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A Comprehensive Review on Wireless Multimedia Sensor Networks

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ABSTRACT

To improve the production of agriculture and support sustainable development, precision agriculture concept has been introduced. It helps to reserve the resources of planet and to reduce the pollution. Wireless Multimedia Sensor Network (WMSN) helps in real-time decision making with regard to various issues such as choosing the optimum point for harvesting, management of water resources for irrigation, predicting crop yield more accurately and estimating fertilizer requirements. In this paper, a comprehensive review on Wireless Multimedia Sensor Network (WMSN) is done. The different applications of WMSN have been studied such as insects in precision agriculture, the presence of plant disease, etc. The comparison between various WMSN protocols has also been given. Finally, the research gaps have also been formulated.

1. Introduction

Most people are likely to be consistently creating modern advances that allow human to widespread their needs. WMSNs quite region yet, buying executive composing of multifunction alarm system nodes which have been modest more prominent plus converse wirelessly all around reasonably limited distances. The initial elements linked to WMSNs give a boost to adaptability decreasing unique donation inside usable jobs for example battlefields. WMSNs can easily perform a vital role in maximum applications, which includes patient healthiness, checking the environmental remark in addition to also be developing building infiltration surveillance. In due course WMSNs are generally a significant part with the lives.

There are many provisions which can keep back the strength of WSNs to assist different applications including sensor devices and limited battery power. To eradicate the difficulty or to balance the WSN.

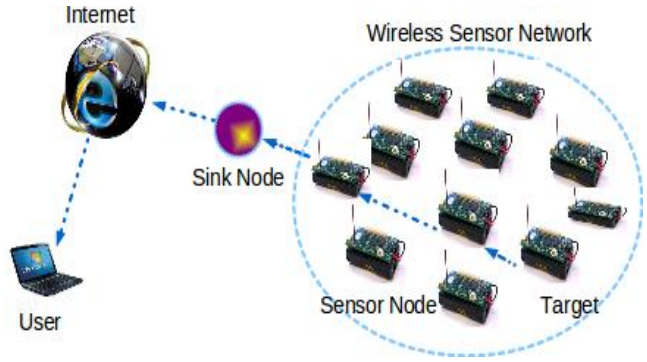

Figure.1: ***wireless sensor network architecture***

WMSN is a wireless group composed spatially dispersed out autonomous instruments by using alerts for us to cooperatively be mindful of physical or environmental conditions, including temperature, sound, anxiety, movements or possibly impurities, from various locations. An everyday WMSN system is created by merging a good number of autonomous versions, plus nodes utilizing routers together with a gateway.

The dispersed technique of calculating nodes communicate wirelessly to a central opening, which provides a link with the reinforced sphere where one can obtain, examine, and in addition to display their particular way of calculating statistics seeing that found during Fig.1. Anyone can utilize routers for getting an additional connection link amongst close nodes and therefore the entry for expansion space gateway in addition to dependability during a wireless sensor network [1].

These wireless sensors are normally networked and scalable, have need of almost not any power. Furthermore it is smart and software programmable, and likewise with the capacity of fast data acquirement, consistent and distinct about the upcoming, however expense bit of to find in addition to mount, as well as nothing maintenance.

2. Clustering

Grouping of sensor nodes into clusters overcomes the drawbacks found in Multi-Hop transmission, Cluster Heads (CHs) performs the task of data fusion and aggregation, thus improves energy consumption. . CHs performs the task of data fusion and aggregation, thus improves energy consumption. CH nodes behave as pathway between nodes and BS. The process of forming clusters consists of two-level hierarchy, where CHs nodes are at higher level and cluster members at lower level. Cluster member send their information to CHs. Then CHs removes the redundant data and sends that information to BS directly or through other CHs. Different algorithms were proposed to decrease energy consumption of sensor. LEACH is well known dynamic clustering algorithm proposed for WMSNs in Ref [1] that assumes all sensor nodes to be homogeneous. LEACH is hierarchal, probabilistic, distributed, one hop clustering protocol designed by Chandrakasan, Heinzelman and Balakrishnan, in MIT to increase the lifetime of WMSNs and to decrease the energy

consumption by uniformly distributing the energy among nodes and by data aggregation. Leach works is designed for homogenous networks (nodes have similar level of initial energy). In it nodes are organized in to cluster. Each cluster has one CH, which aggregates the data and sends to BS.LEACH (Low Energy Adaptive Clustering Hierarchy),.

A. Setup Phase

In this phase the nodes that decided to become TO stage assumes each node to be a Normal Node (NN). The nodes which decide to be a CH is selected using the following criteria i.e. existing CHs percentage.

After CHs are elected, using CSMA (Carrier Sense Multiple Access) CHs broadcasts an advertisement message. During this time period receivers of normal nodes NNs must be kept ON to hear the message. Depending on the signal strength NNs decide to attach with the nearest CH(greater the signal strength closer the node to CH).After clusters are formed, using TDMA protocol CHs assign a particular schedule to nodes i.e. the time period during which node will transfer their data. By doing so helps in saving energy as nodes will keep their receiver ON only during its allotted time slot as well as reduces the problem of collision.

B. Steady phase

Steady Phase is also known as Data Transmission stage. In this phase, during allotted time slot NN sends their data to CH. During this phase CHs must kept their receiver ON to receive data from NNs. After collecting data CH aggregates the data to remove redundancy and sends the data to BS. By aggregating the data helps in reducing energy consumption thus enhances the network lifetime. In spite of these advantages it has certain drawbacks also i.e. there are chances that same node becomes CH as it has more energy and problem of hotspot may occurs i.e. the CH employs more energy than usual alarm nodes

3. Need for energy-efficiency

Energy-efficiency [1] - [4] is a critical style and design function with almost all of the analysis relevant to wireless sensor networks because nodes tend to be cautiously strength governed, and battery power substitution is often never practical. Cluster heads likewise function as synthesis factors intended for aggregation of knowledge, making sure that how much details which is truly carried in order to the base station is definitely reduced. Improving the life with instant sensor cpa networks is vital because sensor nodes with wireless sensor networks to be governed by way of minimal energy. The best way to improve WMSN life is definitely to give energy-efficient project intended for reducing strength conservation. Sensor / probe nodes most often have constrained strength present and they're impractical in order to recharge.

Throughout this, most people Global energy balance protocol, which helps the stable location with regard to clustering bureaucracy method to get a reactive network within homogeneous plus heterogeneous environment. has utilized the initial plus extra endeavors of your nodes to get CH akin to that surrounding LEACH. It doesn't call for virtually any global knowledge of energy during virtually any selection round. When cluster formation is conducted, your CH transmits a couple tolerance values, i.e. ▯▯and ▯▯. Your nodes impression their particular surroundings repeatedly and in case your parameter on the capabilities placed reaches it's ▯▯ cost, your node switches with it's transmitter plus transmits data.

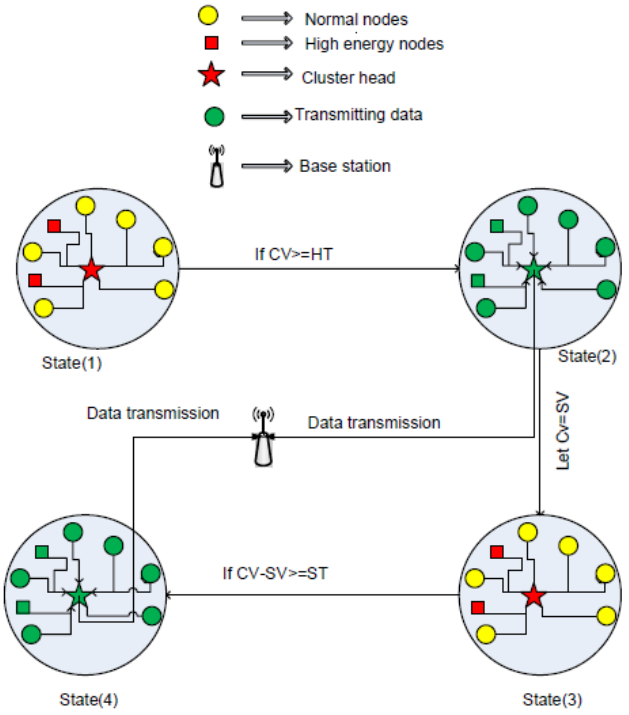

Figure.2: Global energy balance protocol from data sensing to data transmission for a cluster

As soon as CV gets to HT cost, the particular nodes become environment friendly while displayed inside the Figure 2. The node in that case changes for itstransmitter and directs your data towards CH. The CH aggregates and directs information to bottom station. The SV where very first indication occurs can be kept in SV. The node, nonetheless will begin feeling its atmosphere while displayed around State (3) prior to the CV is different from SV by means of what can adequate to or greater than ST. As soon as this disorder results in being correct, the particular node just as before changes for its transmitter and directs information to CH. The CH in that case transmits data to bottom place while displayed around State (4).

4. Literature review

Mottaghi et al. [41] proposed RZ LEACH with mobile sink algorithm. This approach mixed various concepts with LEACH protocol i.e Mobile Sink (MS) and rendezvous point (RP) for enhancing results. Concept of moving sink i.e. MS helps in reducing the transmission distance while RN acts as store point means it will transmit only when MS comes closer to it. The result demonstrates that proposed technique works well especially for large area of networks. Ghotra et al. [43] proposed ACO based RZ LEACH with mobile sink algorithm, which utilizes inter-cluster ACO alongside RZ nodes for transmitting data in WMSN. Addition of ACO helps to find the optimized route for the transmission of data which in turn reduces the distance of transmission; thereby decreases energy consumption of energy. Gu et al. [35] proposes a technique to enhance the lifetime of network having energy

constrained nodes by exploiting the mobility of sinks, which causes delay in collection of information. A unified framework has been developed to analyze joint sink mobility, routing and delay etc. To overcome the problem, solution is generalized and a polynomial-time optimal protocol has been proposed. Sharma et al. [29] has compared some performance metrics like transmission time and throughput for various routing protocols such as EEE LEACH, LEACH and Direct Transmission convention (DTx) in WMSNs. MATLAB is used for this comparison. While comparing we calculate the throughput and transmission time of EEE LEACH, LEACH and Direct Transmission convention (DTx). Among three protocols discussed above, EEE LEACH provides larger time for transmitting data with smaller throughput than LEACH and DTx. Munjal et al. [30] outlines LEACH drawbacks and presents a way to overcome these drawbacks by improving CH selection process. The main issues with LEACH are: it does not provides assurance of even distribution of CHs in WMSNs and assumes that Base Station is fixed, as CH is elected based on the probability or randomly so there are chances that those nodes will be selected as CH whose energy is very low energy and are not fit for large area network as sensors transmit data directly to CHs and then CH transmitted their data to BS using one-hop intra-cluster and inter-cluster topology. These issues can be overcome by improving the process of CH selection using factors like energy and distance. Ji et al. [21] proposes an adaptive clustering hierarchy protocol, to achieve Quality of Services (QOS). In this paper the basic LEACH has been modified and elaborates an enhanced protocol which focuses on enhancing energy efficiency and factors related to QOS i.e. it excludes those sensor nodes from CH participation, which are in improper geographic location. CHs are elected using nodes threshold density that is through the process of nodes distribution and conversation of nodes. By selecting CHs from the area of proper node density leads to the enhancement in both network lifetime as well as communication quality of WMSNs. This approach is quite useful and gives good results in case of uneven distribution of nodes.S. Mottaghi et al. [2015**]** this paper combines the concept of LEACH clustering algorithm, MS and rendezvous factors (RP).By combining the three concept, the proposed approach helps in minimizing energy consumption and work well in case of large networks. In clusters are formed and send data to local CH. In it the concept of moving sink i.e. MS helps in reducing the transmission distance thus reduces energy consumption while RN act as store point means it will transmit only when MS is comes closer to it.Yu Gu et al. [2013] in this paper the various he variable like joint sink mobility, redirecting, and delay are discussed. Then a polynomial-time optimum algorithm has been proposed. The results show the effect of these variables on the network lifetime. Shi et al. (2012) discussed that in LEACH-C algorithm, CHs selection is done random. In it CHs are elected using basic LEACH. A model is created for CH energy consumption. While building a model two factors retransmission and acknowledgement are considered. The quadratic sum of distance between CH with its member nodes is calculated. For next round energy consumption of single CH will be estimated. All the nodes that are having greater residual energy than the estimated energy consumption shall be considered in next round for simulated annealing in order to get optimal solution. By using this approach stability of CHs can be increased. Pantziou, G. et al. [2013] the purpose of proposed work is to reduce energy consumption and is to enhance network lifetime. The proposed work results in reducing network cost and energy consumption related to multi hop information access method, thus enhances network lifetime. The results show the effectiveness and increase in performance of approach. Weifa Liang et al. [2010] in it we study how the concept of mobile sink helps to increase the lifetime of WMSNs. In it author has firstly formulate the problem as (MILP) mixed integer linear programming. The simulation results prove that the proposed approach is optimal.

Table1: Comparison of various clustering protocols

Benefits	Technique	Title of the paper	Author (s)
The proposed approach enhances the lifetime of the sensors and works well in large network.	LEACH has been enhanced by introducing the concept of MS and rendezvous points	Optimizing LEACH clustering algorithm with mobile sink and rendezvous nodes.	Mottaghi, Saeid
In it CHs are elected using basic LEACH. A model is created for CH energy consumption. While building a model two factors retransmission and acknowledgement are considered..	energy-efficiency Optimized LEACH-C	An energy-efficiency Optimized LEACH-C for wireless sensor networks	Shi
Helps in finding optimal RPs.	For RP selection two methods are proposed i.e. Mobile elements (RP-CP and RP-UG)	Rendezvous Planning in Mobility-Assisted WMSNs	Guolia-ng Xing; City
This assures that in case of movement of CH, clusters are distributed minimally as nodes with minimum mobility are selected as CH.	Introduces enhancement of LEACH-mobile that is LEACH-mobile-enhanced protocol..	Mobility Metric based LEACH-Mobile Protocol	Kumar, G.S; Dept
LEACH has been modified and elaborates an enhanced protocol which focuses on enhancing energy efficiency and factors related to QOS	Networking and Mobile Computing (WiCOM)	A low-energy adaptive clustering routing protocol of wireless sensor networks	Ji, P
Among three protocols discussed above, EEE LEACH provides larger time for transmitting data with smaller throughput than LEACH and DTx.	Transmission protocol: a simulation based approach	Transmission time and throughput analysis of EEE LEACH, LEACH and direct transmission protocol	Sharma

It utilizes inter-cluster ACO alongside RZ nodes for transmitting data in WMSN. ACO helps to find the optimized route for the transmission.	ACO based RZ LEACH with mobile sink algorithm	Performance Evaluation of Ant Colony Optimization Based Rendezvous Leach Using For Mobile Sink Based WMSNs	Ghotra,

5. Gaps in literature

By conducting the literature survey it has been found that the every WMSNs protocol has some limitations; i.e. no one is perfect in every case and most of the existing literature has neglected one of the following:

1. The most of the existing researchers has neglected the use of the distance between the sensor node and the base station while selecting the cluster head in WMSN.
2. The optimum numbers of clusters in every round are not consistent in the most of WMSNprotocols.
3. The use of the particle swarm optimization is also ignored in many of the existing protocols.

The majority of existing protocols are proactive in nature, therefore, consumes more energy compared to the existing protocols.

6. Conclusion

In this paper, a comprehensive review of Wireless Multimedia Sensor Network (WMSN) based techniques has been presented. These techniques are related to precision agriculture to improve the production and sustainability of resources. From the literature, it can be seen that WMSN helps in real time decision making with respect to various issues of agriculture such as water resources management, fertilizer management, optimum harvesting, etc. However, WSN cannot meet all the requirements of ubiquitous intelligent environmental event detections such as temperature, soil humidity, air humidity and light intensity are not rich enough to detect all the environmental events such as plant diseases and present of insects. Thus to fulfil those requirements multimedia data is needed. In near future, to improve the lifetime of WMSN using global energy balance protocol and particle swarm optimization. Additionally, existing protocols are proactive in nature; therefore, we will design a reactive WMSN protocol in near future.

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