

Analysis and Experimental Evaluation of Routing Protocol for static and mobile Challenging environment in WSNs

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Abstract— *Targeting a growing number of promising application domains in wireless sensor network nodes can be either static or mobile, towards on the recent applications. Dealing with mobile sensor can made some interest in design of routing protocol, especially network layer. To address difficulties and challenges require mobility aware algorithms need to be predict both static and mobility, quality of service, localize needed to be established. This paper surveys current state of art of routing protocols with focus on currently proposed routing protocol confer type of node, control technique, and parameters. Interestingly this paper also associate hardware testbed results provides way towards approaching future directions for researchers in the field of wireless mobile sensor network*

Keywords—*Wireless Sensor Networks, Routing Protocol, Mobility, Energy efficiency*

I. INTRODUCTION

Wireless Sensor Network (WSN) is obviously one of the most fast-evolving technology fashioned of wireless Pan coordinator and coordinators. The sensor nodes (i.e) coordinators are interconnected with each other and sense the information and with the sink (i.e) pan coordinator, such interconnected network are collectively coined as wireless personal area network operated with low power[1]. Such small low power device gives birth to new developing area called Internet of Thing (IoT), a devices connected with smart objects offer the direction in thrust applications in smart cities, healthcare, military, and environmental areas. Besides mobile sensor building enable special application specifically in surveillance, monitoring in agriculture, Habitat monitoring and target surveillance. In general, WSNs provide low cost solution to real world grant challenging to the researchers to driving force to design an enhanced routing protocol [2].

A. Motivation & Contribution

In early days, WSNs was considered as purely static environment. However few studies are investigated in usage of mobility aware protocols in sensor network. Large numbers of applications are proposed in WSNs but mobility aware protocols not exists and results in a frequent topology change which in turn introduces the following problems. Firstly, Mobility leads to frequent change in topology change and which consequence in delay and as nodes are constructed in multi-hop fashion and instantly reconstruction of nodes not possible, this makes additional overhead for transmission of packet. Hence this makes key factors for researchers to make an eye open to design a mobility aware

protocol for sensor network. Therefore, this paper creates the follow contribution:

- On discussing the start of art of static and mobility based routing protocol.
- We provide performance evaluation under investigation on impact under hardware test bed. in addition we analysis multihop routing for static and mobility environment at out Vinton Laboratory.

The rest of the paper is organized as follows: The Section 2 reviews related literature in detail. The Section 3 describes Experimentation and hardware testbed results are discussed in detail and the paper ends with conclusion and future direction and which is discussed in Section 4.

II. TAXONOMY OF THE RECENTLY PROPOSED STATIC AND MOBILE ROUTING PROTOCOLS FOR WSN

WSNs can be classified and to be considered as following aspects in both static and mobility: Elements and protocol level handler. Elements in sensor modules consists of three levels they are core module, Ethernet gateway module and battery module with integrated antenna and by using software sensor node can be assigned as Full Function device (FFD) and Reduced Function device (RFD). At nutshell pan coordinator is termed as gateway module, coordinators participating in a network sense the information and transmitted to the gateway module. On the other hand one of the final features is to be considered for both static and mobility in WSNs lies in protocol level handler. The Characterization of the following lies on energy aware and hybrid based.

A. Related Work

Energy-efficient clustering (ENEFC) [3] protocol based on the principal of hierarchical schemes in which it adopted three routing mechanisms, namely hierarchical routing using cluster identification (HRCI), multi-hop (HRMH) and multilevel (HRML). In this ENEFC protocol cluster head (CH) selection is done by unique reference identifier and this makes as selection for next-hop. The CH selection is based on residual energy and transfer of date is done by passing of token. HRMH technique is used for multihop mechanism by means of flooding of packet and finally HRML is multilevel technique and separation of levels based of the packet reception. The main setback of ENEFC protocol is on adopting three mechanisms, as sensor is operated with low power by the adopting such mechanism is leads to

TABLE I. SUMMARY OF WORKS THAT STUDY ROUTING IN STATIC AND MOBILITY ENVIRONMENT

Routing protocol	Performance compared with	Type of node	Control Technique	Simulation Tools	Evaluation Parameter
ENEFC [3]	ENEFC-single hop ENEFC-HRCI ENEFC-HRMH ENEFC-HRML	Static	Coverage and Connectivity performance	NS-2	Packet Delivery ratio, packet reception rate
SPEC [4]	SECWP CCP SCPP	Static	stable and predictive energy-aware coverage scheduling	NS-2	Network Lifetime, Coverage metric, computational energy, switch energy
SPCCA [5]	CCP MRCSC CCAJS	Static	Coverage scheduling and network connectivity	NS-2	Hop count Vs Coverage cost
EECC [6]	Greedy-CSC CWGC OCCH, MCLCT	Static	Quality of Service (QoS) metrics such as remaining energy, coverage and connectivity.	NS-2	Network life time
FAF-EBRM [7]	DIR MFR GEDIR Dijkstra's	Static	Residual energy, node degree, distance, and angle	Simulation + analytical	Packet reception, network lifetime, energy consumption
GCRP [8]	VGDR	Mobility	Grid Cell Head (GCH)	NS-2 Simulator	Packet Delivery ratio, Normal routing load , Packet reception
RkM [9]	DBRkM, WRP, CB	Mobility	k-means clustering and a weight function	Matlab R2016a Simulation	Network lifetime, Energy Consumption, Number of active sensor nodes

computing more energy, next choosing CH is on energy based and priority based packet transmission is absent and last choosing level is on packet and if considering RSSI based mechanism it will be enhanced for this mechanism.

Stable and Predictive Energy-aware Coverage Scheduling (SPEC) [4] is stationed on coverage and scheduling protocol for WSN. At this juncture this protocol adopting three main phases namely: one-way scheduling mechanism, sleep time wakeup mechanism and energy loss prediction mechanism. In order to avoid unwanted wakeup transition one-way scheduling behavior is designed. Meanwhile neighboring Sensors on uncover age region is sensed and calculate by adopting sleep mechanism by using new wakeup mechanism and last to avoid energy loss prediction approach used for computation. In SPEC protocol adopting more technique and it leads to excess memory and introduction of timer and computation mechanism make sensor heavily activated.

Shortest path connectivity and coverage algorithm (SPCCA) [5] design and developed to avoid blind spot of sensor nodes and guarantee energy balanced. Here they are divided into two modes: ready-to-sleep and active mode. Redundant sensor nodes enter to ready-to-sleep mode and sleepless node goes to active mode. To achieve the connectivity and coverage SPCCA based on virtual square grid-based coverage algorithm (VSGCA). Gateway or sink node broadcast control message towards global shortest and coverage shortest path.

Energy Efficient Connected Coverage (EECC) [6] algorithm adopt QoS metrics towards residual energy, coverage and connectivity. It is noticeably clear that the EECC is the first mechanism based on QoS towards energy optimization mechanism. The EECC adopt node selection is based on probability and heuristic value for choosing energy. In this EECC protocol they are evaluated predefined data set and not considered as real time packet and if incorporated

makes a strength of this protocol. One main setback is priority and wake-up time not considered for sensor node, if so sleep time may be increase and leads to increase in energy.

Vipin Kumar et.al [7] proposed position based routing algorithm for maximize energy and lifetime of sensor nodes. In this paper on next hop node, selection is based on the metric designed based on the residual energy, node degree, distance, and angle. Each time for selecting best path for data transfer towards base station, this uses to choose different set of metric. Hence position based mechanism is adopted for data transfer and this leads to lot of computation.

Amar Kaswan et.al proposed two algorithm namely reduced k-means (RkM) and delay bound reduced k-means (DBRkM) [8] on mobile sink in WSN. These algorithm apply minimum path selection of overall hop count and average hop distance. DBRkM mechanism determines path by considering delay. Ayush Agrawal et.al proposed Grid-Cycle Routing Protocol (GCRP) based on mobile sensor. In this protocol keeps on updating the current location of mobile sink. Here sensor region are classified in cycles say interior and exterior cycle and all belong to this region cycle is maintained and monitored by grid cell head (GCH). This make the movement of sink gets updated position and leads to successful data transfer. But some shortcoming is that selection of GCH is not considered if more packet arrives and leads to congestion and decrease the performance of network.

B. Design Guidelines for routing Protocols

Mobility based protocols need to be developed for WSNs and they have a given preference to both MAC and network layer approach (cross layer) approach for researcher. Hence Lightweight mobility aware control scheme should be designed with simplicity and operate energy efficiently scheduling mechanism for WSNs.

The mobility based routing protocols for WSNs protocol design guidelines as follows:

- Routing for mobile sensor networks.
- The impact of adapting packet size and error control on energy efficiency in wireless systems is investigated.
- A designing and implementing mobility and position aware routing algorithm for Reliability data transfer, loss detection and notification and error recovery is considered.

III. EXPERIMENTATION AND SETUP

The major goal of the hardware emulation described here is static and mobile node environment of the radio for using each of the multi-hop routing we have setup implemented..

A. Experimental Setup

Fig1. is a topology setup used for our experiments. the core of the module used Jennic 5148 motes, developed at NXP for our development platform and tesbed, which has range support up to 1km range provided with External antenna. It has radio TX power +2.5dBm, Receiver sensitivity -95dBm respectively. Hence this is a multi-hop network with several Coordinators (i.e) sources transmit packets to sink node (i.e) pan-Coordinator. we look at packet transmission of data from each source nodes when utilizing routing protocol.

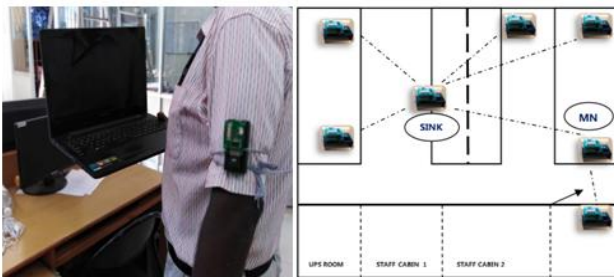


Fig. 1. Experimental evaluation lab Setup with 1 PanCoordinator, multiple Coordinators and a MN attached with shoulder at Vinton Lab

Here sensors nodes are deployed randomly and periodically collect the data packets temperature and light as shown in Fig2. Meanwhile mobile node (MN) moves across the environment and forward the periodic data towards destination. In multi-hop fashion, it is observed that packet delay is more on Mobile environment when compared to static, this make an open issues to the researchers that designing of mobile routing is challenging task in wireless sensor network.



Fig. 2.Experimental Result in terms of static and mobility

IV. FUTURE DIRECTION AND CONCLUSION

The majority of the proposed WSN routing protocol that support static behavior and some features are still to be design and developed for large applications towards agricultural environment protection, habitat monitoring and emergency related applications such as healthcare. with the support and enhancement of sensor to mobile nodes has grow to be a new feature of WSNs. This interest regarding design of mobility aware routing protocol presented in this paper need to be concentrate for future WSNs protocol design. In this paper, a survey of static and dynamic mobile supporting protocols in wireless sensor networks was discussed. These papers begin with the characterization and taxonomy of routing protocol under energy aware and hybrid based protocols. In order to effectively address the importance of future scope of routing under mobility, a classification of Control Techniques, evaluation type and parameters were discussed. Finally this paper investigated seven routing protocols under both static and mobile environment and makes an initial acknowledgement to conduct static and mobile nodes under real-world environment. In future our attempt will further investigating and design of novel mobile-supporting routing scheme for WSN.

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