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Procedia Computer Science 78 (2016) 859 – 866

Procedia Computer Science

International Conference on Information Security & Privacy (ICISP2015), 11-12 December 2015, Nagpur, INDIA

Selective & Secured Code Distribution Approach for Multihop Wireless Sensor Networks

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Abstract

This paper proposes an efficient code distribution approach for multihop wireless sensor networks in heterogeneous environment. Reprogramming a sensor network necessitate to fulfil the changing application requirements, bug fix as it is impractical to reach the node once deployed. We are presenting an efficient code distribution scheme to update the running code in sensors over the air with secure authentication & completion verification. The experimental results shows how proposed approach sdeluge is efficient in terms of significant reduction in average completion & dissemination time, advertisement rate, average energy consumption consequently improvement in lifetime of the network.

Peer-review under responsibility of organizing committee of the ICISP2015

Keywords: Authentication & verification; Code Distribution ; MultihopWireless Sensor Networks (WSN); over the air programming (OAP)

1. Introduction

Supporting capability of reprogram the remote sensor nodes over the air has highlighted it's importance in the recent research of WSN. Wireless sensor networks are usually set up for extended period of time and the nodes in the field are necessitate to modify software code during their lifetime in order to support new requirements[1]. Network reprogramming allow for over-the-air software updates in sensor networks. Remotely patch or upgrade Platforms, operating systems of sensor nodes etc.

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Peer-review under responsibility of organizing committee of the ICISP2015
doi:10.1016/j.procs.2016.02.074

The approaches to adapt the protocols for heterogeneity are not so much efficient which main difficulty of adoption of WSN technology. This paper is structured as, section I deals with introduction, section II present Related Work, section III presents Proposed Approach, section IV Experimental results and discussion, followed by acknowledgement & Conclusion in section V.

2. **Related Work**

This section outlined the current state-of-the-art of various reprogramming architectures for wireless Sensor network (WSN). XNP [5,7] sends whole image to the sensor node to update code in the sensor in a simple way but the limitation is that no multihop support as code disseminates within the radio communication range of a base station only also not optimized for energy, MNP[12,4] uses pipelining, decrease energy consumption & hidden terminal problem, it requires more communication overhead to choose the sender as it is sender selection code dissemination protocol. MOAP[13,5] supports code dissemination to multi-hop, uses NACK based transmission, broadcast and uncast mechanisms, significantly reduce the traffic of transmission as opposed to flooding, ranging from 60 to 90%. It is energy and memory efficient but latency is more, the main drawback of MOAP is that it node receives the entire image & then disseminate further . Trickle[11] mechanism uses a "polite gossip" policy where code summary broadcasted periodically by the nodes to its neighbours hence propagate the new code image quickly into a network while imposing a very small overhead . Deluge[3] is the faster reprogramming protocol compared to XNP, MNP & MOAP , generally used in the TinyOS environment. The rate of advertisement dynamically adjusted depending on the received massages, radio needs to be on at all times . Aqueduct[11] provides robust reprogramming. E3NP[3] mechanism is an energy efficient, timesaving, expeditious network reprogramming mechanism in WSN. TinyCubus[13] supports general reconfigurable framework for sensor networks.

2.1. Deluge Summary

Deluge is the fastest network reprogramming protocol as compared to XNP, MNP & MOAP. It is reliable data dissemination protocol extensively used in the TinyOS environment. It is a three-phase handshaking protocol (advertise – request – data) , divides the data into pages and packets & periodically advertises in its neighbourhood. Uncontrollable nature of its underlying algorithm, not very energy efficient. Since motes automatically update a newer version of the code from their neighbors, if there are ***n***different versions of the code object in the field, the code on each individual mote is reprogrammed up to ***n-1*** times. There is no way to know the current status of the reprogramming as it spreads across the field because Deluge .Offers no feedback to the operator.

2.2. Different Issues:

The issues for Reliably disseminate large objects i.e. size of object is greater than RAM over a multi-hop sensor network from few to many nodes are Constrained storage hierarchy, Packet size(32 bytes) << RAM memory (4K) << program memory (128K) < external flash memory (512K) , 100% reliability , Rapid propagation or small time to completion, Eventual consistency , Scalability (w.r.t. network size and density) ,Difficult task of verifying and updating the version of the code in question on each Mote in the network. Avoid conflicts and reducing idle waiting time of individual mote. Different from reliable multicast due to the expected size of the uploaded code object, low-cost sensors usually do not have the highest grade of radio transmission capabilities.

3. Proposed Approach

An intended Code Distribution approach improves the existing Deluge & supports many features like, reliable dissemination of the object with multihop support. We have used Differenced based code image which disseminate by using the concept of pipelining & segmentation like deluge. Provided the adaptive Slepping by applying MAC 802.11(T MAC) .It also support scope selection ,secured authentication ,suitable for homogeneous as well as heterogeneous environment unlike deluge. Idle listening of sensor nodes is a major source of energy waste during reprogramming and must be reduced. Although CSMA MAC is in the TinyOS release & most reprogramming systems use CSMA, we have tried to replace existing CSMA with more efficient MAC i.e. a T-MAC. T-MAC