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Intelligent Agent Operating in Wireless Sensor Networks: Review Paper

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Abstract: *This paper presents a review of intelligent agent operating in Wireless Sensor Network (WSN) communication system. It shows that, to improve the WSN system performance many researcher proposed the Literature survey given in this paper, gives brief idea on the techniques which are proposed for performance improvement of WSN communication systems. Though, the proposed work in the literature addressed various issues in implementation of WSN system.*

I. Introduction

A wireless sensor network is a collection of nodes organized into a cooperative network [10]. Each node consists of processing capability (one or more microcontrollers, CPUs), may contain multiple types of memory (program, data and flash memories), have a RF transceiver (usually with a single Omni-directional antenna), have a power source (e.g., batteries and solar cells), and accommodate various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc fashion. Systems of 1000s or even 10,000 nodes are anticipated. Such systems can revolutionize the way we live and work.

It may also contain a global positioning system (GPS) receiver that allows it to determine its current location. Large amounts of these small-size and low-cost sensor nodes can be rapidly deployed to a region of interest.

A wireless sensor network (WSN) is composed of small sensor nodes integrating the capabilities of sensing, computing, communication and even mobility. Each sensor node is made up of five components, the battery power source, sensors, CPU, memory, and a communication module. It may also contain a global positioning system (GPS) receiver that allows it to determine its current location. Large amounts of these small-size and low-cost sensor nodes can be rapidly deployed to a region of interest.

(WSN) consists of distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, enabling also to control the activity of the sensors. The development of wireless sensor networks was motivated by military applications such as battlefield supervision; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Nowadays WSN is using so many areas like Area monitoring, Air pollution monitoring, Forest fires detection, Structural monitoring, Landslide detection, Military, Industrial monitoring, Machine health monitoring, Water/wastewater monitoring, Agriculture, and Greenhouse monitoring.

II. Intelligent Agent

Intelligent agent is a new advancement for developing software application. An agent is anything that is capable of acting upon information it perceives (receives). An intelligent agent is an agent capable of making decisions based on experience. An intelligent system is something that processes internal information in order to do something purposeful.

Intelligent Agent=Hardware + Software

Or

Intelligent Agent =Architecture + Program

A computing hardware/ software based system that operates without the direct interaction of human being or other agents. Intelligent Agents also known as rational agents are not just software program, they may also be machines, human beings or anything that is capable of goal directed behavior.

Intelligent Agents are autonomous (independent or self directed) software program which can understand the surrounding environment through its sensors. It has knowledge & on the basis of that knowledge & experience it can takes action in the direction of achieving goal.

Working of Intelligent agent depends on the sensor, percepts, actuator, actions and environment. Agent percepts the environment through the sensors and perform the action with the help of actuator. With the help of knowledge & experience it can takes action in the direction of achieving goal.

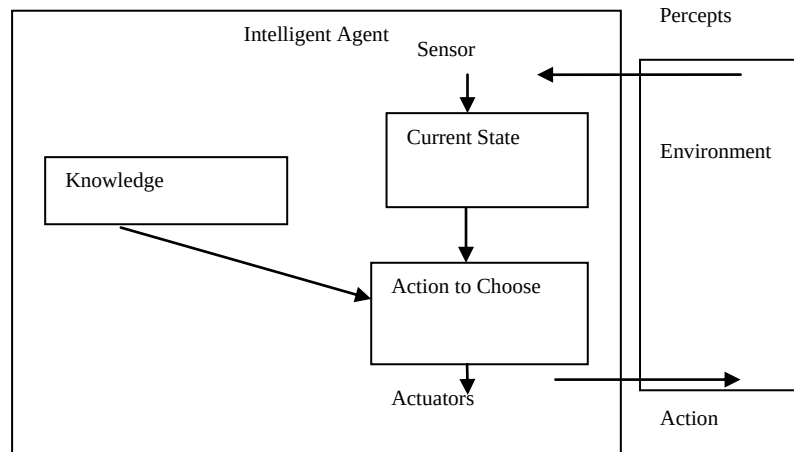


Fig.1 Working Model of Intelligent Agent

III. Review of WSN

Extensive research has been done in the area of wireless sensor network. This section highlights the work of eminent researcher and explores the challenges, which still need to be addressed. Yingyue Xu, Hairong Qi [1] in their paper had described the concept of computing paradigm based upon mobile agent to implement CSIP (collaborative signal information processing) in wireless sensor networks. Their main emphasis on the determination of mobile agent itinerary with the objectives of reducing energy consumption and improving reliability of collaborative processing in sensor networks. They presented three itinerary planning algorithms known as static, dynamic & predictive dynamic. They also use the simulation tool to measure the performance of above three algorithms on the basis of energy consumption, Network lifetime and numbers of Hops. They explained the topic with effectively and efficiency with proper diagram & example. Pratik K. Biswas *et al.* [2] have proposed a multi-layered, middleware driven, agent based architecture for collaborative processing in sensor networks. In the presented architecture they compared the performance of the mobile-agent based computing model with client-server-based computing model, their performance metrics were energy consumption & execution time. Mobile agent based collaborative fusion is beneficial over client-server based model because of amount of sensor nodes deployed and the degree of collaboration needed.

Franco Cicirelli *et al.* [3] have explored that the main limitation is low power capacity. They propose a light weight actor infrastructure, which is more suitable to modeling and simulation for complex & large sensor networks. Basic requirements of sensor networks are coverage & connectivity concerns. Compared the performance of two protocols, one of the protocol based upon the evolutionary game. In this paper a simulation model which explore the agent metaphor to study the coverage problem in sensor networks.

Kai Lin *et al.* [4] have emphasis an unbalanced energy consumption which decreases the lifetime of wireless sensor networks. In the paper, they proposed energy balancing cluster routing based on a mobile agent (EBMA) for WSNs. To obtain the better performance the cluster structure is formed upon cellular topology EMBA is simulated to show that it can effectively balance the energy consumption and gives the better result.

Hua-Wen Tsai *et al.* [5] in their paper proposes a dynamical object tracking (DOT) protocol to track a mobile object in a sensor network dynamically. Basically they concentrated on, how to detect the target position effectively as well as keep the movement information of the target. They also threw light on the topics face discovery, target discovery, target detection & tracking target. They compare the proposed scheme with three flooding based query methods. By the simulation results, the proposed protocol has better performance than that of flooding-based query methods. Finally they applied this protocol in tiny robot (like a bee) to chase an enemy or a wild animal. HUANG Hai-ping *et al.* [6] they have thrown light on a technology, wireless video sensor networks especially on target tracking based on multiple agents' technique. They introduces architecture of VSNs and intelligent algorithms for data routing, various algorithm are simulated annealing algorithm (SA), genetic algorithm (GA), and ant colony optimization algorithm (ACO) or their mixed algorithms, to resolve the optimization of tasks schedule and data transmission. In this article they also analyzes the performance of these algorithms and founded that mixed algorithm gives the maximal result.

Iva Bojic *et al.* [7] in this paper they introduced the concept of software agents in the SOMN architecture. They also highlighted the importance of self optimizing mobile network (SOMN) and proposed software agent technology as a tool for auto tuning the network. Main objectives are to save energy and reduce the operational cost. Simulation result shows that mesh topology gives better result. In this architecture agents must have the knowledge of their neighbors. Mirela Marta & Mihaela Cardei [8] have proposed to use moving sinks node that

change their location when the nearby sensors energy becomes low. In this way the sensors located near sinks change over time. In deciding a new location, a sink searches for zones with richer sensor energy. They also presented a distributed and localized algorithm used by the sinks to decide their next movement location. The focused on the uneven energy consumption will reduce network lifetime. They also developed two extensions of the distributed algorithm using coverage and timely delivery of data.

IV. Limitations and Scope of Research

The literature presented highlights the fact the energy is the indispensable part of WSN nodes, and it determines the lifetime of WSNs. WSNs are implemented in various environments mostly including remote and hostile regions. Main Limitations are:

- Low power Capacity
- Coverage & Connectivity concerns
- Unbalanced energy consumption
- Decide the optimization path for the moving sink node.

So there is a need:-

- To enhance the Reliability & lifetime of sensor nodes.
- Save energy to improve the quality of services
- Algorithms for deciding the routing path for the sensor nodes.
- Some work must be done for energy storage in capacitors by using smart energy saving electronics.
- There is a need for building rechargeable batteries e.g. battery can be recharge from sun light.
- To deploy intelligent agents in the WSN so that it can directly inform the SINK node and in this way it will enhance the lifetime of Wireless sensor network.
- To design an architecture for such system.
- To design an optimal routing path in case of moving sink node

V. Conclusion

Utilization of Intelligent agent in the WSN will have a significant impact on the performance in the form of enhancing the reliability & life time of sensor network. It may be implemented in the so many different ways like using the moving sink node to reduce the unbalanced energy consumption but it require an optimal routing path to perform its working more effectively & efficiently. Future work must be on developing the suitable protocols and algorithms to obtain the optimum result.

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