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EFFECTIVE IMPLEMENTATION OF POWER OPTIMIZATION IN WIRELESS SENSOR NETWORKS

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***Abstract*-One of the main design issues for a sensor network is conservation of energy available at each sensor node. Wireless sensor networks use battery operated computing and sensing devices. A network of these devices will collaborate for a common application such as environmental monitoring and military applications. In this proposed work the author proposed the Multi-Ma protocol in the three phases to improve the energy efficiency in MAC Protocol. In MAC protocol there is only one cluster in a specific area. Where as in this proposed work the author will deployed the sensors in the specific area in form of layers and done the clustering and each cluster head is communication with the Base Station. Second thing the author discuss about the sensor used in the proposed deployment technique.**

Keywords –WSN (Wireless Sensor Network), MEMS (MicroElectronic Mechanical System)

I. INTRODUCTION

Recent advances in electronics and wirelesscommunications gave a rise of sensor applications ranging from environmental monitoring, pollution detection to feature extractions [1, 2]. Battery-powered sensors are integrated with sensing, local processing and communication capabilities [3]. They are always characterized as tiny devices with constrained resources and limited energy that recharge or reuse is implausible. Power issue arises as the key concern. Among all the components, the transceiver including transmitter and receiver contributes the greatest energy consumption [4].Wireless Sensor Networks (WSNs) have been widely considered as one of the most important technologies for the twenty-first century. Enabled by recent advances in Microelectronic Mechanical Systems (MEMS) and wireless communication technologies, tiny, cheap, and smart sensors deployed in a physical area and networked through wireless links [5].Distinguished from traditional wireless communicate

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networks, for example, cellular systems and Mobile Ad Hoc Networks (MANET), WSNs have unique characteristics, for example, denser level of node deployment, higher unreliability of sensor nodes, and severe energy computation, and storage constraints, which present many new challenges in the development and application of WSNs [5, 6].As we all discerns that computer science had magnificentlydeployed the sensor network. To increase the network lifetime, energy should be saved in the every hardware. Software solution composes the network architecture. One way to solve the energy problem for WSN sensor to generate the energy by itself and it can be solved by the mechanical method like conversion of solar energy into electrical energy. Second thing we compare various batteries technology. As we study about the various batteries as like Nickel cadmium, Ag-Zinc, Nickel Metal hydride, Li-ion. After comparing we find Li-ion is reliable as shown in figure 1[7].

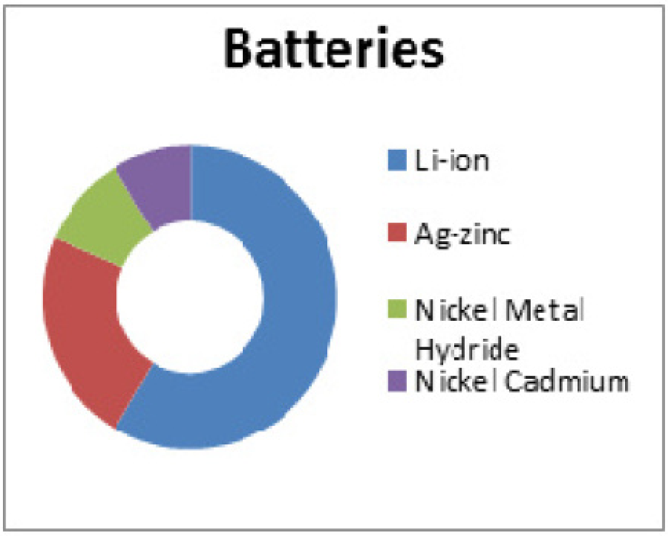

Figure1.Comparison of the Various Batteries.

A large number of potential applications of sensor networks have been reported ranging from early research investigations to commercial systems. A broad range of applications are environmental monitoring, Animal tracking and Control, Medical Applications, Built Environmental and military applications.

II. LITERATURE SURVEY

A. Network Deployment.

Lot of research work has been done in this field to make this technology more scalable, energy efficient and robust.Ibriq and Mahgoub in [8] described different routing models used for WSN. According to authors there are three models rouging in WSN including:

- One Hop Model
- Multi Hop Model
- Cluster Based Model

1) One Hop Model

This is a simple model that uses direct data sending towards BS as shown in figure 3.

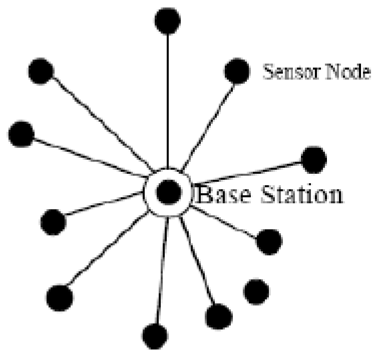

Figure 2. Architecture of One Hop Model

2) Multi Hop Model

In this model nodes choose their neighbors to forward data toward the BS [8], this model is an energy efficient model of routing as shown in figure 3.

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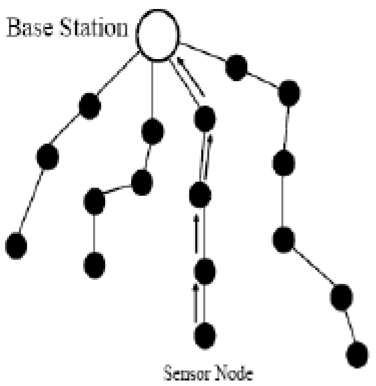

Figure 3. Architecture of Multi Hop Model

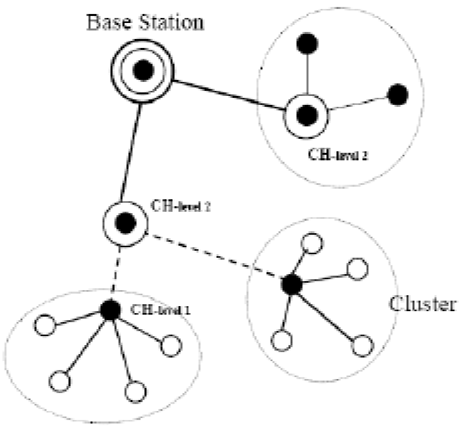

Figure 4. Architecture of Cluster Based Model

3) Cluster Based Model

In this model network is grouped into different clusters [8]. Each cluster is composed of one cluster head (CH) and cluster member nodes. The respective CH gets the sensed data from cluster member nodes, aggregates the sensed information and then sends it to the Base Station as shown in figure 4.

B. Sensor Used

Cyclops consists of an imager, a micro-controller (MCU),a complex programmable logic device (CPLD), an external SRAM and an external Flash in figure 5. The MCU controls the Cyclops sensor. It can set the parameters of the imager, instructs the imager to capture a frame and run local computation on the image to produce an inference. The CPLD provides the high speed clock, synchronization and memory control that is required for image capture. The combination of the MCU and the CPLD provides the low power benefits of a typical MCU with on-demand access to high speed clocking through a CPLD. Furthermore, the CPLD can perform a limited amount of image processing such as background subtraction or frame differentiation at capturetime. This results in extremely economical use of resources since the CPLD is already clocking at the capture time. When MCU does not need the CPLD services it halts its clock to minimize power consumption.

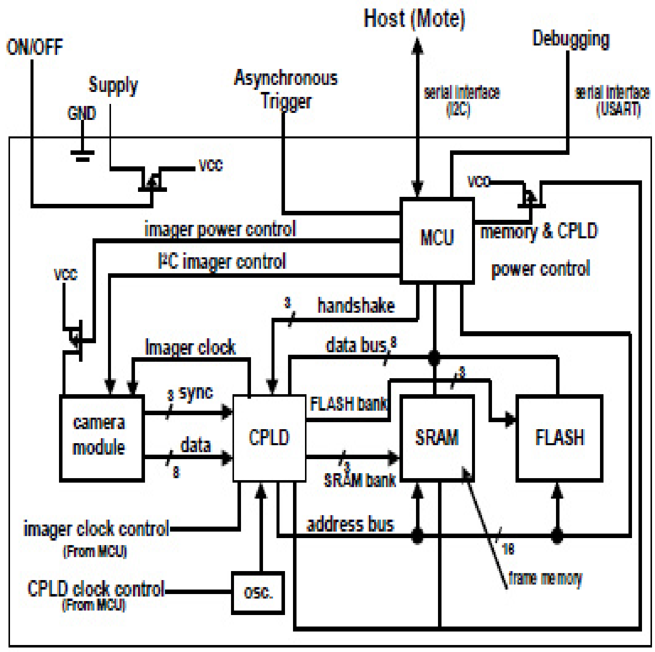

Figure 5. Hardware Architecture of Cyclops

Cyclops uses external SRAMto increase the limited amountof internal MCU memory and provide the necessary memory for image storage and manipulation. In essence, the external memory provides us on-demand access to memory resources

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at the capture and computation time. The SRAM is kept in sleep state when the memory resources are not needed. In addition, Cyclops has an external Flash memory. The Flash memory provides permanent data storage for functions such as template matching or local file storage. The MCU and CPLD and both memories share a common address and data bus. This facilitates easy data transfer between the imager, SRAM and FLASH memory but it also requires an appropriate mechanism that guarantees synchronized access to such shared resources. This will be further described in Cyclops firmware discussion. The image of sensor is mentioned in figure 6 [9].

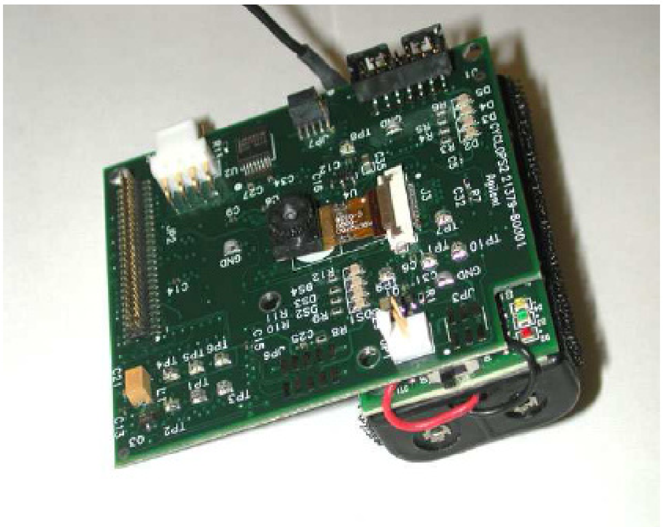

Figure 6. Image of Sensor Used in WSN.

III. PROPOSED MODEL

First we deploy the sensor randomly in a specific area in the forest, which is homogeneous network. After random deployment the clustering algorithm takes action and sensors will arrange themselves in cluster. After clustering each cluster will choose the cluster head among themselves. Then we will deploy the tower and the base station.

After deployment of the network, sensor start sensing the data and the sensors send the sensed data to their cluster head, and then cluster head will send the data to the tower and then tower transfer the data to the base station.

While sensing the data if any disaster occurs and any node failure then the recursive algorithm calls and the sensor reform the cluster and start sensing the data and transmitting the signals to towers shown shown in figure 7. The Algorithm for this technique is mentioned below:-

1. Initialize WSN[n] {n : max. deployable sensor nodes}

2. Activate and Assign WA[x, y] {Max. deployable area}

3. CH[i][WA(a)] {Integration of Cluster Head in the specificarea}

4. Prune the Area WA[m]<=WA[m]

5. Implementation of Cuting into multiple layers L{i<=k}

6. In Each Layer L(i){k}, deploy WSN(j) in WA(a)

7. Fetch CHI(Cluster Head Information) -> WA(a) => WSN(n)

8. Analyze the Power Consumption C(m)=(PC)CH[n]

9. CP(Cumulative Power) => Sum (C(m) => WA(m))

10. Analyze Results

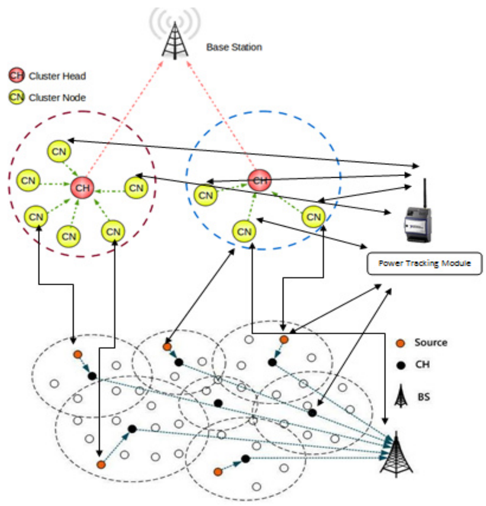

Figure 7. Network Deployment and Data Transmission

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IV. RESULTS

In Figure 8, the efficiency of the Existing and Proposed Approach in terms of the energy consumption is shown. In the graphical view, the performance and efficiency of the proposed approach is better than the existing. The line graph shows the clear performance levels of both the algorithmic approaches.

In the graph the existing approach shows the high energy consumption, above 400mJ but in proposed work at each layer it is near about 200mJ.

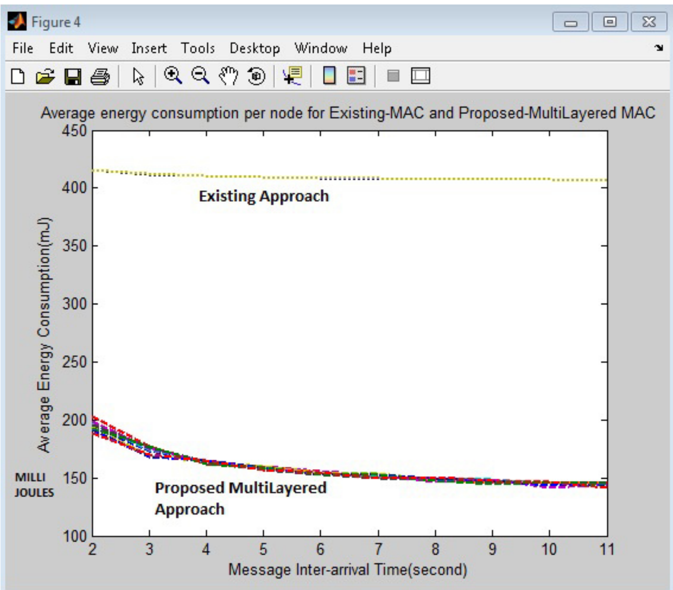

Figure 8. Show the comparison between the existing approach and Proposed Approach.

Figure 9, the efficiency of the Existing and Proposed Approach in terms of the data send and energy consumed is shown. In the graphical view, the performance and efficiency of the proposed approach is better than the existing. The bar graphs graph shows the clear performancelevels of both the algorithmic approaches.

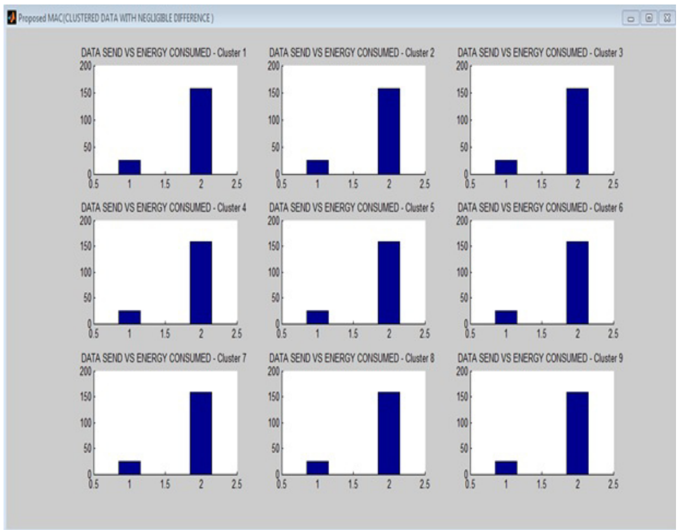

Figure 9.Cluster wise performance in terms of Energy Consumed and Data Transfer

V. CONCLUSION

Sensor networks are formed from a collection of sensing nodes which communicate with one another, typically through wireless channels, in order to collect spatially distributed data about their environment. Wireless Sensor Networks (WSNs) may be considered as the third wave of a revolution in wireless technology. While the performance of battery technology is gradually improving and the power requirements of electronics is generally dropping, these are not keeping pace with the increasing demands of many WSN applications. For this reason, there has been considerable interest in the development of systems capable of extracting useful electrical energy from existing environmental sources. Such sources include ambient light, thermal gradients, vibration and other forms of motion. In this work, we provide an overview of the energy sources available for energy harvesting or scavenging and a summary of the main methods considered for converting these energy sources into a form suitable for use in WSN nodes. Using the proposed algorithmic implementation better and efficient results are obtained. These results can be further improved using grid based parallel algorithms by which optimality can be achieved.

VI. FUTURE RESEARCH WORK

Power optimization is one of the most touched area in the domain of wireless sensor networks can effectively act in multiple applications. Cross-layer is becoming an important studying area for wireless communications. In addition, the traditional layered approach brings three main problems to us. (1) Traditional layered approach cannot share different information among different layers , which leads to each layer not having complete information. The traditional layered approach cannot guarantee the optimization of the entire network. (2) The traditional layered approach does not have the ability to adapt to the environmental change. (3) Because of the interference between the different users, access confliction, fading, and the change of environment in the wireless sensor networks, traditional layered approach for wired networks is not applicable to wireless networks. So we can use cross-layer to make the optimal modulation to improve the transmission performance, such as data rate, energy efficiency, QoS (Quality of Service), etc. Sensor nodes can be imagined as small computers, extremely basic in terms of their interfaces and their components. They usually consist of a *processing unit* with limited computational power and limited memory, *sensors* or MEMS (including specific conditioning circuitry), a *communication device* (usually radio transceivers or alternatively optical), and a power source usually in the form of a battery. Other possible inclusions are energy harvesting modules, secondary ASICs, and possibly secondary communication interface (e.g. RS-232 or USB).For future scope of the work, following techniques can be used in hybrid approach to better and efficient results –

- Ant Colony Optimization
- Artificial Neural Networks
- HoneyBee Algorithm
- Simulated Annealing

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