

# Dynamic Cluster Head Selection Mechanism with Wireless Sensor Networks for Irrigation Application

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**Abstract:** A wireless sensor network is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. The components are selected, which is depends on agriculture application. The WSN node is used for sensing, processing and communicating. These nodes are cluster head and slave. The need of protocol is to define rules for each step and process during communication. The protocol is set of rules. The main job of protocol in our project work is to maintain the lifespan of WSN nodes. In this proposed work, arduino based WSN node system are designed and developed for experimentation. The sensor such as moisture, temperature, humidity and light are used for agriculture application. The data collected from these sensors are stored in memory and transferred to PC using RF modules. A technique based on modified LEACH protocol is used to maintain store energy in WSN nodes. This in turn, enhances the lifespan of cluster head WSN node. The sensor nodes are powered by rechargeable batteries. This system will help farmers to monitor their crop with performance parameter measured and displayed. It will enhance productivity of crops.

**Keywords:** Wireless Sensor Network; Modified LEACH Protocol; Cluster Head

## I. INTRODUCTION

The wireless sensor network has become most important area of research. WSN is collection of nodes, the sensors consist of processing capability. The node consist of microcontroller, CPU, may contain memories, have a power source, some sensor and have a RF transceiver. The WSN carry the information, which is gathered from monitoring field. The sensor node is placed in farm for gathering the information in the farm. India is an agricultural country. An India worldwide rank is at second number in farm output. At present, farmer manually irrigates land at regular interval. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. The proposed work based on WSN, increase the productivity of crops, by dynamically adopting the cluster head mechanism to monitor and control the sensor parameters. The content of water is one of the factor that affect the quality of crops, also called as soil moisture. The plant can observe the water, when the soil moisture is optimum for growth of plant. The need of irrigation schedule is to meet increasing demand of food. The modern intelligent agriculture use wireless transmission for monitoring other agriculture parameters such as temperature, humidity, LDR, and moisture content in soil. The ATmega328 is microcontroller, which is commonly used in many applications as well as in systems where a simple low powered, low cost microcontroller is needed. The microcontroller connected with PC via USB. The Arduino UNO can be powered through USB connection or with external connection and all the sensors are connected to Arduino microcontroller for collecting and monitoring the data. . Sensor provides benefits. They can help to increase productivity, enhance security and enable new application [1].

The main purpose to use LEACH protocol is to maintain energy of nodes, which is based on request response protocol. In this proposed work the cluster head is selected, which is based on battery voltage of slave nodes.

**Static and Dynamic WSN Node:** The number of slaves in the network increases the transmissions via cluster head increase and the battery voltage of cluster head diminishes more quickly. As soon as the cluster head battery discharges the whole network transmission terminates, the cluster head is static. The Cluster head is dynamically selected depending upon battery voltage. So as the number of slaves in the network increases the transmissions via cluster head remain fairly constant since the cluster head is dynamically changed and the battery voltage of cluster head remains constant. Here the cluster head keeps changes so the network life remains fairly constant even though the slaves increase.

**Objectives:** The wireless sensor network plays an important role in agriculture. Arduino based WSN system is designed for monitoring agriculture based sensor parameter. The sensors such as moisture temperature, humidity, light are selected, based on agriculture requirements. The data collected from these entire sensors are stored, analysed and transmitted using RF modules.

The objectives of our project:

1. To study WSN nodes and sensor operation for agriculture domain.
2. To design and developed WSN based system as Master and Slave.
3. To configure modified Leach protocol for selection of cluster mechanism.
4. To test the system for enhancing the lifespan of WSN nodes, that means changing the cluster head from one slave to another slave.

## II. RELATED WORK

The literature survey contain idea of various LEACH protocol. Which all are depends on different parameters such as distance location. The hierarchical protocol is based on grouping of nodes into cluster, the most important purpose behind hierarchical routing is the sensor nodes communicate directly with leader node in their own cluster refered as cluster head[1].

The modified LEACH protocol is based on battery voltage of slave nodes. The modified LEACH protocol is extension of LEACH protocol for wireless sensor network to maintain lifetime of network as comaperd to staic WSN nodes MODLEACH protocol [2] is extension to LEACH to increase lifetime and capacity of network for wireless sensor network. MODLEACH is variant of LEACH that can utilize in other cluster routing protocol for better efficiency. The cluster head only is replaced in MODLEACH, when its energy decrease lowers than threshold. The double transmission power stage also introduced by MODLEACH.

LEACH-R protocol [3] was proposed, which is based on LEACH protocol. This algorithm sends data in multihop way to enhance the network lifespan as compared to LEACH. The selection of cluster head is improved by LEACH-R protocol. In DBES-LEACH protocol [4], two new distance based routing protocol proposed which are DB LEACH and DBEA LEACH. The cluster head is selected according to the position of sensor node to the base station.

In GCMRA [5] protocol, in this proposed work observe hot spot issue and present grid based clustering together with routing algorithm. The protocol is technique based on location, the entire area is split into section, nodes in each section consider as a cluster.

EAC [6] has introduced two main factors distance and energy. A cluster head is selected according to rest energy of node and other nodes select their cluster head based on their cluster head. Cluster head generate TDMA schedule and send plan to cluster member.

## III. PROPOSED SYSTEM

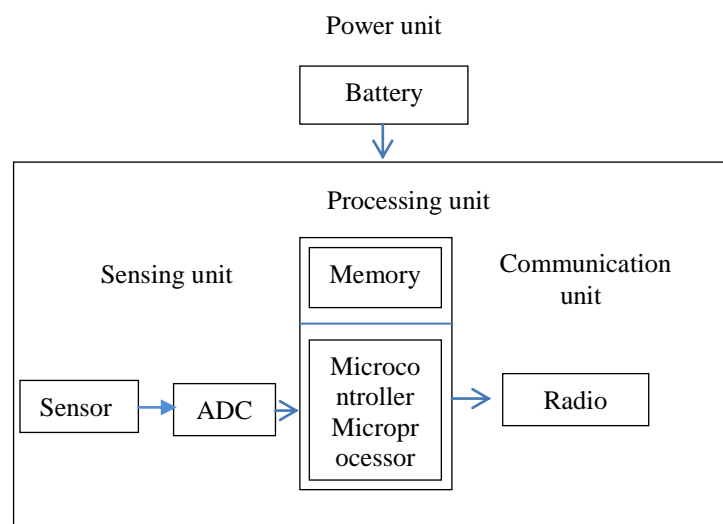


Fig.1 Sensor Node Structure

The modified LEACH protocol is set of rules, which is LEACH protocol extension. As shown in fig. 1 sensor node consists of sensing unit, processing unit, and communication unit. In our proposed work some sensors are connected to ARDUINO  $\mu$ C, such as moisture, Temperature, Light sensor and humidity sensor. These sensors are utilized to check the environmental reading. The sensors are connected to the inbuilt 10 bit ADC of ARDUINO  $\mu$ C. The analogue reading is converted to digital form. It is saved in the internal RAM memory of  $\mu$ C, also sending the data to remote server using RF module. The cluster head collect the data from its member, and collected data is forwarded to sink node. The cluster head have a more workload than its member node, so cluster head consume more energy than its member node. The cluster head workload is distributed among all nodes in wireless sensor network. The sensor node, which may be cluster head or slave node.

**Master:** The designing a remote farm server, having a graphical user interfaces to display all the data from the slaves in the respective columns. The server will communicate with the slaves using RF trans-receiver. The protocol used is the Modified LEACH.

**Slave:** The slave node consist of sensing unit such as moisture, temperature, humidity sensors, processing unit such as microcontroller with memory and communication unit such as RF module. The slave node become cluster head, as the slave node battery voltage is greater than the previous cluster head node.

Network structure for LEACH protocol:

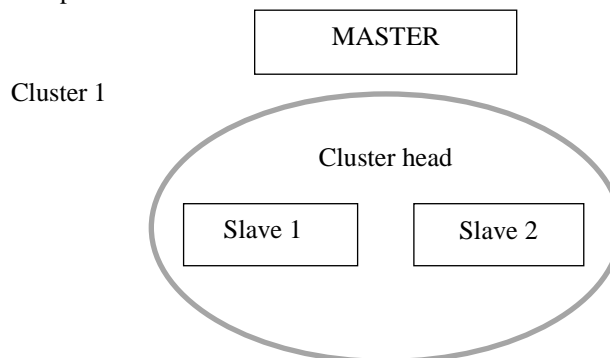


Fig. 2. Network Structure for LEACH Protocol

The master select cluster slaves, and cluster head communicate with each other using request and respond protocol. The inter cluster communication is based on time division multiple access.

- **Algorithm of Master**

```

Start
Select serial port
Load Main form
“A”
  Is time = 5 seconds? N → “B”
  Y → Send Request to cluster head (*P)
“B”
  Is data received? N → “A”
  Y → Store the received data in buffer
  Display the parameters on GUI
  Is Slave1 Battery voltage > Slave 2 Battery
  voltage? N → cluster head = 1 → “C” Cluster
  head=2
“C”
  Send cluster head request to WSN *C(1/2) → “A”
  
```

- **Algorithm of Slave**

```

Start to initialize LCD
Display project name
“A”
  Is time = 1 second? N → “B”
  Y → Read all the sensor parameters one by one
  Store in  $\mu$ C RAM
  Display on LCD
“B”
  
```

Is Data received ?N→”A”  
**Y**→ **Is frame =\*P** ?-->Y→ IS Cluster head= MYID ?  
 Y→ Send data to PC (CH + slave data)→”A”  
**N**→**Is frame = \*C?** → N→”D”  
 Y→ Is MYID =cluster Head → Y→ Change status  
 from CH to slave →”A”  
 N→ Change Slave status to Cluster head →”A”  
 “D”  
**Is frame = \*R** → Y→ Is MYID =slave→Y→ Send  
 OWN data to CH→”A”  
**N**→**Is frame = \*D**→ Y→ Is MYID =CH →Y→  
 Save Slave data →”A”

**Modified LEACH protocol:** In Leach Protocol the Cluster head has to communicate both sides that is collect data from Base stations and transmit data to Master. Due to this the Cluster head uses more energy than the Cluster slaves. Send battery voltage of cluster head as well as the cluster Slaves to the Master. If the Cluster head’s Battery is draining fast then the new cluster head is selected into the cluster that has the most energy level (Battery voltage). So, because of this there is a balance between energy levels along with all the nodes in the cluster. This technique helps in maintain an Energy balance through which the network life increases.

#### IV. EXPERIMENTAL SETUP

The display unit plays important role between human word and machine word to establish good communication. Arduino is interface with 16 Character and 2 Line display on LCD display.The character is display on LCD display. The sensor such as moisture, temperature, humidity, LDR is interface with arduino for displaying results, which display the environmental real time value.

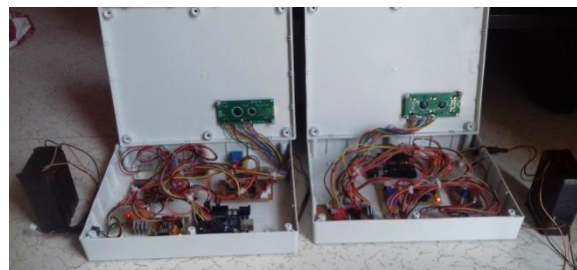


Fig.3. Experimental Setup

The experimental setup contain slave node. The two same same slave node are used for experimentation. The cluster head may be from these two slave nodes and it is changed, which shows with the help of visual basic.

#### V. RESULT

Cluster head is dynamically selected depending upon battery voltage of salve nodes. So as the number of slaves in the network increases the transmissions via cluster head remain fairly constant since the cluster head is dynamically changed, so the battery voltage of cluster head remains constant.

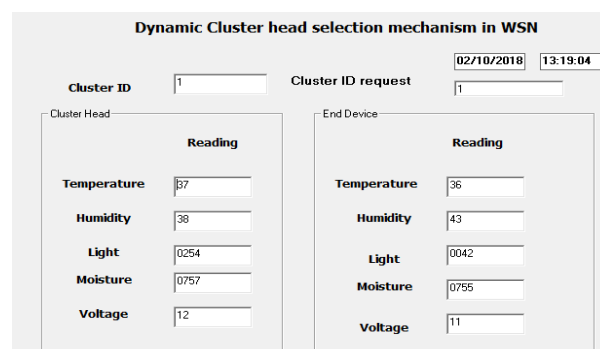


Fig.4: CH = 1

The CH keeps changes so the network life remains constant even though the slaves increase.

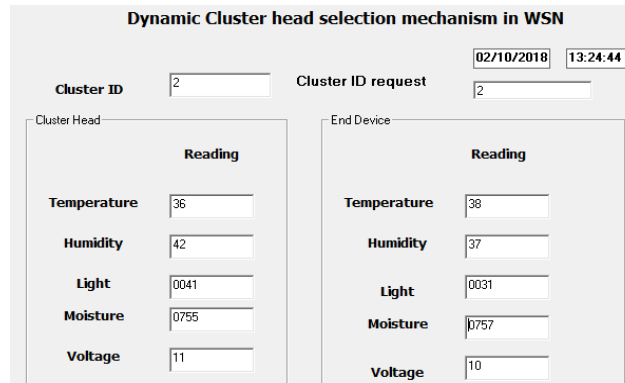


Fig.5: CH = 2

The cluster head is changed, which is depends on the battery voltage of the slave. The slave, which has more battery power will become a cluster head.

## CONCLUSION

This paper use wireless sensor network based system to collect real time data from nodes and transmit to the base station by using RF modules. The number of slaves in the network increases the transmissions via cluster head increase and the battery voltage of cluster head diminishes more quickly. As soon as the cluster head battery discharges the whole network transmission terminates. The agriculture based parameters are sensed it is received, analyzed and displayed on VB, for monitoring agriculture for increasing productivity of crops. The modified LEACH protocol helps to maintain life time of WSN node as compare to static nodes.

## REFERENCES

- [1]. C. P. WalteneusDargie, "Fundamentals of Wireless Sensor Networks," A John Wiley and Sons, Ltd., Publication, 2010.
- [2]. D. Mahmood, N. Javaid, S. Mahmood, S. Qureshi, A. M. Memon, and T. Zaman, "MODLEACH: A Variant of LEACH for WSNs," in Broadband and Wireless Computing, Communication and Applications (BWCCA), 2013 Eighth International Conference on, 2013, pp.158-163.
- [3]. N. Wang and H. Zhu, "An energy efficient algorithm based on leach protocol," in Computer Science and Electronics Engineering (ICCSEE), 2012 International Conference on, 2012, pp. 339-342.
- [4]. T. G. Nguyen, C. So-In, and N. G. Nguyen, "Two energy-efficient cluster head selection techniques based on distance for wireless sensor networks," in Computer Science and Engineering Conference (ICSEC), 2014 International, 2014, pp. 33-38.
- [5]. S. Jannu and P. K. Jana, "Energy Efficient Grid Based Clustering and Routing Algorithms for Wireless Sensor Networks," in Communication Systems and Network Technologies (CSNT), 2014 Fourth International Conference on, 2014, pp. 63-68.
- [6]. M. Mohamed-Lamine, "New clustering scheme for wireless sensor networks," in Systems, Signal Processing and their Applications (WoSSPA), 2013 8th International Workshop on, 2013, pp. 487-491.