CHAPTER 4

RESEARCH METHODOLOGY

A Wireless Sensor Network (WSN) is having a number of sensor nodes connected among them-selves by a wireless medium to perform distributed sensing tasks, which can be used in different types of applications such as surveillance, environmental and health monitoring, and security. Sensor networks are a sensing, computing and communication infrastructure allowing to instrument, observe, and respond to phenomena in the natural environment, and in our day to day life physical and cyber infrastructure. The sensors also can range from small passive micro sensors like "smart dust" to superior range like controllable weather-sensing platforms. Their computation and communication infrastructure is completely different from that found in today's Internet-based systems, which shows the device and application obsessed nature of these systems. An important aspect of WSNs comes from as for the same set of events it has many sensors generating sensing data.

Since number of algorithms and protocols have been proposed for conventional wireless ad hoc networks, which are not well suited to the unique features and application requirements of sensor network. Sensor networks are a new family of wireless networks and are radically different from conventional networks like cellular networks and MANETs. In such conventional networks, the tasks organization, routing and mobility management is performed to optimize the high bandwidth efficiency and Quality of Service (QoS). These networks present superior throughput or delay characteristics under a high level mobility conditions.

Energy consumption is another concerned issue as the battery packs can be replaced as needed. However, sensor networks consist of number of nodes that are designed for unattended operation. The traffic is of a statistical nature in comparison to the multimedia loaded data in MANETs and cellular networks. The data rate is likely to be very low to the order of 1-100 kb/sec. unlike conventional networks; the main motives are prolonging the lifetime of the network and avoid connectivity degradation via aggressive energy management as the batteries cannot usually be replaced because of operations in intimidating or unfriendly or remote environments. In sensor networks the flow of data is primarily unidirectional from the sensor nodes to the sink point.
The following are few features of WSNs creating differentiability between WSN and conventional wireless networks:

- Sensor nodes are compactly deployed.
- Sensor nodes are prone to failures.
- Sensor nodes are limited in memory, power, and computational capacities.
- The topology of a sensor network can be changed repeatedly.
- The number of sensor nodes in a wireless sensor network can be numerous orders of magnitude more than the nodes in other conventional wireless networks.
- Sensor nodes mostly use a broadcast communication prototype, while most of the ad hoc networks are based on point-to-point communications.
- Sensor nodes may not have global identification (ID) because of the great amount of overhead and huge number of sensors.

A sensor network can be composed of thousands of nodes and also:

- Nodes are dispersed in a 2-dimensional space and cannot be recharged after deployment.
- Nodes are quasi-stationary.
- Nodes transmit at the same fixed power levels, which is dependent on the transmission distance.
- Nodes base decisions on local information.
- Nodes are location-aware, which can be defined using GPS, signal strength or direction.
- The energy consumption among nodes is not uniform.

Sensor network do not make any assumptions about:

- The size and density of the network.
- The distribution of the nodes.
- The distribution of energy consumption among nodes.
- The probability of a node becoming a cluster head.
• The synchronization of the network.

This model and said assumptions are appropriate for many real networks. In a sensor network, sensor nodes collect their local information and send them to the data center. Frequently, the information is location-dependent, so the nodes know their own position via GPS or by other means. On the other hand, density is not uniform or known.

4.1 The Key Challenges in WSN

WSN are engaged in a range of real time fields like military, disaster, agriculture, medical etc especially in the areas of need for efficient techniques, protocols and intellectual algorithm. Some prospective issues and challenges are there when we are designing these techniques and algorithm. Some of them are as follows:

• **Routing:** In sensor network the sensed data is to be routed from multiple sensor nodes to sink, via the most suitable path taking into account the resource constraints of WSN. Thus routing is a challenging concern here.

• **Time Synchronization:** In order to fuse data effectively, various levels of data integration are desirable at various levels and should be synchronized, as data is propagated towards the sink.

• **Localization:** For obtaining the accuracy in data reception and location, the complexity increases in large scale networks for complex environments. The challenge here is to find the location of each sensor node, its data with less communication and processing cost.

• **Security and Privacy:** From catastrophic attacks, wireless connected nodes embedded in the environment cannot be ensured. Node network can be modified, replaced with malicious counterpart, and in making observation the sensors can be fooled by attackers which do not precisely reflect the environment.

• **Scalability:** Are deployed with hundreds, thousands or more sensor nodes, based on the applications requirement and the region to be monitored. With such large number of wireless connected sensor nodes, there is requirement of techniques and their computations to be scalable enough to respond and operate in real time.

• **Energy Conservation:** In WSN, development of new secure and energy efficient methods enabling fusion of relatively large amount of data is the basic requirements of
data processing. Over a massively Distributed database with constraint resources, data aggregation/data fusion has to be performed. How to evaluate a system where, the information essential for the evaluation is not available. The accuracy reflection of the state of the environment in final, high level sensing results delivered by the System, the sensors’ deployment event timing, in insufficiency of energy and bandwidth to record all the raw data surety also will be considerable.

4.2 Existing System

In Wireless sensor network, Power consumption is definitely one of the most important issues of wireless sensor network. The general applications of wireless sensor networks require many wireless sensor nodes to form a network to sense the signal of interest. The battery lifetime will be a major constraint on the field application. Therefore, researchers and engineers have been doing a lot of efforts on how to reduce the power consumption of the wireless sensor network in recent years, while at the same time how to acquire power from ambient environment is another direction to extend the battery lifetime. The data forwarding involves modifying existing WSN routing protocols, has been modified to incorporate information on whether the node is running on solar or battery power, and the results have shown that the solar aware variant performs better than shortest path routing. Similarly, a solar-cell energy model is incorporated into geographic routing to improve network performance.

4.3 Drawbacks of existing system

- They have limited energy storage capability due to small form-factors.
- There is always a mismatch between the available energy budget for system operation and the required energy budget to obtain desire lifetimes.
- Power consumption is more in case of wireless sensor network.
- The sensors in most WSNs typically use batteries, but it is generally infeasible to replace or recharge all the batteries.
- Batteries used in wireless sensor network have limited recharge cycles.
4.4 Proposed System

Proposed system discusses about the evolutionary nature of Elephants and designing an Elephant Swarm Optimization Algorithm for WSN Design. Based on the elephant’s behavior, can develop a network model to control and induce the sensors to a sleep/awake state saving energy, data aggregation, security and increasing network life time which controls the power utilized by the sensor.

Elephants are the largest of land mammals living in very advanced social organizations that require good levels of communication between the groups of individuals. This is because they live in a "fluid fission-fusion" society which simply means that their family units are constantly being divided and reunited whilst, at the same time, they are meeting different individuals on a daily basis. This requires an advanced level of communication and recognition to allow individuals to mediate between the complex relationships that they develop with other individuals.
The elephants are social animals. There is a large degree of philanthropy and cooperation which is related to relative selection within the family group. This means that one individual will help to increase another individual's lifetime number of offspring and thus help maximize that individual's gene contribution to future generations, but at a cost to their own survival and reproduction. Their behavior is as similar to Honey Ant also who corporate each other always. On the basis of this sociality of elephants we can design our WSNs for protective load sharing in the domain. Also the family unit characteristic may emphasize the data clustering in WSNs.

Another important characteristic of elephants is that when they feel they are about to die and have completed their life they break away from the herd in which they were living not to affect the lifecycle of others. Also an altruistic behavior observed in elephants is the courageous behavior of the matriarch, who protects his herd by exposing herself to danger. This characteristic in turn will be helpful for us to design WSNs having high data aggregation and increased network lifetime.

### 4.5 Advantages of Proposed System

- Insensitive to scaling of design variables.
- Simple implementation.
- Easily parallelized for concurrent processing.
- Derivative free.
- Very few algorithm parameters.
- Very efficient global search algorithm.
- They can operate for longer periods of time until hardware failure.
- They use super capacitors instead of batteries as energy storage devices.
- Minimizes the power consumption during packet transmission and data processing.
CHAPTER 5

REQUIREMENT SPECIFICATION

To design proposed model we need some minimum software and hardware specifications and necessary simulators or built in simulators to simulate the results which are discussed below.

5.1 Software Requirements

An operating system is software, consisting of programs and data that runs on computers manages computer hardware resources, and provides common services for execution of different application software. Operating system is the most important type of system software in a computer system. Without an operating system, a user cannot run an application program on their computer, unless the application program is self-booting.

Microsoft first introduced an operating environment named Windows on November 20, 1985 as an add-on to MS-DOS in response to the growing interest in graphical user interfaces (GUIs). Windows XP is an operating system that was produced by Microsoft for use on personal computer, including home and business desktops, laptops and media centers. The Professional Edition of Windows XP platform has many more network features than the Home Edition. An update of Windows 9 x/ME is possible, with Windows NT/2000 only the Professional Edition can be used for update.

**Operating System:** The .NET Framework 3.5 SDK can be installed on the following platforms:

i) Microsoft Windows® XP Service Pack 3

Note: The .NET Framework SDK 3.5 cannot be installed on 64-bit computers; Windows Millennium Edition and Microsoft Windows NT® 4.0 are not supported

**Other:**

i) Prior to installing the .NET Framework SDK version 3.5, the .NET Framework 3.5 Redistributable has to be installed first.

ii) Microsoft Visual Studio 2010

**Language:** C#

5.2 Hardware Requirements

**Processor:** 133-MHz Intel Pentium-class processor
Memory : 512 MB of RAM, 1GB recommended

Hard Disk : 110 MB of hard disk space required, 40 MB additional hard disk space required for Installation (150 MB total)

Display : 1024x768 or higher-resolution display with 16 bits colors

5.3 Performance Requirements

Increased admin security: The PC should be highly secured and accessible only by the administrator to avoid the misuse of the application.

Portability: The GUIs of this application is user-friendly so it is very easy for the user to understand and respond to the same.

Reliability: This system has high probability to deliver us the required queries and the functionalities available in the application.

Response time: The time taken by the system to complete a task given by the user is found to be very less.

Scalability: The system can be extended to integrate the modifications done in the present application to improve the quality of the product. This is meant for the future works that is to be done on the application.

CONCLUSION

Elephant Swarm Optimization approach takes a novel kind of optimization algorithm, to train and prolonging the lifetime of the wireless sensor network. The feasibility and effectiveness of this new approach can be validated and illustrated by the experiments and various test cases. The diagnosis results show the Elephant Swarm Optimization - WSN has better training performance, better convergence behavior, as well as better diagnosis ability than Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) - WSN. Owning to the flexibility of this approach, it can be adapted to other problems very easily.