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A CRITICAL REVIEW ON WIRELESS COMMUNICATION NETWORK

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Abstract: In this study, effective distributed techniques for wireless network cost reduction are explored. We look at the difficulties of multi-hop data aggregation for correlated data in wireless sensor networks, specifically how to minimise energy consumption and maximise throughput. The proposed techniques make advantage of redundant information within a game-theoretic framework. Using optimum reaction dynamics to local data, routes are selected to reduce the network's overall energy consumption. Routing uses a cost function that considers several factors, including distance, interference, and data accumulation inside the network. The energy consumption of the network is drastically decreased by the suggested energy-efficient correlation-aware routing method, which converges in a bounded number of iterations. We optimize performance by constructing paths that minimize network-wide disturbance and maximize correlation between forwarded data. Each path's nodes are selected to optimize data gathering inside the network while reducing the potential for local interference. The method is guaranteed to converge in a limited number of steps thanks to optimal response dynamics, and the resultant network design optimizes global network throughput.

***Index Terms* - Wireless sensor networks, Network Lifetime, Energy efficiency**

1.1 Introduction

While today's WSNs are used mostly in the consumer and light industrial sectors, their roots may be traced back to the military and heavy industry. The United States Military Sound Surveillance System (SOSUS), developed in the 1950s, was the first wireless network resembling a WSN and was used to detect and track Soviet submarines. Hydrophones were dispersed over the Atlantic and Pacific using this method. Marine life and volcanic activity are still what these sensors see, not pirate submarines. Wireless Sensor Networks employ radio waves to perceive, monitor, and understand the real environment. IR link Motes may sense. A wireless sensor network (WSN) connection has one sensor node. A sensor network node typically has a CPU, power supply, electrical circuit for sensor communication, and radio transceiver with internal or external antenna. A sensor network is a system in which individual nodes, or "sensors," monitor and, in some cases, alter the state of the physical environment around them. WSN employs a high-tech wireless mesh network with a star topology and several hops between nodes. The three main parts of a WSN are the sensor nodes, the users, and the backbone.

In order to construct wireless networks in real time, it is necessary to have efficient distributed algorithms. This is due to the fact that as the network evolves, nodes become more autonomous and the network as a whole becomes more decentralized. Designers of decentralized wireless networks face a number of substantial and difficult obstacles. A network functioning in a multi-user environment has several issues, including energy economy, interference control, throughput needs, the number of user interactions or collaborations, data latency, reliability, and quality of service.

The sophisticated mathematical foundation of game theory might provide the key to understanding and evaluating wireless networks. The interactions that take place between users or nodes may be modelled as a game played by a variety of users, with the steady-state equilibrium point serving as the target destination. Within the scope of wireless sensor networks (WSNs) and wireless ad-hoc networks, the focus of this dissertation is on discussing some of the significant challenges that have been raised so far. In addition, we use the fundamentals of game theory in order to conduct an analysis of the adjustments that may take place in such decentralized networks.

1.2 Related Work

Jennifer Yick et. al (2008), In this study, an overview of numerous recently developed applications is presented, and then a literature review is conducted on different aspects of WSNs. In this article, the problems that must be solved are broken down into three groups:. Its underlying core platform and operating system Stack of protocols used in communication. The provisioning, management, and operation of the network. This article discusses the key developments that have occurred in these three areas and outlines the new problems that have arisen.

Kemal Akkaya, Mohamed Younis, (2005), This study gives a taxonomy for the different methodologies that have been investigated as well as a comprehensive discussion of the modern routing methods used for sensor networks. Within the scope of this body of work, we concentrate our attention largely on three distinct categories of classifications: data-centric, hierarchical, and location-based. Additionally investigated is the modelling of network traffic in addition to quality of service.

Gomez, J. et. al (2001), In this work, we provide the whole architecture of PARO and conduct simulation and experimental analysis of the protocol. In comparison to traditional broadcast-based routing protocols, PARO's simulation findings indicate that its power-efficient point-to-point on-demand design provides superior performance. (such as MANET routing protocols). Also discussed are lessons learned from pilot projects using commercially available radio technology in a wireless experimental test bed.

Zahra Rezaei, Shima Mobininejad (2012), To execute local calculations based on data collected from the environment, a WSN distributes a large number of sensor nodes throughout a wide region. While it is possible to replace or recharge the batteries in each network node, this begs the question: "how to prolong the network lifetime to such a long time?" Due to their ad hoc placement in potentially dangerous situations, sensors cannot be replaced or recharged, making it difficult to increase network lifetime while reducing energy usage in WSN. We'll take a look at the most well-known approach now in use to the pressing problem of energy efficiency in wireless sensor networks. Focusing on data-driven methods that may be used to improve energy efficiency, this article also covers duty cycling programmes, often regarded as the most effective approach to reducing energy use.

Sidharth Indora, Naveen Dhadich (2016), Wireless communication technology enabled compact, low-cost, low-power, multi-functional sensor nodes in wireless sensor networks. "3 any"—anyone, anywhere, anytime—has made wireless networks popular. Scalability, energy consumption, environment, and application affect sensor network architecture. Communication consumes most energy. Wireless sensor networks prioritise energy saving. Packet delivery depends on routing strategy choice. Energy-efficient communication techniques are being developed to increase network longevity. Since energy regeneration is too costly, energy harvesting wireless sensor networks prevent battery-powered networks from draining energy. Energy collecting nodes utilise environmental energy. Energy harvesting is an additional topic that is covered in this study, which focuses on energy-efficient routing in wireless sensor networks.

1.3 Wireless sensor networks (WSNs)

A wireless sensor network, an ad hoc network of wireless sensors, also known as a (WSNs) monitor system, physical, and environmental parameters without infrastructure. Wireless Sensor Networks monitor the world. WSNs administer and monitor a local ecosystem using sensor nodes with an embedded CPU. Many military and civilian industries are adopting "wireless sensor networks" (WSNs). A wireless sensor network (WSN) uses independent sensor devices to monitor the environment or other physical factors. A wireless sensor network (WSN) is a system of interconnected, low-power sensor nodes. These nodes may communicate with one another and exchange resources. These nodes may collect data on environmental conditions in their local vicinity and relay that data to a coordinating centre. The latter may transfer the data to a wired network, set off an alert, or take some other action, depending on the nature and volume of the data being watched.

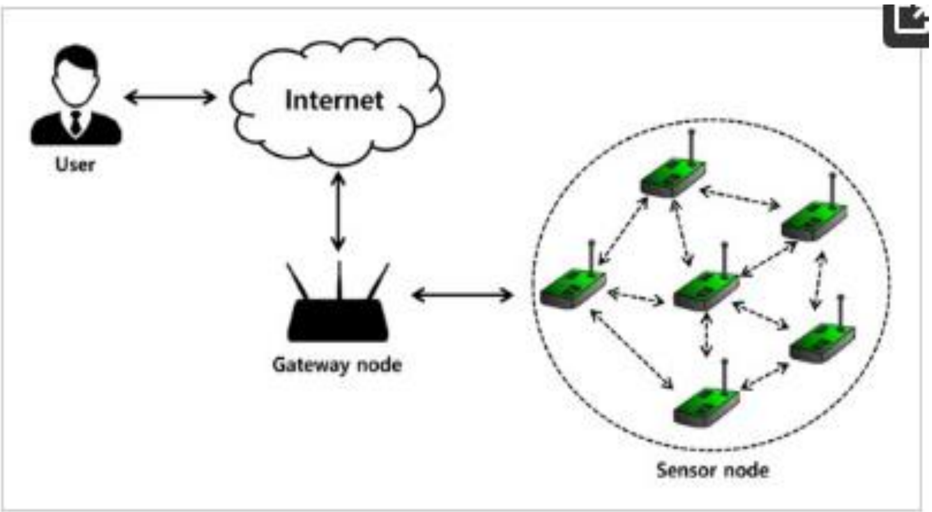

Figure 1 Authentication model in wireless sensor network

A contemporary wireless sensor network (WSN) must overcome a number of obstacles, including the following:

- **Limited power and energy:** WSNs are often made up of sensor nodes that are powered by batteries and have limited access to other sources of energy. Because of this, it is difficult to guarantee that the network will continue to operate for extended periods of time without the need of often replacing the batteries.
- **Limited processing and storage capabilities:** The sensor nodes that make up a WSN are generally rather tiny, and their processing and storage capacities are severely restricted. Because of this, it is difficult to do complicated activities or store a significant quantity of data.
- **Heterogeneity:** WSNs often include a wide number of distinct sensor types and nodes, each of which has a unique set of capabilities. Because of this, it is difficult to guarantee that the network is capable of functioning in an effective and efficient manner.
- **Security**: WSNs are susceptible to several different kinds of assaults, including eavesdropping, jamming, and spoofing, among others. A significant obstacle is making certain that both the network and the information it gathers are secure.
- **Scalability**: WSNs are often required to have the capacity to support a high number of sensor nodes and to process a substantial volume of data. A key obstacle consists in overcoming this demand on the network while maintaining its scalability.

- **Interference**: WSNs are often used in locations that have a high density of other wireless devices that might cause interference. Because of this, it may become challenging to maintain reliable communication between the sensor nodes.
- **Reliability**: WSNs are often used in mission-critical applications, including as environmental monitoring and the management of industrial operations. A significant obstacle is presented by the need of ensuring that the network is dependable and capable of operating appropriately under all circumstances.

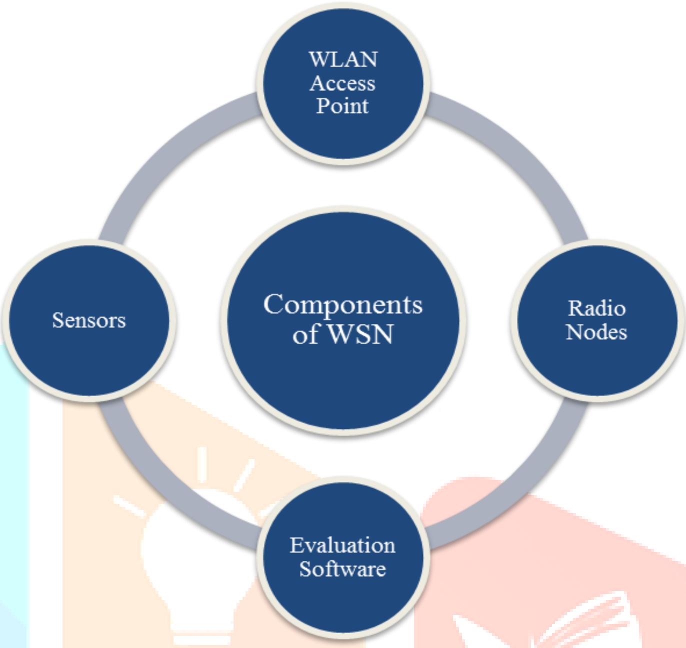

Figure. 2 Components of WSN

1.4 Network Lifetime

Wireless sensor networks that make use of a mobile sink have the potential to mitigate the hot-spot issue and lengthen the network's operational lifespan. In actuality, however, the trajectories of the components cannot vary as smoothly as they would in a perfect world because to the constraints imposed by the environment or the demands of the application. The mobile sink and sensor node require different amounts of time to connect due to trajectory restrictions. Energy utilisation may be unequal. This research presents an efficient data gathering method that accounts for the sink's restricted mobility and the sensor node's variable connection time. Through optimization of the assignment sensor node, the strategy extends the amount of time that a wireless sensor network may function in the presence of a path-constrained mobile sink. WSNs' network lifespan—the time until the first sensor's energy supply runs out—is an important performance metric [2, 9]. Each sensor node in typical wireless sensor networks (WSNs) sends data to the sink through multihop communication. One of the biggest problems of this communication is that the node closest to the sink will transfer a lot of data from other nodes to the sink. Unbalanced traffic depletes energy at the sensor node near the washbasin quickly. In wireless communication, this issue is referred to as the hot-spot problem, and it might potentially result in the energy not being dispersed equally across the sensor nodes [6].

Mobile sinks may equalise energy usage across hot-spot nodes. This is done to reduce the hot spot problem caused by the static washbasin. The hot-spot nodes will be updated in a distributed fashion over time as the sink travels through the networks, at least according to common sense. When this happens, the sensor nodes in the vicinity share the load of keeping the network alive, making it more reliable for longer [8].

1.5 Energy efficiency

The procedure that saves the maximum amount of energy is to place the radio transceiver into the sleep mode, which uses very little power, whenever there is no need for it to be communicating. The radio should be turned off when no data is being broadcast or received and turned back on when a fresh packet is ready. There is a tendency to equate this criterion with the longevity of a network. Since each sensor has a limited amount of energy, it is imperative that we make efficient use of them to prolong the network's lifespan. One of the biggest challenges to WSN adoption is improving their energy efficiency. To solve the issue of low energy efficiency in sensor networks that are connected with strategic deployment, at least two different techniques [10] have been developed. The first tactic is to time active sensors such that their detecting ranges coincide with those of inactive ones. The second strategy involves modifying the detecting range of sensors to save energy. When it comes to mobile sensors, energy efficiency mostly entails timing their movement to the prescribed places in accordance with the placement strategy's calculated findings in order to minimize energy consumption during movement.

1.6 Conclusion

In this paper, Throughput optimization in wireless ad hoc networks (WANETs), power efficiency in wireless ad hoc networks (WCANs), and energy efficiency in wireless sensor networks (WSNs) were examined as potential means of reducing the overall cost of wireless networks. To begin, we provide an energy-efficient transmission architecture for WSNs in which sensors send correlated data to intermediate nodes, delivers aggregated data to the sink. We examined how efficient data aggregation affects sink-bound routing in energy reduction. We devised a game-theoretic distributed correlation-aware routing method that converges in a limited number of iterations. We also demonstrated that incorporating correlation structure and multi-hop aggregation during route construction may provide considerable energy improvements over traditional methods.

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