

An Energy Efficient of Estimation in Wireless Sensor Networks Based On Hierarchical Clustering Algorithm

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Abstract— Different environments supervision and control needs local variables measurements. When the places where these measurements are going to be made are of hard access it is used to use Wireless Sensor Networks (WSN). A hierarchical routing algorithm in two levels is proposed in this work to periodically collect the environment's data. Clusters which headers are rotated to uniform the power consumption are defined in the first level. The environment is divided in a grid which is used to locate the headers and to apply aggregation techniques. An inter-cluster communication structure is defined in the second level. Two well defined rounds are used to send the data to the base station, one to define the enrouting tree and the other to send the collected data. Finally, two kinds of critical network failures are considered: fail in the header election and fail in the inter header communication structure. In both cases solutions are proposed to mitigate the negative effects on the system performance.

Index Terms— Communication Networks, Wireless Communication, Sensor Networks, Routing, Aggregation.

I. INTRODUCTION

In this paper we present a routing algorithm for sensor networks based in clusters, which performs periodic data collection environment. The environment monitor is divided into a uniform grid to locate clusters headers. The algorithm works in two distinct rounds of selection and training of headers of clusters, and other supply information to the base station using some function aggregation. The measurement of environmental variables is essential for monitoring and control environments and activities of diverse nature. In industrial applications is done, medical, agricultural, environmental preservation or creation of intelligent environments, among others. In many of the above applications, the sensing of the variables of interest must be made in remote or hostile environments that make it difficult wiring and routine care of the measuring devices. For these reasons, they have begun to use wireless smart sensor networks (RISI) to obtain the necessary data. The RISI are a particular type of Ad-Hoc networks consist of nodes in addition to collecting data from the environment, are able to process and work with your neighbors to transmit to the / base stations. These networks are self-organizing to adapt to changing topologies, and work under tight restrictions of energy, trying to maximize their lifetime [1] [2]. A RISI performs two key activities to bring relevant information to the base node for the application. The first deals with the sensing and information processing, and the second of the spread of the same network. Both tasks consume energy, which has already mentioned is a resource that must be carefully preserved. It has

been established that transmission consumes most of the available energy, so try to minimize the task of disseminating information by all possible local processing [3]. In this sense, techniques have been developed that allow data aggregation that information processing is performed in a distributed way network nodes. The efficiency and applicability of these techniques depend on the problem to be addressed, so must be carefully chosen and possibly adapted taking into account the work domain [4].

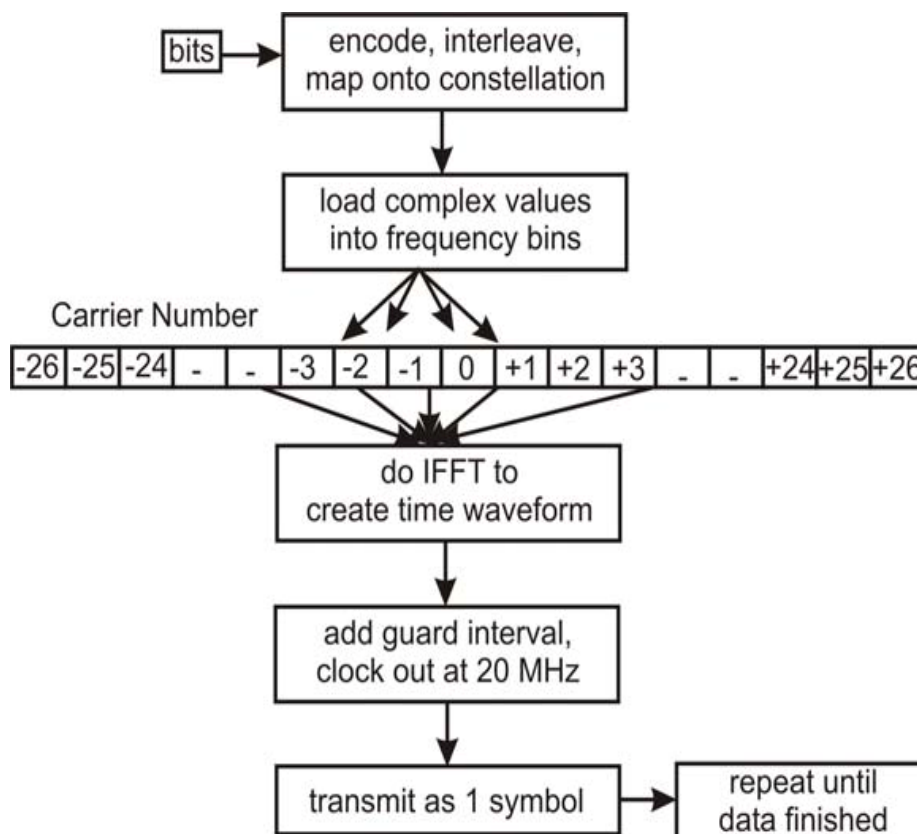


Fig 1. Generation of OFDM symbol

By incorporating aggregation algorithms prolong the life of the network, reducing the number of messages to spread. Reducing energy consumption depends largely on the application to address, as are their characteristics that determine the aggregation function to use. Some applications support simple aggregates such as obtaining maximum, minimum or average. The study of other phenomena in contrast, requires the transmission of values obtained all or most of them. These latter cases are the most challenging when designing any aggregation technique that maintaining the dimensional errors, can effectively meet the requirements of the application [6].

II. SYSTEM PERFORMANCE WITH NON-IDEAL LINK ADAPTATION

The above studies are based are ideal link adaptations. That is, the system can always choose a proper modulation and coding scheme for each transmission block so that the data rate is optimized under constraints of channel conditions. To realize this, we control the input to the link adaptation algorithm as ideal SNR instead of CSI estimation. But in reality, this is not always the case. The CSI estimation error can directly lead to link adaptation error. The system performance when we take into account the influence of imperfect CSI estimation on link adaptation performance.

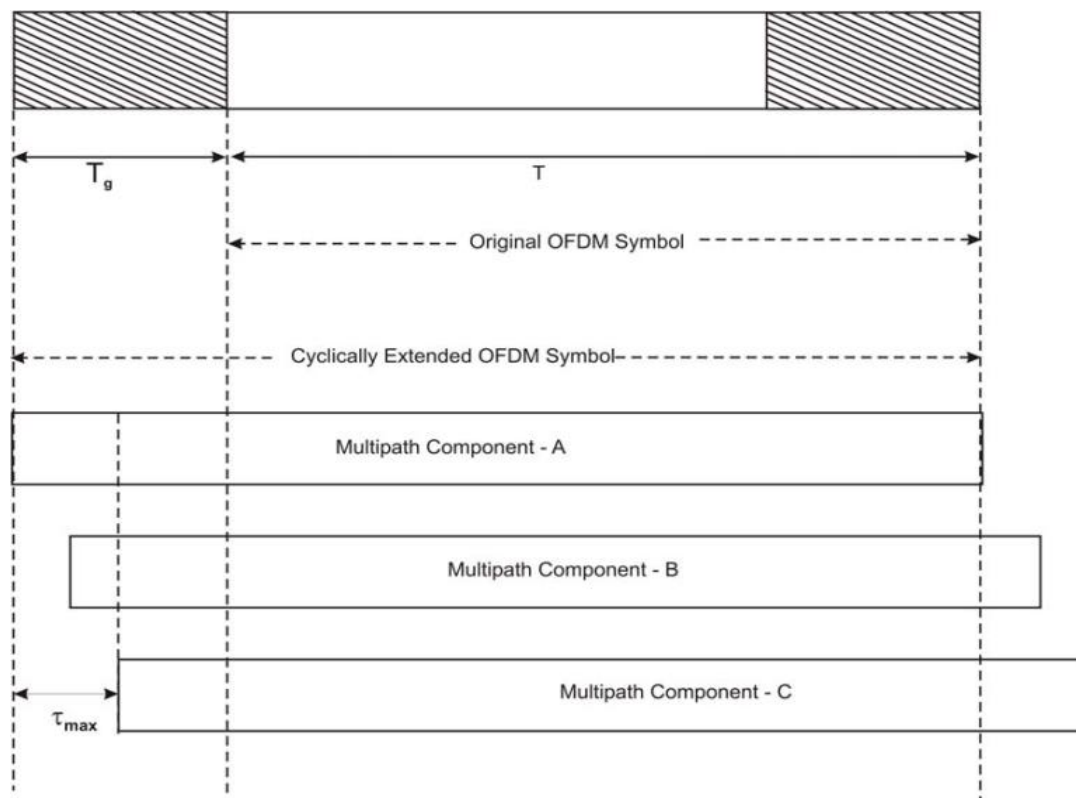


Fig 2. Illustration of cyclic prefix extension.

System throughput and coverage are not affected under PFF scheduling by non-ideal link adaptation. Same situation holds for PFTF accompanied with power control. For PFTF scheduler, both throughput and coverage are harmed. The system throughput is even worse than the situation when less transmission power is invested (power control). And its coverage advantage over PFF is missing. The power control strategy actually affects the scheduling decisions. To fully understand this phenomenon, we need to revisit to the CSI estimation method applied in our study. The CSI value variation in time. The upper picture shows how the CSI value varies for different scheduling and power control schemes. The lower picture displays the corresponding channel fading variations.

III. METHODOLOGY

This paper focuses on applications where it is common to perform periodic data acquisition, in order to maintain a status update on the phenomenon to be sensed. There is talk of "collection rounds or sensing" where nodes obtained values of the variables of interest and transmit them to the base station. These "rounds" are repeated in periods whose duration is determined by the nature of the phenomenon under study. In general, we can classify the periodic aggregation techniques such as [4] [7]. Periodic simple: In this type of algorithms, each node waits a fixed period, add the received data into a single data packet and transmitted. If a node is delayed sending data or fails, your information will not form part of the aggregate sent to the base station. A well-known example is the directed diffusion algorithm [8]. Periodic hopping: In these algorithms, each node knows who among their neighbors will send information (child nodes). Then, nodes aggregate the received data and send when they have collected the information of all her children. In case any child does not report a predetermined waiting period, and if no response is obtained, disseminates the aggregate achieved so far. The algorithm we propose in this work belongs to this category. Hopping periodically adjusted:

These algorithms use the same principle as that of periodic aggregation jump, but incorporate a scheme for the dissemination delays messages, based on the position of the nodes in the distribution tree. The Solis proposed by [7] algorithm falls into this category.

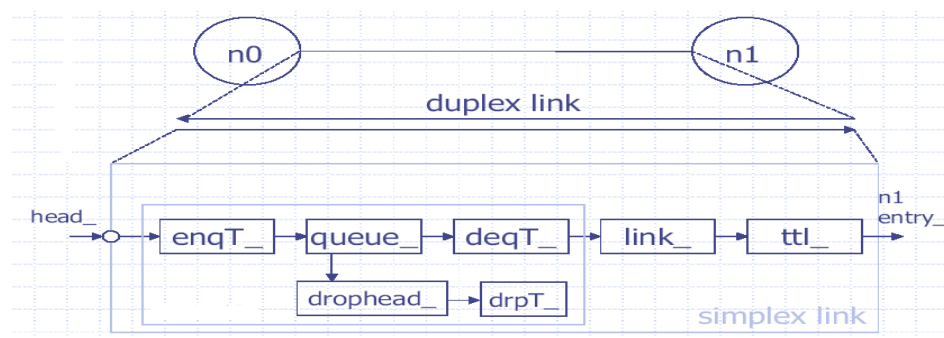


Figure 3. Duplex link structure

The RISI are very densely populated large networks where each node has a number of potential neighbors. It is also customary for the network to be reconfigured small changes in their topology. These features cause problems for Network performance: the probability of interference and the cost rises reconfiguration is high by the existence of a large number of possible routes. Solution to these problems is to limit the number of neighbors, which is known as topology control. One option is to control the topology defined networks hierarchical clusters based on local groups or nodes. For operation of the clusters usually select nodes with known roles as special header (CH). The CH organized communication of member nodes in the cluster.

IV. RESULT

An algorithm has been proposed for periodic measurement of the variables of interest. This type of data collection is widely used in environmental monitoring. In these applications it is often a strong correlation time / space of the variables involved, allowing use aggregation techniques. The use of a grid is proposed to avoid network subdivisions and minimize the number of hops for the data messages. In addition, the proposed cluster header rotation contributes to a more uniform power consumption, prolonging the lifetime of the network. The algorithm does not guarantee receipt of all messages to the base station. However controls two critical points on the shipping, which is the selection of headers and defining the structure of communication between headers.

This control involves incorporating messages that increase network traffic. This increase was deemed necessary since faults in these stages quickly degrade system performance. The performance of the proposed algorithm to be verified by simulation. Are expected to perform this task in order to evaluate its performance corresponds with the analysis. For a single work environment is proposed to compare the efficiency of the proposed algorithm in terms of the lifetime of the network, with respect to an algorithm that does not perform any aggregation. Another simulation is of interest to compare the two approaches raised to the communication structure of headers. Finally, one could vary the size of the defined grid, which would amend the definition of clusters, and consider their impact on network performance. The latter test would be particularly interesting when working with networks of nodes inhomogeneous distribution.

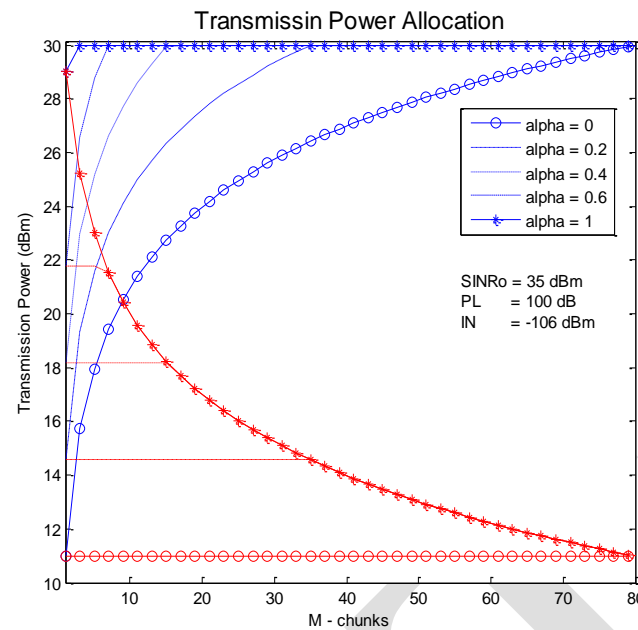


Fig 4. Power per user and power per chunk according to different value of pathloss compensation parameter

During each of the tasks carried out in the two rounds of the algorithm performance, malfunctions may occur. This protocol gives no assurance regarding the arrival of messages to the base station. This approach was adopted as for the type of applications of interest is sufficient to set a threshold that is a percentage of allowable loss measurements, which once exceeded indicates that the lifetime of the network has expired. However, setting the R1 tree routing round are certain errors which occur significantly degrade the network performance. Are regarded as critical failures that occur in the steps of choosing headers and definition of the communication structure of headers.

V. DISCUSSION AND CONCLUSION

Radio resource management is responsible for adapting transmission parameters to ever changing channel conditions in wireless communication systems. For radio management functions to work there's a presumption that we could obtain channel state information accurately. However, due to some factors such as feedback delay, the channel state information can never be ideal. To combat this delay problem and approach as accurate CSI value as possible, there are mainly two ways to get there:

1. Smooth CSI variation in time.

In this case, CSI value obtained from previous measurement is still valid for future transmissions. That is, make the delayed channel state information as valuable as instantaneous one. This is what basically we do in the thesis. But of course, there is another alternative to cope with the feedback delay of CSI.

2. Advanced prediction algorithm

If we can predict future CSI based on previous measurement, we don't have to worry about the CSI variation in that case. This is a very interesting area to be exploited in the future. Wireless mesh networks are a special case of ad-hoc networks. Since they are easy to setup and maintain, and have good scalability, WMNs are potentially a popular wireless-access

method for hospitals, hotels, and conference centers. This paper studies routing algorithms for wireless mesh networks, using diverse routing, which addresses load-balancing and fault-tolerance problems. The gateway's effect on network performance is also discussed.

Future research is needed to integrate routing and scheduling algorithms and study wireless mesh network's performance. The number of gateways and their placement are also significant open problem, with network topology having a great impact on the final results. Particularly, in most papers, symmetric traffic is assumed. That is, all the nodes have similar traffic intensity. This is not the case in most applications, where most users' bandwidth demand is small, while a small portion of users have large bulk- or streaming-data transmission. A measurement study on wireless network's traffic model is needed. The current wireless LAN standards offer very unsatisfactory level of security and one could not truly trust them. When using products based on these standards must the security issues been taken care in the upper layers. The authentication mechanism described in 5.3 may be used over IP to perform end-to-end authentication, as described in [12], but this approach gives a potential launch pad for the attacker. Some commonly used attacks are more stressed in wireless environment and some additional effort should be used to prevent those. The nature of the radio communication makes it practically impossible to prevent some attacks, like denial of service using radio interference. When the wireless networks are used in strategic applications, like manufacturing or hospitals, the possibility of this kind of attack should be taken into account with a great care. As showed in chapter 5 the quite secure wireless LAN is possible to implement with current technology. The current hardware could be used with only some modifications in the MAC layer protocols and over that new MAC the current IP may be used without any problems.

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