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Improved Energy Efficient Routing Protocols for UWSN

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Abstract: Geographical Clustering Energy Efficient Routing Protocol (GCEER) protocol has been proposed for UWSNs. It is a geographic and opportunistic routing protocol. Increasing attention has recently been devoted to underwater sensor networks (UWSNs) because of their capabilities in the ocean monitoring and resource discovery. UWSNs are faced with different challenges, the most notable of which is perhaps how to efficiently deliver packets taking into account all of the constraints of the available acoustic communication channel. In this paper, we propose an enhanced routing protocol, called Geographical Clustering Energy Efficient Routing Protocol (GCEER). This address the void problem and the energy reliability trade-off in the selection of forwarding set. GCEER takes advantage of distributed beaconing, constructs the adjacency graph at each hop and selects a forwarding set that holds the best trade-off between reliability and energy efficiency. The unique features of GCEER in selecting the candidate nodes near each other leads to the resolution of the Using geographical information for distributing the queries to the appropriate regions which is done by neighbor selection on the basis of energy and the location to route the packet.

Keywords: Underwater sensors, opportunistic routing.

I. INTRODUCTION

The earth is a water planet, because human being covers the sea and ocean, the remaining part cover more than 70% of its surface. Several reasons attract to discover this underwater world such as the still large unexplored surface, the biological and geological wealth, the natural and man-made disasters, which have given rise to significant interest in monitoring oceanic environments for scientific, environmental, commercial, security and military fields [1]. Due to these reasons, underwater wireless sensor networks (UWSN) are very promising to this hostile environment. They have many potential applications, including ocean sampling networks, undersea explorations, disaster prevention, seismic monitoring, and assisted navigation [2]. The function of a routing protocol in UWSN is a fundamental part of the network infrastructure to establish routes between different nodes. UWSN routing protocols are difficult to design in general. It is a challenging task, caused by the aquatic environment. UWSN are significantly different from the terrestrial sensor technology. First, the suitable medium of communication in underwater networks is the acoustic waves and is preferred to both radio and optical waves because they have great drawbacks in aquatic channel [3]. Secondly, the terrestrial sensors are static, while underwater sensor nodes may be mobile with water movements and other underwater activities. Consequently, the challenge imposed by UWSNs leads to the inability to adapt directly the existing routing protocols in terrestrial WSN, so new routing approach must be implemented for UWSN. In spite of the existence of a considerable number of papers about routing protocols in UWSNs presented by we perceived a lack of a specific overview involving the geographic routing protocols. In this paper, we provide an insight into geographic routing protocols designed specifically for UWSN. In addition, we introduce the main challenges of using geographic routing protocols in UWSN from different perspectives and discuss some directions of future research on this field.

Similar to terrestrial sensor networks, under water sensor networks consist of a variable number of sensor nodes (cabled seafloor sensors, acoustically connected sensors, moored sensors, and autonomous underwater vehicle) as illustrated in Figure 1, that are deployed to perform collaborative monitoring over a given volume. The data collected by these sensors are transmitted to the surface station. The surface station is equipped with an acoustic transceiver that is able to handle multiple parallel communications with the deployed underwater sensors. It is also endowed with a long range RF and/or satellite transmitter to communicate with the onshore sink and/or to a surface sink [8]. Underwater wireless sensor network architecture has been classified into two-dimensional, threedimensional with fixed nodes, and three-dimensional with Automatic Underwater Vehicles (AUVs) [8].

This classification is based on the geographical distribution of the nodes and their mobility. The architecture deployed depends upon the application. These include networks of sensors with depth controlled by attaching each sensor node to a surface buoy, by wires of regulated length, to adjust the depth of each sensor node. This kind may be used for

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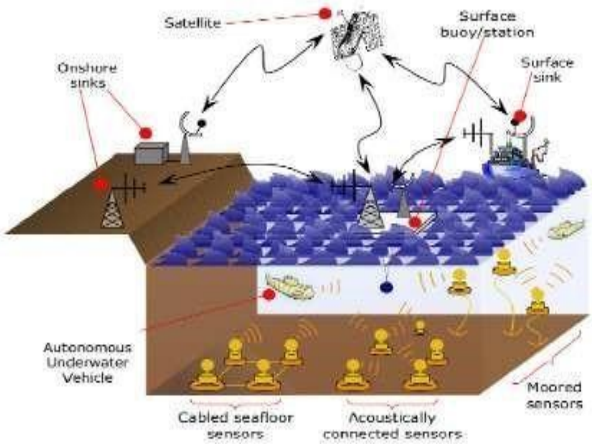

Fig.1. Different ways deployments of UWSN

applications or monitoring of ocean phenomena (ocean bio– geochemical processes, water streams, pollution). The major characteristic of geographic routing protocols that is involves location information in routing decisions. Location based routing is very promising for packets transmission in mobile wireless adhoc and sensor networks particularly in hostile environments because it does not add any burden in the network design although the localization process itself in this kind of routing is an intrinsic source of communication errors [9].Although the research on geographic routing being more recent than topological routing, it has received a special attention due to the significant improvement that geographic information can produce in routing performance. Geographic routing does not require that a node perform maintenance functions for topological information beyond its one-hop neighborhood [10]. Consequently, geographic routing is more feasible for large-scale networks than topological routing, which requires networkwide control message dissemination. Besides that, geographic routing requires lower memory usage on nodes by maintaining the information locally.

In geographic routing protocols, the key information is the current position of the destination, so the sender must be aware of this important information, which can be obtained by a location service. In this category the node forwards the packet to a single node as a next hop which is located closer to the destination than the forwarding itself. Greedy protocols do not create and maintain paths from source to the destination; as an alternative, a source node includes the approximate position of the receiver in the data packet and selects the next hop according the optimization, To ensure the packet delivery from a source to a destination this kind of routing broadcast periodically small packets (beacons) to advertise their position and allow other nodes to maintain a one-hop neighbor table. The greedy routing can well scale with the size of network also are flexible to topology changes without using routing discovery and maintenance. The sender will broadcast the packet (whether the data or route request packet) to all single hop neighbors towards the destination. The node, which receives the packet, checks whether it is within the set of nodes that should forward the packet (according to the used criteria). If yes, it will retransmit the packet. Otherwise the packet will be dropped. In restricted directional flooding, instead of selecting a single node as the next hop, several nodes participate in forwarding the packet in order to increase the probability of finding the shortest path and be robust against the failure of individual nodes and position inaccuracy. It is based on TBF (Trajectory based forwarding) protocols, which use the source and Cartesian routing. VBF is a geographic routing protocol, which requires a full localization. The position of each node is estimated with angle of arrival (AOA) technique and strength of the signal, the location information of the sender, the forwarder, and the target are carried in the packet. The path transmission is specified by a vector from a sender to a destination, and this vector is located in the centre of a pipe routing, the entire nodes in this pipe are candidate for packet transmission. When a node receives a packet, it firstly calculates its position with (AOA) technique, if the node determines that it is included in the pipe, it continues transmission of the packet otherwise it discards the packet.

II RELATED WORK

Underwater wireless sensor networks (UWSNs) have been showed as a promising technology to monitor and explore the oceans in lieu of traditional undersea wireline instruments [1]. Nevertheless, the data gathering of UWSNs is still severely limited because of the acoustic channel communication characteristics. One way to improve the data collection in UWSNs is through the design of routing protocols considering the unique characteristics of the underwater acoustic communication and the highly dynamic network topology. In this paper, Rdolfo et al propose the GEDAR routing protocol for UWSNs. GEDAR is an anycast, geographic and opportunistic routing protocol that routes data packets

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from sensor nodes to multiple sonobuoys (sinks) at the sea's surface. When the node is in a communication void region, GEDAR switches to the recovery mode procedure, which is based on topology control through the depth adjustment of the void nodes, instead of the traditional approaches using control messages to discover and maintain routing paths along void regions. Simulation results show that GEDAR significantly improves the network performance when compared with the baseline solutions, even in hard and difficult mobile scenarios of very sparse and very dense networks and for high network traffic loads.

Recent advances in environmental energy harvesting technologies have provided great potentials for traditional battery-powered sensor networks to achieve perpetual operations. Due to dynamics from the temporal profiles of ambient energy sources, most of the studies so far have focused on designing and optimizing energy management schemes on single sensor node, but overlooked the impact of spatial variations of energy distribution when sensors work together at different locations [2]. To design a robust sensor network, it has beedn used mobility to circumvent communication bottlenecks caused by spatial energy variations. Wang et al employ a mobile collector, called SenCar to collect data from designated sensors and balance energy consumptions in the network. To show spatialtemporal energy variations, first they conduct a case study in a solar-powered network and analyze possible impact on network performance. Next, the system presents a two-step approach for mobile data collection. First, adaptively select a subset of sensor locations where the SenCar stops to collect data packets in a multi-hop fashion. Wang et al develop an adaptive algorithm to search for nodes based on their energy and guarantee data collection tour length is bounded. Second, focus is on designing distributed algorithms to achieve maximum network utility by adjusting data rates, link scheduling and flow routing that adapts to the spatial-temporal environmental energy fluctuations. Finally, numerical results indicate the distributed algorithms can converge to optimality very fast and validate its convergence in case of node failure. In wireless sensor networks, sensor nodes are usually selforganized, delivering data to a central sink in a multi-hop manner. Reconstructing the per-packet routing path enables fine-grained diagnostic analysis and performance optimizations of the network. The performances of existing path reconstruction approaches, however, degrade rapidly in large scale networks with lossy links. Gao et al presents Pathfinder, a robust path reconstruction method against packet losses as well as routing dynamics. At the node side, Pathfinder exploits temporal correlation between a set of packet paths and efficiently compresses the path information using path difference. At the sink side, Pathfinder infers packet paths from the compressed information and employs intelligent path speculation to reconstruct the packet paths with high reconstruction ratio. Gao propose a novel analytical model to analyze the performance of Pathfinder and further evaluate Pathfinder compared with two most related approaches using traces from a large scale deployment and extensive simulations. Marchang et al reduce the duration of active time of the IDSs without compromising on their effectiveness. To validate the proposed approach, model the interactions between IDSs as a multi-player cooperative game in which the players have partially cooperative and partially conflicting goals

III PROBLEM STATEMENT/SPECIFICATION

DBR, EEDBR and CDBR, node density decreases sharply with time. The instability period is better in DBR as compared to EEDBR as there is a gradual increase in energy Consumption. When network becomes sparse, number of neighbors decreases quickly which causes Network instability. In DBR and CDBR, low depth nodes die at an earlier stage due to huge data forwarding and constant EEDBR neglects link state, which badly affects network throughput of these protocols. Number of dead nodes sharply increases with time in EEDBR, as there is high load on high-energy nodes because of considering residual energy as a routing metric Network residual energy steadily decreases as total number of eligible neighbors drops off with network density. Energy consumption CDBR is the highest among all other protocols due to frequent selection of high-energy nodes. Moreover, higher energy consumption in DBR, EEDBR and CoDBR is because of reactive routing being performed in these protocols.

IV PROPOSED SYSTEM

The proposed routing protocol employs the greedy forwarding strategy by means of the position information of the current forwarder node, its neighbors, and the known sonobuoys, to determine the qualified neighbors to continue forwarding the packet towards some sonobuoys. GCEER Routing protocol is an anycast, that tries to deliver a packet from a source node to some sonobuoys(sink).The proposed routing protocol employs the greedy forwarding strategy by means of the position information of the current forwarder node, its neighbors, and the known sonobuoys, to determine the qualified neighbors to continue forwarding the packet towards some sonobuoys . For that, we need to find a next-hop forwarder selection to forward the data packet. In traditional multi hop routing; only one neighbor is selected to act as a next-hop forwarder. In opportunistic routing, takes shared transmission medium, each packet is broadcast to a forwarding set composed of several neighbors. The packet will be retransmitted only if none of the neighbors in the set receives it. During the transmissions, each node locally determines if it is in a communication void region by

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examining its neighborhood. If the node is in a communication void region, that is, if it does not have any neighbor leading to a positive progress towards some surface sonobuoy, it announces its condition to the neighborhood and waits the location information of two hop nodes in order to decide which new depth it should move into and the greedy forwarding strategy can then be resumed. After, the void node determines a new depth based on 2-hop connectivity such that it can resume the greedy forwarding.

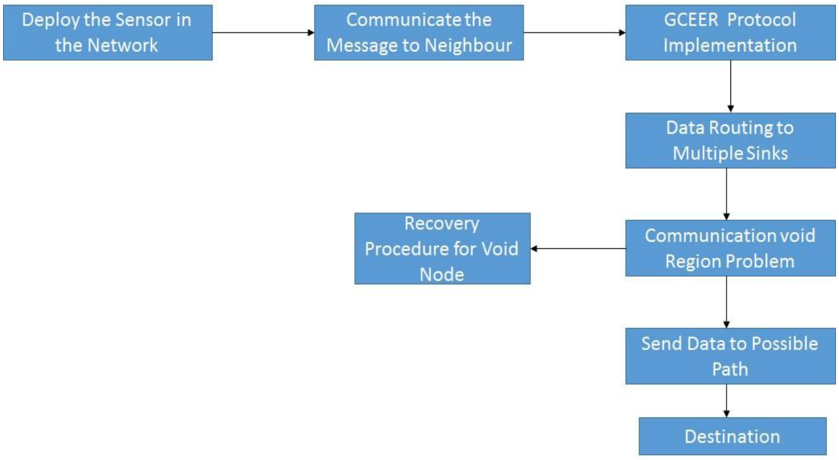

Figure 2: GCEER Model

A. Network Creation

The network is framed with multiple sinks on the surface of sea level. Each Sonoboys (sinks) is equipped with a GPS and uses periodic beaconing to disseminate its location information to the underwater sensor nodes. The monitoring center keep tracks the periodic information's from sonoboys.

B. Routing

Packet forwarding is more likely to be successful if packets are relayed over multiple short distances instead of traversing over long distances. Geographic and opportunistic routing protocol is used for communication recovery over void region. The problem occurs whenever the current forwarder node does not have a neighbor nodes closet to the sonoboys. To avoid unnecessary transmissions, low priority nodes suppress their transmissions whenever they detect that a high priority node sent the same packet.

C. Topology Control Algorithm

The aim of the topology control algorithm is to move void nodes to new depths to resume the Geographic routing whenever it is possible. The depth adjustment is based on the neighbor nodes closet to the sonoboys location in order to organize the network topology and improve the routing task. The current forwarder node forward the packet to neighbor node closet to the sink based upon the energy based routing. Energy consumption is less.

1. Packet delivery ratio is increased.
2. Throughput response is increased.

It is compatibles in hard and difficult mobile scenarios of very sparse and very dense networks and for high network traffic loads. Improves the network performance when compared with existing underwater routing protocols Improve the data routing in underwater sensor networks.

D. Algorithm for the proposed UWSN (GCEER) routing protocol

Input: Forwarding Node F, Destination Node D, Neighbor_List (F)

Auxiliary Variables: Progress (F, I), where I ∊ Neighbor_List (F)

Output:
Next_Hop_Node //if Greedy forwarding is successful.
Null // if Greedy forwarding is not successful and perimeter forwarding is needed.

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Initialisation Process: Next_Hop_node = NULL
Maximum_Process ← 0.0

Begin: GPRS Greedy Forwarding Algorithm
$\text{Distance}_{\text{F.D}} = \sqrt{(\text{X}_\text{F} - \text{X}_\text{D})^2 + (\text{Y}_\text{F} - \text{Y}_\text{D})^2}$

for every neighbor node I∊ Neighbor_List (F) ***do***,
  $\text{Distance}_{\text{I.D}} = \sqrt{(\text{X}_\text{I} - \text{X}_\text{D})^2 + (\text{Y}_\text{I} - \text{Y}_\text{D})^2}$,
  if $\text{Distance}_{\text{I.D}} < \text{Distance}_{\text{ F.D}}$ ***than***,
    $\text{Progress (F, I)} = \frac{\text{Distance}_{\text{ F-D}} - \text{Disatance}_{\text{ I-D}}}{\text{Distance}_{\text{ F-D}}}$,
      if $\text{Maximum\_Progress} < Progress(F, I)$ ***than***,
        $\text{Maximum}_{\text{Progress}} = \text{Progress(F, I)}$,
        Next_Hope_Node ← 1
      end if
  end if
end for

$\boldsymbol{if}$ $\text{Maximum}_{\text{Progress}} > 0.0$ ***than***,
  return Next_Hope_Node //Greedy Forwarding is successful

else
  return NULL // Greedy forwarding is not successful and perimeter forwarding is needed.
end if

end Greedy forwarding algorithm

V EXPERIMENTAL/SETUP AND RESULTS

Network Simulator (NS2) is a discrete event driven simulator developed at UC Berkeley. It is part of the VINT project. The goal of NS2 is to support networking research and education. It is suitable for designing new protocols, comparing different protocols and traffic evaluations. NS2 is developed as a collaborative environment. It is distributed freely and open source. A large amount of institutes and people in development and research use, maintain and develop NS2. This increases the confidence in it. Versions are available for FreeBSD, Linux, Solaris, Windows and Mac OS X.

In this work, we proposed and evaluated the GCEER routing protocol to improve the data routing in underwater sensor networks. GCEER is a simple and scalable geographic routing protocol that uses the position information of the nodes and takes advantage of the broadcast communication medium to greedily and opportunistically forward data packets towards the sea surface sonobuoys.

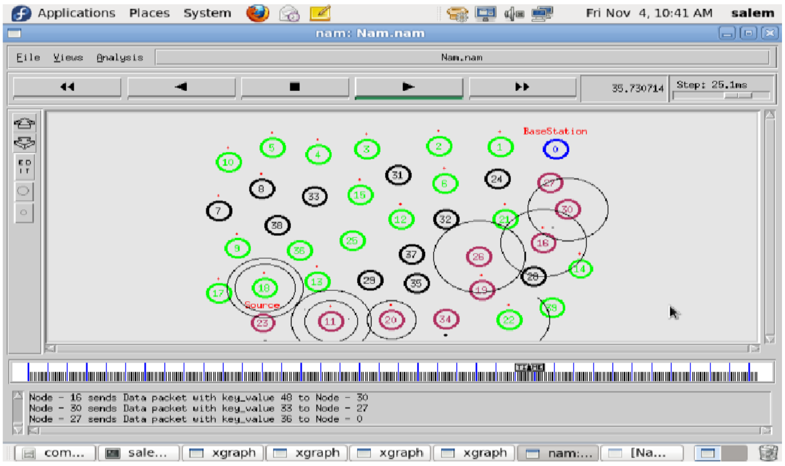

Figure 3: Packed Data

Furthermore, GCEER provides a novel depth adjustment based topology control mechanism used to move void nodes to new depths to overcome the communication void regions.

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VI. DISCUSSION AND RESULT COMPARISON

In order to minimize the energy consumption each protocols aims to limit the number of candidates relay that are qualified by the packet transmission. These protocols used different shape for this purpose, GCEER uses a specific domain. In case of FBR the forwarders are restricted in a transmitting cone. GCEER robustness is high since the packets are delivered in redundant and interleaved paths. We can determine the scalability performance of the protocol with an increasing number of nodes in the network. It can be classified as follows high scalability, when a network grows as much as it needs and the approach is still able to maintain a good performance. As the case of the three greedy routing protocols VBF, HH-VBF, and GCEER because they do not need routing discovery and maintenance. Moreover, they have a low packet overhead due to the small number of small-size packets and reduction of the use of control messages. LCAD uses a clustering approach, which is a favorite to large-scale networks. The rest of protocols have a medium scalability because that can handle networks with a reasonable size, but may have problems if it grows. Since all the position-based routing protocols are scalable compared to topology based ones, all the discussed protocols have at least medium scalability. It is considered low, medium or high depending on whether the position of a given node will be inaccessible upon the failure of a single node, the failure of a small subset of the nodes or the failure of all nodes, respectively. Hence, in the proposed protocols, a given node will be inaccessible upon the failure of a subset of nodes. Thus, their location services robustness is regarded to be medium

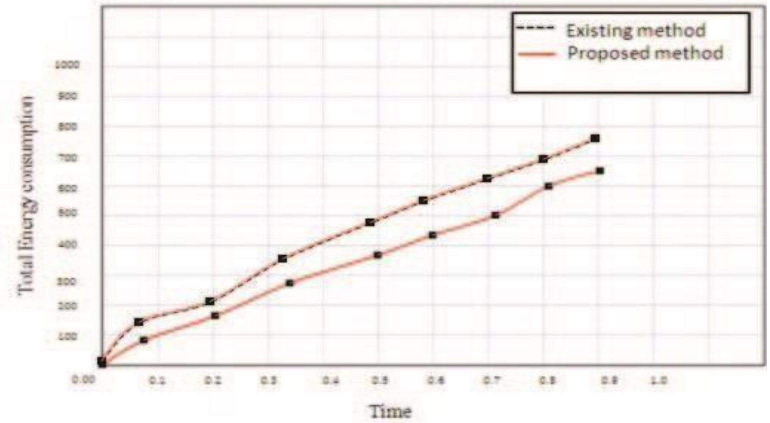

Figure 3: Comparison of energy consumption
(GEDAR and GCEER (PROPOSED METHOD))

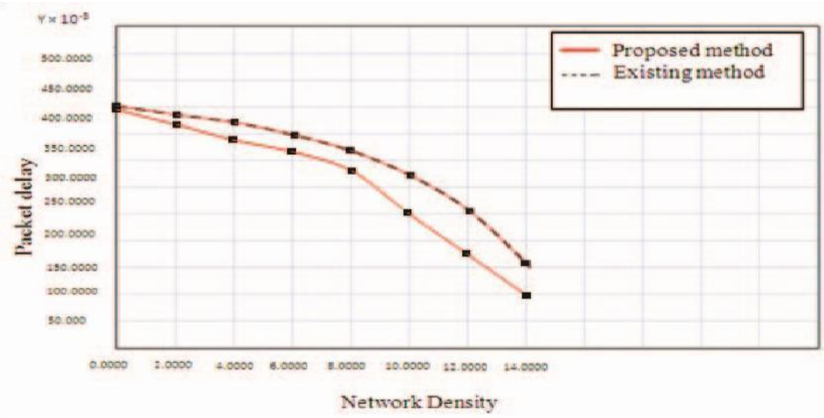

Figure 4: Comparison of packet delivery ratio
(GEDAR and GCEER (PROPOSED METHOD))

VII. CONCLUSION AND FUTURE SCOPE

The design of any routing protocol depends on a specific goals and requirements. Development of a geographic routing protocol for the aquatic environments is regarded as a vital research area, which will make these networks much more reliable and efficient. In this paper we have conducted a comprehensive survey of various geographic routing protocols in underwater wireless sensors networks. We classified the geographic routing protocols according to their forwarding strategies into three categories: greedy, restricted directional flooding and hierarchical approaches. We presented a

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performance comparison of the most relevant routing protocols in terms of forwarding strategy (type, shape region, robustness, scalability, packet overhead), location service (type, robustness), design goal (density, mobility, handling void and destination mobility.

As future work, we plan to investigate the relationship between the opportunistic data forwarding and network energy balance based on the residual energy distribution in the entire network. In future plan to enhance the work by using the layering phase to identify the shortest path to communicate the data packets between nodes. How to avoid "void" areas is very important for any greedy strategy, so we plan to investigate how the depth adjustment of some nodes can impact void areas and how opportunity forwarding of data packets to sink nodes can be incorporated into the routing protocol.

REFERENCES

[1] P. Xie, Z. Zhou, Z. Peng, J.-H. Cui, and Z. Shi, "Void avoidance in three-dimensional mobile underwater sensor networks," in Wireless Algorithms, Systems, and Applications, pp. 305–314, Springer, 2009.
[2] H. Yu, N. Yao, and J. Liu, "An adaptive routing protocol in underwater sparse acoustic sensor networks," Ad Hoc Networks, 2014.
[3] R. W. Coutinho, A. Boukerche, L. F. Vieira, and A. A. Loureiro, "A novel void node recovery paradigm for longterm underwater sensor networks," Ad Hoc Networks, 2015.
[4] Rodolfo W.L. Coutinho, Azzedine Boukerche, Luiz F.M. Vieira, and Antonio A.F. Loureiro "Geographic and Opportunistic Routing for Underwater Sensor Networks" IEEE Transactions on Computers, Vol. 65, no. 2, Feb 2016.
[5] Cong Wang, Songtao Guo, and Yuanyuan Yang "An Optimization Framework for Mobile Data Collection in Energy-Harvesting Wireless Sensor Networks" DOI 10.1109/TMC.2016.2533390, IEEE.
[6] Yi Gao, Student Member, IEEE, Wei Dong, Member, IEEE, Chun Chen, Member,