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The Based Anchor-free Fixture Algorithm with Sensor Networks through end-to-end Standards

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Abstract: The Localization in underwater environments has been constrained by the dependencies on the line of sight due to the challenging variability's of the environment. This dependency hinders node discovery and ad-hoc formation in underwater networks and limits the performance of routing protocols. Most proposed algorithms in the literature rely on anchor nodes that are at fixed positions to serve as reference points, which is not practical in many applications. A novel approach to the localization problem that allows for node discovery without depending on the LOS and any fixed reference node. In the proposed surface-based reflection anchor-free localization algorithm all nodes will apply homomorphism, de-convolution to establish a water-surface reflected communication link. SBRAL then creates a relative coordinate system where every node in the network identifies others nodes by increasing the SBRAL transmit angle and using the reflection points on the water surface as temporary reference points. The simulation results confirm the effectiveness of the proposed SBRAL algorithm.

Keywords: ad-hoc formation, underwater networks, anchor nodes, reflection points, simulation results.

I. INTRODUCTION

The underwater applications have grown over time, mainly using underwater sensor networks to carry out environmental state monitoring, oceanic profile measurements, distributed surveillance[6], and navigation. These applications require sensors to work cooperatively to achieve the desired goal. It is also common to find autonomous underwater vehicles acting as mobile sensor nodes[4] in search-and-rescue missions and coastal patrol, these AUVs will need to corporate in an ad-hoc manner to be able to establish and sustain communication links to ensure a sustainable quality of service. This requires each node to adapt of environmental changers and be able to overcome broken communication links due to external noise affecting the communication channel and due to node mobility. To mitigate the multipath effect, directional transmission techniques have been adapted for underwater communications[1].

Therefore, node mobility becomes a challenge when directional communication constraints are place. Even non mobile nodes tend to change positions over time due to the water current and drift. Severe natural conditions and complex terrain make it difficult to apply precise localization in underground mines[2]. In this paper, an anchor-free localization method for mobile targets is proposed based on non metric multi-dimensional scaling[7] (Multi- dimensional Scaling: MDS) and rank sequence. Firstly, a coal mine wireless sensor network[3] is constructed in underground mines based on the ZigBee technology. Then a non- metric MDS algorithm is imported to estimate the reference nodes location. Finally, an improved sequence-based localization algorithm[9] is presented to complete precise localization for mobile targets. The proposed method is tested through simulations with 100 nodes, outdoor experiments with 15 ZigBee physical nodes, and the experiments in the mine gas explosion laboratory with 12 ZigBee nodes. Experimental results show that our method has better localization accuracy and is more robust in underground mines.

Over the past decade, there has been a surge of accidents in coal mines all over the world. Realization of environment monitoring and miner localization in underground mines plays an important role in mining safety. Wireless sensor networks have attracted more and more research interest in coal mine applications for their advantages of self-organization, low cost and high reliability. Localization algorithms[8] in WSN can be divided into two classes: anchor-based algorithms and anchor-free algorithms[5]. Anchor-based algorithms assume that all reference nodes are anchor nodes or nodes whose real position coordinates are known in advance. Anchor-free localization algorithms only require a few anchor nodes. The coordinates of all the reference nodes are estimated automatically.

However, in underground mines, localization will face the following challenges.

a. Water-vapor and coal dust will potentially absorb the wireless signal in different ways and lead to large localization errors.
b. The complex terrain and irregular network topology in underground mines make many localization algorithms do not work well.

To solve the above problems, an anchor-free localization method in coal mine WSN (Coal Mine Wireless Sensor Networks: C-WSN) is proposed. The main contributions of this paper are as follows:

a. A coal mine wireless sensor network is constructed in underground mines based on the ZigBee technology.
b. Non-metric MDS algorithm is introduced into the estimation of the reference nodes' location, which provides higher fault-tolerance ability.
c. An improved SBL algorithm, N-best SBL, is proposed to improve the localization accuracy.

II. II COAL MINE WIRELESS SENSOR NETWORKS

To execute our localization algorithm, first a C-WSN was constructed in underground mines based on the ZigBee technology. We deployed the sensor nodes, called Cicada as end devices in the C-WSN. There are six types of nodes including methane sensors, oxygen sensors, carbon monoxide sensors, smoke sensors, temperature-humidity sensors and voice sensors. These sensor nodes join the C-WSN, acquire the environment information on a fixed time cycle and transmit sensing data to the ZigBee gateway. Static router nodes are previously deployed to construct the ZigBee backbone network. They are also reference nodes for mobile targets. Voice sensor nodes are installed on miner's helmets. Miners are the mobile targets for localization. The ZigBee gateway collects sensor data and transmits them to the monitoring center. The gateway connects to a fiber modem which can transmit the data transparently. All the information data are processed and displayed in monitoring center with several distributed servers and clients. Four function units are implemented in the C-WSN system: miner attendance management, miner localization, environment monitoring, and voice communication.

Packet forwarding prioritization (PFP) in routers is one of the mechanisms commonly available to network operators. PFP can have a significant impact on the accuracy of network measurements, the performance of applications and the effectiveness of network troubleshooting procedures. Despite its potential impacts, no information on PFP settings is readily available to end users. In this paper, we present an end-to-end approach for PFP inference and its associated tool, POPI (*POlarimetric Phase Interferometry*). This is the *first* attempt to infer router packet forwarding priority through end-to-end measurement. POPI enables users to discover such network policies through measurements of packet losses of different packet types. We evaluated our approach via statistical analysis, simulation and wide-area experimentation. POPI flagged 15 paths with multiple priorities, 13 of which were further validated through hop-by-hop loss rates measurements. In addition, we surveyed all related network operators and received responses for about half of them all confirming our inferences. Besides, we compared POPI with the inference mechanisms through other metrics such as packet reordering.

There are a couple of challenges for designing and implementing POPI. First, background traffic fluctuations can severely affect the end-to-end inference accuracy of router properties. Secondly, probe traffic of a relatively large packet bursts are neither independent nor strong correlated. Most existing inference methods have to assume certain independence or strong correlation models for inference. Thirdly, we want to measure more than two packet types at the same time, so simply determining whether they are treated differently is not enough.

a. The probe overhead of packet loss metric is larger than the other two. Obviously, loss rates difference will not become evident until the associated link is saturated and begins to drop packets. This simple observation defines the basis of loss-based inference approach. On the other hand, packet reordering and delay differences can be observed as soon as queue begins to build up.
b. Loss difference can be observed for all kinds of QoS mechanisms while the other two cannot. Although using delay and reordering metrics can result in less probe overhead, they cannot detect certain router QoS mechanisms simply because those mechanisms do not generate different delays at all
c. Packet delay difference can be caused by many other mechanisms than QoS. The root cause of packet reordering is the existence of parallel packet forwarding paths. Such paths can be in a router, parallel links between two routers, or different routes over a number of hops. When packets are split to these parallel paths according to their packet types and these paths have different delays.

III. MULTI-HOP COMMUNICATION CHANNEL

Wired networks include fixed nodes and fixed wired communication lines. Wireless ad hoc networks[10] have mobile wireless nodes (often in the form of hand held devices) and, as suggested, their communication medium is wireless. This allows for greater network availability and easy network deployment. Each node's transmission range is limited and network communication is realized through multi-hop paths. Co-operation and trust along these paths is a crucial aspect of the security mechanism and ensures successful communication[1].

A. Traffic End-to-end inference of router:

The accuracy of end-to-end inference of router properties can be severely affected by background traffic fluctuations. Clearly, if one's probing introduces relatively small additional traffic, whether the link is saturated or not depends solely on the amount of background traffic. To make our approach more resistant to background traffic fluctuations we opt for sending relatively large amount of traffic to temporarily saturate bottleneck traffic class capacity, which increases the probability of observing loss rates difference.

B. packet loss model and insensitive to loss correlations:

Probe traffic of a relative large packet bursts are neither independent nor strongly correlated. Once the loss rate for each packet type is obtained, we need to determine whether the loss rates difference among them is large enough to conclude that they are treated differently. When packet losses can be described with a good mathematical model[6]. Packet losses in one burst are not independent but correlated.

C. Grouping is needed for multiple packet types:

Grouping is needed for multiple packet types probing. If we only probe two packet types at one time, simply determining whether they are treated differently is enough. However, we sometimes probe more than two packet types and need to group them based on their priorities. Here, we assign a rank-based metric to each packet type and use hierarchical clustering method[4] to group them. In summary, POPI saturates the link with relatively large amount of traffic and clusters packet types based on their loss ranks. Such an approach gives POPI better resistance against background traffic fluctuations, allows it to cope with the inherent characteristics of its measurement traffic, and enables it to measure more than two packet types at one time

D. Background on Priority Mechanisms:

Network administrators can enforce priority/link-sharing mechanisms in a router by defining a traffic class and associating with it a particular queuing/scheduling mechanism.

a. Priority Queuing (PQ):

This allows users to assign arbitrarily defined packet classes to queues with different priorities. Since queues are served based on their priority, this allows specified packet types to be always sent before other packet types.

b. Proportional Share Scheduling (PSS):

With PSS each traffic class is given a weight. Bandwidth is allocated to classes in proportion to their respective weights. There is no strict priority difference between classes.

c. Policing:

This restricts the maximum rate of a traffic class. Traffic that exceeds the rate parameters is usually dropped. The traffic class cannot borrow unused bandwidth from others. Only the first mechanism sets absolute priorities between traffic classes.

IV. CHOOSING INFERENCE METRIC

Three basic end-to-end performance metrics, loss, delay and out-of-order, can all be used as inference metrics. This is because these metrics of different packet types can become different when a router is configured to treat them differently. Consider a *PQ* of two priorities, where the high priority queue is always served first. Low priority packets will experience larger loss rates and longer queuing delays than the high priority packets. Besides, a low priority packet may arrive earlier than a high priority packet but leave after it while the contrary will never happen. The reordering events between them are *asymmetric*. Here, the loss, delay, and reordering can all be used as a metric to infer priority settings. Essentially, the delay and reordering metrics are equivalent because when a packet gets lagged behind another packet, its delay should be larger than the other. In the following, we discuss the *pros* and *cons* between loss metric and the other two metrics and the reason why we choose packet loss eventually.

V. CONCLUSIONS

A navel approach to the underwater localized problem by removing the dependencies on the LKOS. The presented SBRAL approach starts by requiring each node to transmit towards the water surface to discover its neighbors. All receiving nodes will use the homomorphism techniques to establish the RSR estimates to its neighbors to use in error minimization. Each node then locates its neighbors by selecting intersecting points on the sampled water surface as temporary reference points for the triangulation process. The simulation experiments show that the frequency of the water waves. The results show that the acoustic transmitter resolution, i.e., increment in the transmission resolution, i.e., increment in the transmission angle, can be scaled to increase the number of identified nodes and lower the localization[5] errors for high frequency water waves by creating more intersection points.

VI. REFERENCES

[1] Kennedy, G.A. High resilience wireless mesh networking characteristics and safety applications within underground mines. Ph.D. Dissertation, University of Exeter: Devon, UK, 2006.

[2] Mohanty, P.K. Application of wireless sensor network technology for miner tracking and monitoring hazardous conditions in underground mines. Available online: http://www.msha.gov/regs/comments/06-722/AB44-COMM-95.pdf. (accessed July 22, 2006).

[3] Multimedia Systems Lab. Real-time wireless sensor network platform. Available online: http://www.ece.cmu.edu/ ~firefly/ projects.html. (accessed January 12, 2007).

[4] Xia F.; Tian, Y.; Li, Y.; Sun, Y. Wireless sensor/actuator network design for mobile control applications. Sensors 2007, 7, 2157-2173.

[5] Priyantha, N.B.; Balakrishnan, H.; Demaine, E.; Teller, S. Anchor free distributed localization in sensor networks. In Proceedings of 1st International Conference on Embedded Networked Sensor Systems (SenSys), Los Angeles, CA, USA, November 5, 2003; pp. 340-341.

[6] Meertens, L.; Fitzpatrick, S. The Distributed construction of a global coordinate system in a network of static computational nodes from inter-node distances; Technical Report, Kestrel Institute: Palo Alto, CA, USA, 2004; Available online:

ftp://ftp.kestrel.edu/pub/papers/fitzpatrick/LocalizationReport.pdf. (accessed November 24,2008).

[7] Shang, Y.; Ruml, W. Improved MDS-based localization. In Proceedings of the Twenty-third Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM'04), Hong Kong, China, March 7-11, 2004; Vol. 4, pp. 2640-2651.

[8] Kwon, O.K.; Song, H.J. Localization through map stitching in wireless sensor networks. IEEE Trans. Parallel Distrib. Sys. 2008, 19, 93-105.

[9] Yedavalli, K.; Krishnamachari, B. Sequence-based localization in wireless sensor networks. IEEE Trans. Mob. Comput. 2008, 7, 81-94.

[10] Rappaport, T.S. In Wireless communications: principles and practice, 2nd Ed.; Prentice Hall.