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Providing Mobility Support for Low Power Wireless Application (LPWA): MoMoRo

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Abstract: Recently, mobile devices have been introduced in various wireless sensor network (WSN) applications in order to solve complex tasks or to increase the data collection efficiency. However, the current generation of low-power WSN protocols is mainly designed to support data collection and address application-specific challenges without any particular considerations for mobility. In this paper, we introduce MoMoRo, a mobility support layer that can be easily applied to existing data collection protocols, thereby enabling mobility support in the network. MoMoRo robustly collects neighborhood information and uses a fuzzy estimator to make link quality estimations. This fuzzy estimator continuously reconfigures its thresholds for determining the fuzzy sets, allowing MoMoRo to easily adapt to changing channel environments. Furthermore, MoMoRo includes an active destination search scheme that allows disconnected mobile nodes with sparse traffic to quickly reconnect if there are packets in the network destined to this mobile node. We evaluate MoMoRo both indoor and outdoor and show that a continuously moving device in a MoMoRo-enabled RPL (i.e., IPv6 Routing Protocol for Low-Power and Lossy Networks) network can achieve a high packet reception ratio of up to 96% and stay connected in areas where RPL alone cannot and with less than half the packet overhead needed by the well-known Ad hoc On-Demand Distance Vector routing protocol.

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I. INTRODUCTION

WITH the emerging cyber-physical systems (CPS) and Internet of Things (IoT), low-power wireless networks are now taking their next step toward widespread usage in various everyday life applications. Examples of such applications include wireless physiological data sensing for clinical care, military-related sensing applications, and robotic network systems for various automation and sensing tasks. A decade worth of research by the wireless sensor network (WSN) community provides the foundation for forming such wireless networks with proven network layer protocols that addresses the unique challenges in low-power and lossy networks (LLNs). Protocols, such as Collection Tree Protocol (CTP) and Routing Protocol for Low-Power and Lossy Networks (RPL), allow a system developer too simply choose a network layer protocol that suits the target application well rather than designing a completely new routing protocol. However, in these new CPS and IoT applications, mobility and actuation becomes an integral part of the low-power wireless network and cause radically different network traffic patterns than those found in traditional data collection applications?

Hence, protocols specifically designed for stationary networks are ill equipped to tackle the low-power data collection challenges found in hybrid networks with both stationary and mobile nodes. Furthermore, they cannot provide adequate performance in these applications; therefore, a new approach is needed to address the mobility issue in these networks. Previous efforts to support mobility in LLNs show that a multiple-tier network architecture that separates the role of data forwarding from the mobile nodes is effective in achieving high reliability, but such architecture requires a large set of nodes to form the backbone network and require careful consideration in the deployment phase.

While this two-tier architecture captures the essence of a hybrid network, we seek a solution with less rigid division between data forwarding and mobile nodes, thereby reducing the constraints imposed on the underlying data collection backbone.

II. BRIEF LITERATURE SURVEY

Paper [1] Vibe:An energy efficient routing protocol for dense and mobile sensor networks

We present a new protocol that manages wireless sensor networks in several scenarios including large scale, high density and high mobility deployments. An example of one of the main applications is to communicate important information from inaccessible areas by spreading "enough" mobile sensors which must self-configure and assemble. According to our protocol, virtual infrastructure-based energy-efficient (VIBE) routing, the information is routed in a multihop, cluster level fashion by enabling each sensor to make individual decisions regarding its mode of operation. The aim is to prolong the network's lifetime by minimising the average energy spent for each communication. VIBE is capable of addressing mobility requirements as it is completely independent of any kind of topological knowledge and control messages. We show by extended experiments that VIBE performs very well in terms of consumed energy by comparing it to standard directed flooding and greedy forwarding protocols.

Paper [2] RPL: IPv6 routing protocol for low-power and lossy networks

In this paper the IPv6 Routing Protocol for Low-Power and Lossy Networks RPL), which provides a mechanism whereby multipoint-to-point traffic from devices inside the LLN towards a central control point as well as point-to-multipoint traffic from the central control point to the devices inside the LLN are supported. Support for point-to-point traffic is also available.

Paper [3] Cluster based routing protocol for mobile nodes in wireless sensor network

In this paper, we propose adaptive Time Division Multiple Access (TDMA) scheduling and round free cluster head protocol called Cluster Based Routing (CBR) protocol for Mobile Nodes in Wireless Sensor Network (CBR Mobile-WSN). In this protocol the cluster head receive data from not only its member during the TDMA allocated time slot but also other sensor nodes that just enter the cluster when it has free time slots, each cluster head takes turn to be the free cluster head in the network. CBR Mobile-WSN change TDMA scheduling adaptively according to traffic and mobility characteristics. The proposed protocol sends data to cluster heads in an efficient manner based on received signal strength. The performance of proposed CBR Mobile-WSN protocol is evaluated using MATLAB and it has been observed that the proposed protocol reduces the packet loss by 25% compared to LEACH-Mobile protocol.

III. PROBLEM FORMULATION

- W\e compute the PRR at the final destination to evaluate the application level efficiency of MoMoRo.
- We compute the end-to-end number of transmissions, which represents how many transmissions (including retransmissions) a packet experienced from the source to the destination.
- We count the number of overhead packets issued per node per minute to monitor the cost of establishing quality routes.
- The MoMoRo mobility support layer to a collection protocol does not significantly degrade the performance of the network when the network is stationary, regardless of the two traffic patterns.

IV. OBJECTIVES

The primary objectives of this study can be summarized as follows:

1. Mobile devices have been introduced in various wireless sensor network (WSN) applications in order to solve complex tasks or to increase the data collection efficiency.

2. a mobility support layer that can be easily applied to existing data collection protocols, thereby enabling mobility support in the network.

3. MoMoRo robustly collects neighborhood information and uses a fuzzy estimator to make link quality estimations.

4. MoMoRo includes an active destination search scheme that allows disconnected mobile nodes with sparse traffic to quickly reconnect if there are packets in the network destined to this mobile node.

5. We evaluate MoMoRoboth indoor and outdoor and show that a continuously moving device in a MoMoRo-enabled RPL network can achieve a high packet reception ratio of up to 96% and stay connected in areas where RPL alone cannot and with less than half the packet overhead needed by the well-known Ad hoc On-Demand DistanceVector routing protocol.

V. RESEARCH METHODOLOGY/PLANNING OF WORK

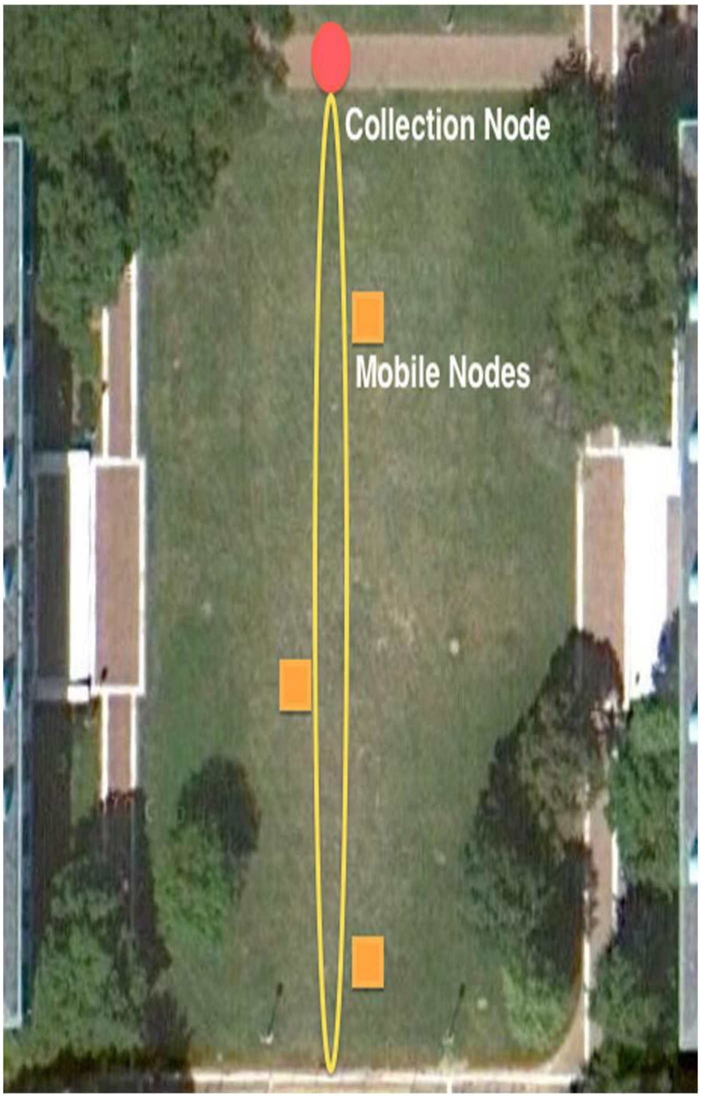


Fig.1: Basic system architecture

weconsider three mobile nodes and one stationary node. The three mobile nodes were carried by humans moving at typical walking speeds back and forth on a 40-m path, as shown in Fig. 12. The three nodes were evenly spaced out across the entire path, with at least one node in range of the stationary data collection node at any given time. With this experiment, we quantify the performance of a fully mobile network in which nodes experience both changing parents and changing children. We set the inter packet interval to 1 s and decreased the radio transmit power to −15 dBm to achieve a multihop network within the designated area.

VI. FACILITIES REQUIRED FOR PROPOSED WORK

i) Hardware

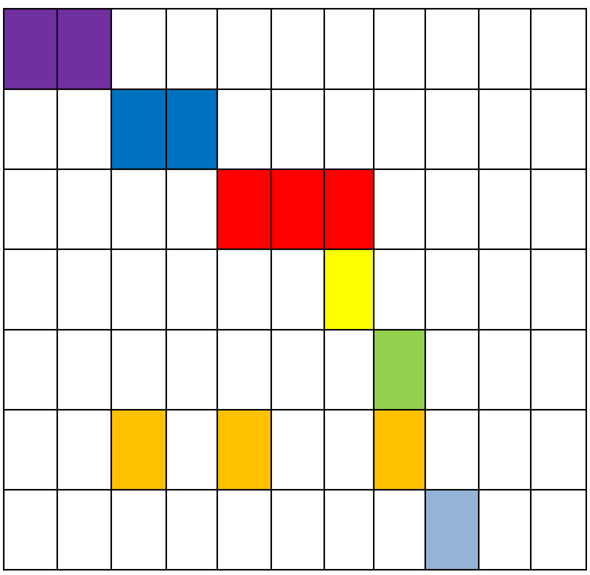
- Microcontroller 8051.
- DC Motor.
- Motor Driver.
- LCD Display.
- Infrared Proximity Sensor.
- 250 GB HDD
- 1GB RAM

ii) Software

- Embedded C
- Keil Compiler
- Flash Magic
- Windows XP/7

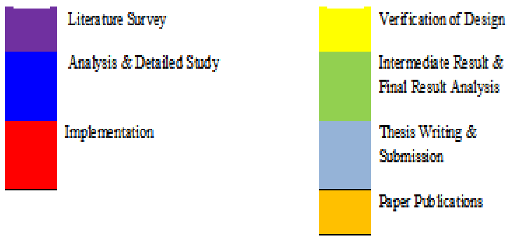
VII. PLAN OF RESEARCH

Research Planning



July-14	Aug-14	Sept-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15

Duration in Months



VIII. CONCLUSION

The requirement for versatility support in low-control remote systems (LPWNs) is generally expanding for application situations, for example, mechanical computerization, social insurance checking, process control and keen urban communities. In this Thesis, we focused on giving hand-off components that consider the constraints of problematic connections in LPWNs and adjusted the significant hand-off parameters. We likewise created multi-bounce hand-off backing for a COTS directing convention—RPL.

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