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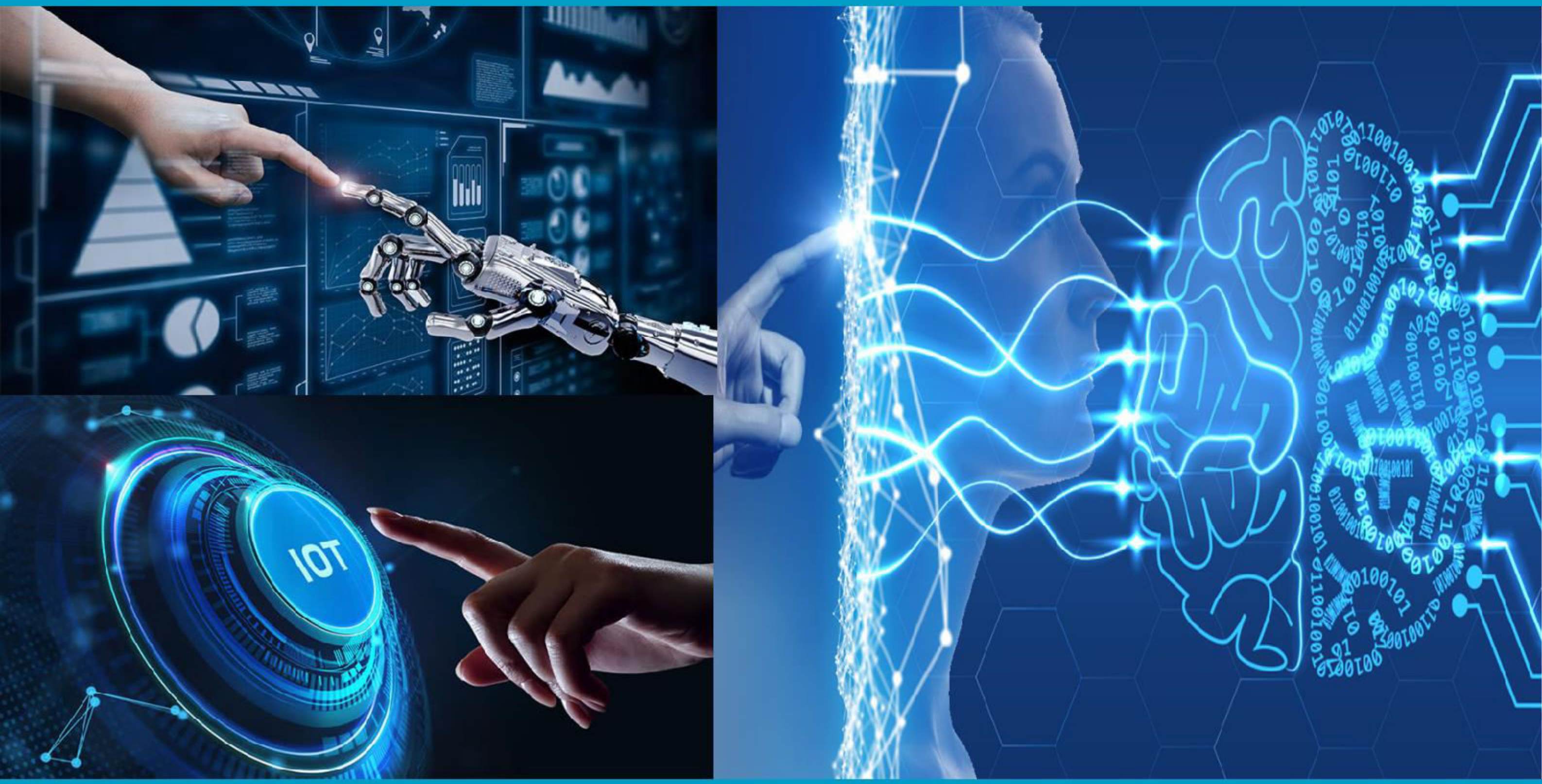

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Optimization of Energy of Sensor Network through Ant Colony Algorithm

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ABSTRACT: This paper offers a workable solution to this critical issue by developing low-power routing protocols for WSNs. Due to their high-power requirements, sensor nodes situated at great distances need vigilant monitoring of the network's energy usage. The power needs of these nodes are often met by batteries. Energy-efficient network operation is guaranteed by a suite of battery-powered power-saving features. This study provides a taxonomy of approaches to controlling power consumption in WSNs at a high level. Batteries and energy harvesting are only two of the many energy supply technologies considered. Recent developments in wireless energy transmission to a sensor node as an alternative to conventional batteries are also highlighted. We recommend that, while designing energy-efficient solutions for a sensor network, designers take into account both established methods for conserving energy and emerging technologies for producing it. The ultimate goal of energy management is to guarantee that not a single network node will fail due to a lack of electricity. The energy reserves of sensor nodes must be carefully managed to meet the needs of all of the many tasks running on them. In extreme cases, it may be hard to reconnect power to sensor nodes that have been installed in distant regions where it is rare. For this reason, it is crucial to control the supply and demand of energy in a network. The current status of energy management practices is captured in this study, making it a valuable resource for the academic community. To better understand the topic at hand, we have separated energy management in WSNs into two different categories. The majority of sensor nodes in use today are powered by removable, rechargeable, and replaceable batteries. Several scientists have turned to ambient energy as a way to circumvent battery limitations. An infinitely functional network of sensors is possible if it can harvest enough power from its environment. However, there is a limit to what can be achieved with solutions based on energy harvesting, since there may be cases in which a node has less harvesting capacity than its power requirements. When nodes' energy reserves run low, the whole network slows down. This thesis focuses on the optimization of routing in wireless sensor networks. A WSN routing scheme must priorities lifetime due to the sensors' finite energy reserves. This paperprovides Ant Colony Optimization as a heuristic technique to lessen the load on the network's power supply during routing processes in WSNs.

KEYWORDS: WSNS, Ant Colony Algorithm,power consumption in WSNs

I. INTRODUCTION

The amazing thing about modern technology is that it has given us the opportunity to completely revamp our normal activities and the way we interact with the world around us. As an example of a technology that is rapidly progressing, consider the meteoric rise of WSNs. To collect data on an incident, WSNs deploy a large number of Sensor Nodes, which are autonomous nodes that may be located anywhere and run by any number of different processors. WSNs are similar to wireless ad hoc networks in that they can automatically self-organize and adapt to new network topologies with little to no human oversight, but they rely on a significantly less amount of fixed infrastructure. Because of their advantages, WSNs are a good option when a permanent infrastructure network is either not feasible or cannot meet the demands of the circumstance. WSNs are useful for a broad variety of tasks because to their flexibility, such as monitoring habitats, keeping tabs on enemies, keeping tabs on the whereabouts of items, checking on the condition of buildings, and even farming. While WSNs have a lot of potential, there are also several big problems that need to be

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addressed. Some of the most well-known challenges are connectivity, connection quality, localization, scalability, security, and energy efficiency. Improving energy efficiency for WSNs remains a top problem for researchers throughout the globe, despite the best design and deployment strategies. A solution to this pressing problem is proposed in this thesis, which is the creation of low-power routing protocols for WSNs. [1-6]

WSNs may collect, analyses, and send event data at the site of deployment with the help of self-configured, autonomous SNs with limited power and storage capacity. As a group, the SNs in a WSN may interpret information from previously unavailable sources and draw meaningful conclusions. An SN gathers data using an ADC and transmits it to a BS or a Sink, where it may be processed in various ways (Al-Karaki, 2004). During data transmission, every node acts as a repeater, carrying the signals of other SNs on to the base station. More complex SNs may perform functions like data processing and aggregation to increase a WSN's efficiency, but all SNs have the capacity to gather and transmit data about the location and status of a specific physical event. Powerful nodes may transfer data directly to the BS, bypassing intermediary nodes, and have a greater communication range. The degree of difficulty and intended usage region determine which SNs are chosen. The SN's power source satisfies the energy requirements of its many components (sensors, processors, and transceivers), but its short battery life means that frequent usage may soon exhaust its reserves (Akkaya Kemal, 2005). Additionally, GPS receivers might be included on certain nodes to improve position accuracy; however, these wide-area networks (WSNs) tend to be quite power-hungry, rendering them unsuitable for low-cost, low-power SNs. Common design for WSNs is shown in Figure 1.1 [7-11], where SNs cluster together and are led by a single node called the Cluster Head (CH).

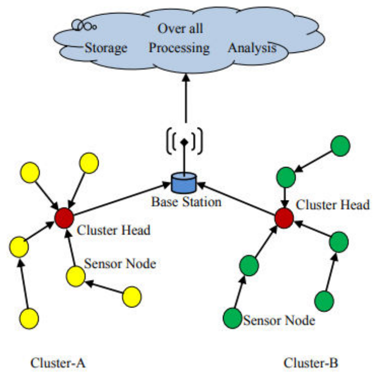

Figure 1WSN and Cluster formation

II. LITERATURE REVIEW

Raj et al. (2019), Improved functionality of wireless sensor networks for the Internet of Things is possible with the aid of quality of service and energy-efficient routing. Tracking the dynamic physical state requires wireless sensor networks that include autonomous sensing nodes outfitted with actuators, processors, communicators, and batteries. These small networks of wirelessly communicating sensors may be included into IoT because to their cheap cost, low power consumption, great scalability, and adaption to hostile and severe conditions. The current approaches for interfacing WSNs with the IoT are inefficient in terms of energy consumption and often fail to guarantee always-on network availability, timely packet delivery, and low latency. Measuring the number of packets delivered, the amount of energy used, the longevity of the network, and the time it takes to send a packet are just a few examples of the many metrics that may be used to demonstrate a sensor network's functioning.

Yang et al. (2009), Power-Saving Measures for Submarine Sensor Network Transmission. Due to the one-of-a-kind nature of the channels involved, underwater communication is a complex field to study. Underwater environments provide unique challenges for wireless communication protocols, therefore most of those developed for use on land are not suitable for use below the surface. In this research, they apply a thorough and theoretical analysis to the problem of energy efficient transmission in underwater sensor networks (UWSNs). They formally formulate an optimization problem with the goal of minimizing energy usage while also accounting for other performance indicators like data dependability and communication latency. They use the Karush-Kuhn-Tucker conditions (KKT conditions) to construct a straightforward and explicit approximation solution that, given plausible circumstances, is close to the true answer. Theoretical directions for creating robust and dependable UWSNs are provided by this approximation of a solution.

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Our findings further highlight the importance of dependability and communication latency in determining overall transmission energy requirements.

Jadhav et al. (2013), Due to their compact size and non-removable batteries, these sensor nodes are severely limited in their ability to generate and transmit electricity. This exemplifies the extent to which data transmission consumes a WSN's resources. When it comes to maximizing data transmission speeds while also decreasing energy consumption in a WSN, clustering is one of the most successful solutions. The proposed method is assessed in relation to established norms for network durability, efficiency, throughput, and steadiness.

Al-Aboody et al. (2016), Grey Wolf is the most efficient energy-saving routing protocol for DSNs. For wireless sensor networks, this study aims to provide a Grey Wolf Optimizer (GWO)-based approach to a hybrid clustering routing protocol (MLHP). It is recommended that the base station (BS) play a significant role in selecting cluster heads for Level 1. Nodes in Level 2 are advised to use GWO routing for data transmission, selecting the best available route to the BS. To complement this, they provide a distributed, cost-based clustering approach for Phase 3. The algorithm's effectiveness in a network was evaluated using many criteria, including its energy efficiency, lifespan, and stability. By comparing it to established routing protocols, they were able to gauge the method's potential usefulness. The results showed that the proposed approach trumped the competing algorithms in terms of network longevity, stability period extension, and residual energy buildup.

Rao et al. (2016), In this study, they provide PSO-ECHS, a particle swarm optimization-based strategy for selecting cluster heads that minimizes energy consumption (PSO). Particle encoding and a fitness function are used in the development of this strong algorithm. Many factors are taken into account while determining the PSO method's energy efficiency. Among them are the distance between nodes within a cluster, the distance to a sink, and the leftover energy of sensor nodes. They also provide a method for forming clusters, whereby nodes that aren't CHs would voluntarily join clusters according to a weight function we've devised. The algorithm is put through its paces on many WSN setups, each with its own unique number of sensor nodes and central hubs. In order to prove the superiority of the suggested strategy, they compare it to current best practices in the field and provide the results of our analyses.

III. SIMULATION AND RESULT

Optimization of routing in wireless sensor networks using ant colony search Abstract: Due to the sensors' finite energy reserves, maximizing longevity is crucial to the success of any WSN routing scheme. Here, thisprovides Ant Colony Optimization as a heuristic approach to lowering the energy requirements of WSNs' routing processes.

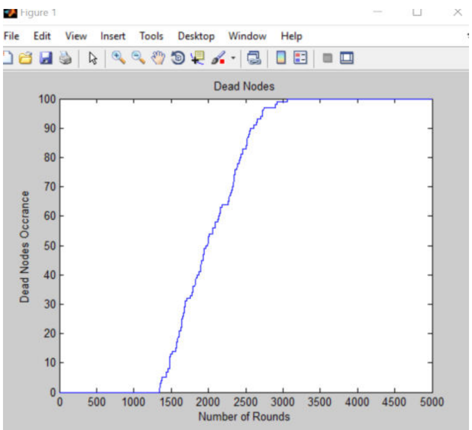

Figure 2: Dead node vs No of round

As the above figure suggested that the occurrence of dead node as the number of round increases. As see that the dead node has been after the round of 1300, only dead node has been increased and continues till 3000 rounds and then it stagnant. This reflect that the number of node alive has been totally finished at the end of 3000 rounds.

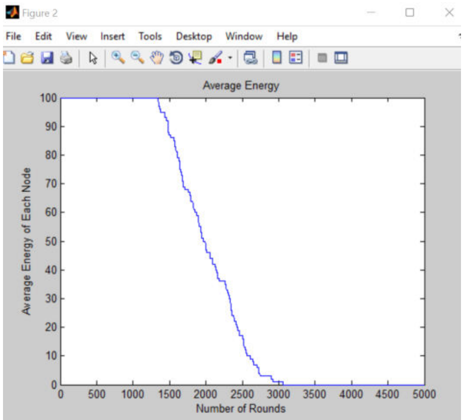

Figure 3: Avg. energy vs number of rounds

As the above figure suggested that the avg energy of node decrease as the number of round increases. At the beginning of the communication round, it is very contestant after that the fall of energy very diacritically and fall to zero value.

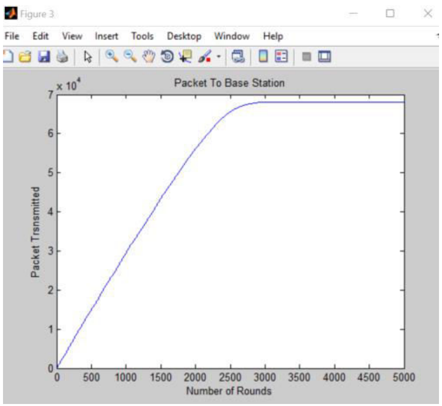

Figure 4: Total Packet Transmitted vs number of rounds

As the above figure suggested that the Packet transmitted of node increases as the number of round increases. At the beginning of the communication round, it is very contestant after that the fall of energy very diacritically and fall to zero value.

Figure 5: Occurrence of Dead node in steps vs number of rounds

As the above GUI suggested the occurrence of dead node and number of rounds in numeric quantity. [12-22]

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IV. CONCLUSION AND FUTURE SCOPE

This extraordinary development in technology has allowed us to drastically alter our lifestyles and the way we relate to the natural world. Wireless sensor networks (WSNs) are one example of a technology that is rapidly progressing. WSNs have seen phenomenal growth in recent years (WSNs). Data about an event is collected in WSNs via the use of a network of nodes called Sensor Nodes (SNs), which are deployed arbitrarily and run independently of one another. Although WSNs have certain characteristics with wireless ad hoc networks, such as the ability to quickly adapt to different topologies and networks with little to no monitoring from a centralized authority, WSNs depend on a much smaller or nonexistent set of physical nodes. WSNs are useful in situations were setting up a permanent network infrastructure would be too expensive or otherwise impractical because of these benefits. Because of their adaptability, WSNs may be used for a wide range of purposes, such as smart farming, adversary surveillance, item tracking, structural health monitoring, and monitoring habitat quality, among many others. While WSNs show promise for a variety of future applications, they also confront significant obstacles that must be overcome. Connectivity, connection quality, localization, scalability, security, and energy efficiency are among the most well recognized difficulties. It is generally agreed upon by scientists from different parts of the world that WSNs might be more efficient with regard to energy use, even when using the most modern designs and deployment tactics. However, since there is usually no fixed framework in place for WSNs, they may adopt dynamic networks and topologies and self-organize without any human involvement. When a permanent infrastructure network is not an option, wireless sensor networks (WSNs) may fill the void. WSNs may be utilized for a wide variety of purposes, including smart farming, opponent surveillance, item tracking, and monitoring the health of buildings and other structures. While WSNs have a great deal of promise, they also face some serious obstacles. Problems with accessibility, connectivity, localization, scalability, security, and efficiency in resource use abound. Energy efficiency in WSNs is still a major concern despite advances in design and implementation methods. It is proposed in this thesis that novel low-power routing techniques be developed for WSNs. Due to their high energy requirements, sensor nodes spread across large distances need meticulous energy management. Such nodes often rely on battery power. Many energy-saving features, powered by batteries, contribute to the effectiveness of the network as a whole. Researchers are looking at ambient energy as an alternative to batteries due to its limitations. The methods for managing energy consumption in WSNs are classified in this study. Examines various methods of producing and storing energy, such as batteries and solar panels. An alternative to using batteries in a sensor node is discussed: wirelessly transferring energy to the node. Energy-efficient sensor network systems should be built with both tried-and-true methods of energy conservation and cutting-edge developments in energy delivery in mind. In wireless sensor networks (WSNs), "energy management" describes how individual sensor nodes access and use the available network power. The goal of energy management is to ensure that no device in the network ever loses power. Due to the limited energy available at a sensor node, applications must be controlled to ensure proper energy management. When a sensor node is deployed in an unreachable location, its available energy is limited, and recharging it might be challenging, if not impossible. Energy supply and demand must be managed meticulously to prevent network blackouts. Researchers can learn a lot from this survey about how energy is currently being managed. As a means of better understanding the issue, we categories WSNs' energy management into two categories. The difficulties that may arise while powering a sensor node from a variety of sources will be discussed first. A sensor network may operate indefinitely if it draws enough power from its surroundings. Sometimes a node's ability to gather energy is inadequate to meet its power needs. A drop in a node's energy level may have a negative impact on the performance of the network as a whole. In this research project, we use ant colony search to find the most efficient paths for wireless sensors to travel between sensors. Given the constraints imposed by the sensors' finite power, WSN routing must priorities longevity. WSN routing energy may be decreased using the heuristic of Ant Colony Optimization.

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