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A Joint Time Synchronization and Localization Design for Mobile Underwater Sensor Networks

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Abstract

Time synchronization and localization are basic services in a sensor network system. Although they often depend on each other, they are usually tackled independently. In this work, we investigate the time synchronization and localization problems in underwater sensor networks, where more challenges are introduced because of the unique characteristics of the water environment. These challenges include long propagation delay and transmission delay, low bandwidth, energy constraint, mobility, etc. We propose a joint solution for localization and time synchronization, in which the stratification effect of underwater medium is considered, so that the bias in the range estimates caused by assuming sound waves travel in straight lines in water environments is compensated. By combining time synchronization and localization, the accuracy of both are improved jointly. Additionally, an advanced tracking algorithm IMM (interactive multiple model) is adopted to improve the accuracy of

localization in the mobile case. Furthermore, by combining both services, the number of required exchanged messages is significantly reduced, which saves on energy consumption. Simulation results show.

Key words : synchronization, investigate, challenges, transmission, range estimates

CHAPTER- 1

INTRODUCTION

1.1 Overview Of The Project

In recent years, underwater sensor networks UWSNs have gained significant attention from academic and industrial researchers due to the potential benefits and unique challenges posed by the water environment. UWSNs have allowed a host of applications to become both feasible and effective, including coastal surveillance, environmental monitoring, undersea exploration, disaster prevention and mine reconnaissance. However, due to the high attenuation of radio waves in water, acoustic communication is emerging as the most suitable media. Several characteristics specific to underwater acoustic communications and networking introduce additional design complexity into almost every layer of the network protocol stack .

CHAPTER 2

2.1 FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY
- SOCIAL FEASIBILITY

2.2 ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

2.3 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.4 SOCIAL FEASIBILITY

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The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

CHAPTER 3

LITURATURE SURVEY

3.1 Underwater acoustic sensor networks: Research challenges

Underwater sensor networks have enabled a new era in scientific and industrial underwater monitoring and exploration applications. However, these networks are energy constrained and, more problematically, energy hungry, as a consequence of the use of underwater acoustic links. In this work, we thoroughly review potential techniques for greening underwater sensor networks. In a top down approach, we discuss the principal design and challenges of the appealing highlighted techniques. We also exemplify their use by surveying recent proposals in underwater sensor networks. Finally, we describe potential future research directions for energy conservation in underwater networks.

3.2 scalable mobile underwater wireless sensor networks for aquatic applications,

The large scale mobile underwater wireless sensor network UWSN is a novel networking paradigm to explore aqueous environments. However, the characteristics of mobile UWSNs, such as low communication bandwidth, large propagation delay, floating node mobility, and high error probability, are significantly different from ground-based wireless sensor networks. The novel networking paradigm poses interdisciplinary challenges that will require new technological solutions. In particular, in this article we adopt a top-down approach to explore the research challenges in mobile UWSN design. Along the layered protocol stack, we proceed roughly from the top application layer to the bottom physical layer.

3.3 Research challenges and applications for underwater sensor networking

This paper explores applications and challenges for underwater sensor networks. We highlight potential applications to off shore oilfields for seismic monitoring, equipment monitoring, and underwater robotics. We identify research directions in short range acoustic communications, MAC, time synchronization, and localization protocols for high latency acoustic networks, long duration network sleeping, and application level data scheduling. We describe our preliminary design on short range acoustic communication hardware, and summarize results of high latency time synchronization

3.4 A Survey of Practical Issues in Underwater Networks

Recently, underwater wireless sensor networks UWSNs have emerged as a promising networking technique for various underwater applications. An energy efficient routing protocol plays a vital role in data transmission and practical applications. However, due to the specific characteristics of UWSNs, such as dynamic structure, narrow bandwidth, rapid energy consumption, and high latency, it is difficult to build routing protocols for UWSNs. In this article we focus on surveying existing routing protocols in UWSNs. First, we classify existing routing protocols into two categories based on a route decision maker. Then the performance of existing routing protocols is compared in detail. Furthermore, future research issues of routing protocols in UWSNs are carefully analyzed.

CHAPTER 4

EXISTING SYSTEM

The potential benefits and unique challenges posed by the water environment. UWSNs have allowed a host of applications to become both feasible and effective, including coastal surveillance, environmental monitoring, undersea exploration, disaster prevention and mine reconnaissance. due to the high attenuation of radio waves in water, acoustic communication is emerging as the most suitable media.On the other hand, knowledge of location helps time synchronization because it can be used to estimate propagation delays. Furthermore, both localization and time synchronization require a sequence of message exchanges among the nodes. Based on these bonds relationships, we believe that localization and time synchronization could be solved jointly, with two major benefits. First, a joint strategy would save energy, since localization and synchronization can use only one set of message exchanges instead of two.

CHAPTER 5

PROPOSED SYSTEM

For each round of message exchanges, time synchronization and localization are performed at different phases. During iterations, the output of synchronization is fed back as the input of localization, and the output of localization is fed back as the input of synchronization in the next round of message exchanges. In this way, synchronization and localization are interleaved and can benefit each other by improving the accuracy of both services. During the localization phase, unlike other algorithms that assume sound waves travel in straight lines in the water environment, JSL compensates the stratification effect when performing the underwater acoustic ranging, so that the propagation delay estimation will be significantly improved. the time synchronization is a base for them in order to convert time information into range information. Tries to avoid time synchronization by using half of the round-trip time to estimate the propagation delay. It requires a sensor node to communicate with multiple surface buoys, which may introduce a heavy load of traffic in the network. A silent positioning scheme is proposed which does not depends on time synchronization. Instead, all the sensor nodes get localized by passively listening to the beacon messages exchanged among anchor nodes, so that it requires four non coplanar anchors that can mutually

CHAPTER 6

SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

TYPES OF TESTS

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked.Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

Black Box Testing

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Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

6.1 Unit Testing:

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

6.2 Integration Testing

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects.The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

6.3 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

CHAPTER 7

Module Description

7.1 UWSNs

However, the research on joint design of synchronization and localization in UWSNs is still limited. Additionally, in UWSNs, all current localization algorithms assume the straight line transmission of acoustic waves. In fact, due to the sound speed variation with depth in the water environment, called “stratification effect”, the real transmission path usually bends. This will severely affect the ranging estimation, and in turn affect localization accuracy. In this paper, we propose a joint solution for localization and synchronization, called *JSL*, for UWSNs. JSL is a four phases scheme. For each round of message exchanges, time synchronization and localization are performed at different phases. During iterations, the output of synchronization is fed back as the input of localization, and the output of localization is fed back as the input of synchronization in the next round of message exchanges. In this way, synchronization and localization are interleaved and can benefit each other by improving the accuracy of both services.

7.2 Synchronization

Although localization and synchronization services are closely related, they are usually studied independently. This is mainly because localization is traditionally studied from the signal processing point of view in radio networks, and synchronization is mainly studied from protocol design point of view. However, especially in UWSNs, localization and synchronization are closely “bonded”. Since the ranging is estimated based on time of arrival TOA or time difference of arrivals TDOA in UWSNs, many localization algorithms rely on the time synchronization services. For example, in TOA, a popular localization algorithm, synchronization is a prerequisite. On the other hand, knowledge of location helps time synchronization because it can be used to estimate propagation delays. Furthermore, both localization and time synchronization require a sequence of message exchanges among the nodes.

7.3 Localization

Usually, connectivity-based method is only used when there is no direct communication between nodes and sensors, where range estimation is achieved based on network connectivity. proves that euclidean method performs the best in anisotropic topologies, but with more cost on computation and communication. In, it proves that with short communication range among anchor nodes, Euclidean method can be adopted for 3D underwater localization. relaxes this limitation by proving it is also working when the anchor nodes communication range is long. However, both are suffering from heavy traffic due to using flooding mechanism. introduced "SLMP", which applies some prediction schemes to localization algorithm to reduce its overhead.

7.4 Sensor Node

Traditionally, localization algorithms are either rangebased or range free. In this work, we focus on the rangebased localization algorithms. Ranging techniques are either communication-based or connectivity-based. GPS Intelligent Buoys GIBs and PARADIGM use underwater GPS. Those to be localized sensor nodes need to communicate with the surface buoys, because of which, the time synchronization is a base for them in order to convert time information into range information. tries to avoid time synchronization by using half of the round trip time to estimate the propagation delay. It requires a sensor node to communicate with multiple surface buoys, which may introduce a heavy load of traffic in the network. A silent positioning scheme is proposed which does not depends on time synchronization.

CHAPTER 8

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SYSTEM REQUIREMENTS

8.1 Hardware Requirements:

- System : Pentium IV 2.4 GHz.
- Hard Disk : 40 GB.
- Floppy Drive : 1.44 Mb.
- Monitor : 15 VGA Colour.
- Mouse : Logitech.
- RAM : 256 Mb.

8.2 Software Requirements:

- Operating system : - Cent OS
- Front End : - Matlab Script
- TOOL : - VMware Workstation

CHAPTER 9

SYSTEM ORGANIZATION

9.1 Use case diagram:

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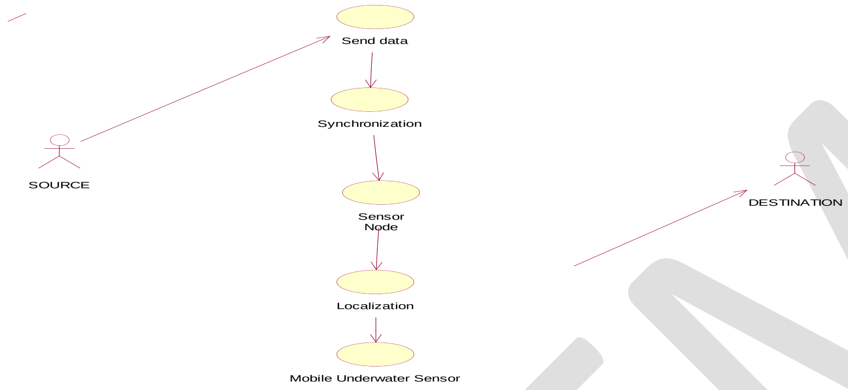
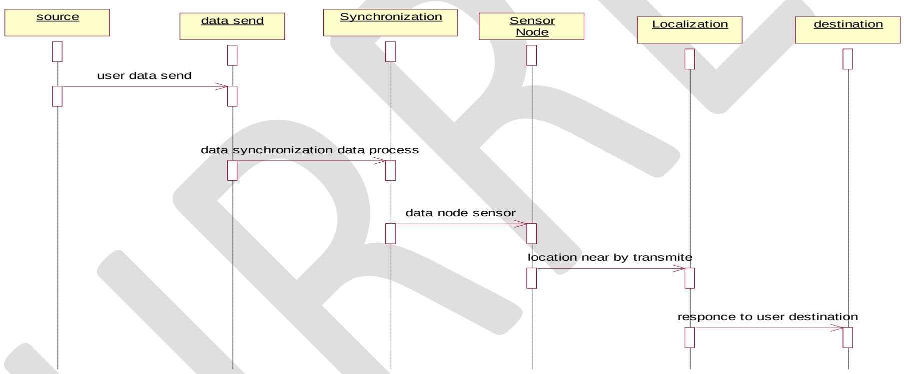
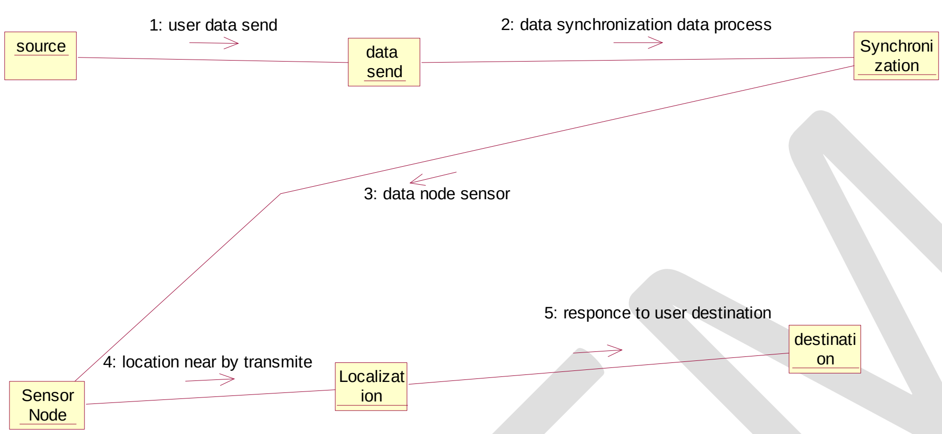


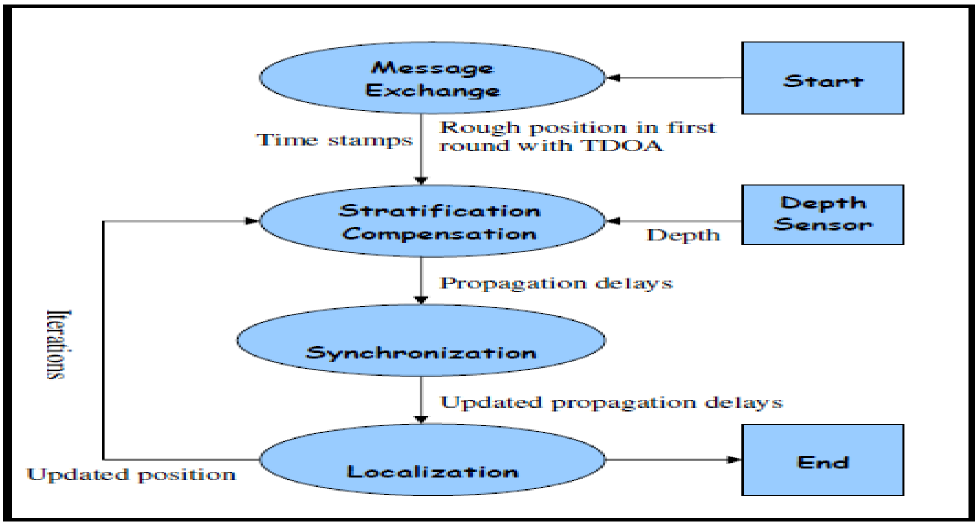
9.2 Sequence Diagram:



9.3 Collaboration Diagram:



9.4 Architecture Diagram:



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CHAPTER 10

ADVANTAGE

Usually, connectivity based method is only used when there is no direct communication between nodes and sensors, where range estimation is achieved based on network connectivity. proves that euclidean method performs the best in anisotropic topologies, but with more cost on computation and communication. In, it proves that with short communication range among anchor nodes, Euclidean method can be adopted for 3D underwater localization. relaxes this limitation by proving it is also working when the anchor nodes communication range is long. However, both are suffering from heavy traffic due to using flooding mechanism. introduced “SLMP”, which applies some prediction schemes to localization algorithm to reduce its overhead. In SLMP, anchor nodes conduct linear prediction by taking advantages of the inherent temporal correlation of underwater object mobility pattern. While each ordinary sensor node predicts its location by utilizing the spatial correlation of underwater object mobility pattern, weighted averaging its received mobilities from other nodes. However, because the prediction is based on temporal and spatial correlations, the algorithm only works in dense network.

CHAPTER 11

DISADVANTAGE

In this paper, we propose a joint solution for localization and synchronization, called *JSL*, for UWSNs. JSL is a four phases scheme. For each round of message exchanges, time synchronization and localization are performed at different phases. During iterations, the output of synchronization is fed back as the input of localization, and the output of localization is fed back as the input of synchronization in the next round of message exchanges. In this way, synchronization and localization are interleaved and can benefit each other by improving the accuracy of both services. During the localization phase, unlike other algorithms that assume sound waves travel in straight lines in the water environment, JSL compensates the stratification effect when performing the underwater acoustic ranging, so that the propagation delay estimation will be significantly improved. Furthermore, to account for the mobility characteristic in UWSNs, a tracking method called interactive multiple model IMM, is used to predict sensor node mobility to improve the accuracy of localization.

CHAPTER 12

CONCLUSION

In this paper, we presented JSL, a joint solution for time synchronization and localization in UWSN. It compensates the stratification effect in the underwater environment instead of assuming straight line transmission. Furthermore, synchronization and localization are closely coupled and help each other to improve the accuracy of each other. An advanced tracking algorithm IMM is adopted to further improve accuracy. Our simulation results show that JSL can achieve high accuracy for both synchronization and localization. In the future, we plan to implement and evaluate the JSL in real underwater environment, since the device for testing the SVP is getting less expensive. And we would also consider how a time varying clock skew and time-variable transmission rate affect the performance of JSL.

REFERENCES

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ISSN NO (online) : Application No : 17320 RNI –Application No 2017103794

[1] I. F. Akyildiz, D. Pompili, and T. Melodia, "Underwater acoustic sensor networks: Research challenges," Ad Hoc Networks (Elsevier), vol. 3, no. 3, pp. 257–279, March 2005.

[2] J.-H. Cui, J. Kong, M. Gerla, and S. Zhou, "Challenges: Building scalable mobile underwater wireless sensor networks for aquatic applications," IEEE Network, Special Issue on Wireless Sensor Networking, vol. 20, no. 3, pp. 12–18, 2006.

[3] J. Heidemann, Y. Li, A. Syed, J. Wills, and W. Ye, "Research challenges and applications for underwater sensor networking," in *Proc.* of the IEEE Wireless Communications and Networking Conference (WCNC), 2006.

[4] J. Partan, J. Kurose, and B. N. Levine, "A Survey of Practical Issues in Underwater Networks," in Proc. of ACM International Workshop on UnderWater Networks (WUWNet), September 2006, pp. 17–24. [Online]. Available: http://prisms.cs.umass.edu/brian/pubs/partan.wuwnet2006.pdf

[5] J.-H. C. Z. Zhou, S. Le, "An ofdm based mac protocol for underwater acoustic networks," in Proceedings of ACM International Workshop on UnderWater Networks (WUWNet), Sep 2010.

[6] P. Xie, L. Lao, and J.-H. Cui, "VBF: vector-based forwarding protocol for underwater sensor networks," in To appear in Proceedings of IFIP Networking, May 2006.

[7] H. Yan, Z. Shi, and J.-H. Cui, "DBR: depth-based routing for underwater sensor networks," Proceedings of IFIP Networking, May 2008.

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INTERNATIONAL JOURNAL OF RESEARCH REVIEW IN ENGINEERING AND MANAGEMENT (IJRREM)
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Scribd impact Factor: 4.7317, Academia Impact Factor: 1.1610
ISSN NO (online) : Application No : 17320 RNI –Application No 2017103794

[8] Z. Zhou, J.-H. Cui, and S. Zhou, "Localization for large-scale underwater sensor networks," In Proceedings of IFIP NETWORKING, Atlanta,

Georgia, USA, May 2007.

[9] Z. Zhou, J.-H. Cui, and A. Bagtzoglou, "Scalable localization with mobility prediction for underwater sensor networks," In Proceedings of IEEE INFOCOM'08, Mini-Conference, Phoenix, Arizona, USA, 2008.

[10] Kenneth and D. Frampton, "Acoustic self-localization in a distributed sensor network," IEEE Sensors Journals, vol. 6, pp. 166 – 172, Feb. 2006.

[11] N. Bodhi, H. Balakrishnan, E. Demaine, and S. Teller, "Mobile-assisted localization in wireless sensor networks," in Proceedings of Infocom, March 2005, pp. 172–183.

[12] J. Elson, L. Girod, and D. Estrin, "Fine-grained network time synchronization using reference broadcasts," in Proceedings of the Fifth Symposium on Operating Systems Design and Implementation (OSDI2002), Boston, MA, USA, December 2002, pp. 147–163.

[13] S. Ganeriwal, R. Kumar, and M. B. Srivastava, "Timing-sync protocol for sensor networks," in Proceedings of the First International ACM Conference on Embedded Networked Sensor Systems (SenSys), 2003, pp. 138–149.

[14] M. Maroti, B. Kusy, G. Simon, and A. Ledeczi, "The flooding time synchronization protocol," in Proceedings of the Second International ACM Conference on Embedded Networked Sensor Systems (SenSys), Baltimore, MD, USA: ACM Press, 2004, pp. 39–49.