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# Energy Efficient Routing Protocols for Wireless Sensor Network in Application to Design IOT based Soil Sensing

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***Abstract: - Precision agriculture is increasingly being employed worldwide to increase cultivation and output rates through the use of wireless sensor networks (WSN). Improved sensor effectiveness is sought to enhance both the number and the quality of soil commodities. The main objective is to examine and assess how well the various WSN protocols currently in use function while routing data across a centralized server. IOT is now an innovation that can be used to provide inexpensive, WSN-based immediate time remedies for challenges in agriculture. In this research, it is recommended to develop a low-energy option for ground sensor networks and WSN routes. For extending the lifespan of the network, latency and throughput are the main issues that need to be addressed. This study validates and assesses the energy-efficient clustering and data aggregation protocols such as LEACH and its several variants, Directed Drift, EDEEC, PEGASIS, SEP, and DEC.***

***Keywords:*** **-Internet of Things, Wireless sensor network, Soil Sensing, Energy Efficiency, Clustering, Data aggregation, Routing protocols, network lifetime.**

## I. INTRODUCTION

Over 40% of MP soil has a mineral deficiency as a result of the lack of education. Therefore, it is suggested to apply effective WSN design to provide a low cost, user-friendly soil sensing solution for central India. An Internet of Things can be conceptualized as an internet of sensors that can exchange data gathered about the region that is important and transmit it to an online server using WSN. A substantial amount of information is generated as a result of an IOT networking's continuous growth, which raises network traffic and costs more to transport the data. By examining such a scenario, it becomes clear that only an energy-efficient data aggregation or clustering-based routing strategy is required to get around obstacles and prolong the life of IOT-based sensor nodes as a whole.

The battery life of sensor nodes determines how long the network will last. This study studies and reviews a variety of routing approaches in light of these challenges. With the goal to increase the WSN's lifespan, it is also necessary to create a low-cost, low-power sensor unit for soil sensing applications. The many soil sensors are utilized to keep track of the chemical and physical characteristics of the soil. The purpose for data aggregating route is to combine information collected by several networked detectors [1]. Contradiction is also eliminated through the collection of data. Cutting down on transmissions, and conserving energy in this method [3]. A common method for improving the energy efficiency of the WSN system is grouping. The grouping strategy employed in WSNs maximizes overall lifespan of networks by minimizing interaction. Aggregation reduces the number of trips to the starting station through combining data, and by reducing the amount of transmitted geographical separation; it also reduces energy consumption [1]. The study's main goal is to evaluate soil sensing performance and address issues with various clustering-based WSN designs. In the agricultural sector, Wireless Sensor Networks (WSNs) are known to be an effective instrument for data collection and processing at minimal cost and energy consumption.

Consequently, creating an energy-efficient WSN is still a difficulty, and WSN design is taken into account twice. 1). The first step in prolonging the system's overall life is to develop environmentally friendly transport techniques. 2). Build a trustworthy device that will precisely monitor the required variable in accordance with the application's specifications. This paper focuses on researching and analyzing the development of effective WSN protocols for use in soil parameter monitoring.

Increasing agricultural product production and soil monitoring are two common uses of Wireless Sensors Internet (WSN). For Bluetooth wireless sensor networks, the Low-Energy Appropriate Grouping Topology

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(LEACH) networking approach [4] is frequently utilized. The main justifications for utilizing network protocols are

- When a node's battery resources run out, it loses life and becomes useless.
- Using protocols enables us to marginally lengthen the lifespan of nodes by reducing the energy needed Transferring information.

Therefore, it is essential to develop a viable protocol method that makes use of the idea of least cost. Figure 1 depicts the four IOT network architectures as well as our suggested application and approach. Figure 1 shows that the four layers of IOT networks are made up of a physical layer with sensors. Designing soil parameter monitoring sensors for this layer, as indicated in the blue box, is the focus of our effort. The second layer of the network, which is in charge of routing, is the layer that is most crucial for communication setup...

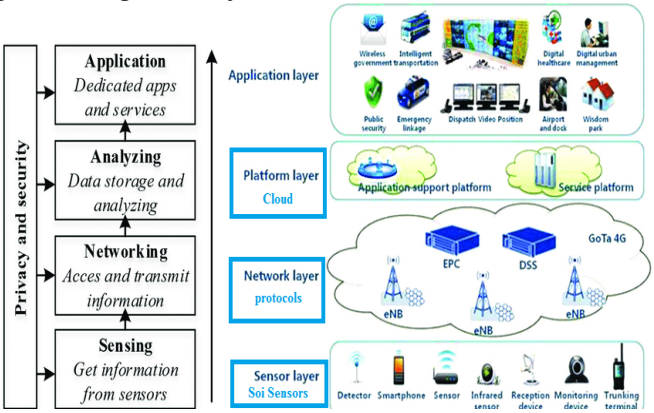


**Fig.1 Four layer IOT network and proposed application and approaches**

At this layer, developing an environmentally friendly soil sensors is our main focus. A service, which in this case is cloud for IOT, is the third layer. The data is finally presented on the application layer, which in this case is soil parameter monitoring. The objective of this investigation is to offer suggestions. for developing an energy-efficient routing protocol by studying several protocol literatures. Additionally, existing comparative analyses of aggregation and methods based on clustering are provided. Finally, a comprehensive review was offered, putting the results in a clear light and providing future guidance for experts in wireless sensors for the Internet of Things.

***A. Structure of WSN***

Multiple nodes are used to forward the data, and a gateway is used to connect it to other networks. Sensor networks that are wireless (WSNs) are widely used in fields including environment monitoring, nuclear or radiation threat detection, ship-mounted weapon sensors, surveillance, military power, regulation, intellectual ability, smart cities, healthcare sector, automation, and targeting systems has recently drawn more attention from researchers. Agriculture is in the process of changing from conventional farming to contemporary agriculture scientifically. The Internet of Things (IOT) for agriculture should play a bigger role in promoting agriculture information, including the development of agriculture-specific information technology and the utilization of information resources by agriculture.

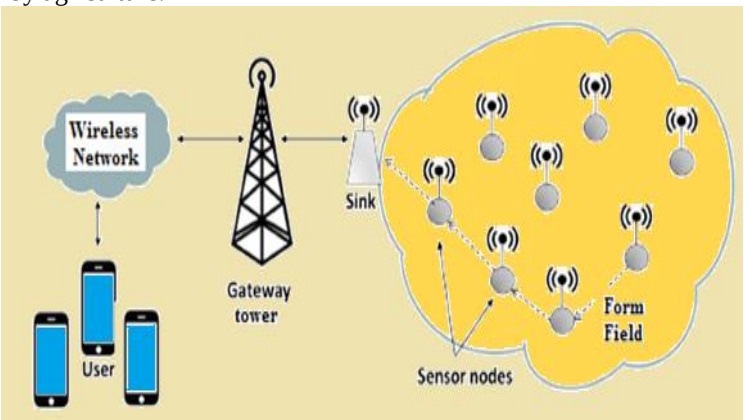


**Fig.2 Structure of the WSN for Soil parameter monitoring**

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Clustering has many advantages when used in WSN construction, among which are listed in the following table. There is no doubt that the primary objective of collecting information in wireless sensor networks is energy conservation and longevity enhancement. Although clustering and aggregation have the potential to fail and consume more energy, it is still necessary to create a routing protocol that is energy efficient.

**Table 1. Advantages of Aggregate in the construction of WSNs**

| **Problems** | Devoid of Clustering | Utilizing Aggregate |
|---|---|---|
| Advantages | That holds true in any setting. The routing issue can be resolved using the straightforward linear programmer. | The amount of data transmitted is reduced by the aggregate. |
| Disadvantages | Because there are more transmissions, there is a higher energy usage. | Energy consumption rises when duplicate data is aggregated. The aggregation as well as clustering might fail in rare instances.. |
| Challenges | Absent collection, it is possible to form a hollow near to the washbasin node. Massive data transmissions might potentially result in data degradation. | There are different levels of compressing for different uses. Scheduling methods must also be implemented to preserve the structure of power-saving nodes used for sensors. |

## II. STEPS OF CLUSTERING BASED WSN

Figure 3 explains the main sequential phases for designing the WSN.

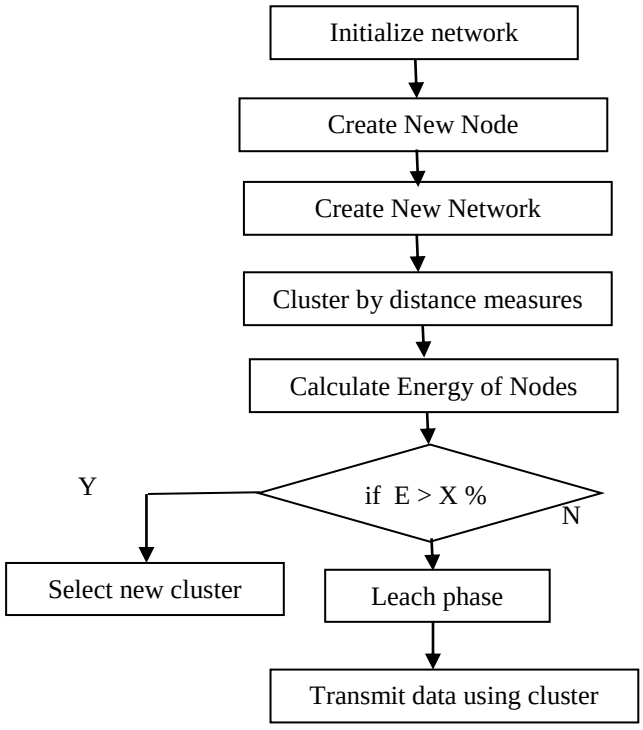


**Fig.3 Development procedures for WSN cluster according to LEACH**

Any protocol of WSN aims to adjust these phases in order to increase the algorithm's effectiveness for greater network effectiveness. In WSN, clustering-based protocols are widely utilized to reduce energy consumption. The basic study depends on cluster depending on power, cluster depending on geographical separation, or grouping based upon the head of the cluster choice method. This study studies the various aspects of clustering-based Em data transfer methods.

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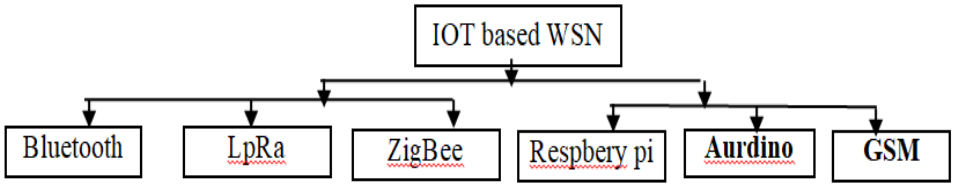


**Fig. 4 Segmentation of WSN devices according to IOT**

## III. WSN CATEGORIZATION FOR IOT

Modern agriculture is now a business, and WSN is looking for low-cost technological solutions to boost Indian agricultural standards and increase output rates. According to the wide WSN classification shown in Figure 4, sensor node designs and communication options are based on hardware as well as connectivity technologies.

## IV. PROBLEM AND CHALLENGES

According to the review, the primary problems that need to be resolved for a successful implementation of environmentally friendly clustering-based wireless networked sensors are given below.

1. Creating an effective distance-based node clustering algorithm.
2. Quick and effective node model creation, network architecture design, and energy impact analysis.
3. The power consumption of multiple protocols for routing under different characteristic conditions is being evaluated to improve WSN effectiveness.
4. Study the requirement of the soil sensing in the central India agricultural soil.

## V. COMPARATIVE ANALYSES OF DIFFERENT PROTOCOLS

A survey of research revealed that, the various routing protocols and WSN approaches are compiled in Table 2 along with performance metrics, categorizing the each protocol type and its methodology. It is clear that the majority of methods aim to increase life and energy efficiency.

**Table 2. WSN routing specifications**

| The authors | Method for Protocols | Summary | The variables |
|---|---|---|---|
| Sasirekha et al [21] | Techniques of collecting data | An examination and evaluation of the different information gathering techniques employed by the WSN | Connection vitality, delay, and power |
| Arumugam et al [16] | EE-LEACH | Improve the altered form of energy-based dynamic grouping. | Longevity of the system, cost effectiveness, delay, and capacity. |
| Lindsey et al [5] | PEGASIS as | In the sensed computer system, a clustering approach centered around chains that uses fewer resources. | Remaining Connection Energies, Latency |
| Qiang Wang et al [4] | DEC WSN | WSN architecture addressing soil surveillance has been provided, specifically for soil characteristics such as moisture, moisture in the soil, and soil temperature of the water (SWT). | SWT moisture in the soil levels and grouping effectiveness |
| Stephan et al [7] | ANN and GA | An method for WSN designing using the ANN and the GA for protocol implementation | Lifetime, energy and computation time. Delay |
| G. Smaragdakis et al [1] | SEP | Protocol using Stable election probability for cluster heads selection | Heterogeneity, methods for preserving energy, both living and deceased nodes, as well |
| Femi A. et al [2] | SEP-E | Improved Introduce the notion of an intermediary node to form a three tire with an even voting chance. | Heterogeneity, methods for conserving energy, alive and deceased the nodes, |
| T. Shah,et al. [8] | EESAA | Routing protocol based on sleep aware and awake method designed for WSN | Energy efficiency and dead nodes, throughput |

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## VI. RESULT

According to the analysis, Table 3 contrasts renowned methods and provides a summary of the network at the time. Any protocol has advantages and disadvantages of its own, thus for greater variability it is important to raise the FND and lengthen the duration of the WSN.

**Table 3. A Rough assessments of routes**

| Protocol | Fastest node to die delay (FND) |
|---|---|
| LEACH | Earliest |
| SEP | Intermediary (more advanced than LEACH) |
| E SEP | superior to SEP |
| DEC | Better than E SEP |
| EESAA | Intermediate then DEC |

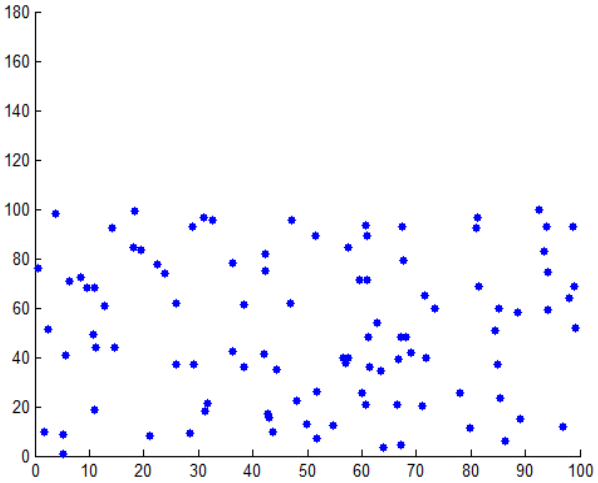


**Fig.5. Assignment of assigned group heads following transmission of 8000 messages and 200 lo**

Figure 5 illustrates the validation of the basic node distribution for the 100 randomly selected nodes.

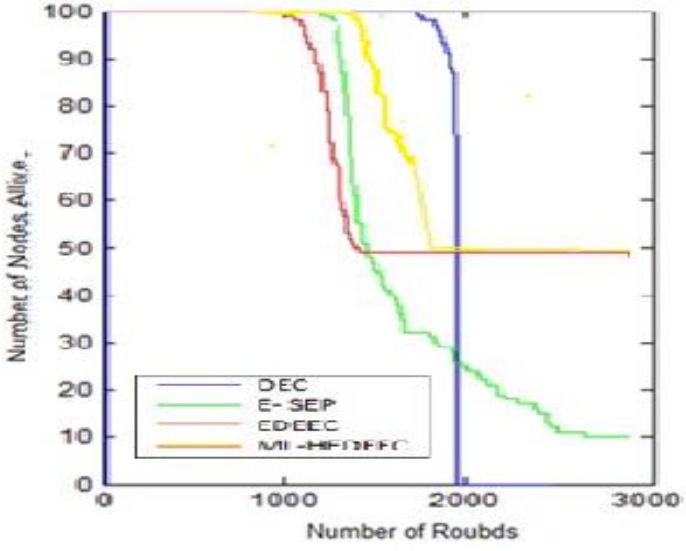


**Fig. 6 Comparison of the protocols performance for 300 rounds as validations**

Figure 6 displays the results of the routing protocol performance for active nodes. Although the stability period of DEC is longer, it can be seen that the EEFED protocol outperforms the other routing protocols because all nodes perished more quickly when the first node died in DEC. As a result, the EDEEC performs better than all other protocols overall.

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## VII. CONCLUSION AND FUTURE SCOPE

For the purpose of tracking soil parameter changes, the wireless sensor network is crucial. This study studies and reviews a variety of routing approaches in light of these challenges. Additionally covered were the value and restrictions of data aggregation. The basic architecture of WSNs based on IOT networks is discussed in the paper, along with a classification of IOT-based WSN communication technologies. There is discussion of several protocols design approaches that use flat, hierarchical, combined hierarchical, aggregation, but also chain oriented protocols. These protocols are compared based on many performance indicators, including network delay, throughput, overall success, latency, energy consumption, as well as network longevity. Consequently, each protocol has pros and cons of its own. According to the findings of the confirmation, EDEEC does better overall when thinking of its network life. But a longer WSN lifespan is necessary to create better variability.

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