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Review on Different Approaches on Trust Establishment in Wireless Sensor Networks

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ABSTRACT

Wireless Sensor Networks (WSNs) has foreseen big changes in data gathering, processing and disseminating for monitoring applications like as emergency services, disaster management, and military applications etc. A wireless sensor network is a collection of nodes organized into a cooperative network. Trust plays the major role in this research work. Trust establishment is an important tool which improves cooperation and enhance security in wireless sensor networks. This performs better than the other trust schemes in terms of detecting an on-off attack and persistent misbehavior. This has good performance in ensuring the reliability and accuracy of the data. Moreover, the energy consumption of transmitting will also get greatly reduced. In order to bring a cooperation between nodes Game theory concept is used. When cooperation is perfomed meanwhile the trust stratergy is established.

Keywords : Wireless Sensor Network, Trust game, Game theory, Routing protocols

I. INTRODUCTION

A literature review is a manuscript of the scholarly paper that includes the existing experience including substantive findings by means of both theoretical and practical contribution to the particular topics. Literature review is said to be an academic oriented resource which is associated with thesis, dissertation, article and journal. It is staple for all kinds of research in each and every academic field. It can also be phrased as a systematic review that focuses on analyzing and synthesizing the research work.

Writing a literature review provides framework for relating new findings to previous findings. Because it is difficult to establish the new research without knowing the stage of previous research. Moreover a literature review plays an important role in the following situations.

- ✓ Gaining methodological insights
- ✓ Identifying recommendations for further research
- ✓ Distinguishing what has been done and what is to be done.

II. RELATED WORK

RESEARCH FOCUS ON WIRELESS SENSOR NETWORK

Wireless sensor network has gradually become the industrial and academic research focus, in the military and civilian fields has a very broad application prospects. With the development of computer and related technology, making computing, communications, networks and sensors, as well as other functions are integrated in a single device, wireless sensor networks is associated with these technologies. People want to use computing resources and information services anywhere, anytime, pervasive computing, in order to adapt to the new model needs. Wireless Sensor Networks (WSN) is an important research area for pervasive computing. Integration of environmental data collection and monitoring tasks micro-sensor nodes sensor unit, a microprocessor and a communication module in the wireless sensor networks by way of self-organization.

✓ GAME THEORY IN WIRELESS SENSOR NETWORKS

"A Survey of Game Theory in Wireless Sensor Networks Security" by Shigen Shen, Guangxue Yue, Qiying Cao[21]. This paper presents a survey of security approaches based on game theory in WSNs. According to different applications, a taxonomy is proposed, which divides current existing typical game-theoretic approaches for WSNs security into four categories: preventing Denial of Services (DoS) attacks, intrusion detection, strengthening security, and coexistence with malicious sensor nodes. The main ideas of each approach are overviewed while advantages and disadvantages of various approaches are discussed. Thus, a global view of WSNs security approaches based on game theory is provided.

✓ ROUTING PROTOCOLS IN WSN

Routing in wireless sensor networks differs from conventional routing in fixed networks in various ways. There is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements. Many routing algorithms were developed for wireless networks in general. All major routing protocols proposed for WSNs may be divided into several categories.

A. Location-Based Protocols

In location-based protocols, sensor nodes are addressed by means of their locations. Location information for sensor nodes is required for sensor networks by most of the routing protocols to calculate the distance between two particular nodes so that energy consumption can be estimated.

A1. Geographic Adaptive Fidelity (GAF) GAF[34] is an energy-aware routing protocol primarily proposed for MANETs, but can also be used for WSNs because it favors energy conservation. The design of GAF is motivated based on an energy model that considers energy consumption due to the reception and transmission of packets as well as idle (or listening) time when the radio of a sensor is on to detect the presence of incoming packets.

A2. Geographic and Energy-Aware Routing (GEAR) GEAR[36] is an energy-efficient routing protocol proposed for routing queries to target regions in a sensor field, In GEAR, the sensors are supposed to have localization hardware equipped, for example, a GPS unit or a localization system so that they know their current positions.

A3.Trajectory-Based Forwarding(TBF) TBF[4] is a routing protocol that requires a sufficiently dense network and the presence of a coordinate system, for example, a GPS, so that the sensors can position themselves and estimate distance to their neighbors.

A4. Bounded Voronoi Greedy Forwarding [BVGF]: BVGF [4][9] uses the concept of Voronoi diagram in which the sensors should be aware of that replied to that neighbor discovery message. If this is the case, the sensor will use the corresponding power p to communicate with its immediate neighbors. Otherwise, it increments p and rebroadcasts its neighbor discovery message.

B. Data Centric Protocols

Data-centric protocols differ from traditional address-centric protocols in the manner that the data is sent from source sensors to the sink. In address-centric protocols, each source sensor that has the appropriate data responds by sending its data to the sink independently of all other sensors.

B1. Sensor Protocols for Information via Negotiation (SPIN) SPIN[11][30] protocol was designed to improve classic flooding protocols and overcome the problems they may cause, for example, implosion and overlap. The SPIN protocols are resource aware and resource adaptive.

There are two protocols in the SPIN family: SPIN-l (or SPIN-PP) and SPIN-2 (or SPIN-EC). While SPIN-l uses a negotiation mechanism to reduce the consumption of the sensors, SPIN-2 uses a resource-aware mechanism for energy savings

B2. Directed Diffusion Directed diffusion[6][7] is a data-centric routing protocol for sensor query dissemination and processing. It meets the main requirements of WSNs such as energy efficiency, scalability, and robustness. Directed diffusion has several key elements namely data naming, interests and gradients, data propagation, and reinforcement.

B3. Rumor Routing Rumor routing[8] is a logical compromise between query flooding and event flooding app schemes. Rumor routing is an efficient protocol if the number of queries is between the two intersection points of the curve of rumor routing with those of query flooding and event flooding.

B4. Cougar The cougar routing protocol[35] is a database approach to tasking sensor networks. The Cougar approach provides a user and application

programs with declarative queries of the sensed data generated by the source sensors.

B5. Active Query Forwarding in Sensor Networks (ACQUIRE) ACQUIRE[17] is another data- centric querying mechanism used for querying named data.. It provides superior query optimization to answer specific types of queries, called one-shot complex queries for replicated data.

B6. Energy-Aware Data-Centric Routing (EAD) EAD[1] is a novel distributed routing protocol, which builds a virtual backbone composed of active sensors that are responsible for in-network data processing and traffic relaying.

C. Hierarchical Protocols

Many research projects in the last few years have explored hierarchical clustering in WSN from different perspectives. Clustering is an energy-efficient communication protocol that can be used by the sensors to report their sensed data to the sink.

A hierarchical approach breaks the network into clustered layers. Nodes are grouped into clusters with a cluster head that has the responsibility of routing from the cluster to the other cluster heads or base stations.

C1. Low-energy adaptive clustering hierarchy (LEACH): LEACH[13][31][32] is the first and most popular energy-efficient hierarchical clustering algorithm for WSNs that was proposed for reducing power consumption.

C2. Power-Efficient Gathering in Sensor Information Systems (PEGASIS) PEGASIS[23][24][25] is an extension of the LEACH protocol, which forms chains from sensor nodes so that each node transmits and receives from a neighbor and only one node is selected from that chain to transmit to the base station (sink).

C3. Hybrid, Energy-Efficient Distributed Clustering (HEED) HEED[18][19] extends the basic scheme of LEACH by using residual energy and node degree or density as a metric for cluster selection to achieve power balancing. HEED was proposed with four primary goals namely (i) prolonging network lifetime by distributing energy consumption, (ii) terminating the clustering process within a constant number of iterations, (iii) minimizing control overhead, and (iv) producing well-distributed CHs and compact clusters.

C4. Threshold Sensitive Energy Efficient Sensor Network Protocol (TEEN) TEEN[2] is a hierarchical clustering protocol, which groups sensors into clusters with each led by a CH. The sensors within a cluster report their sensed data to their CH. The CH sends aggregated data to higher level CH until the data reaches the sink.

C5.AdaptivePeriodic Threshold Sensitive Energy Efficient Sensor Network Protocol (APTEEN) APTEEN[3] is an improvement to TEEN to overcome its shortcomings and aims at both capturing periodic data collections (LEACH) and reacting to time-critical events (TEEN).

C6. Energy Efficient Homogeneous Clustering Algorithm for Wireless Sensor Networks[22] Singh proposed homogeneous clustering algorithm for wireless sensor network that saves power and prolongs network life.

D. Mobility-based Protocols

Mobility brings new challenges to routing protocols in WSNs. Sink mobility[14] requires energy- efficient protocols to guarantee data delivery originated from source sensors toward mobile sinks. In this it discusses a sample mobility-based routing protocols for mobile WSNs.

D1. Joint Mobility and Routing Protocol: This protocol[10] with a static sink suffers from a severe problem, called energy sink-hole problem, where the sensors located around the static sink are heavily used for forwarding data to the sink on behalf of other sensors.

D2. Data MULES Based Protocol: Data MULE[20] was proposed to address the need of guaranteeing cost-effective connectivity in a sparse network while reducing the energy consumption of the sensor. It is a three-tier architecture based on mobile entities, called mobile ubiquitous LAN extensions (MULE).

D3. Scalable Energy-Efficient Asynchronous Dissemination (SEAD) SEAD is self-organizing protocol, which was proposed to trade-off between minimizing the forwarding delay to a mobile sink and energy savings.

D4. Dynamic Proxy Tree-Based Data Dissemination A dynamic proxy tree-based data dissemination[28] framework was proposed for maintaining a tree connecting a source sensor to multiple sinks that are interested in the source. This helps the source disseminate its data directly to those mobile sinks.

E. Multipath-based Protocols

Considering data transmission between source sensors and the sink, there are two routing paradigms: single-path routing and multipath routing.

E1. Disjoint Paths Sensor-disjoint multipath routing is a multipath protocol that helps find a small number of alternate paths that have no sensor in common with

each other and with the primary path. In sensor-disjoint path routing, the primary path is best available whereas the alternate paths are less desirable as they have longer latency.

E2. Braided Paths Braided multipath is a partially disjoint path from primary one after relaxing the disjointedness constraint. To construct the braided multipath, first primary path is computed.

E3. N-to-1 Multipath Discovery N-to-1 multipath discovery[29] is based on the simple flooding originated from the sink and is composed of two phases, namely, branch aware flooding (or phase 1) and multipath extension of flooding (or phase 2).

F.Heterogeneity-based Protocols

In heterogeneity sensor network architecture, there are two types of sensors namely line-powered sensors which have no energy constraint, and the battery-powered sensors having limited lifetime, and hence should use their available energy efficiently by minimizing their potential of data communication and computation.

F1. Information-Driven Sensor Query (IDSQ) IDSQ[15] addresses the problem of heterogeneous WSNs of maximizing information gain and minimizing detection latency and energy consumption for target localization and tracking through dynamic sensor querying and data routing.

F2. Cluster-Head Relay Routing (CHR) CHR routing protocol uses two types of sensors to form a heterogeneous network with a single sink: a large number of low-end sensors, denoted by L-sensors, and a small number of powerful high-end sensors, denoted by H-sensors.

F3. Sequential Assignment Routing (SAR) SAR is one of the first routing protocols for WSNs that introduces the notion of QoS in the routing decisions.

F4. SPEED SPEED[26] is another QoS routing protocol for sensor networks that provides soft real- time end-to-end guarantees.

F5. Energy-Aware QoS Routing Protocol In this QoS aware protocol[12] for sensor networks, real- time traffic is generated by imaging sensors.

III. REFERENCES

[1]. A. Boukerche, X. Cheng, and J. Linus, "Energy-aware data-centric routing in microsensor networks", Proceedings ACM MSWiM, in conjunction with ACM MobiCom, San Diego, CA, Sept. 2003, pp. 42- 49.

[2]. A. Manjeshwar and D. P. Agrawal, “TEEN: A Protocol for Enhanced Efficiency in Wireless Sensor Networks”, in the Proceedings of the 1st International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, San Francisco, CA, April 2001.

[3]. A. Manjeshwar and D. P. Agrawal, "APTEEN: A Hybrid Protocol for Efficient Routing and Comprehensive Information Retrieval in Wireless Sensor Networks", in the Proceedings of the 2nd International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile computing, San Francisco CA, April 2001, pp. 2009-1015.

[4]. B. Karp and H. T. Kung, "GPSR: Greedy perimeter stateless routing for wireless networks", Proceedings ACM MobiCom'00, Boston, MA, Aug. 2000, pp. 243-254.

[5]. B. Nath and D. Niculescu, "Routing on a curve", ACM SIGCOMM Computer Communication Review, vol. 33, no.1, Jan. 2003, pp. 155-160.

[6]. C. Intanagonwiwat, R. Govindan, and D. Estrin, "Directed diffusion: A scalable and robust communication paradigm for sensor networks", Proceedings ACM MobiCom'00, Boston, MA, Aug. 2000, pp. 56-67.

[7]. C. Intanagonwiwat, R. Govindan, D. Estrin, J. Heidemann, and F. Silva, "Directed diffusion for wireless sensor networking", IEEE/ACM Transactions on Networking, vol. 11., no. 1, Feb. 2003, pp. 2- 16.

[8]. D. Braginsky and D. Estrin, "Rumor routing algorithm in sensor networks", Proceedings ACM WSNA, in conjunction with ACM MobiCom'02,Atlanta, GA, Sept. 2002, pp. 22-31.

[9]. G. Xing, C. Lu, R. Pless, and Q. Huang, "On greedy geographic routing algorithms in sensing-covered networks", Proceedings ACM MobiHoc'04, Tokyo, Japan, May 2004, pp. 31-42.

[10]. J. Luo, and J.- P. Hubaux, "Joint mobility and routing for lifetime elongation in wireless sensor networks", Proceedings IEEE INFOCOM'05, vol. 3, Miami, FL, Mar. 2005, pp. 1735-1746.

[11]. J. Kulik, W. Heinzelman, and H. Balakrishnan, "Negotiation-based protocols for disseminating information in wireless sensor networks", Wireless Networks, vol. 8, no. 2/3, Mar.-May 2002, pp. 169- 185.

[12]. K. Akkaya and M. Younis, “An Energy-Aware QoS Routing Protocol for Wireless Sensor Networks,” in the Proceedings of the IEEE Workshop on Mobile and Wireless Networks (MWN 2003), Providence, Rhode Island, May 2003

[13]. Lan Wang and Yang Xiao, “A Survey of Energy-Efficient Scheduling Mechanisms in Sensor Network”.

[14]. Li and J. Y. Halpern, "Minimum-energy mobile wireless networks revisited", Proceedings IEEE ICC'01, Helsinki, Finland, June 2001, pp. 278-283.
[15]. M. Chu, H. Haussecker, and F. Zhao, "Scalable information-driven sensor querying and routing for ad hoc heterogeneous sensor networks", International Journal of High Performance Computing Applications, vol. 16, no. 3, Feb. 2002, pp. 293-313.
[16]. M. Zorzi and R. R. Rao, "Geographic random forwarding (GeRaF) for ad hoc and sensor networks: Mutlihop performance", IEEE Transactions on mobile Computing, vol. 2, no. 4, Oct.-Dec. 2003, pp. 337-348.
[17]. N. Sadagopan, B. Krishnamachari, and A. Helmy, "The ACQUIRE mechanism for efficient querying in sensor networks", Proceedings SNPA'03, Anchorage, AK, May 2003, pp. 149-155.
[18]. Ossama Younis and Sonia Fahmy, "Distributed Clustering in Ad-hoc Sensor Networks: A Hybrid, Energy-efficient Approach", September 2002. International Journal of Computer Science & Engineering Survey (IJCSES) Vol.1, No.2, November 2010 82
[19]. Ossama Younis and Sonia Fahmy" Heed: A hybrid, Energy-efficient, Distributed Clustering Approach for Ad-hoc Networks", IEEE Transactions on Mobile Computing, vol. 3, no. 4, Oct.-Dec. 2004, pp. 366-369.
[20]. R.C. Shah, S. Roy, S. Jain, and W. Brunette, "Data MULEs: Modeling a three-tier architecture for sparse sensor networks ", Proceedings SN P A '03, Anchorage, AK, May 2003, pp. 30-41.
[21]. Shigen Shen, Guangxue Yue, Qiying Cao "A Survey of Game Theory in Wireless Sensor Networks Security" Journal Of Networks, Vol. 6, No. 3, March 2011
[22]. S.K. Singh, M.P. Singh, and D.K. Singh, "Energy-efficient Homogeneous Clustering Algorithm for Wireless Sensor Network", International Journal of Wireless & Mobile Networks (IJWMN), Aug. 2010, vol. 2, no. 3, pp. 49-61.
[23]. S. Lindsey and C.S. Raghavendra, "PEGASIS: Power-efficient Gathering in Sensor Information System", Proceedings IEEE Aerospace Conference, vol. 3, Big Sky, MT, Mar. 2002, pp. 1125-1130.
[24]. S. Lindsey, C. S. Raghavendra, and K. M. Sivalingam, "Data gathering in sensor networks using the energy delay metric", Proceedings IPDPS'01, San Francisco, CA, aApr. 2001, pp. 2001-2008.
[25]. S. Lindsey, C. S. Raghavendra, and K. M. Sivalingam, "Data gathering algorithms in sensor networks using energy metrics", IEEE Transactions on Parallel and Distributed Systems, vol. 13, no. 9, Sept. 2002, pp. 924-935.
[26]. T. He et al., "SPEED: A stateless protocol for real-time communication in sensor networks," in the Proceedings of International Conference on Distributed Computing Systems, Providence, RI, May 2003.
[27]. V. Rodoplu and T. H. Meng, " energy mobile wireless networks", IEEE Journal on Selected Areas in Communications, vol. 17, no. 8, Aug. 1999, pp. 1333-1344.
[28]. W. Chang, G. Cao, and T. La Porta, "Dynamic proxy tree-based data dissemination schemes for wireless sensor networks", Proceedings IEEE MASS'04, Fort Lauderdale, FL, Oct. 2004, pp. 21-30.
[29]. W. Lou, "An Efficient N-to-1 Multipath Routing Protocol in Wireless Sensor Networks", Proceedings of IEEE MASS'05, Washington DC, Nov. 2005, pp. 1-8.
[30]. W. R. Heinzelman, J. Kulik, and H. Balakrishnan, "Adaptive protocols for information dissemination in wireless sensor networks", Proceedings ACM MobiCom '99, Seattle, WA, Aug.1999, pp. 174-185.
[31]. W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy-efficient Communication Protocol for Wireless Microsensor Networks", in IEEE Computer Society Proceedings of the Thirty Third Hawaii International Conference on System Sciences (HICSS '00), Washington, DC, USA, Jan. 2000, vol. 8, pp. 8020.
[32]. W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "An Application-Specific Protocol Architecture for Wireless Microsensor Networks" in IEEE Tmnsactions on Wireless Communications (October 2002), vol. 1(4), pp. 660-670.
[33]. X. Du and F. Lin, "Improving routing in sensor networks with heterogeneous sensor nodes", Proceedings IEEE VTC'05, Dallas, TX, Sept. 2005, pp. 2528-2532.
[34]. Ya Xu, J. Heidemann, and D. Estrin, "Geography-informed energy conservation for ad-hoc routing", Proceedings ACM/IEEE MobiCom'01, Rome, Italy, July 2001, pp. 70-84.
[35]. Y. Yao and J. Gehrke, "The Cougar approach to in-network query processing in sensor networks", SGIMOD Record, vol. 31, no. 3, Sept. 2002, pp. 9-18.
[36]. Y. Yu, R. Govindan, and D. Estrin, "Geographical and energy aware routing: A recursive data dissemination protocol for wireless sensor networks", Technical Report UCLA/CSD-TR-01-0023, UCLA Computer Science Department, May 2001.