

**FORMAT
For
PROJECT COMPLETION REPORT FOR
RPS PROGRAMMES**

(Please include sufficient details in sections 8-10 so as to facilitate proper evaluation of your project.)

File No. : 8023/BOR/RID/RPS-212/2007-08
(as mentioned in sanction letter)

Date of Sanction : 25/03/2008

Subject Area : Wireless Sensor Networks

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|---|---|
| 1. Principal Investigator
(Name & address) | : Dr. Nityananda Sarma
Department of Computer Sc. & Engg.,
Tezpur University, Napam,
Tezpur-784028 (Assam) |
| 2. Project Title | : Security Enabled Data Gathering Protocol
for Wireless Sensor Networks |
| 3. Total Cost of the Project | : Rs. 6.06 Lakhs only |
| 4. Date of Commencement of the Project | : 12-05-2008 |
| 5. Duration of the Project | : 2 years (Two years) |
| 6. Date of Completion | : 11-05-2010 |
| 7. Objectives of the Project | : |

In WSN, as the nodes are associated with small power source, they need power efficient and fault tolerant routing protocols to form a network among them. At the same time, we need to introduce effective and low cost security mechanisms in the routing protocol due to unattended and remote deployment of the sensor nodes. The objectives of this project are:

- i. To analyze the available energy efficient routing protocols & their security issues.
- ii. To develop energy efficient routing protocols for data gathering.
- iii. To develop a low cost security mechanism to be suitable for resource constrained (computing power, energy, storage & bandwidth) sensor nodes.

8. Salient Research Achievements :

8.1 New Findings/Achievements/IPR Potential:

The main idea behind energy efficient data gathering protocols in wireless sensor network (WSN) is to allow communication among neighboring nodes and allow a few nodes to take responsibility to become the leader for communications with the base station. This helps in consumption of minimum possible amount of energy and distributes the load evenly among the nodes in the network. In this project, we have simulated a data gathering protocol for sensor field called HCEPSN (hierarchical cluster based data gathering protocol), which gives longer life to the network as compared to other existing protocols found in the research literature. The motivation behind the proposed protocol is based on two ideas - i) the multi-hop communication consumes less energy as compare to single hop communication, and ii) we introduce a backup node for root level cluster head to reduce re-clustering overhead to some extent. These two ideas help conserving overall energy in the network and hence improve the life time of the deployed sensor network.

Wireless sensor network (WSN) is usually used in civil and military applications for gathering data from the surrounding environment. As WSN is a self-configuring and self-organizing network and mostly works in an unattended wireless environment, there is a lot of scope for the adversaries to tamper the sensed data as well as they may also try to alter the underlying working principle of the network. Several factors like, physical exposure of the sensor nodes to the adversaries, the ad-hoc network infrastructure etc. makes WSN more prone to security threats. Providing security solution to the WSN is again a challenging task due to inherent constraints associated with the sensor nodes like, limited processing power, smaller memory and fixed battery power etc. Security solutions based on public key cryptography are not usually recommended or suitable for WSN due to their comparatively heavy computational costs. In this project, we have analyzed different security threats associated with the energy efficient data gathering protocols and simulated a symmetric key based security solution. Our security solution either eliminates or localizes the attacks. Analysis shows that attack like Spoofed, altered, or replayed routing information, Acknowledgement spoofing, Sniffing and Data integrity can be avoided due to the adopted encryption/decryption technique. However there is some scope for attacks like Selective forwarding, Sinkhole attacks, Sybil attacks, HELLO flood attacks, Energy drain and Black hole attack which can be minimized or localized within a smaller region.

8.2 Product/Process Developed :

In this project, we have simulated a new data gathering protocol for sensor field called HCEPSN (hierarchical cluster based data gathering protocol), which gives longer life to the network as compared to other existing protocols. Further we analyzed different security issues associated with HCEPSN and proposed a symmetric key based solution for it.

8.3 Patent(s) Applied for/Taken, if any :No

8.4 B. Tech. Project / M. Tech Thesis / : i) Three B.Tech projects completed.

Ph.D., if any

- ii) Three M.Tech dissertations produced
- iii) One Ph.D. scholar continuing research on Energy efficient data gathering methods.

8.5 Consultancy

:None

9. Conclusions Summarizing the Achievements Indicating the Scope for Future Work:

This project helped us to develop a sensor network infrastructure in the department. We did an extensive survey on energy efficient data gathering protocols, developed and simulated an energy-efficient data gathering protocol named HCEPSN, analyzed the security issues associated with our data gathering protocol and developed a symmetric key based security solutions on top of the HCEPSN. We have produced six dissertation reports. Further, with the help of the developed infrastructure, especially the WSN professional Kits in the department, we along with our PhD, M.Tech & B.Tech students are exploring several issues in wireless sensor network like Data centric data gathering protocols, coverage issues, MAC mechanism etc.

10. List of Publications Arising from the Project (please give Author (s), Title, Journal and Year)

1. P.Mohanty, S.Panigrahi, N.Sarma and S.S.Satapathy, "Security Issues in Wireless Sensor Network Data Gathering Protocols: A Survey", *Journal of Theoretical and Applied Information Technology*, Vol 13. No. 1 – 2010.
2. P.Mohanty, S.Panigrahi, N.Sarma and S.S.Satapathy, "HCEPSN: A Hierarchical Cluster based Energy efficient data gathering Protocol for wireless Sensor Network", *ICIT-2009, Bhubaneswar, Orissa, 21-24 December 2009*.
3. P.Mohanty, S.Panigrahi, N.Sarma and S.S.Satapathy, "A symmetric Key based Secured Data Gathering Protocol for WSN", *ASID-2009, City University of Hong Kong, 20-22 August 2009*.
4. P Mohanty, S Panigrahi, S S Satapathy, and N Sarma, *Routing Protocols for Wireless Sensor Networks: A Survey, National Workshop cum Seminar on Distributed Computing (NSDC 2009), Sikkim, 6-7 March, 2009*.

Dated: 23-02-12 Principal Investigator


(NITYANANDA SARMA)



020312
Registrar/Director/Principal
(Signature & Seal)

(Investigators may please note that sections 8-10 of the report will serve as essential inputs for experts to judge the success of the project. These must therefore be included in sufficient detail.)

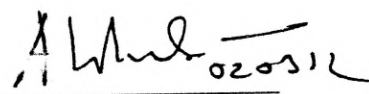
**FORMAT
For
AUDITED UTILISATION CERTIFICATE**

Certified that out of **Rs. 6,06,000.00** of Grant-in-aid sanctioned during the year 2007-2008 Letter No. **8023/BOR/RID/RPS-212/2007-2008** dtd: **25-03-2008**, **Rs. 5,67,189.00** has been utilized For the purpose of **Non-Recurring** and **Recurring** Expenses of the Project "**Security Enabled Data Gathering Protocol for Wireless Sensor Networks**" For which it was sanctioned and the balance of **Rs. 38,811.00** remaining unutilized at the end of the year has been surrendered to All India Council For Technical Education (vide DD. No. 718874 dated 20-03-2012) / ~~will be adjusted towards the Grants~~ ~~in-aid payable during the next year i.e., _____~~ as per the details attached:

Certified that the grant has been utilized as per laid down terms and conditions for which it was sanctioned.




Finance Officer
(Signature and Seal)



Registrar/Principal/Director
(Signature and Seal)

Dated:



Chartered Accountant 02/03/12
(Signature and Seal)
Internal Audit Officer
Tezpur University