**I J C T A**, 9(28) 2016, pp. 417-424


# STUDY OF WIRELESS SENSOR NETWORKS USING JPEG 2000 ENCODER

**K. Raja Kumar* and K. Magesh****

***Abstract:*** In many practical applications, sensor nodes can be used with very small cameras to retrieve the task of tracing a particular object to capture images, or the continuous periodic monitoring of any change in the environment. In addition, due to the high costs involved, most sensors are not used with the Global Positioning System (GPS). Low complexity algorithm in image processing in order to reduce timetransfer of selected data by this way allows saving energy. Most image-based applications consist of a large number of wireless sensor nodes and the source is at least eight hops away from the sink. A multi-hop wireless sensor network that wirelessly interconnected sensor nodes able to retrieve and handle a still image. The proactive routing protocols keep information about all of the routes in the network, thus they are not required. The Destination Sequence Distance Vector routing (DSDV) protocol is an example of this type of protocol. Their operation can be considered as the convergence between the classical wireless sensor nodes and distributed image sensors. After receiving an image request, every image sensor generates a raw image and transmits it to the sink. When sending an image request, the sink specifies the desired image quality. To analyze and compare the experimental evaluation of M-DART, proactive multipath protocol, and AOMDV, reactive multipath protocol using Network Simulator. In the request, the bit rate of a compressed image, the wavelet decomposition level, the PSNR, the quantization level QL and the lifting scheme LS & CR are specified.

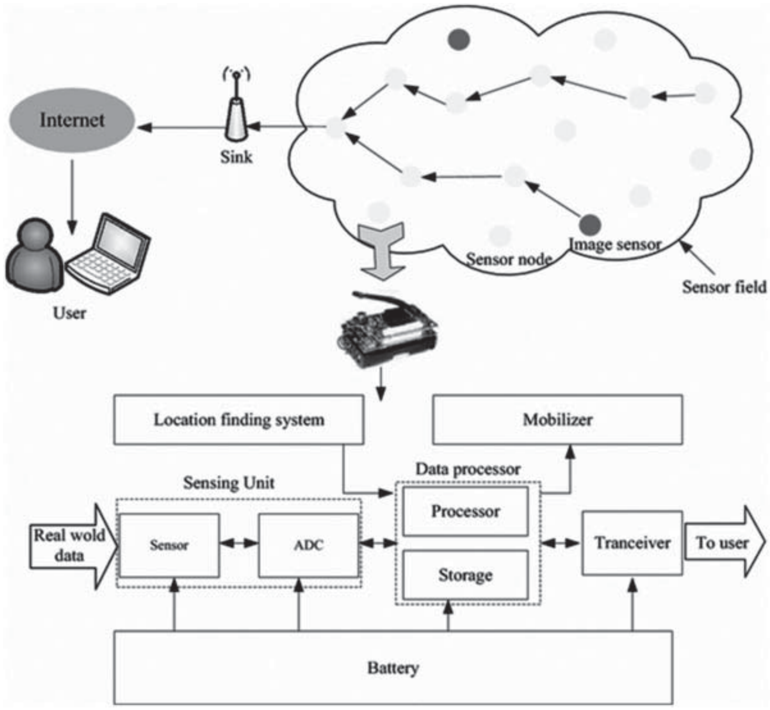
***Keywords:*** Wireless Sensor Networks, Global Positioning System, Wavelet Transform, Quantization Level, M-DART - Multipath Dynamic Address Routing Protocol, AOMDV- Adhoc on Demand Distance Vector Routing Protocol, DSDV - Destination Sequence Distance Vector routing.

## 1. INTRODUCTION

A Wireless Sensor Network (WSN) consists of base stations and a number of wireless sensors nodes. WSNs are ad hoc networks (wireless nodes that self-organize into an infra-structureless network). Wireless sensor networks are widely applicable to many sophisticated military or industrial applications, including environmental monitoring, surveillance, object tracking or health monitoring. Wireless sensor network is a network that consists of many sensing devices that communicate over a wireless channel with the capability of performing data processing and computation at the sensor nodes. In order to maintain connectivity, we offer the sleep AODV protocol . The protocol takes into account the behavior of nodes and the using of camera module in the sensor node.

* Associate Professor, School of Computer Science and Engineering, VIT University, Vellore. rajakumar.krishnan@vit.ac.in

** Research Scholar, School of Computer Science and Engineering, VIT University, Vellore. Email: magesh.k2016@vitstudent.ac.in




**Fiure 1** **Sensor Network Architecture**

## 2. SURVEY ON EXISTING METHODS

The goal of EDAL is to generate routes that connect all source nodes with minimal total path cost, under the constraints of packet delay requirements and load balancing needs ( Meng et al **2015**) Recently wireless sensor network (WSN) has become one of the basic networking technologies since it can be deployed without communication infrastructures (Mohamed El-Semary and Mostafa Abdel-Azim **2013**). A global survey regarding image transmission over WSN, More information's and details(Sarisaray-Boluk. P. 2013). Xiang et al. A new data aggregation technique derived from compressed sensing and minimizing the total energy consumption of a WSN in collecting sensory data from the whole network. Chilamkurti et al **2011**). WSNs are being deployed in a wide range of potential applications scenarios, including forest monitoring, military surveillance, object tracking, traffic control, remote medical systems, and industrial applications (Flammini et al. **2009**). In typical wireless sensor network applications, the energy consumption is the most critical factor because sensor nodes have a very limited energy supply and are expected to operate independently over a long time-period (Liu et al. **2009**).

Its main idea is based on the distribution of the wavelet transform processing workload between various nodes. Two methods for data exchange have been proposed: The parallel wavelets transform method and the tiling method (Lu. Q et al. **2008**). Therefore, extensive research has focused on how to minimize the energy consumption and prolong the network lifetime (Park et al. **2007**). In this method, we consider the data partitioning scheme proposed using the LS 9/7 DWT. An example of distributed cluster-based compression using four nodes in each cluster is shown in. A routing algorithm is assumed to be in place and nodes are self-organized into a two-tiered architecture (Krishnan and Starobinski **2006**).

Research shows that SS is the unique algorithm which presents energy savings with respect to the no-compression case, allowing a power reduction of about 29 % the mechanism proposed(Wu and Chen **2005**).

A scheme based on an SPIHT coding of data blocks generated from parent–child relationships of wavelet coefficients. This parent–child relationship is performed in order to reinforce SPIHT fragilities in bit error transmission cases (Wu and Abouzeid **2004**). In has introduced a power aware technique that incorporates the local compression JPEG2000 standard (Wu. H, & Abouzeid. A. A. **2004**).

Distributed image compression for sensor networks using correspondence analysis and super-resolution. In Proceedings of IEEE International Conference on Image Processing (ICIP'03) (pp. 597–600) Boston: Kluwer Academic (Wagner. R, Nowak. R, & Baraniuk. R **2003**). A distributed image compression for images captured by sensor nodes having overlapping fields of view is considered. The approach uses a technique similar to the stereo-image compression to identify an overlap in the images of neighboring sensor nodes (Boulgouris and Strintzis **2002**). The value of the parameter of the computation energy model (6) is estimated as follows we have employed (Joule Track Sinha and Chandrakasan **2001**).

## 3. IMAGE PROCESSING IN WIRELESS SENSOR NETWORKS

Due to limited battery lifetime at each sensor, it is obvious that reducing transmitted data will increase energy efficiency and network lifetime. However, the most evident solution is the image compression. The purpose of image compression is to reduce the number of bits required in representing image by removing the spatial and spectral redundancies as much as possible. In this paper, the proposed image transmission scheme is based on wavelet image transform. The structure of a transform coder is illustrated in.

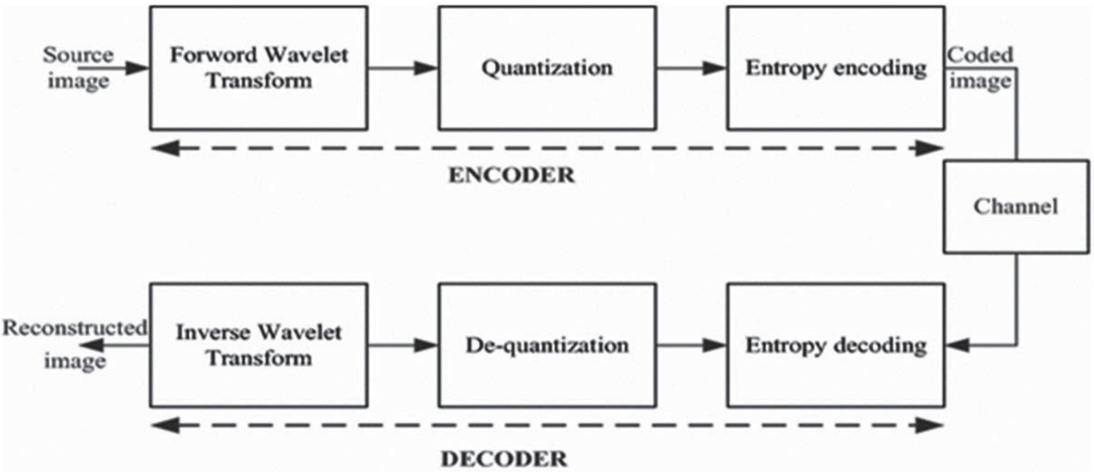



**Figure 2. Functional Block Diagram of JPEG 2000 ENCODER**

The implementation of JPEG Compression for images is typically carried out on raw binary files where each byte represents the intensity of a pixel. The image is split into blocks of 8 _ 8 pixels, and each block of pixels is serially fed into the image compression device in a raster order. The first step in JPEG Compression is the de-correlation of adjacent pixels by converting their intensities to functions frequency through the use of functions. The de-correlated values are represented as coefficients of the same functions and are obtained using the Discrete Cosine Transform (DCT). After the application of the DCT.

The image is represented by parameters that relate to all the frequency components of the original image. The first step in JPEG compression is the removal of high frequency effects through Quantization. Since the quantization process is irreversible, JPEG is a loss compression technique in the sense that some information content in the original image are lost in the compression process. The second step in JPEG compression is the ordering of the quantized data and its encoding to reduce the size of the image. The zig-zag process is an approximate ordering of the basis functions from low to high spatial frequencies.

This mechanism using control frames called RTS (Request To Send) and CTS (Clear To Send). Exchanges RTS/CTS standard combines a reservation mechanism are called Vector Allowance or NAV (Network Allocation Vector).

## 4. CHARACTERISTICS OF WIRELESS SENSOR NETWORKS

Requirements: small size, large number, tether-less, and low cost. Constrained by Energy, computation, and communication. Small size implies small battery. Low cost & energy implies low power CPU, radio with minimum bandwidth and range. Ad-hoc deployment implies no maintenance or battery replacement. To increase network lifetime, no raw data is transmitted.

For wireless multimedia network, sensor nodes are equipped with multimedia devices such as cameras. These devices are smaller, and offer more performances in terms of speed and image quality. Thus such network will have the capability to transmit multimedia data. The most important requirements of image transmission in WSNs are: Image sensing, allocated memory and image processing.

Despite the advantages of wireless sensor network applications, the wireless sensor nodes are limited energy, storage capacity, computation capability, and communication range. Given the stringent resource, WSNs present strong limits for the image transfer because the image based applications represent visual data requires a large amount of information, which in turn leads to high data rate. Therefore, approaches to optimize data transmission and increase network lifetime are useful.

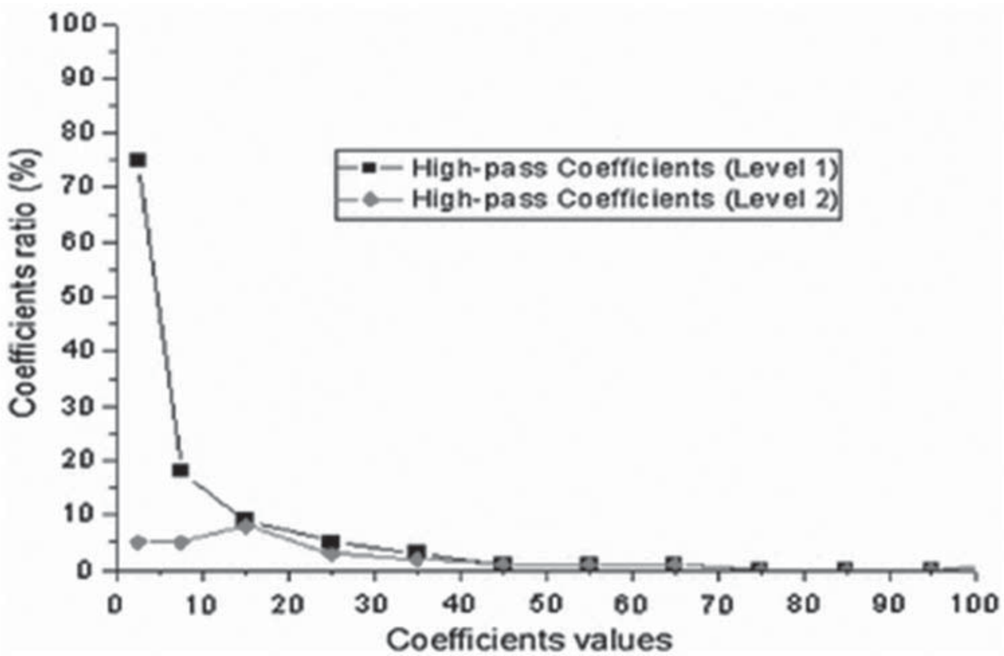



**Figure 3. Decomposition in High Pass Level**

Therefore, an additional decomposition level is useless and will waste energy without extracting more details. This shows that the required number of wavelet decomposition levels in practice is typically small. Most image-based applications consist of a large number of wireless sensor nodes and the source is at least eight hops away from the sink. Thus, at least eight clusters are used. For the reasons above, the sensor nodes located next to the sink are less likely to be overburdened with computational requirements.

The set of member nodes which located next to the sink, the data is in a more compressed form than those towards the source; therefore, the energy cost of these nodes is smaller than the energy cost of previous processing nodes on the path. For the reason the 'last-cluster overload' will not have a significant effect on the system lifetime.

The other high-pass sub-bands (LHiLHi, and HHiHHi) are removed. After one transform level, the image is then processed by applying the 2-D sub-band decomposition to the LLiLLi low-pass sub-band while applying only the LPF in the vertical direction. This process can be repeated up to any level.

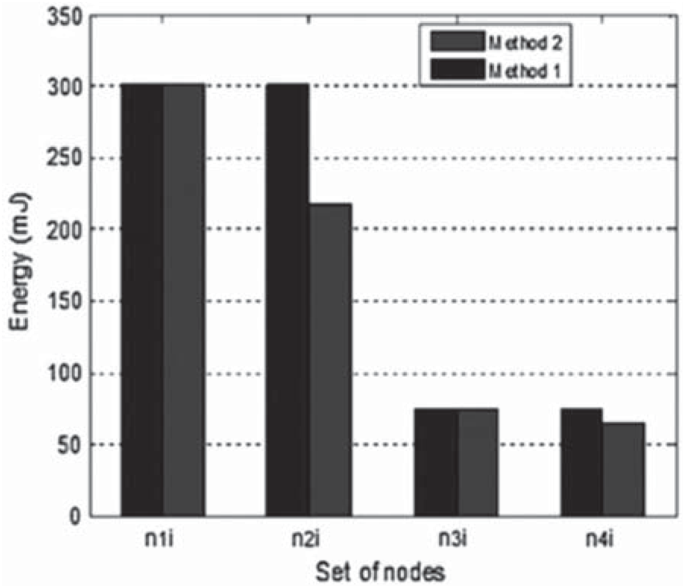



**Figure 4. Computational Energy Dissipated by Every Set of Nodes**

## 5. AD HOC WIRELESS NETWORKS

Large number of self-organizing static or mobile nodes that are possibly randomly deployed. Near(est)-neighbor communication. Wireless connections Links are fragile, possibly asymmetric. Connectivity depends on power levels and fading. Interference is high for omni-directional antennas. Sensor Networks and Sensor-Actuator Networks are a prominent example.

After receiving the results, c4c4 divides quantized sub-bands into a number of smaller code-blocks of equal size and forwards their processed results to set of nodes n4in4i. In these nodes each code-block is entropy encoded independently to provide a sequence of binary symbols.

## 5. LOCALIZATION PROCESS

A localization algorithm localizes sensor nodes based on input data. If there is any anchor available in the network, the most common inputs are the location of anchors. Other inputs are connectivity information for range free techniques, distance or angle between nodes for range based techniques that calculated based on signal modality. Generally, the output of localization algorithm for anchor based techniques is absolute coordinate and for anchor free methods is relative coordinate.

## 6. MDART (MULTIPATH DYNAMIC ADDRESS ROUTING PROTOCOL)

MDART stands for multi-path dynamic address routing protocol based on DHT paradigm, which is used for escalating mobile networks. This protocol originates from DART, a routing protocol. It extends the DART protocol (Single path) by discovering various routing paths from one node to another thereby increasing the forbearance against node's mobility as well as route breakage. M-DART has two important points that need to be considered, which makes it different from existing multi-path protocols.

Firstly, the repetitious route located by M-DART does not need any additional overhead 5 and they are assured to be communication-free and coordination-free. Secondly, M-DART detects each possible superfluous routes that can exist among two different nodes. The key concepts of the DART protocol are discussed below which are essential to understand the M-DART.

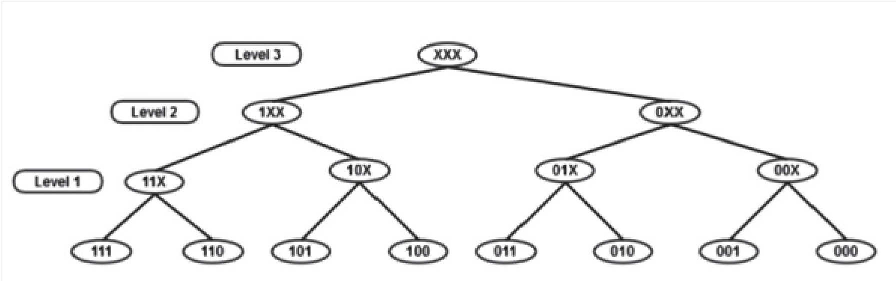



**Figure 5.**

## 7. AOMDV (ADHOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL)

AOMDV originates from an ad hoc on-demand distance vector routing protocol (AODV), a prominent on demand single path routing protocol. AOMDV, extension of AODV11 routing protocol is used to locate various routing paths between two given nodes in each route discovery. Different paths discovered are assured to be loop free and disjoint. For self-organizing or mobile networks where the problem of route breakage and link failures occurs frequently, AOMDV was primarily originated.

AOMDV devise different routing paths to the given destination node in active communication. AOMDV provides loop avoidance mechanism by keeping track of recent routing updates using sequence numbers 8. For mobile networks AOMDV is very helpful as it can react quickly to the link breaches and changes in network topology.

Communication between nodes using AOMDV protocol requires Route Request (RREQ) message, Route Reply (RREP) message and Route Error (RERR) message to locate routes. Else if no route or alternative path to the destination is reachable, it conveys RERR message backward to the upstream sensor node. AOMDV routing table entry consists of 5 fields, which are, Destination address, sequence number, advertised hop count, to store multiple route entries 8, next hop field, to define multiple next hops with relevant hop counts and expiration time out.

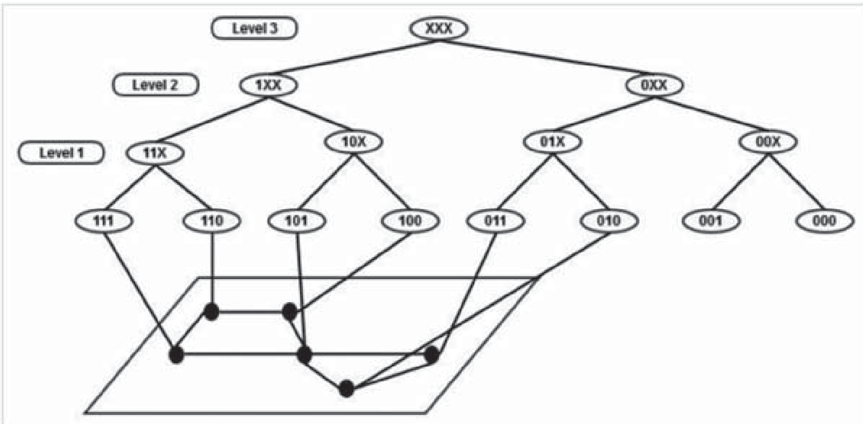



**Figure 6.**

## 8. A TYPICAL SENSOR NODE CONSISTS OF FOUR MAIN COMPONENTS

A sensing unit including one or more sensors and an analog-to-digital converters for data acquisition. A data processor including a micro-controller and a memory for local data processing. A radio sub-system (RF unit) in order to transmit the data over a wireless channel to a designated sink and a power source.

For wireless multimedia network, sensor nodes are equipped with multimedia devices such as cameras. These devices are smaller, and offer more performances in terms of speed and image quality. Thus such network will have the capability to transmit multimedia data. The most important requirements of image transmission in WSNs are: Image sensing, allocated memory and image processing.

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## 9. SYSTEM MODEL

We consider a multi-hop wireless sensor network that wirelessly interconnected sensor nodes able to retrieve and handle a still image. The registers where the odd - even samples of the input data were originally stored at the beginning of the computation. As a result, no extra memory is required at any stage.

For each sample pixel, low-pass decomposition requires 8 shifts (S) and 8 additions (A) instructions whereas high-pass decomposition requires 2 shifts and 4 additions. The energy needed for low-pass/high-pass decompositions may be defined by the number of operations. This energy called "computational load".

The total computational energy for this process can be computed as a sum of the computational load and data-access. Data exchange of distributed task for image compression in a multi-hop wireless network.

Two levels of wavelet decomposition are used. Since all even-positioned image pixels are decomposed into the low-pass coefficients and odd positioned image pixels are decomposed into the high-pass coefficients, the total computational energy involved in horizontal decomposition.

The basic idea of the proposed technique is avoiding the computation of insignificant coefficients during the transform step. This technique attempts to conserve energy by skipping the least significant sub-band. Thus, the proposal reduces the number of arithmetic operations and memory accesses. The proposed technique is called *EHPF: ELIMINATION HIGH PASS FILTERING.*

We have considered Lena image with different sizes. As a result, reducing the quantity of transmitted data will extend the topological lifetime of WSNs. From the experiment, a Lena image of 256×256256×256 pixels is used as a test image. We first apply the decomposition in the horizontal direction. Since all even-positioned image pixels are decomposed into the low-pass coefficients and odd positioned image pixels are decomposed into the high-pass coefficients, the total computational energy involved in horizontal decomposition.

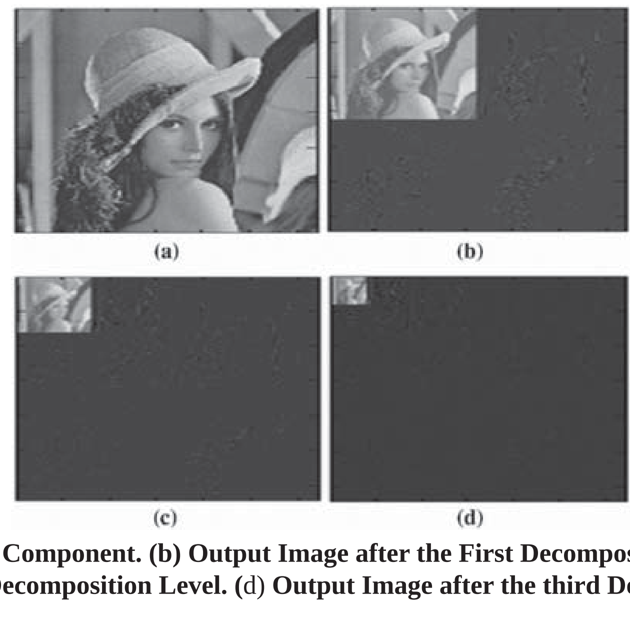


**Figure 7. (a) Original Image Component. (b) Output Image after the First Decomposition Level. (c) Output Image after the Second Decomposition Level. (**d**) Output Image after the third Decomposition Level.**

## 10. CONCLUSION

In this paper, we have proposed and analyzed a image processing in wireless sensor networks. This technique presents a potential solution to the emerging problems related to image processing in wireless sensor applications. With our adaptation unnecessary communication are

avoided in the routing to maintain a good level of energy for all mobile nodes and to route via stable routes. This work offers much flexibility at different process levels. We have focused our study on the design and evaluation of an efficient image processing depending on the operating parameters at different process levels. A breakdown of time from start to finish depending on the density of nodes in the network. Increasing network density leads to the occurrence of more collisions in both protocols the data packets spend more time in queues communication interfaces due to frequent retransmissions. Performance evaluation shows that the proposed scheme should minimize communication energy which is proportional to the number of transmitted bits and therefore, extends the overall network lifetime.

In future work it is reasonable to validate our approach using a real plat-form to satisfy the real time constraints.

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