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A Fuzzy Logic Energy Efficient Cluster Head Selection for Wireless Sensor Network-Based Smart Agriculture Systems

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ABSTRACT: The advancement of high-resolution satellite and drone imagery, as well as the Internet of Things (IoT), has brought changes to remote sensing in agriculture. This has improved accessibility and frequency of innovation. The latest intelligent agricultural systems that are based on IoT use wireless sensor networks (WSN) to gather information about the ecosystem that regulates the amount of water in agricultural fields. One of the functions of these systems is to collect data through small sensor architectures that are stacked together to bring efficiency and scalability to the network. However, creating a protocol for selecting an effective leader is challenging. The computing capacity, storage capacity, and energy source of sensor nodes prevent them from switching to a different cluster regularly. The WSN cluster-head voting procedure requires a lot of energy. Therefore, it is crucial to evaluate and compute to select the most appropriate node with the least impact on network fragmentation in the energy consumption of the selected node. The next step is to design a system that allows WSNs to communicate with distant sensing sources while using the least amount of energy possible. In this research, a cluster election method based on a fuzzy logic inference system is presented.

KEYWORDS: Clustering, fuzzy logic, decision-making process, smart agriculture, networked devices, and WSN.

I. INTRODUCTION

In To ensure efficiency and sustainability in agricultural yields, remote sensing is extensively used in smart agriculture systems. These systems consist of advanced communication tools that help farmers increase their agricultural output. Smart farm systems include sensors, actuators, and autonomous aircraft vehicles. Sensors are installed on agribusiness farms to monitor changes and patterns. These devices communicate with each other through wireless technology. A wireless sensor network (WSN) is an essential component of a smart farm system. WSN is extensively used for surveillance and monitoring purposes. It is widely used to track temperature, pressure, and climate.

WSN does not have an external power source, and its sensors rely on their internal power. As a result, they are difficult to replenish or replace. This is a significant factor to consider when using WSN. However, efforts have been made to address this issue. Due to the complexity of WSN nodes, their computing capacity and size are frequently constrained. However, energy usage can be minimized or compensated for to the best of our abilities.

II. RELATED WORK

[1].Fuzzy logic based maximum power point tracking technique for a stand alone wind energy system.

The development of a straightforward and trustworthy maximum power point tracking method (MPPT) for a standalone wind energy system using fuzzy logic is described in this article. A sensor less wind rotor, a PMSG (permanent magnet synchronous generator), a three-phase bridge rectifier, and a DC-DC boost converter are all components of the device.

The MATLAB/Simulink simulation findings demonstrate that the suggested MPPT technique consistently generates the highest output power corresponding to the wind speed..

[2].Smart Agriculture: IOT based smart sensors agriculture by Anand Nayyar and Er.Vikram Puri, November 2016
The Internet of Things (IOT) technology, which has made every part of the life of the average person clever and intelligent, is discussed in this piece. The term "IOT" describes a collection of interconnected devices that can self-configure. The emergence of IOT-based farming smart devices is gradually altering the way food is produced, making it less wasteful and more cost-effective while also increasing efficiency. This publication's goal is to suggest a new intelligent agriculture model based on IOT, which enables intelligent agriculture and enhances total yield and product quality by assisting farmers in obtaining real-time data (temperature, soil moisture) for efficient environmental tracking.

[3]. Application of fuzzy logic in transport planning

When it comes to modeling traffic and transportation systems that are susceptible to subjectivity, ambiguity, doubt, and inaccuracies, fuzzy logic has proven to be a very hopeful mathematical strategy. A thorough analysis of fuzzy logic systems created to address of various traffic and traffic planning issues is given, as well as the primary goals of fuzzy logic. We stress the value of using fuzzy logic systems as all-purpose approximation systems to address transit and traffic issues. This paper analyzes the outcomes of using fuzzy logic to model intricate traffic and transit systems.

III. METHODOLOGY

EXISTING METHOD

A PSO-based cluster selection method Not taken into account was efficacy in dying networks. The choosing of a fuzzy-based cluster leader is heavily influenced by the distance between the nodes. Fuzzy logic is used in large-scale networks to identify a cluster head Limit in leftover energy and network lifetime. The cluster head distance from a base station is not taken into account in PSO-C based optimum cluster head portions. The energy centre determines the strategy for allocating network resources to CHs.

PROPOSED METHOD

This paper develops an automatic WSN-based irrigation device for coriander fields. The region is split up into several segments with similar sizes. The coriander planting land under consideration spans roughly 1 Acre. An IR sensor is attached in each region among the different plants, in one of the plants, in one of the leaves. The IR sensors keep an eye on the plants' moisture levels. As a result, n sensors have been placed throughout the complete region. Each sensor has an RF emitter and receiver device attached to it. The TX and RX components, as well as the sensor, are battery-operated. A pair of thermistor is also placed close to the moisture sensors and the TX RX devices to measure the temperature in the vicinity of the plants. A central control device receives the moisture and temperature data.. Each section of the coriander patch has a water flow control spigot beside it. A remote master control system device can regulate the flow control valve's degree of opening. The main management system receives the data sent by the WSN, runs an optimization algorithm, and decides based on the information gathered. The choice pertains to how far the different water flow control devices are opened.

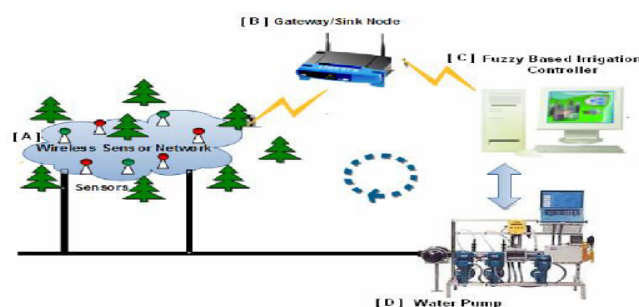


Fig 1 Proposed method basic block diagram

IV. FUZZY ALGORITHM

Proposed Fuzzy -Logic based cluster -head selection algorithm

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Input ← Non -cluster head WSN
Output← Cluster-head WSN
Cluster Head ← empty
# All parameters are included
# In the beginning, nodes are chosen as the cluster head in random order
Start Advertising stage
    R← Rand (0,1)
    If (R<T(N)), Then the node selected as Cluster Head
    # Each node selected as CH with P probability
    broadcast message ()
    Start Cluster formation stage
    Each node joined to a cluster
    Each Node join -request message (Join -REQ) to cluster head
Start Forming stage schedule
    Cluster Head (X) ← Data of Cluster nodes
    Cluster Head broadcast advertising
Start data transfer stage
    Data transfer begins
    If (Radio equipment non-cluster== False) Node turn off
    Else
    Data transfer continue
    the fuzzy system calculates the number of step messages
    (Nodes to CH.)
End
    
```



Fig 2 Master control unit

V. INTERFACE WITH THE COMPUTER

The link between the computer and the master transceiver device is a crucial part of the suggested system. The computer is used to operate the main transceiver device. The computer's USB interface is used to establish a link between the computer and the master control transceiver.

An embedded PIC micro processor of type PIC 16F877A is found in the master transmission unit that is computer-controlled. This micro controller takes instructions from the computer and sends them via the transceiver to the distant devices. The data gathered using the master transmitter is entered into the computer by the same PIC micro processor.

The PIC board's RS 232 interface facilitates communication with the PC. Connectivity between the PC and PIC chip is established using a USB to RS 232 converter. The prototype board for a PIC microcontroller used in this study is depicted.

The PIC development board is a multipurpose development board, as shown. The picture clearly shows the RS 232 serial interface, which is used as the PC's communication terminal.

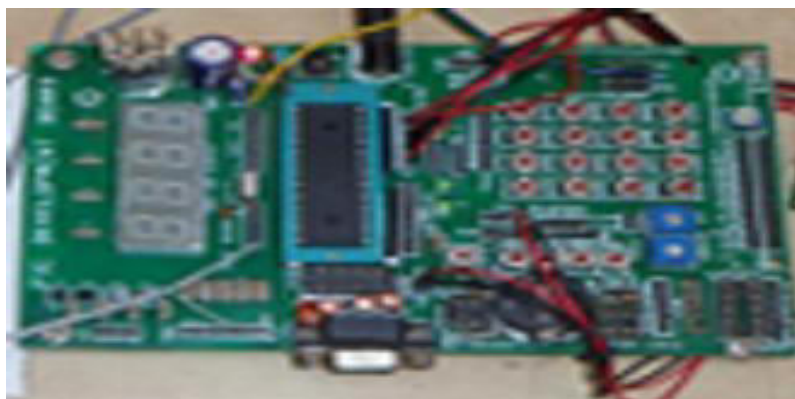


Fig 3 PIC development board

40 PV modules make up a solar PV field that is taken into consideration. These images are all linked together in a sequence. The PV panels may experience various solar insulations caused by natural phenomena like clouds, partial shading produced by shades of birds, etc., depending on the extent of the region where they are distributed. A WSN is used to track the solar insulation dropping on the 40 panels, and a shared master processor receives the data. The master controller uses a neural network to determine the ideal voltage that should be kept across the PV farm's connections. A Sliding Mode Controller integrated into a DC to DC converter maintains the output voltage recommended by the ANN. For this, the Positive Output Luo Converter is employed. A three phase inverter's DC lines receive the output of the POLC. The converter used by the inverter to supply electricity to the grid. The specifics of the SPV farm and how training data is created have already been covered in this thesis' prior chapter. The following suggested system components are given along with their outputs.

The block schematics in the MATLAB SIMULINK environment of the fuzzy logic

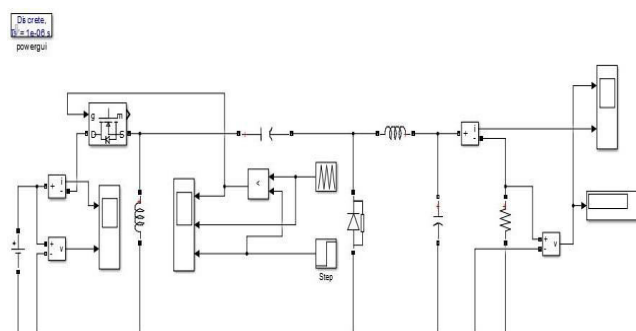


Fig 4 MATLAB SIMULINK

The effects of variations in solar insulation on the amount of electricity collected are displayed. The MPPT application in the MATLAB SIMULINK system using the Sliding Mode type Experimental results

Compared to other conventional systems of fixed time watering systems typically used in many areas of India, the suggested system can help save and preserve water. The second benefit is that the suggested data transfer scheme only transmits those particular physical parameters that have changed from the prior cycle of measurement cycles. Thus, data transfer uses significantly less electricity. The main benefit of this method is that plants receive the ideal amount of watering, which results in water savings. In addition, the plants are kept at the proper moisture level through tracking of temperature and hydration.

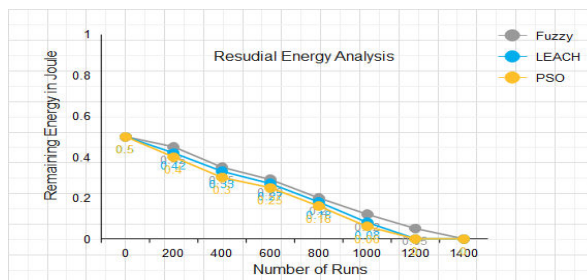


Fig 5 Residual energy analysis



Fig 6 Number of live nodes

VI. CONCLUSION

This article provides information on how the solar power gathering system and the coriander plant watering systems were implemented. These two systems are comparable in that they both rely on wireless sensing networks for support. The Solar MPPT system and the Plant Watering System both use the critical data that is brought in by the wireless sensing network to inform their respective decision-making processes. Additionally, it has been demonstrated that the strategy of delaying data transmission until a parametric value change results in a substantial reduction in the overall power consumed by data transmission in virtually constantly needed WSN systems.

VI. FUTURE SCOPE

This study project presents uses of a wireless sensing network for watering the coriander field in the proper amounts at different places throughout the field. The approximate mathematical model has been created in this study. To determine which valves should be closed or opened, and if opened, how much, a particle swarm optimization method has been used.. The amount of moisture in the leaves and the local weather serve as cues to the decision-making process in this study. Throughout the entire area, a number of devices have been spread. The wireless sensor network receives the signals, which are then passed on to the shared controller device. The shared control unit determines the valve opening levels of several valves dispersed throughout the entire area using this data and an optimization method.. Simulation and actual testing have shown that the suggested method of watering the coriander area is more effective, consistent, and cost-effective. Given that the transmitters only operate when the metric being measured is above a certain threshold, the suggested approach has significantly reduced the overall energy usage in terms of the power used by the transmitters. Since the plant moves slowly, the receivers' power consumption is higher.

REFERENCES

- Zhang, X., Davidson, E. A, "Improving Nitrogen and Water Management in Crop Production on a National Scale", American Geophysical Union, December, 2018. How to Feed the World in 2050 by FAO.
- [1]. Abhishek D. et al., "Estimates for World Population and Global Food Availability for Global Health", Book chapter, The Role of Functional Food Security in Global Health, 2019, Pages 3-24. Elder M., Hayashi S., "A Regional Perspective on Biofuels in Asia", in Biofuels and Sustainability, Science for Sustainable Societies, Springer, 2018.
- [2]. Zhang, L., Dabipi, I. K. And Brown, W. L., "Internet of Things Applications for Agriculture". In, Internet of Things A to Z: Technologies and Applications, Q. Hassan (Ed.), 2018.
- [3]. S. Navulur, A.S.C.S. Sastry, M.N. Giri Prasad, "Agricultural Management through Wireless Sensors and Internet of Things" International Journal of Electrical and Computer Engineering (IJECE), 2017; 7(6) :3492-3499.
- [4]. E. Sisinni, A. Saifullah, S. Han, U. Jennehag and M. Gidlund, "Industrial Internet of Things: Challenges, Opportunities, and Directions," in IEEE Transactions on Industrial Informatics, vol. 14, no. 11, pp. 4724-4734, Nov. 2018.
- [5]. M. Ayaz, M. Ammad-uddin, I. Baig and e. M. Aggoune, "Wireless Possibilities: A Review," in IEEE Sensors Journal, vol. 18, no. 1, pp. 4-30, 1 Jan. 1, 2018.
- [6]. J. Lin, W. Yu, N. Zhang, X. Yang, H. Zhang and W. Zhao, "A Survey on Internet of Things: Architecture, Enabling Technologies, Security and Privacy, and Applications," in IEEE Internet of Things Journal, vol. 4, no. 5, pp. 1125-1142, Oct. 2017.
- [7]. hi, X.; An, X.; Zhao, Q.; Liu, H.; Xia, L.; Sun, X.; Guo, Y., "State-of-the-Art Internet of Things in Protected Agriculture", Sensors 2019, 19, 1833.
- [8]. O. Elijah, T. A. Rahman, I. Orikumhi, C. Y. Leow and M. N. Hindia, "An Overview of Internet of Things (IOT) and Data Analytics in Agriculture: Benefits and Challenges," in IEEE Internet of Things Journal, vol. 5, no. 5, pp. 3758-3773, Oct. 2018.

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