A Systematic Review on WSN

Poongodi T, Associate Professor, Department of Computer Science & Engineering, Galgotias University

ABSTRACT

This paper provides a review to sensor cooperation in wireless sensor networks. These networks consist of a high number of sensor nodes with resource constraints: limited computing power, memory, power sources, etc. The integration of Soft Computing Technologies into wireless sensor networks is becoming increasingly interested. However, there was little concern about the integration of Fuzzy Regulatory Systems into the collaborative networks of wireless sensors. The aim of this project is to develop a collaborative knowledge-based network in which each sensor execute an adaptable Fuzzy rule-based system with significant advantages, for example: expert knowledge can be defined with uncertainty and imprecision, collaborative knowledge can be separated from knowledge-control or modelling and a collaborative approach can help neighbouring people As an actual application of this methodology in the world, we show a collaborative modelling system for pests that contains an alert about the growth of olive trees.

Keywords: Sensor Network, WSN, Modelling

INTRODUCTION

In recent years, many researchers have called attention to the Wireless Sensor Networks (WSN)[1,2]. WSNs [1] are characterised as networks consisting of a large number of sensor nodes that may be designed as miniature computers with very simple components and interfaces. Each node consists of a processing unit with a limited computer and memory capacity, sensors, a communicating device and a restricted energy supply, often in battery form. WSNs thus have substantial energy resources and computing capability limits. In addition, network protocols and algorithms must have the capacity to organise themselves so that they can autonomously adapt to changes arising from external interventions or external demands.

SENSOR NODES

Sensor nodes may be utilised for continuous sensing, event detection, event identification, location sensing, local actuator control, as detailed in [1]. There is a broad variety of applications for WSNs including smart agriculture, industrial control and monitoring, environmental monitoring systems, surveillance, health surveillance, traffic surveillance, etc.

There is an ongoing tendency nowadays to put more and more functionality in the sensors to be applied to complicated systems, to minimise the requirement for inter-sensor communication and to extend battery life. Sensors with certain intelligent functions were suggested in this sense and numerous soft computing (SC) technologies were used for WSNs.

On the other hand, WSNs are great conditions for sensor cooperation to achieve a global objective. This activity requires communication between the sensors of separate measurements to fulfil their jobs and reach a shared aim.

Despite the widespread emphasis on sensors and collaborative WSNs, the Fuzzy collaborative rule-based systems (FRBSs) for WSNs have received little attention. Instead of classical logic, FRBS's [3] are an extension of classical rules-based systems, as they deal with IF THEN's rules whose history and consequence consist of fuzzy logic statements [4]. One of the key features of these systems is their ability to absorb human knowledge because of its inaccuracy and uncertainty or imprecision. For example: a) the essential elements of knowledge covered by fuzzy sets entail the managing of uncertainty and b) inference techniques become more resilient with an approximation reasoning approach adopted by the furious logic.

SENSOR NETWORKS

The introduction to sensor networks of certain cognitive characteristics allows them to be employed for the control or modelling of complex systems. An intelligent sensor has been described in [5] that adjusts its internal behaviour, optimising its capacity to gather and send physical data in a reactive way to a host system. Benoit et al.[6] established a smart sensor systems paradigm and provided three major areas in which intelligence is used for sensors: perceptual intelligence, reasoning and social intelligence. Deckneuvel [7] revealed an intelligent sensor analysis and suggested a language particularly built for designing such systems. As defined in [8], the intelligent behaviour sensor network is a system that can adapt to the circumstances and deliver relevant information at present. In addition, Mekid [9] introduced new structural notions of intelligent sensors and intelligent agent networks.

In recent years, there has been rising interest in intelligent SC sensors like as neural networks [10], furious logic [11-15], evolutionary algorithms [16] and hybrid systems consisting of furious logic and neural networks [17]. Srinivasan et al. introduced a multi-path data-centered routing strategy in WSNs using a fluctuating logic controller architecture at each node. A distributed general-purpose reasoning engine for WSNs was described by the authors of [19]. As explained in [20], inference is one of the most prevalent data fusion methodologies, strategies, and algorithms. Inference-based approaches take judgments based on the perceived condition of the system. In [17], in the realm of WSNs the phrase "soft computing" was developed.

More applications of SC in WSNs were recently published: Two smart localisation schemes, designed specifically for the WSN, where SC technology is a major part of the programme; [22] shows a model that improves sensor distance estimation errors and [23] provides guidance on the selection of the most optimal sensor combinations for accurate residential fires.

Two real-world applications using fuzzy inference systems were reported in [24] and [25] for implementing a collaborative approach. These documents demonstrate two strategies based on fuzzy inference systems used for the navigation of an independent, sensor-equipped mobile robot.

WSN

Several research have recently been dedicated to collaborative WSNs. [26] suggested that nodes employed in their study must cooperate in order to carry out their tasks: sensing, signal processing, computation, routing, location, security, etc. In [27] P. J. Marrón further stated that "...the idea of the WSNs has recently begun to arise, where organisations that feel their environment not only work individually, but cooperate with each other using ad hoc network technology to achieve a defined purpose of monitoring a certain field and some process, etc." Both[27] and[28] described a cooperative object (CO) as a single entity or collection of entity made up of sensors, controllers (information processors), actuators or cooperating objects, communicating with each other and achieving a shared objective in a more or not autonomous way. Wireless sensors and actuator networks are, as detailed in [28], typical instances of such collaborating items. These networks include of items that are individually capable of basic sensing, actuating, communicating and calculating, but only by the collaboration of all these things is the full capacity of these networks attained.

CONCLUSION

All of the foregoing efforts are linked and relevant: sensors with intelligent capabilities, sensors based on SC technologies, collaborative sensors and sensors. The dependability, responsiveness and accuracy of the sensor behaviour may, as stated in these studies, be enhanced in WSNs when they contain collaborative algorithms. Nonetheless, a considerable number of resources are needed for CPU performance, memory, wireless bandwidth and battery usage.

A complex rule-based collaborative technique (D-FLER) was described in [19] to resolve this challenge. This system integrates distributed and integrated collaborative reasoning methods for the data seen and coordinates judgments or actions. D-FLER employs two sorts of inputs according to this idea: individual observations (the sensor readings of the present node) and observations in the vicinity (fuzzified sensor data from the neighbouring nodes).

REFERENCES

1. Abdul Razak, A. H., Zayegh, A., Begg, R. K., & Wahab, Y. (2012). Foot plantar pressure measurement system: A review. *Sensors (Switzerland)*, *12*(7), 9884–9912. https://doi.org/10.3390/s120709884

2. Arafat, M. M., Dinan, B., Akbar, S. A., & Haseeb, A. S. M. A. (2012). Gas sensors based on one dimensional nanostructured metal-oxides: A review. *Sensors (Switzerland)*, *12*(6), 7207–7258. https://doi.org/10.3390/s120607207

3. Bandodkar, A. J., Jeerapan, I., & Wang, J. (2016). Wearable Chemical Sensors: Present Challenges and Future Prospects. *ACS Sensors*, *1*(5), 464–482. https://doi.org/10.1021/acssensors.6b00250

4. Bodas, D., & Khan-Malek, C. (2007). Hydrophilization and hydrophobic recovery of PDMS by oxygen plasma and chemical treatment-An SEM investigation. *Sensors and Actuators, B: Chemical*, *123*(1), 368–373. https://doi.org/10.1016/j.snb.2006.08.037

5. Buratti, C., Conti, A., Dardari, D., & Verdone, R. (2009). An overview on wireless sensor networks technology and evolution. *Sensors*, *9*(9), 6869–6896. https://doi.org/10.3390/s90906869

6. Cao, J., Sun, T., & Grattan, K. T. V. (2014). Gold nanorod-based localized surface plasmon resonance biosensors: A review. *Sensors and Actuators, B: Chemical*, *195*, 332–351. https://doi.org/10.1016/j.snb.2014.01.056

7. Chowdhury, R. H., Reaz, M. B. I., Bin Mohd Ali, M. A., Bakar, A. A. A., Chellappan, K., & Chang, T. G. (2013). Surface electromyography signal processing and classification techniques. *Sensors (Switzerland)*, *13*(9), 12431–12466. https://doi.org/10.3390/s130912431

8. Cui, X., & Martin, D. C. (2003). Electrochemical deposition and characterization of poly(3,4-ethylenedioxythiophene) on neural microelectrode arrays. *Sensors and Actuators, B: Chemical*, *89*(1–2), 92–102. https://doi.org/10.1016/S0925-4005(02)00448-3

9. Ferrari, F., Zimmerling, M., Thiele, L., & Saukh, O. (2011). Efficient network flooding and time synchronization with Glossy. *Proceedings of the 10th ACM/IEEE International Conference on Information Processing in Sensor Networks, IPSN'11*, 73–84. https://www.scopus.com/inward/record.uri?eid=2-s2.0-79959320279&partnerID=40&md5=dee298b2281f844f2689194aee5c5339

10. Foix, S., Alenyà, G., & Torras, C. (2011). Lock-in time-of-flight (ToF) cameras: A survey. *IEEE Sensors Journal*, *11*(9), 1917–1926. https://doi.org/10.1109/JSEN.2010.2101060

11. Gong, H., Hu, J. Q., Wang, J. H., Ong, C. H., & Zhu, F. R. (2006). Nano-crystalline Cu-doped ZnO thin film gas sensor for CO. *Sensors and Actuators, B: Chemical*, *115*(1), 247–251. https://doi.org/10.1016/j.snb.2005.09.008

12. Gupta, V. K., Singh, A. K., & Kumawat, L. K. (2014). Thiazole Schiff base turn-on fluorescent chemosensor for Al3+ ion. *Sensors and Actuators, B: Chemical*, *195*, 98–108. https://doi.org/10.1016/j.snb.2013.12.092

13. Hull, B., Jamieson, K., & Balakrishnan, H. (2004). Mitigating congestion in wireless sensor networks. *SenSys'04 - Proceedings of the Second International Conference on Embedded Networked Sensor Systems*, 134–147. https://doi.org/10.1145/1031495.1031512

14. Lee, B. H., Kim, Y. H., Park, K. S., Eom, J. B., Kim, M. J., Rho, B. S., & Choi, H. Y. (2012). Interferometric fiber optic sensors. *Sensors*, *12*(3), 2467–2486. https://doi.org/10.3390/s120302467

15. Li, Q., Stankovic, J. A., Hanson, M. A., Barth, A. T., Lach, J., & Zhou, G. (2009). Accurate, fast fall detection using gyroscopes and accelerometer-derived posture information. *Proceedings - 2009 6th International Workshop on Wearable and Implantable Body Sensor Networks, BSN 2009*, 138–143. https://doi.org/10.1109/BSN.2009.46

16. Li, Z., Trappe, W., Zhang, Y., & Nath, B. (2005). Robust statistical methods for securing wireless localization in sensor networks. *2005 4th International Symposium on Information Processing in Sensor Networks, IPSN 2005*, *2005*, 91–98. https://doi.org/10.1109/IPSN.2005.1440903

17. Lin, S., Zhang, J., Zhou, G., Gu, L., Stankovic, J. A., & He, T. (2006). ATPC: Adaptive transmission power control for wireless sensor networks. *SenSys'06: Proceedings of the Fourth International Conference on Embedded Networked Sensor Systems*, 223–236. https://doi.org/10.1145/1182807.1182830

18. Park, C., & Chou, P. H. (2006). AmbiMax: Autonomous energy harvesting platform for multi-supply wireless sensor nodes. *2006 3rd Annual IEEE Communications Society on Sensor and Adhoc Communications and Networks, Secon 2006*, *1*, 168–177. https://doi.org/10.1109/SAHCN.2006.288421

19. Sa, I., Ge, Z., Dayoub, F., Upcroft, B., Perez, T., & McCool, C. (2016). Deepfruits: A fruit detection system using deep neural networks. *Sensors (Switzerland)*, *16*(8). https://doi.org/10.3390/s16081222

20. Sankarasubramaniam, Y., Akyildiz, I. F., & McLaughlin, S. W. (2003). Energy efficiency based packet size optimization in wireless sensor networks. In E. E. Znati T. Cayirci E. (Ed.), *Proceedings of the 1st IEEE International Workshop on Sensor Network Protocols and Applications, SNPA 2003* (pp. 1–8). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/SNPA.2003.1203351

21. Sansoni, G., Trebeschi, M., & Docchio, F. (2009). State-of-the-art and applications of 3D imaging sensors in industry, cultural heritage, medicine, and criminal investigation. *Sensors*, *9*(1), 568–601. https://doi.org/10.3390/s90100568

22. Shishiyanu, S. T., Shishiyanu, T. S., & Lupan, O. I. (2005). Sensing characteristics of tin-doped ZnO thin films as NO2 gas sensor. *Sensors and Actuators, B: Chemical*, *107*(1 SPEC. ISS.), 379–386. https://doi.org/10.1016/j.snb.2004.10.030

23. Sichitiu, M. L., & Ramadurai, V. (2004). Localization of wireless sensor networks with a mobile beacon. *2004 IEEE International Conference on Mobile Ad-Hoc and Sensor Systems*, 174–183. https://www.scopus.com/inward/record.uri?eid=2-s2.0-20344396105&partnerID=40&md5=0027db1787a1a7d06fc310af54b92584

24. Usamentiaga, R., Venegas, P., Guerediaga, J., Vega, L., Molleda, J., & Bulnes, F. G. (2014). Infrared thermography for temperature measurement and non-destructive testing. *Sensors (Switzerland)*, *14*(7), 12305–12348. https://doi.org/10.3390/s140712305

25. Wan, J., Tang, S., Shu, Z., Li, D., Wang, S., Imran, M., & Vasilakos, A. V. (2016). Software-Defined Industrial Internet of Things in the Context of Industry 4.0. *IEEE Sensors Journal*, *16*(20), 7373–7380. https://doi.org/10.1109/JSEN.2016.2565621

26. Wang, C., & Sahay, P. (2009). Breath analysis using laser spectroscopic techniques: Breath biomarkers, spectral fingerprints, and detection limits. *Sensors*, *9*(10), 8230–8262. https://doi.org/10.3390/s91008230

27. Zeng, S., Chen, C.-H., Mikkelsen Jr., J. C., & Santiago, J. G. (2001). Fabrication and characterization of electroosmotic micropumps. *Sensors and Actuators, B: Chemical*, *79*(2–3), 107–114. https://doi.org/10.1016/S0925-4005(01)00855-3

28. Ziegler, S., Woodward, R. C., Iu, H. H.-C., & Borle, L. J. (2009). Current sensing techniques: A review. *IEEE Sensors Journal*, *9*(4), 354–376. https://doi.org/10.1109/JSEN.2009.2013914