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Minimization of Energy Hole in Under Water Sensor Networks (UWSNs)

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ABSTRACT

The major difference between underwater sensor networks (UWSNs) and terrestrial sensor networks is the use of acoustic signals as a communication medium rather than radio signals. The main reason behind this is the poor performance of radio signals in water. UWSNs have some distinct characteristics which makes them more research-oriented which is the large propagation delay, high error rate, low bandwidth, and limited energy. UWSNs have their application in the field of oceanographic, data collection, pollution monitoring, off-shore exploration, disaster prevention, assisted navigation, tactical surveillance, etc. In UWSNs the main advantages of protocol design are to a reliable and effective data transmission from source to destination. Among those, energy efficiency plays an important role in underwater communication. The main energy sources of UWSNs are batteries which are very difficult to replace frequently. There are two popular underwater protocols that are DBR and EEDBR. DBR is one of the popular routing techniques which don't use the full dimensional location information. In this article the authors use an efficient area localization scheme for UWSNs to minimize the energy hole created. Rather than finding the exact sensor position, this technique will estimate the position of every sensor node within certain area. In addition to that the authors introduced a RF based location finding and multilevel power transmission scheme. Simulation results shows that the proposed scheme produces better result than its counter parts.

KEYWoRDS

Depth Based Routing, Forward Directed Graph, Path Optimization, Routing Protocols, Under Water Sensors

1. INTRoDUCTIoN

Sensor network have many revolutionizing benefits in the area of science, industry and government like structural monitoring, industrial applications etc. A wireless sensor network (WSN) (Gomathi et al., 2016) consists of randomly distributed sensor nodes in a given area to monitor physical or environmental conditions, such as temperature changes, sound, pressure, etc. The main working principle of WSN is to collect data from group of objects distributed in a given area and send those collected data to a main location. Nowadays some bi-directional sensors are used. The WSN has many applications in military applications such as battlefield surveillance. Each sensor network node has many parts such as a microcontroller, an electronic circuit for interfacing with the sensor and an energy source, usually a battery, a radio transceiver with an internal antenna or connection to an external antenna. The major benefits of terrestrial senor networks are self-configuration maximizing the utility of energy consumed. The sensor networks consist of low-cost nodes, dense deployment, and short range, multi-hop communication (Latif et al., 2013). The earth is a planet with 70% of the surface covered by water. Underwater Acoustic Sensor Network (UWASNs) are mainly consists of maximum number of sensors on and underwater which can communicate through acoustic links. Like terrestrial WSNs, underwater sensor networks provide several advantages in terms of coverage, cost, and deployment. Because of their limited propagation power, radio signal (range is 50-100cm) is not suitable for underwater communication so we basically prefer to use acoustic communication for underwater sensor network because of long propagation range. By the advancement and growth of micro electro mechanical system (MEMS) technology and wireless communication technology, WSNs are very attractive for numerous fields. Pre requisites for UWSNs application are network efficiency and reliability in terms of high throughput, energy conservation, and low bit error rate (BER) and reduced delay. There is some distinct feature of UWSNs which makes them popular now days are like low available bandwidth, large propagation delay, highly dynamic network topology and high error probability. Typical frameworks of UWSNs are composed of basically sink nodes, underwater sensor nodes, surface station etc. Acoustic signals are used for communication medium in underwater environment. The harsh underwater environment and unique characteristics of acoustic signals impose many research challenges for effective data routing in UWSNs. Sensor nodes consume more energy due to typical underwater environment condition where replacement or re changing battery is not possible.

Section 2 presents a survey of the related works, and gives an overview on some concepts which is required for the future work on energy hole minimization in under water sensor network. Section 3 presents the proposed path optimization algorithm for energy hole minimization and network life time enhancement. Section 4 presents the simulation and results of the proposed method. Section 5 concludes the discussion and gives a direction to future research in this issue which we have discussed.

2. RELATED WoRKS

Mahapatra, and Shet (2018) have proposed a localization base Gaussian and Averaging filter for detecting senor node position. RSS based position algorithm is used to estimate the unknown senor node in the specified region. Localization method is also used to improve the position estimation in different environmental condition.

Dhirendra Pratap Singh, Vikrant Bhateja, and Surender Kumar Son (2014) have proposed a rolling gray model for an optimal routing scheme for WSNs. EECB based routing with residual energy and distance-based CH selection methods are used to reduce the overhead during cluster formation.

Sri, Prasad, and Kumar have proposed a dynamic data transmission algorithm, these algorithms have ability to maintain mobility in large networks.

POR (position based opportunistic routing) used for routing algorithm.

Pompili et al. (2009), have proposed two communication architectures for UW-ASN i.e. two-dimensional architecture (sensor nodes are anchored to the bottom of the ocean). Second one is the three-dimensional architecture, (sensor nodes are float at different ocean depth covering the entire ocean volume). This proposed communication architectures provide guidelines on how to choose optimal sensor deployment surface area under ocean, provide an estimate of the number of required redundant sensors, robustness of the sensor network to node failure.

Xie et al. (2006), have proposed a novel routing protocol, called Vector Based Forwarding (VBF) which is basically a position-based routing approach in which only a small number of the nodes are involved in routing. VBF is a novel protocol designed to address the routing challenges in UWSNs. It has high success of data delivery, scalable, robust and energy efficient. It provides scalable, robust and energy efficient routing.VBF also use a localized and distributed self-adaptation algorithm which discard the low benefit packets thus reduce energy consumption of the network

Zhou et al. (2007), have proposed the localization problem in large scale UWSNs which can be solved by a hierarchical approach in which the complete localization process is divided into two sub process that is anchor node localization and ordinary node localization. For ordinary node localization, a novel distributed method based on 3-dimensional Euclidean distance estimation is

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