Energy Attentive Steering Algorithms in WSN

Shruti Aggarwal, Dr. Kulvinder Singh

Abstract: Wireless Sensor Network is an exigent enclosed commercial & industrial technologies, IOT revolution with generate an unsurpassed demand for wireless sensor nodes with high energy efficiencies & power saving techniques as most of them will be battery powered & will be required to have an expected run time of a few years on a singular battery run. Thus it is indispensable that energy efficiency has to be the next buzzword in WSN domain. The author has proposed a highly energy efficient WSN architecture which follows a hierarchical tree topology, various space/modes & variable transmit power. The WSN node hardware architecture is proposed to have up to three or more sleep / wave modes with peripheral power control. The proposed workup types are timer interrupt, memory interrupt & RF wake on call interrupt. Also the transmit power is variable controlled using ANFIS (Artificial neural network fuzzy logic). The author by combination of above techniques has demonstrated a highly energy efficient Wireless Sensor Network protocol.

Keywords: WSN, IOT, Attentive Algorithms, ANFIS, Wireless Sensor Network Protocol.

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I. INTRODUCTION

WSNs are dispersed self-governing sensors to invigilate physical environmental conditions, such as pressure, noise, hot and cold temperature conditions etc. to simultaneously pass their information via network to a designated place. The W.S.N is made up of "nodes" ranging from miniscule to hundreds or even thousands of devices, where each node is attached to one (or on occasion a large number of) sensors. The more modern networks are bi-directional that implements command of sensor movements. The buildup of wireless sensor networks was triggered by armed-force applications such as disaster relief services, Public gatherings, Traffic sensing etc, presently such networks have become an essential part of many Corporate and end user applications, such as smart Agriculture, Animal's Rearing, Heavy Machinery Operations and so on.

II. OBJECTIVES OF STUDY

[1.] Structure & Development of a Highly Energy Efficient WSN Architecture, Employing Multiple Sleep/Wake Up Modes, With Individual Component Power Control & Variable Transmission Power.
[2.] Design of a WSN Node Capable of Employing Multiple Sleep/Wake Up Profiles, comprising primarily Timer Interrupt, Memory Threshold, RF Receiver Energy Threshold, to reduce energy draw in idle/partial utilization states.
[3.] Design of a WSN Node Capable of Peripheral Power Control i.e. Switching of Power to various peripherals such as ADC, RF Frontend Etc, to save energy when specific peripherals are not required.
[4.] Development of an energy efficient routing protocol for key distribution which enables maximum energy conservation & reduction on battery load.
[5.] Use of Artificial Neural Network or/and Fuzzy Logic to Control Transmitted Power According to Deployment Distance, to reduce power when transmitting to proximity nodes.
[6.] Reduction in Space, Time & Energy Complexity of existing algorithms.
[7.] Usage of an open framework & easily available tool such as MATLAB enables for easy integration of our design into existing technologies.
[8.] Use of MATLAB also allows for implementation of the designed algorithm on FPGA & further production of VLSI-ASIC for specific WSN's.
[9.] Development of a multi-tier encryption system to encrypt data according to priority.

III. EXISTING TECHNIQUES

We have encountered the utilization of "network simulation software –OMNET++" in this paper. We have various situations dependent upon position of nodes or modulation in WSN & examined various guidelines, for example, how many frames have been dropped or utilization of energy. These situations set the reason for frame dropping or energy utilization in 3D MSK is more prominent than 2 D MSK based WSN. That's why we need to do nodes positioning of MSK occupying 1174WSN in 3D environment instead of 2D so as to keep up a decent quality of administration for the network. [1]
The point of this paper was to discover an answer for two noteworthy targets of the examination with respect to remote provincial electrocution in MP. Firstly ,Right off the bat, The HRES utilizing "PV-BG" framework using battery is demonstrated in "HOMER" programming. Secondly, the energy storage framework with battery was picked among "advanced LA, LI, and Zn-Br FB for the HRES model" in the wake of contrasting them as far as specialized, monetary, and ecological concerns. During the investigation among these three battery types, the "HRES" utilizing "LI" batteries has been prescribed for unelectrified town zone. This game plan was defined to offer, a nominal "PV" framework capacity of 26.0 kW with the rating of 28.0kW BG, & having 266.00 kWh rating of battery. The configuration of HRES which is utilizing LI batteries has the least Net Present Cost- 15.90 million INR and the least Cost of Energy- 12.889 INR/kWh. The framework demonstrates most exceptionally productive system with minimal limit deficiency of 86.0 kWh/year & very least amount of CO2 discharge i.e. 40.0 kg/year. The proficiency of this HRES model can be utilized by distinctive

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components having "PV" modules. At last, many other sources can be incorporated with current HRES and it will shift burden conditions.[2]
Security concerns in WSNs emerge because of the constrained abilities of the sensor nodes utilized in numerous essential applications. This literature review has focused on the various security solutions used for popular attacks on WSNs, and has also explored the pros and cons of each technique. [3]

Energy storage technologies hold noteworthy potential to help drive advancement in rising economies by improving the nature of the power supply and encouraging the effective integration of sustainable power source. The quickly falling expenses and improving abilities of stationary ESSs, alongside developing industry skill, will immediately open new markets and savvy applications for energy storage. Improvements in the Industry to date have demonstrated that the particular patterns and dynamics in energy storage markets are far and wide differ generally; this is especially valid for some developing economies. The points of interest of each market, for example, the applications that storage frameworks will give, and the sorts of advances best fit to them, will rely upon various elements, including.[4]
This paper portrayed the W.S.N. model & we have explained the whole process of sensing. Then we have given an outline of wireless sensor networks history & how it is being utilized in Army operations , likewise, it can be utilized in various operations, for example, 'Weather Monitoring, Missile launching, Clinical operations, Tsunami operations and many more '. We have compared here the Wireless Sensor Network with Traditional Wireless Sensor Network that demands new strategies with this changing world. It has extraordinary attributes that includes bandwidth for the communications, area that is to be used and energy consumption. Our paper abridged most interesting difficulties & requirements that has affected the structure of a Wireless Sensor Network. As a remainder for this paper we have described our examination details on Wireless Sensor Network. [5]

The need of adaptability inside the electricity system increments with the up and coming extent of sustainable energy generation. Auxiliary administrations must be used more to guarantee electrical lattice strength. BESSs are one of these adaptable alternatives. The significance of BESS innovation will keep on expanding because of the declining portion i.e. our source of energy-The Power Plants. However a single source for storage can never be an answer for these tests. Only many sources of storage can explain it better. Capacity advancements next to the battery framework are in the form of kinetic/thermal and electrical storage of energy. That can be any geothermal energy to heat your home or office, Ovens used in home to cook the food, Automobile fuels and many more. [6]

Capacity of huge amount of energy will be a challenge in an upcoming lifespan to satisfy up the need during pinnacle hours. Pumped hydro storage plant is as of now the most economical answer for this reason. Another option for pumped hydro storage plant is adiabatic CAES plant which likewise has a high productivity rate. This paper displays the most pertinent properties of mechanical energy storage technologies as of now being created in the plan of power systems. It depicts the most significant parameters that portray the conduct of various mechanical energy storing technologies.[7]

The energy storage market is quickly developing because of headways that are making these innovations increasingly alluring to purchasers and progressively moderate for investors. Thus, storage frameworks help to modernize the network by improving power reliability and coordinating renewable resources. Government support in all parts of the market, from research to sending, is making new open doors for the local energy industry and bringing about a cleaner, less expensive, and more grounded network. By broadening and improving strategies, for example, the venture expense credit and permitting spotless and effective energy properties access to ace constrained associations, government policymakers can enable these innovations to progress and grow considerably more rapidly. Congress and the organization should cooperate to help progressing activities and new proposition to help U.S. authority in energy storage. [8]

Working on wide characteristics that provided us with cost effective, flexible to modifications, maximum fault tolerance brings out a modern and energizing model to sense remotely on wireless connections. So this broadens the scope of Wireless sensor networks. In our daily life whenever we require any information this cost effective model proved to be imperative in all forms. In this modern era new wireless ad hoc networking administration procedures are required. [9]
The expanding job of various Solar plants in the electricity management has provoked worries about frameworks unwavering quality. This condition leads our concern basically on energy storage for which we need to provide cost effective output . By considering all aspects we have figured out that the inquiry is a budgeting issue. It collaboratively comprise of budget required for storage of energy, area governing, sources of energy etc. Plainly high infiltration of variable age expands the requirement for all adaptability choices including storage, and it likewise makes showcase open doors for these advancements. [10]

As represented in this report, energy storage is equipped for giving a suite of thirteen general electricity administrations to the electricity lattice, and the further downstream from focal age stations energy storage is found, the more administrations it can offer to the electricity system on the loose. A considerable lot of these downstream benefits, for example, customer bill management, strongly impact the financial aspects of battery storage and help legitimize batteries that likewise add to grid administrations. [11]

IV. UNITS

System Block Diagram

(A) Improved WSN Node With multiple sleeps-woke up modes & variables transmit power control

In this block diagram we can see sensor suit give signal to ADC then this signal goes to microcontroller and microcontroller send and receive data from memory and it send signal from RF Transmitter and RF transmitter connect with variable power controller and it communicate with peripheral power controller and this send signal to sleep

controller and then signal goes to battery management system which is connect with battery.

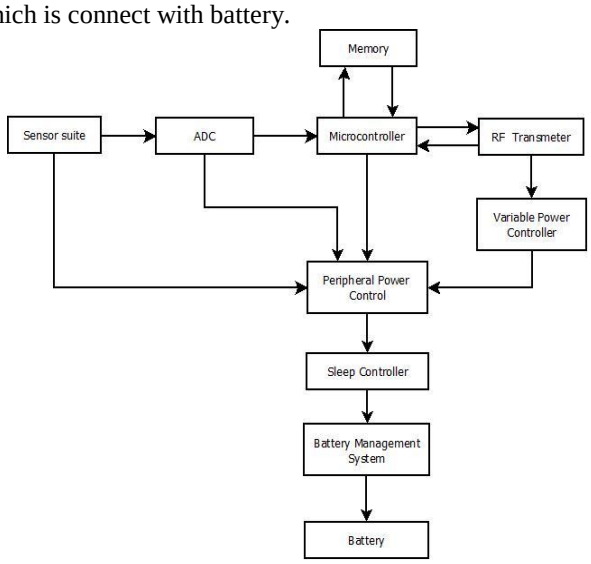
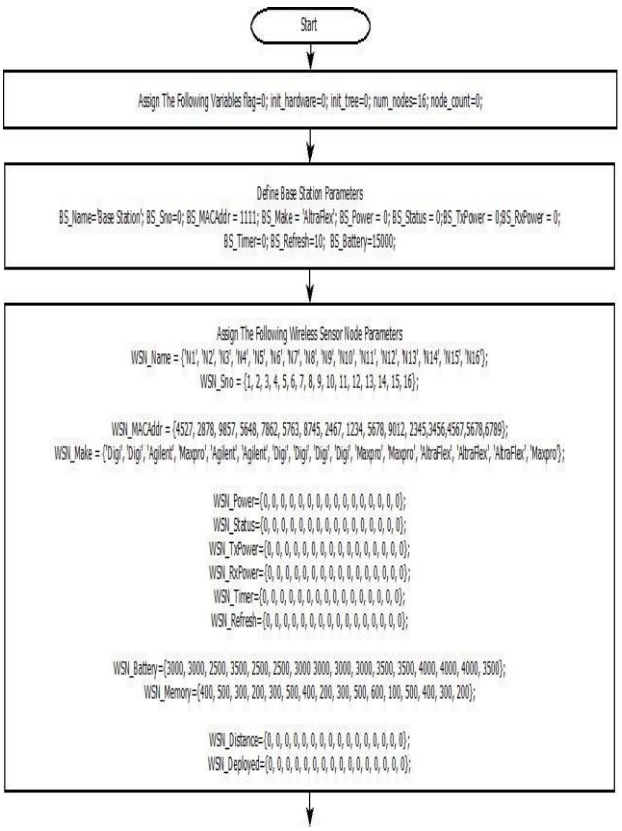


Figure 1.1 An Improved WSN Node With multiple sleep-woke up modes & variables transmit power control

(B) Main process chart

According to this Process-chart 1st algorithm initiates, then assignment of complete set of variables takes place & just after that defined base stations parameters then assign the wireless sensor node parameters. Then read fuzzy ANFIS system. Then clear all the screen and display main menu options. Then if Y==1 is true then call init hardware , if Y==2 is true then call unit Hierarchy, if Y==3 is true then call display Hierarchy, if Y==4 is true then call add node, if Y==5 is true then start simulation and if Y==6 then break.



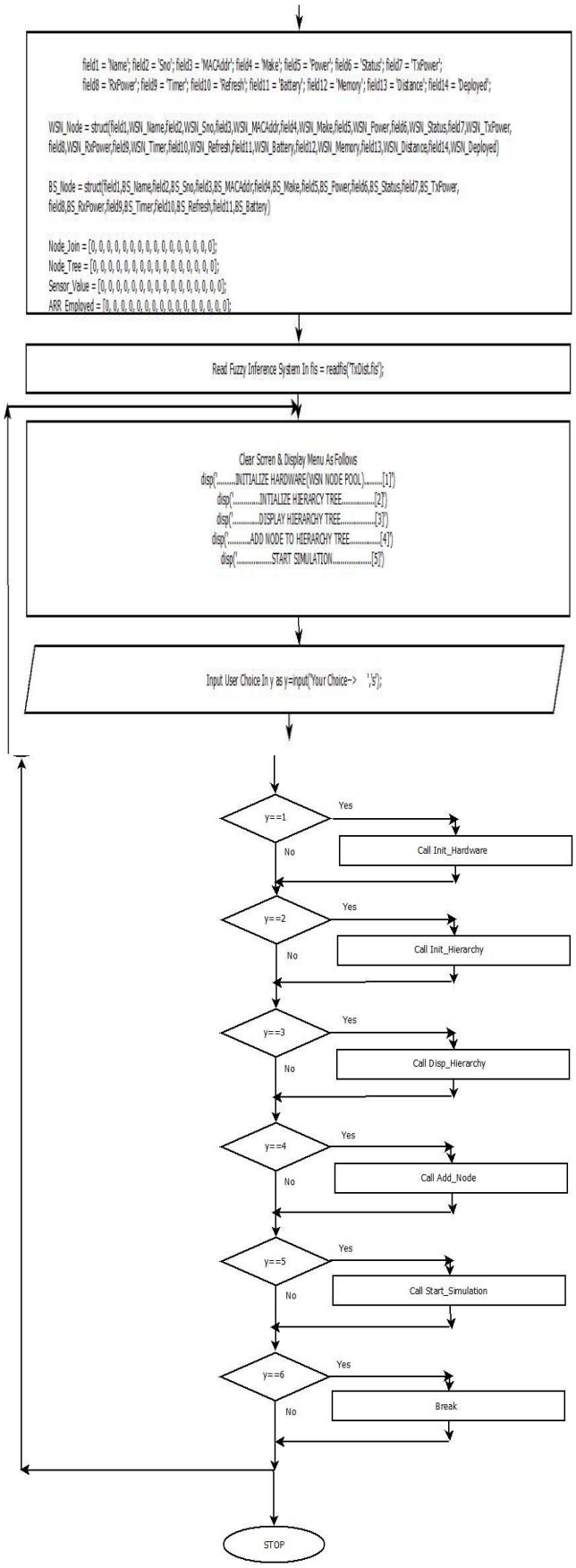


Figure 1.2: Main Code

(B)Add Nodes to the Flow-Chart

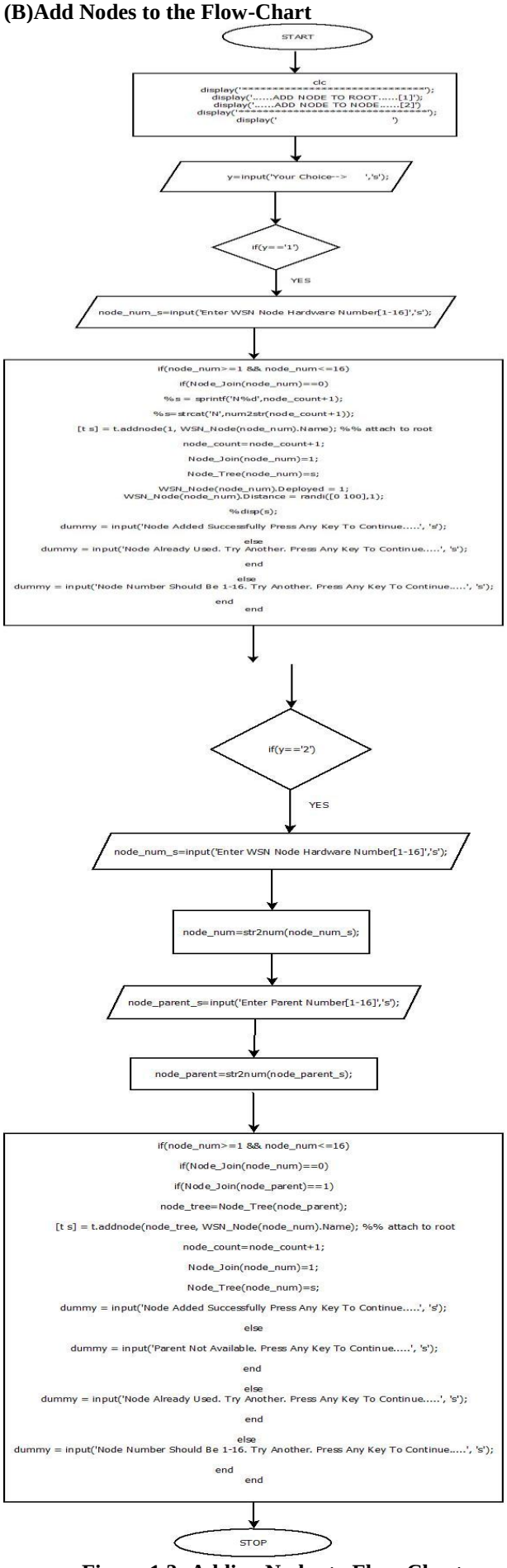


Figure 1.3: Adding Nodes to Flow-Chart

V. RESULTS

5.1 ANFIS Result

5.1.1 Testing Result

In this window we can see ANFIS editor which is used for give training.

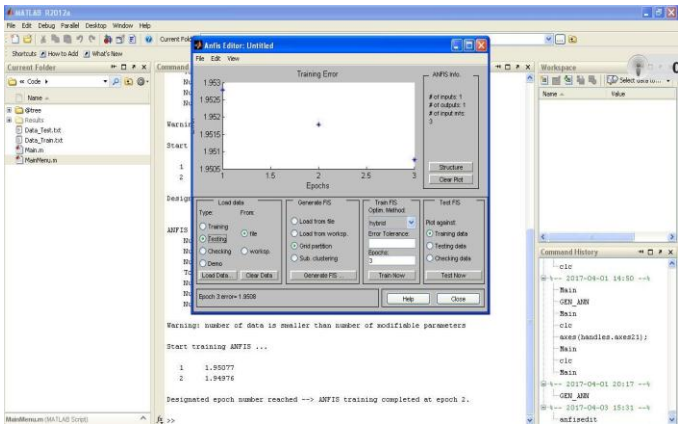


Figure 5.1 ANFIS Editor

This window demonstrate testing data plot, between data set index and output.

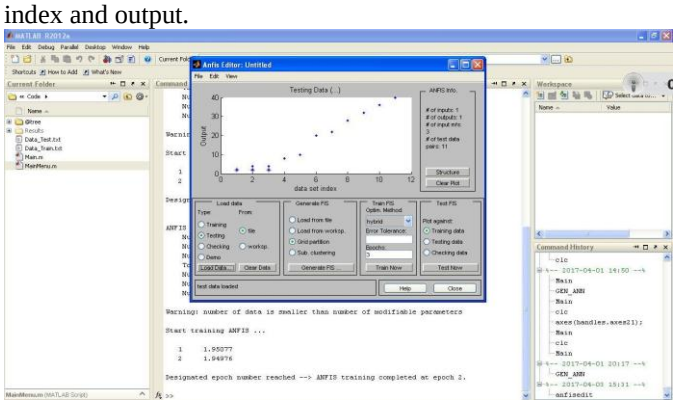


Figure 5.2 Data Plot Between Set Index and Output

5.1.2 Training Result

In this window we can see Anfis editor window here selected option is tracing and file in load data, grid partition in generated FIS and option method is hybrid.

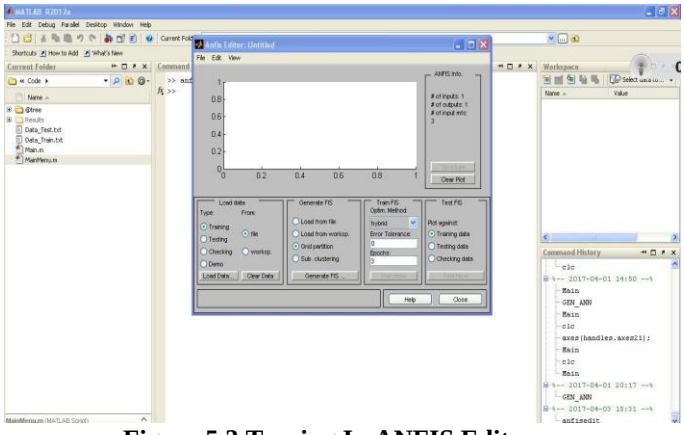


Figure.5.3 Tracing In ANFIS Editor

In this window we can see we select file by using select file then click on open button.

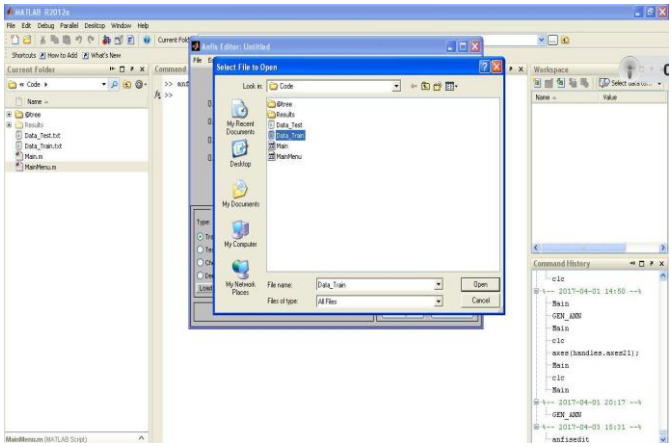


Figure.5.4 Selecting File

This window demonstrates that when we click train now button then ANFIS training starts.

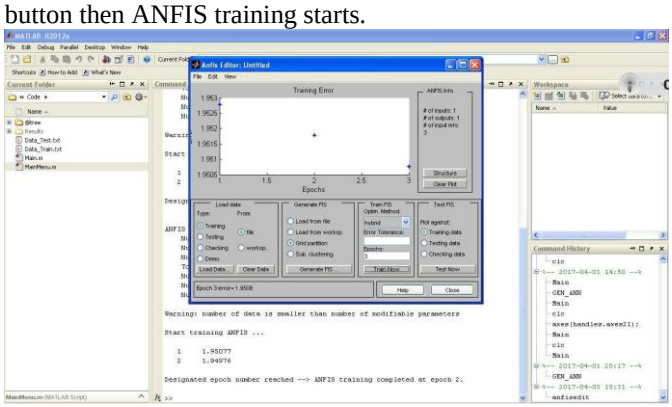


Figure 5.5 Start ANFIS Training

This window demonstrate numbers of nodes is 16, numbers of linear parameters is 3, numbers of non-linear parameters is 9, total number of parameters is 12, numbers of training data pair is 11, number of checking data pairs is zero and number of fuzzy rules is 3.

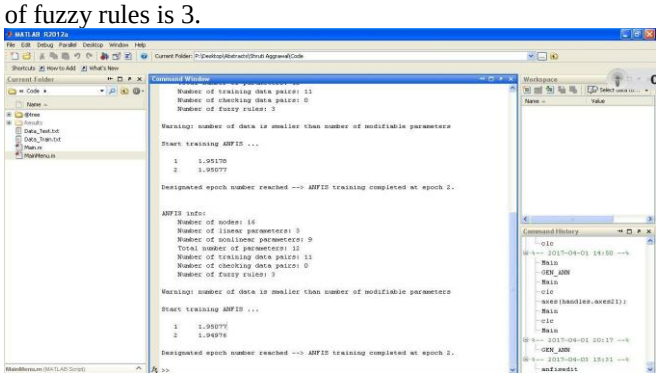


Figure 5.6 Parameter

5.2 Flow of Process

This window shows 5 main menu options, which are selected by user .

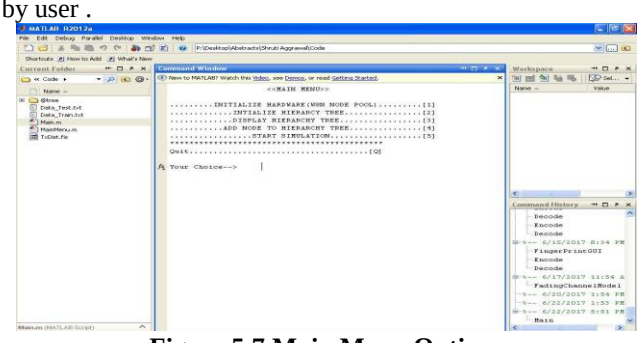


Figure 5.7 Main Menu Options

This window demonstrate the selected option 3 of main menu that will display the outline of hierarchy tree.

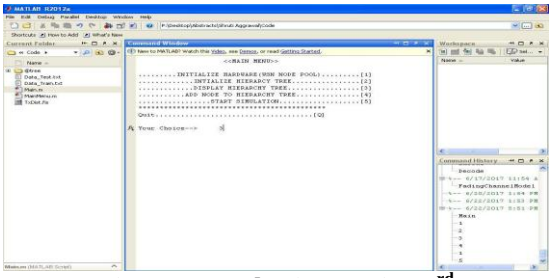


Figure 5.8 Selecting Option 3rd

In this window we can see base stations that are N5, N8 when we our press any key of keyboard then process will be continue.

Figure 5.9 N5 and N8 Base Stations

In this window we can see different graphs that is node status, node power, BS stations & power, sensor readings, total energy consumption, WSN battery status.

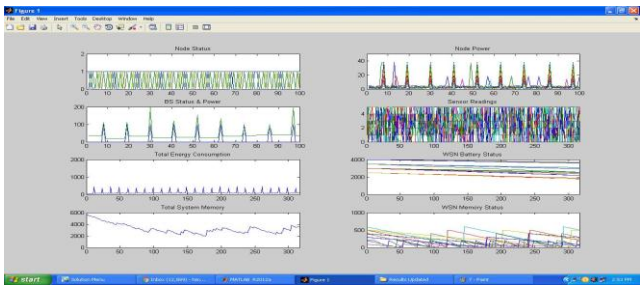


Figure 5.10 Different Graph of Different Parameters

5.4 Exp Result

Different Parameter Graph Till 50 Sec.

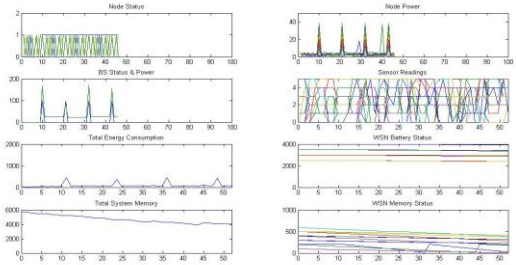


Figure 5.11 Parameters Graph Till 50 Seconds

As above process we take results for 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000 Seconds.

VI. CONCLUSION

In this paper author has suggested innovative WSN architecture employing a hierarchical structure for highly energy efficient operation in battery critical application. As WSN's are rapidly entering common day to day usage the need to lower hardware costs & increases battery life typically to life time of the device or a few years is rapidly emerging

technological challenge. The proposed WSN architecture benefits from the hierarchical structure of the network to implement a multi sleep woke up mode & variable transmit power strategy to reduce energy consumption minefields drastically. The proposed system relies on a innovative WSN node which has multiple sleep & woke modes. The woke up methods employed as timer interrupt memory interrupt & RF woke on call interrupt. The WSN nodes have the ability of peripheral power control to provide power to specific peripherals in various operational modes. The proposed WSN node has the ability to vary the transmit power according to requirement. Thus an advanced energy efficient configurable WSN node is developed.

The proposed architecture benefits from the hierarchical architecture by using ANFIS combination of artificial neural network & fuzzy logic to estimate the transmit power required according to the distance of the receiving node and as data mover up word hierarchically long distance transmission from node to central node is avoided instead node passes information to its parent node till it reaches the base station at toot thus reducing energy consumption directly. The successful implementation of the proposed technique demonstrating radio off during sleep only ADC woke up timer radio receive power threshold interrupt & ANFIS transmit power computation has been demonstrated in results above.

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