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EFFECTIVE MULTIPATH COMMUNICATION FOR UWSN IN THE UNDERWATER THINGS

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Abstract: In the fast development world, the energy efficiency of wireless networking protocols becomes a concern for many stakeholders. The wireless networking protocol can also be used for gathering the underwater data and routing in the data using the source and destination node. The routing plays a main role for collecting data in networks, in such a way it is required to play the networking in underwater, and a way to localize the device nodes makes an incredibly in cost and error prone situation. The packets are routed from one to another node, where hop to hop network is measured. The Underwater Wireless Sensor Network (UWSN) is a model to discover underwater environment. The uniqueness of Mobile Underwater sensor networks has a problem in low communication bandwidth, large transmission delay and mobility of nodes. In this proposed research, a new efficient routing protocol is to be introduced, such protocol gives multipath utilizing method from source to destination, the series with sub paths are already taken into account by its introduced protocol and also helps to calculate the neighboring node from source to destination nodes. In such a way, relay nodes can be calculated from nodes using transmission delays. Through this work, it send the packets very secure by multipath communication in underwater sensor networks, and secure communication helps to send or receive the packets safely.

Keywords: Multipath Communication, Mobile Underwater Sensor Networks, Underwater Wireless Sensor Networks (UWSN).

I. INTRODUCTION

The ocean is so vast and covers over 70% of the Earth's surface. The environment is mostly impacted by the ocean and the life of humanity depends heavily on the ocean. The importance of ocean to humanity is well-recognized. However, only less than 1% of the whole ocean has been explored now-a-days; due to the reasons including vast volume, high pressure, and harshness of underwater environment.

The knowledge about the underwater environment is insignificant compared with that of land. Since the ocean plays more and more important roles in human's life, discovering the vast unexplored ocean volume becomes critical and urgent from the last decades. With the advance of sensing technologies, sensor networks have been used to support widespread domain applications, and Underwater Wireless Sensor Networks (UWSNs) has recently been attracted significant attention and considered as a promising alternative to explore the underwater environment. Generally, smart underwater physical objects, which called sensor nodes. It contains current record information about underwater environment.

UNDERWATER WIRELESS SENSOR NETWORK

UWSN is rapidly increasing interest from scientist and business group, because there are large amount of available resources in the sea. Human are not suitable for underwater environment exploration which increase deployments cost Underwater based networks is much higher than terrestrial based networks. Fig.1 represented Underwater Sensor Networks. Large surface and deep height result in underwater equipment sparsely deployed. In the past three decade, most applications of UWSN are usually applied for undersea exploration. The UWSN is used to extracting oil or detecting reservoirs from underwater. It is a long-term exploration and typically spend many years to discover resources. For the application of the pollution monitoring, disaster prevention, such as tsunami warning or seaquakes investigation. UWSN are investigated besides, the military reconnaissance is also an important application for UWSN. The Navy uses UWSN to perform anti-submarine mission because submarines and mines always cause seriously damage. In the wireless sensor network (WSN), sensor nodes are only restricted to work in low power consumption for power saving. However, the UWSN has more restrictions because of intrinsic properties. The first is the propagation delay. The propagation speed in

water (1.5×103 m/s) is lower than radio propagation speed (3×108 m/s). Second, the power consumption for underwater WHOI modem and RF sensor is listed in. Underwater sensor nodes mainly use battery power. It is a difficult task to change the battery for senor node in underwater represent in figure1. The energy efficient communication protocol designing is an important issue to extend the network lifetime. The third is sensor node mobility. The sensor nodes in the WSN are typically static. The fourth is the error probability of acoustic channel.

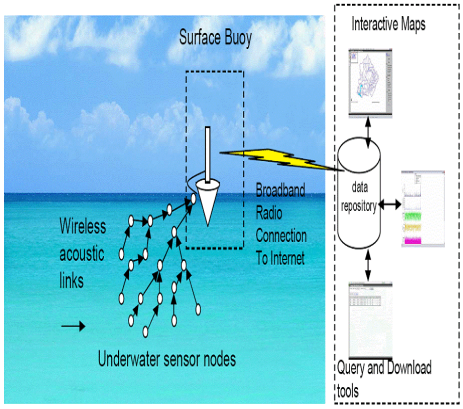

Figure1: Underwater Sensor Networks

On the other side, sensor nodes in UWSN usually move at the speed of 3-6 km/h in typical underwater condition due to ocean current.. Sound propagation is primarily determined by noise, transmission loss, multi-path and Doppler spread. Noise can be classified as man-made noise and ambient noise. Man-made noise is mainly caused by machinery noise and shipping activity. Ambient noise is related with the background sustained noise emanating from lots of unidentified sources. The level of underwater ambient noise may have large variations upon a change location, time or depth. Finally, Doppler spreading causes degradation in the performance of digital communications. Moreover, transmissions at a high data rate cause many adjacent symbols interferences at the receiver.

As mentioned earlier, many intrinsic properties of acoustic channel are harmful transmission process, such as the long propagation delay; Therefore routing protocols for WSNs cannot directly apply to UWSNs. In this paper, propose a new protocol, called multi-path routing (MPR) protocol, for time efficient which increase network lifetime extending and scalability in UWSNs. In this work, all the nodes send the data to surface sink when they detect an event in water. Source node divides the data packet into several time slots based on the bandwidth. Then source node uses two-hop transmission scheme to transmit data packet to relay nodes. The contribution of this work is to minimize propagation delay. When a relay node receives packet, it checks transmission scheduling to detect whether there is a collision with other nodes. If there is a collision, the relay node defers appropriate time slots to avoid collision. Otherwise, the relay node transmits packets to the destination.

II. RELATED WORK

The Routing in sensor networks is very difficult problem other than contemporary communication which is due to many characteristics that differentiate them from the wireless ad hoc network [1]. It is impossible to build a global addressing scheme for the deployment of sheer number of sensor nodes. The classical IP-based protocols cannot be applied to sensor networks . The next in contrary to typical communication networks and the almost all applications of sensor networks require the flow of sensed data from multiple regions (sources) to a particular sink . Third, since multiple sensors may generate the same data within the vicinity of a phenomenon generated data traffic has important redundancy in it. Fourth, sensor nodes are tightly constrained in terms of transmission power, on-board energy, processing capacity, storage, and thus require careful resource management [4]. According to the aforementioned differences between WSN and traditional wireless networks, numerous routing protocols the vicinity of phenomenon generated data traffic has significant redundancy in it. Fourth, sensor nodes were proposed over the past decade to address the routing challenges imposed by the new features of WSN of which multipath routing is one of them in figure2.

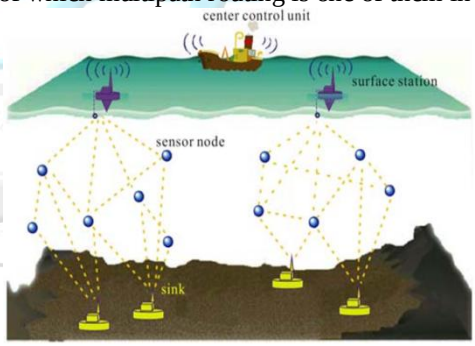

Figure2: Sensor Node Process

Existing routing protocols on the global based sensor network are categorized into proactive routing protocols, reactive routing protocols, and geographical routing protocols [5]. As mentioned above, terrestrial-based routing protocols are unsuitable for UWSN because they focus on stationary networks and incur long delay time and vast initial flooding overhead. In addition, GPS (Global Positioning System) does not work accurately in UWSN [6]. Recently, some routing protocols are specifically designing for UWSN, which are divided into three major types of routing protocol for UWSN as follows: proposed a new architecture to use large number of altered low-cost sensor node to locally monitor and report non-accessible underwater [7] .

Event in real time author proposed a UWD (Under Water Diffusion) which uses no proactive routing message exchange. Exploit dynamic unicast based path management technique to reduce on demand flooding and random node mobility. Proposed a PLURP (Path aware Layered Routing Protocol for underwater sensor networks), a novel on the fly routing algorithm. To solve multipath or loss of connectivity problem, PULRP find the path on the fly because it does not need much information such as fixed routing table, localization synchronization process etc. Proposed a GPS free clustering scheme for underwater routing protocol, while GPS system is unsuitable in underwater environment [8].

In this system, assume all the sensor node always has data transmit to sink. Every sensor node first use the self battery information to estimate whether it could become cluster head and each non-cluster head decides to which cluster it belongs by choosing the cluster head that required the minimum communication energy. Time compensating technique solve that underwater communications in different cluster member could overlap message at the cluster head due to long propagation delay, only cluster head can compute this value. Once cluster get all information, it start to arrange member transmission order by propagation delay. Developed multipath virtual sink architecture for harsh underwater environment. To solve the bottlenecks happen around the sink node region, including sensor node, because they are usually transmission data. In this architecture the author propose a virtual sink, which sensor node can transmit data to one or more sink to increasing reliability and consider as retransmitting a packet simultaneously instead of sequentially. Besides, use of spatially diverse paths also reduces the probability of contention.

III. BACKGROUND STUDY

PROBLEMS IN EXISTING ROUTING PROTOCOLS

The existing routing protocols proposed for terrestrial mobile and ad hoc networks usually fall into two categories: proactive and reactive. Unfortunately, protocols belonging to both of these extremes are not suitable for underwater sensor networks. Proactive or table driven protocols require large signaling overhead in order to establish end-to-end routes, especially for the first time and every time when any change occur in the topology. For underwater sensor networks, it is already known that continuous node movement produces continuous topology changes.

On the other hand, for reactive or on demand routing, the protocols belonging to this category are suitable for dynamic environments, but they face large delays as they require source initiated flooding of control packets for route discovery process. Not only this, but also the experimental results show that reactive protocols provide better results with symmetrical links in the network. For underwater conditions, the propagation delays are already high with asymmetric links; so the protocols of this type also seem unsuitable for these environments. Without any proactive neighbor information and with small flooding option, it is a challenging task to construct a multi-hop data delivery routing scheme for a continuous mobile network. Geographical routing can be a possible solution for these situations. The protocols that belong to this type forward the data packets using the location information of their neighbors and the location of the destination. This technique has much potential but only for terrestrial networks, where facilities like Global Positioning System (GPS) are available. While for underwater environments, where high frequencies face the problem of quick absorption, GPS waves with 1.5 GHz band cannot propagate in these conditions.

IV. PROPOSED METHODOLOGY

In this paper, multi-path scheme and multi-sequence transmission of approaching is proposed to give efficient result in underwater network transmission. It overcomes the propagation delay seriously in underwater environment. In existing investigation, single path scheme waste more time to transmission cause ineffective network. The MPR protocol achieve a new low communication delay routing protocol to transmission, which use multipath scheme to communication packets; every node only need to get two hop information which is used to adapt rapid change network topology environment; our MPR protocol can reduce end-to-end propagation delay form source node to destination node because every packet distributed sanded by different path.

4.1 A MULTI-PATH ROUTING PROTOCOL

In MPR work efficiently transmitted packets in underwater environment. The MPR containing three phases: propagation delay collection phase intermediate node selection phase and relay node selection phase. In first phase, since routing path is determined by transmission delay, so the source node required to know the two hop delay information from the hop node neighbor node and form neighbor node to next hop node. In neighbour node selection phase, node use propagation delay information to decide which node is intermediate node I. The third phase source check all the relay nodes whether the collision is occurred between each node.

4.2 BENEFITS OF MULTIPATH ROUTING

Reliability and Fault-Tolerance: The unique idea after using multipath routing advance in WSN was to create available path flexibility and consistent data communication. And the fault tolerance domain, whenever a sensor node cannot progressive its data against the sink, it can be used as efficient from the availability of alternative paths to deliver its data packets from node or link failures.

Load Balancing: The traffic distribution is not equal in all links in the network, spreading the traffic along multiple routes can ease congestion in some links and bottlenecks.

QOS Improvement: The QOS support in terms of network throughput, end-to-end latency and data delivery ratio is an important objective in designing multipath routing protocols for different types of networks.

Reduced Delay: In multipath routing the delay is minimized, because the backup routes are identified during route discovery.

Bandwidth Aggregation: The separate data to the same destination into multiple streams while everyone is routed through a different path, the efficient bandwidth can be aggregated and the strategy is particularly valuable when a node has multiple low transmission links but it has need of a greater one which an separate link can provide.

4.3 ENERGY-EFFICIENT AND COLLISION-AWARE MULTIPATH ROUTING PROTOCOL (EECA)

An energy efficient and collision aware (EECA) node disjoint multipath routing algorithm for WSNs. The main idea of EECA is very effective to the broadcast nature of wireless communication to avoid collisions between two discovered routes without extra overhead. Additionally, this protocol restricts the route detection flooding and adjusts node broadcast power with the aid of node position information, resulting in energy efficiency and good performance of communication that proposed scheme in terms of the average packet delivery ratio, and the average end-to-end delay, and the average residual energy of the node.

4.4 LOW-INTERFERENCE ENERGY-EFFICIENT MULTIPATH ROUTING PROTOCOL (LIEMRO)

This protocol is mainly designed to improve packet delivery ratio, lifetime and delay, through discovering multiple interference minimized node disjoint paths between source nodes and sink node. The Low Interference Energy Efficiency contains a load balancing algorithm to diffuse source nodes traffic over many paths based on the relative quality of every path. It consists of a multipath routing protocol and load balancing algorithm.

4.5 RELIABLE INFORMATION FORWARDING USING MULTIPLE PATHS IN SENSOR NETWORKS

In multiple copies of the same packet are transmitted over randomly chosen routes. Specifically, it is assumed that a packet is destined to a sink node and that each node knows its hop distance to the sink as well as the hop distances of all its immediate neighbors. Packet redundancy can occur not only at the source node but also at every relay node. The intermediate node has to decide two things: the number of copies to create and the upstream nodes to which the packet is actually forwarded. With respect to the latter choice, the prefer nodes must really closer to the sink, otherwise the choice is random. It distributes the load over many nodes and avoids quick depletion of nodes.

V. RESULT AND ANALYSIS

MPR protocol is performed an analysis in terms of end-to-end delay, successful rate, throughput and overhead. Based on NS-2, it modifies our simulation using underwater module. To consider the effect of the network density and node velocity, our simulator consider a 3-Dimensional space of 2000m x 2000m x 500m; The source is fixed at location (1850, 1850, 550) near to the corner at the floor. Sink is located at location (500,500,250) near to the opposite corner at the surface. All the nodes are mobile which affect by the water current, only the source and the surface sink are static. Mobile nodes move in X-plane and Y-plane in common mobility pattern.

VI. CONCLUSION

In this paper we discussed in multipath routing is one of the effective methods to improve the capacity of network and productivity of sources under heavy traffic conditions. This paper presented a comprehensive analysis of multipath routing protocols in wireless sensor networks and specified the challenges related to designing multipath routing protocols in WSN and compared various properties of these routing protocols. The mentioned comparison is of great significant to understood the existing solutions and also design new multipath routing protocols.

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