of the collision-tolerant increases slightly as pl gets larger in that region. However, the collision-tolerant approach performs better for a wide range of pl, and can be implemented in practice with low computational complexity since the anchors work independently of each other.



III. EXPERIMENTS AND RESULTS

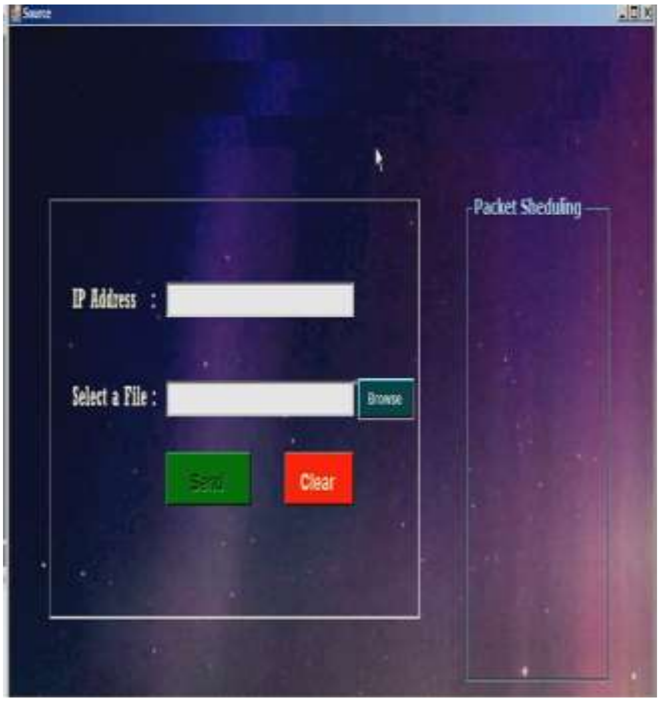


Fig 3.1: SOURCE SERVER

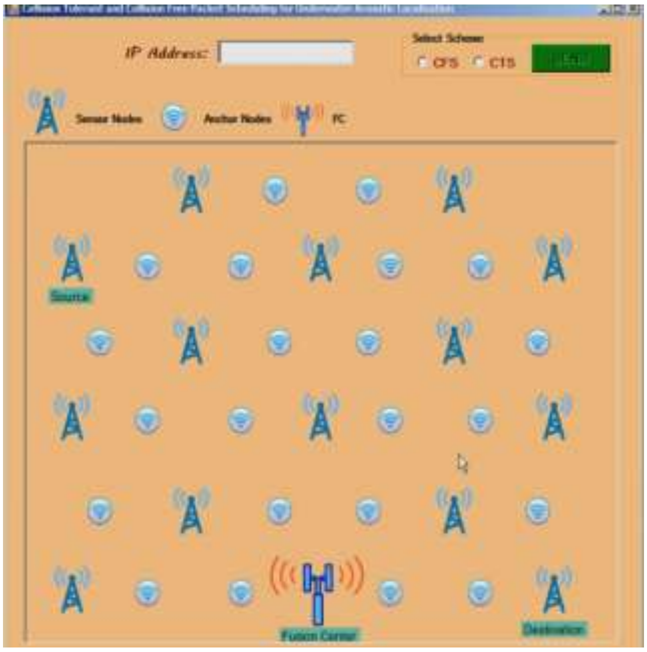


Fig 3.2: NODES CONFIGURATION

Fig 3.3: DESTINATION

C:\Users\dotnet1\Desktop

Waiting

Fig 3.4: SELECTED LOCATION

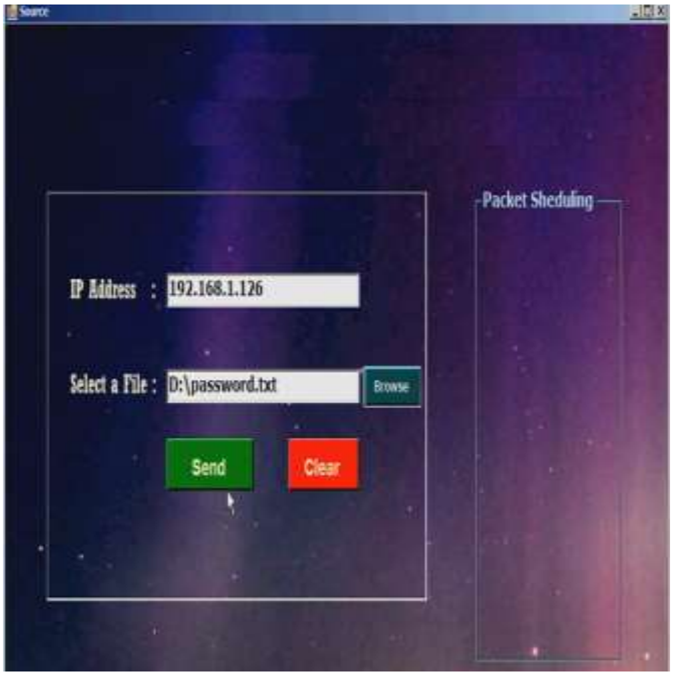

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Fig 3.5: SELECTED SOURCE DATA


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Fig 3.6: PACKET SENDING

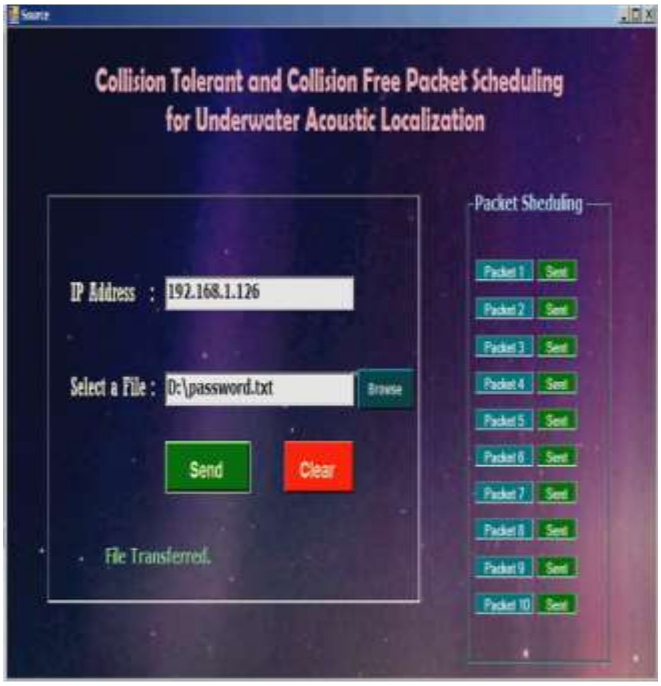
Collision Tolerant and Collision Free Packet Scheduling for Underwater Acoustic Localization

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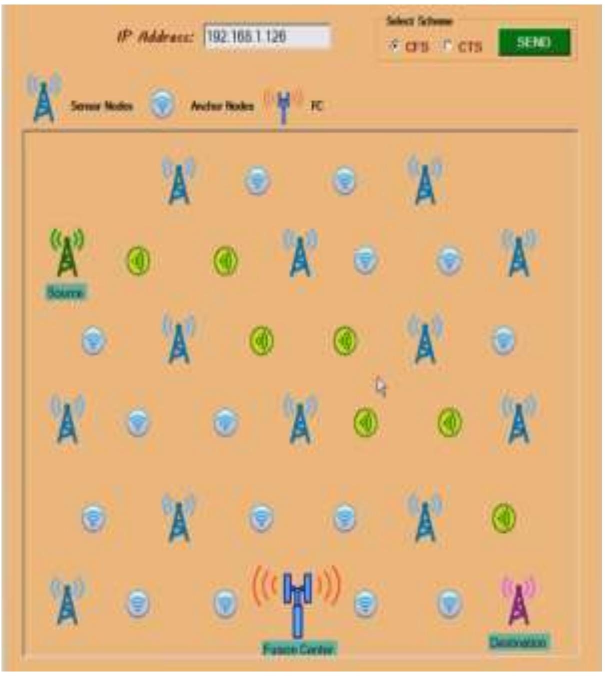
Fig 3.7: FILE TRANSFERRED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Select Scheme ● CFS ○ CTS

Fig 3.8: SOURCE TO DESTINATION

IV. CONCLUSION

We have considered two classes of packet scheduling for self-localization in an underwater acoustic sensor network, one based on a collision-free design and another based on a collision-tolerant design. In collision-free packet scheduling, the time of the packet transmission from each anchor is set in such a way that none of the sensor nodes experiences a collision. In contrast, collision-tolerant algorithms are designed so as to control the probability of collision to ensure successful localization with pre-specified reliability. The performance of the two classes of algorithms was shown to be comparable. Moreover, when the ratio of the packet length to the maximum propagation delay is very low, the collision-tolerant protocols require less time for localization in comparison with the collision-free ones for the same probability of successful localization. Furthermore, in the collision-tolerant approach there is no order in the anchors' packet transmissions, and they work independently of each other. As a result, there is no need for a fusion center, and the anchors do not need to be synchronized. These features make the collision-tolerant localization scheme appealing for a practical implementation. In the future, we will analyze the localization accuracy under the collision-tolerant packet transmission scheme, and extend this work to a multi-hop network

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