ENERGY EFFICIENCY IN WIRELESS VISUAL SENSOR NETWORKS USING PEGASIS

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Abstract - *This work analyzes the node-selection complication for target tracking in wireless visual sensor networks. The objective of node selection is to improve the accommodation between the energy consumption of wireless visual sensor networks and the quality of target tracking. We introduce a collegial target tracking algorithm, which is achieved by two phases: 1) target detecting phase and 2) target tracking phase. For the target detecting phase, we establish a power efficient gathering in sensor information system (PEGASIS)-depend upon density control method to selected the appropriate subset of expanded camera sensors for providing the desired density of nodes in the detecting mode. For the locating phase, we design the node-selection complication into XOR arrangement and then introduce an optimal node-selection algorithm to select a subset of camera sensors for evaluating the tracking of a target while controlling the energy consumption. We perform considerable experiments and analysis to verify and calculate our suggested schemes.*

Key Words: **WVSN, XOR, PEGASIS, camera node etc.**

I.INTRODUCTION

Visual sensor network is a network of several wireless camera-nodes. In which the camera-node have image circuitry, a processor with a wireless transceiver. The network has some local image processing, communication and storage capacity for the images captured by cameras themselves with desirable one or more than one main processors, where image information through different cameras will processed. Visual sensor networks also provide some high-order facility to their subscriber by which a lot of data can be extracted into information by fulfilling special demands. Visual sensor networks are relevant for usage in applications where momentary scanning is required and also in those applications where fast employment and elimination of the sensor node network is required [1].

Sensor cameras are working relevantly in their range of aspect for capturing visual information. This information can be processed by the processor independently without affecting the image data provided by other nodes in the setup. We consider only two issues in this work i.e. Data processing and Power consumption between various features of visual sensor network e.g. data processing, resistance to node failure, energy limitations, scalability, flexible architecture, heterogeneity, Quality of Service (QoS).

Power Consumption: Power is a limited resource in case of wireless sensor networks due to which it will become a primary limiting factor for the node's lifetime and it reduces network performance. Batteries are the mostly used sources of power in the wireless visual sensor network, in the absence of auspicious energy-saving schemes that will give sufficient power supplies for the sensor nodes [2]. Thus, resourceful approaches for the efficient application of the energy capability are needed. In this work, we have analyzed the energy consumed by the network during network operations.

Data processing: The information captured by the camera nodes in the network that lie in adjacency to each other may contain a huge order of spatial and temporal repetition [3]. By using data fusion local data processing decreases the size of data that will be required to be returned back towards the data sink. So that by granting the application with high order data illustrations that fulfills the application's requirements efficiently. We can reduce the size of the image and the energy required to transmit each pixel by adopting any background subtraction technique.

II. PROBLEM FORMULATION

Let us consider a visual wireless sensor network in which there are N cameras placed almost in horizontally direction around the system. If there is an overhead camera in the network, that would have a comparable lower view as with horizontally arranged camera. It has a more bounded view of the scene and is usually impractical to apply. The targets can be captured easily in case of horizontal placing. It is assumed that the cameras are stationary and their locations and orientations are known.

The visual sensor network's function is to identify any target in the existence of stationary obstacles (such as trees, tables etc) and any other moving targets in the field of view. We consider that the target is to be identified as a point target. This is reasonable because the target can be acclaimed from various other interferences using convincing point features [4].

Let us consider that there are M targets, all are in shape of a cylinder of diameter D, are moving. If it is considered that the position of all target are to be the midpoint of its cylinder respectively (Figure 1). So now, we will indicate the target to be identifying as the "object" and the other moving targets in search area as "dynamic occluders."

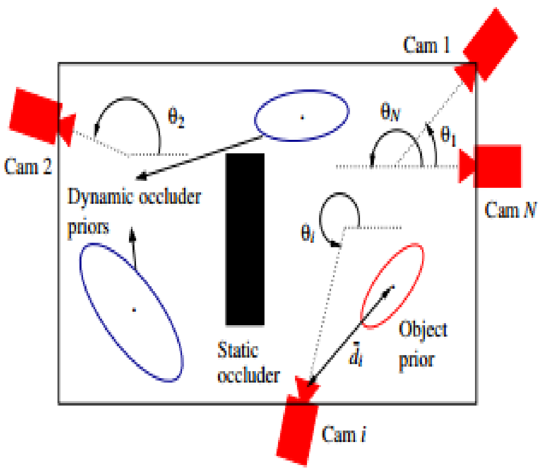

Figure 1: Graphic example of the setup [5]

The main purpose is to opt a sub-set of nodes whose size will be k < N, where N is total number of nodes to achieve the localization. The selection will be achieved in a span of time that all targets should be examined during the procedure [5]. The positions of the static obstacles have to be totally known in advance with their sizes and shapes. It is also considered that there are only some primary statistics of the target and dynamic occluder positions are known. This information will be provided by a high order application through which tracking of target will be analyzed by the visual sensor i.e. camera node.

Let us consider that there is a target whose position is X and it have a Gaussian random vector whose mean is µ and covariance matrix is Σ_x, so that the position of this moving target ∈ {1,2,...M},x_s will also Gaussian with mean μ_s and covariance matrix Σ_s . It will also be assumed that the positions of the target and dynamic occluders are independent to each other. At every camera sensor node the simple background subtraction is done. Because of the horizontal position of the target in each camera's image plane is the most appropriate data for 2-D localization so that the background subtracted images will be vertically summed up and incepted for achieving a "scan-line" (Figure 2). The visual sensor nodes will be able to differentiate the target and the occluders. The center of the target in the scan-line will only be transmitted to the cluster-head. Either a camera will be able to detect the target, or not. If the camera is not be able to identify the target due to the presence of obstacles, it will be assumed that the target is positioned at its mean, due to which no new information is to be provided by the node. Mathematically, we define for camera i = 1,2,...,N, the random variable.

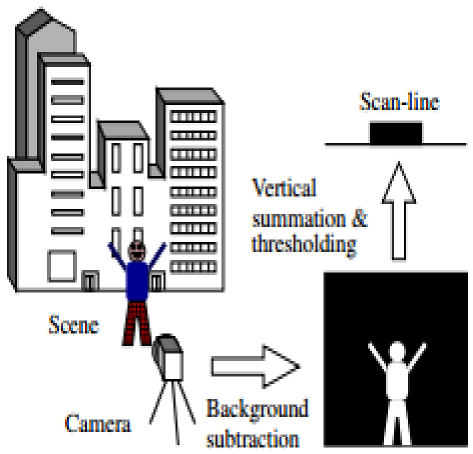

Figure 2: Local processing at each camera node [5]

$$\eta_i = \begin{cases} 1, & \text{if camera } i \text{ sees the object} \\ 0, & \text{otherwise} \end{cases}$$

III. SYSTEM SCENRIO

The camera-based system in our scenario contains of the camera-nodes s_m, m∈1..N, mounted at random locations on the four vertical walls of a room (an art gallery, for example). The direction of each camera c, which is represented by a vector in 3-D space n_c, is arbitrarily chosen toward the room's interior.

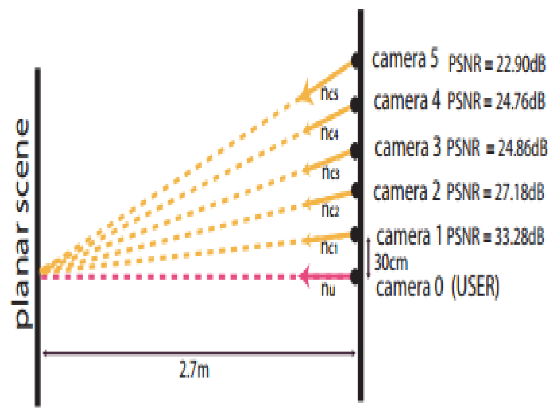

Figure 3: Experiment with aligned cameras [6]

We consider that a user is capable to "move" through the room, meaning that the user can change position and viewing angle over time. As the user virtually moves through the monitored space, the system periodically receives queries that contain the user's 3-D location in the room and viewing direction (represented by $\sim n_q$).

It is assumed (Figure 3) that there is an user who is able to move in the room which means that the user is changing its positions and specter angle with time. Since the user is moving in the supervised space, the system will receives queries on particular time interval which contain the user's location in the room in 3-D and viewing angle (represented by $\sim n_q$). The user will be changed as a *virtual camera* which contains the same characteristics as the real camera nodes used in the setup for system perspective. At the beginning it is assumed that the space that is been supervised by camera node setup, does not have any target which will obstruct the view of camera either partially or fully. This type of scenario is the simplest version, when target will pop-up in the supervised space. If the obstacles are not presented in the supervised space, the user's view at a random space is the view of the planar space from the aimed viewpoint. The planar space will be projected according to the perspective projection model [6] onto the user's image plane, as per the user's requested image.

IV. PROPOSED METHOD

Algorithm 1: POWER EFFICIENT GATHERING IN SENSOR INFORMATION SYSTEM (PEGASIS)

PEGASIS is chain based method for hierarchical network architecture based on greedy algorithm. Nodes communicate with only close neighbor nodes in PEGASIS. PEGASIS is suggested as improvement over LEACH [7] protocol. In LEACH, randomly few nodes are elected as cluster head and nodes are grouped in a cluster. Cluster head receives data signals from non-cluster head nodes and after performing data aggregation, data is transmitted to base station by cluster head. Role of cluster head is rotated among other nodes to balance the energy consumption. Cluster heads are randomly nominated despite the location of node, some cluster head can be near to base station and some can be far. More energy is consumed in transmitting signals to receiver at far place. PEGASIS assign responsibility of transmitting signals to base station to only those nodes which are positioned near to base station.

A. Assumptions made in PEGASIS

In PEGASIS paper some assumptions are made, before discussing working of protocol assumptions are listed below. x Sensor node can control its power range. x Each node in the network can directly transmit signals to base station. x Nodes in the network contain equal energy. x Each node in the network has position information.

B. Working of PEGASIS

To form the chain of communication, node which is farthest from base station is chose as first member of chain. Closest neighbor of first member of chain is elected as second node of chain. Nodes receive data packets from previous member of chain and fuse its own data signals into received data packet to form single packet. This process continues till chain gets its last member node which is closest to base station. Data gathering round can be initialized by synchronization with beacon packet from base station [8]. A token can be passed among nodes in chain to indicate the turn of data transmission. In LEACH five percent of nodes of network are selected as cluster heads, these nodes can transmit data signals to base station. But in PEGASIS only one node transmits the data to base station that is end node of the chain nearer to base station. After node's death, chain can be reformed [9].

Algorithm 2: XOR METHOD

The Network coding Duty cycle and the packet processing in the Linear Network Coding Layer of the block region has been given in algorithm [10].

1. Every node in the network conserves the conventional line (accept Queue ()) and an identified queue (sense Queue ()). On sensing information a node place the packet in the sense Queue (P_j). On getting a packet of p_i and a node place the packet in the obtain Queue (P_i).

2. In network, nodes form the lines length where it is beneath the threshold or overhead. If when threshold is less possession the node away goes to sleep condition then sits should be energetic formal.

3. If the established packet previous handled through the node than it is cast-off, or else node developments the packets more. The node checked the part after the Nodes (), where its Communicate node or Lined network Coding node.

4. Whether node is communicating node in Linear Network coding [11], the Layer will onward the packet to the base then advancing the packet or container to the Linear Network Coding layer.

5. Here, node encoder if the packet conventional non implicit packet before it does the XOR process. On positively making programmed packets, the LNC node conveys the programmed packet to the Sink. The administered packets implanted into Conveyed set.

6. This provisions the conveyed packet and assistances confining more dismissed broadcast. Though the established packet P_i is now procedures formerly it is rejected by node.

Table 1: Simulation Parameters

Parameter	Values
Network Area	100x100 m^2
No of nodes	30,100
Packet size	240
Battery capacity	1000
No of round	1000
bottle neck zone radius	60
sleep schedule mode	50
distance of base station from the network	50

V. RESULT

To evaluate quantitatively the performance of the proposed method, we compared our approach with two different methods described as follows: (1) PEGASIS method. In this method, node selection is determined by comparing the chain target. (2) XOR method: node encoder if the packet conventional non implicit packet before it does the XOR process.

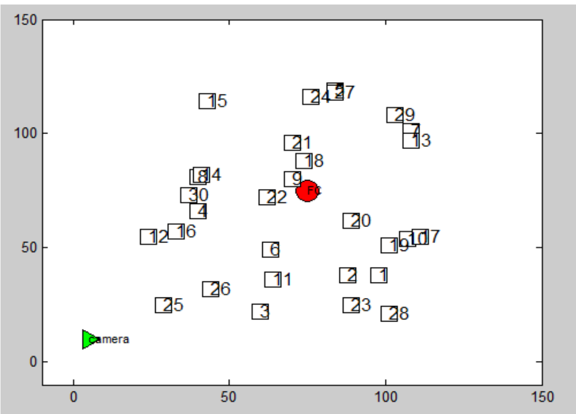

Figure 4: Illustration of WVSN

The aim of the visual sensor network is to provide a user with visual information from any random viewpoint within the monitored field. This can be accomplished by making data from a selection of cameras whose fields of view overlap with the desired field of view.

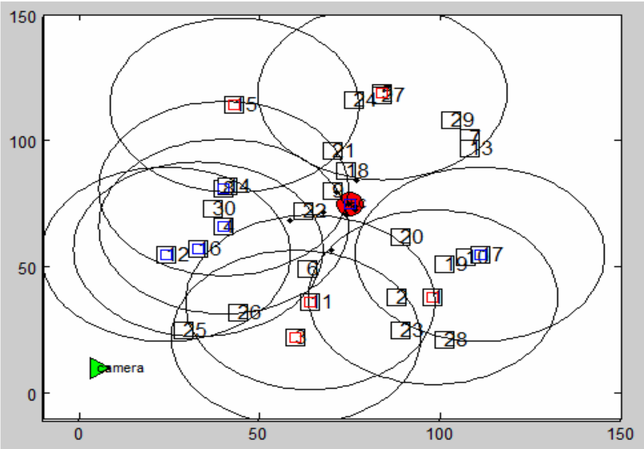

Figure 5: Random Sensor node deployed in WVSN

In above figure the node communicates to each other from the camera base station.

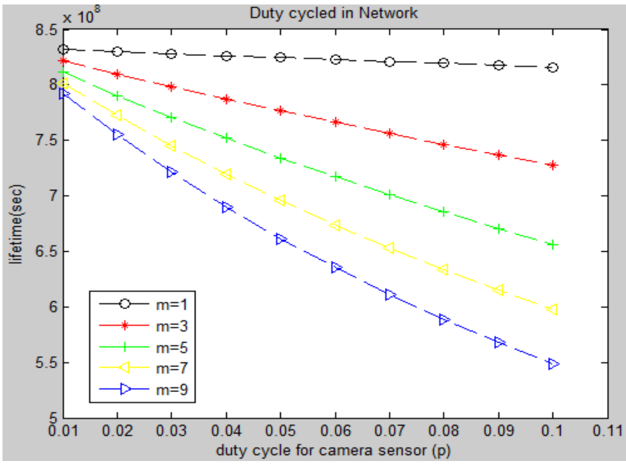

Figure 6: Lifetime for various m parameters

Here m=1 get best lifetime as compare to m=3, m=5, m=7 and m=9.

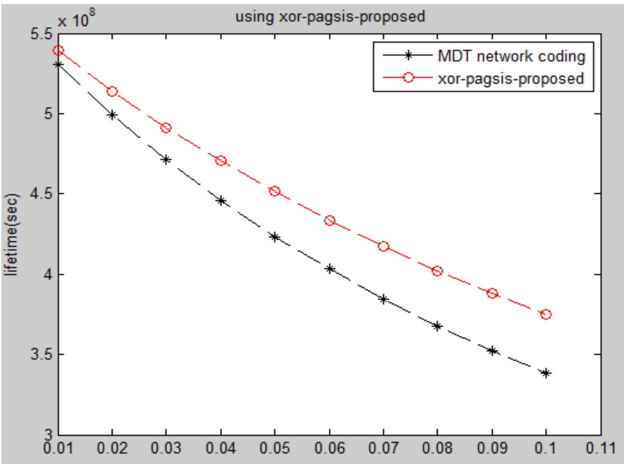

Figure 7: Comparison between XOR Pegasis and MDT network coding for lifetime

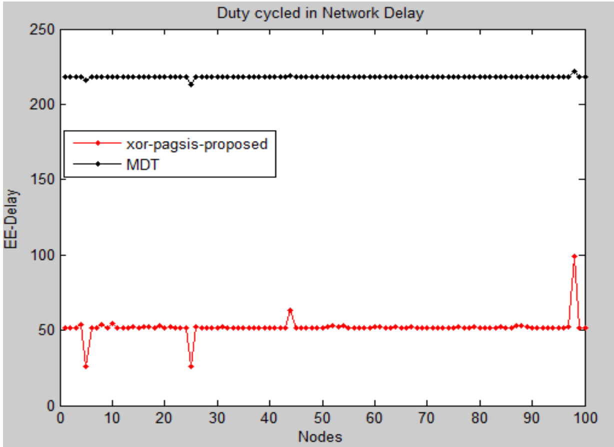

Figure 8: Comparison between XOR Pegasis and MDT network coding for EE-delay

Number of Alive Nodes to analyze PEGASIS's performance graph is shown in Figure 9 for the number of alive nodes in the network with respect to round.

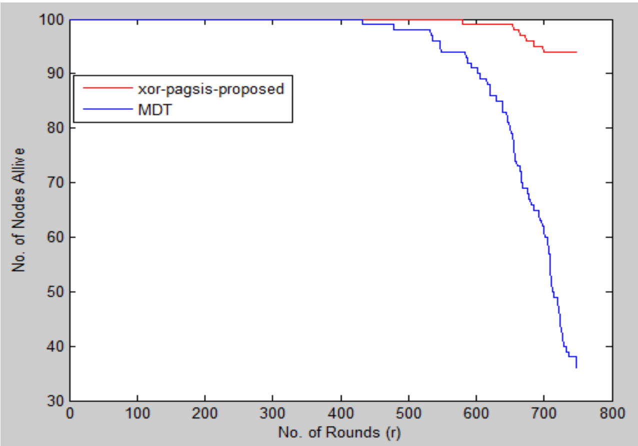

Figure 9: Comparison between XOR Pegasis and MDT network coding for no. of alive node on 800 rounds

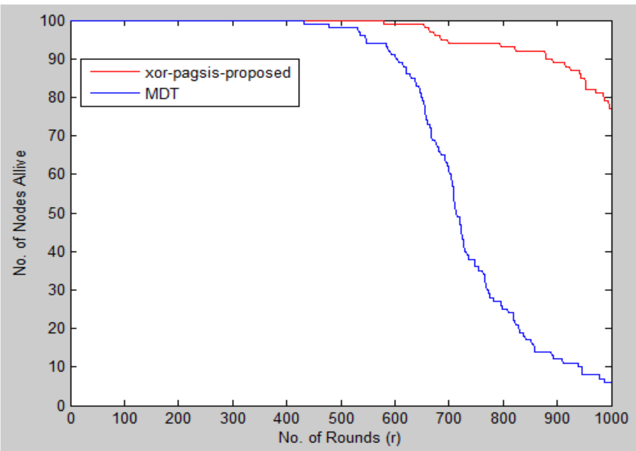

Figure 10: Comparison between XOR Pegasis and MDT network coding for no. of alive node on 1000 rounds

VI. CONCLUSION

This paper describes a feasible method for target tracking along with node selection, which can be easily implemented in wireless visual sensor networks. The PEGASIS and XOR are introduced to detect and extract the target blobs. The analytical complexity for background modeling will be decreased due to the frame reconstruction and the flexibility of Network duty cycle. Also, the result of target extraction and the tracking information are integrated to select the optimal camera node. Experimental results show that the proposed method effectively achieves the target association and continuous tracking and solves the blocking and merging in the overlapping fields. Additionally, the proposed approach will be able to accomplish a good arrangement between the tracking accuracy and the implementation complexity as it compared with presently used methods.

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