Report of CAP 706 on Topic:
Energy Issues of Wireless Sensor Network & Cloud Computing

Submitted To:-

Mr. Raj Singh

Submitted By:-

Gautam Kr. Kushwaha (11111100)
Sandeep Kr. Attri (11112964)
Ruchi Kumari (11402956)
Shivani Choudhary (11412081)

<u>DECLARATION</u>

I hereby declare that the Paper writing entitled, **Energy Issues of Wireless Sensor Network & Cloud Computing** submitted for the Master of computer application Degree is entirely our original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

<u>CERTIFICATE</u>

  This is to certify that Shivani Choudhary, Ruchi Kumari MCA, Gautam Kumar Kushwaha, Sandeep Kumar Attri MCA(Hons.) paper writing titled, **"Energy Issues of Wireless Sensor Network & Cloud Computing"** below my direction and command. To the best of my knowledge, the present work is the result of their original investigation and study. No part of the paper writing has ever been submitted for any other degree or diploma. The paper writing is fit for the submission and the partial fulfilment of the conditions for the award of Master's Degree.

  We further declared that we or any other person has not previously submitted this report to any other institution/university for any other degree/ diploma or any other person.

Date: 28 April 2015   Signature of Supervised

                               Mr. Raj Singh

                           (Assistant professor)

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Introduction:-

In this modern era as we know WSN (Wireless Sensor Network) & Cloud Computing has got more importance for the purpose of tracking & monitoring activities. The deployment of wireless sensor network through wireless medium has increased and adding cloud computing in this field makes it so powerful for its applications. Wireless sensor network is broadly functional in various arenas ever since from beginning. Though, the unfinished properties of a sensor, mainly inadequate battery-operated lifespan, inadequate bandwidth & inadequate handling influence, are the key contests for installing and functioning of WSN. Cloud performances as crucial sink points that collect detecting data from sensors. Every data collection point is accountable for gathering data from the nodes in area. Detecting data are kept and managed in disseminated way in cloud. But it got so much-issues like energy, security, architecture, power management etc.

Problem Background:-

Energy issues in WSN have a very much history because failure of nodes in sensing zone creates lots of problems for its users to use this technology. Because of limited power resources & high energy consumption of sensor nodes for performing all data related operations like transmission of data, data processing, data sensing it is lowering the network lifetime.

Literature Review:-

Cloud Computing:

Cloud calculating is a duration castoff to define together a phase & kind of solicitation. Cloud figuring policy vigorously supplies, organises, reconstructs attendants as required. Attendants in the cloud can be bodily engines or virtual engines. It is substitutes to consuming local server's holder solicitations. The close users of a mist figuring network generally have no idea wherever the servers are actually positioned they just turn up their application and start working. Tolerant clouds normally consist of additional computing assets. Cloud computing also defines solicitations that are prolonged to be reachable over Internet. [1]

Sensor Network:

Wireless Sensor Network contains circulated self-directed sensors to helpfully monitor physical or environmental situations, as high temperature, encyclopaedic, quivering, pressure, motion or contaminants. The enlargement of wireless sensor networks was encouraged by military applications such as battleground observation. A sensor network is a computer network collected of a great number of sensor nodes. Every node in a sensor network is normally fortified with a radio transceiver or other wireless transportations device, a minor microcontroller, and a power heart, typically a battery. Generally these devices are small and reasonable, they can be created and mounted in huge numbers, and so their resources in terms of energy, memory, computational rapidity and bandwidth are strictly controlled. Generally these Sensor nodes comprise of three elements: perceiving, control and interrelating. [1]

Sensor Issues (where we can reduce energy consumption):-
1) Power Management
2) Scalability
3) Network Connectivity & Protocols
4) Scheduling

Cloud Issues (where we can reduce energy consumption):-
1) Reliability
2) Data Backup
3) Privacy
4) Security
5) Ownership
6) Availability & Performance
7) Legal [1]

Sensors are commonly low cost devices armed with restricted resources, like processing power, memory, wireless bandwidth, and battery. The project of WSN must take care of these restrains, mainly battery limitation that controls the lifetime of a sensor and a sensor network. A number of energy proficient methods have been recommended. All layer protocols used in WSN are improved to shrink energy depletion, comprising MAC layer, network layer routing protocols, transport layer, and cross-layer schemes. Since communicating procedure consumes extra energy associating against sensing and processing manoeuvres, several additional technologies have been anticipated to protect energy, like in-network data handling, mobile sink for data gathering, and topology restructuring. Cloud computing is deliberated as a cost effective method of IT resource delivery routine. It propositions amount of benefits such as scalability, liveliness and budget effectiveness, in contrast of out dated IT structure. The cloud computing expertise is appropriate for large data storing and handling. WSN is logically separated into different types of components which we mention as sensing zones. Every node in the cloud is accountable for data gathering of sensors in a zone. The sensors in a zone are structured as a native WSN in regular or grading topology, and these resident networks are combined together by cloud. Such as result, the middling endways path distance of packet broadcast can be reduced, & the liveliness feasting would be compact. The requisite bandwidth for data broadcast is compact as well. Besides, data in cloud are kept and managed in dispersed mode, thus complex jobs could be finished well-timed, which would be favoured for huge size data progression. [2]

Problem: creating an energy efficient automatic network management for WSN

These people explained in their report that how we can automatically manage our wireless sensor network through cloud computing. Because the huge volume of data, source type is heterogeneous and limited data processing ability of WSN creating lots of problems for its users, which can be easily simplified with the help of cloud computing. They represented an architecture framework which covers all aspects of cloud computing like fault tolerant and security issues. This framework supports sensor data management using Hadoop Technology in cloud. Cloud connects WSN using 802.22 & MPLS. It can process, collect & distribute sensor data & utilizes the policy based management system to automate WSN's management task. [3]

Problem: creating an energy efficient routing protocol for WSN
WSN consists of so many sensor nodes feast over sensing zone to sense data. These data must be collected & transferred to the Base Station for further queries. Sensor nodes which

are going to be used are not cost effective & having low computation as well as limited energy, not so much reliable. In a place whether all nodes have to send data to the base station we need an effective utilization of energy of sensor nodes which can increase network lifetime as well as nodes lifetime. In this paper they proposed a protocol MSMTP (minimum spanning multi-tier protocol); It which uses data aggregation and fusion technique, by using this protocol we can get an effective energy utilization of nodes which increases system lifetime instead of using a conventional routing protocol. Through generating a MST (minimum spanning tree) among all sensor nodes we can reduce transmission energy of network and then by selecting a high energy conserving node among the top tier will transmit the accumulated data of complete network to Base Station. Possession of same network topology until any of the nodes in that network goes down other high energy node from top rank tier will be chosen and communication between network and Base Station will be continued. By applying this protocol user can achieve 10xs to 20xs enhancements in system lifetime comparative to MTP (multi-tier trace back protocol), PEGASIS. [4]

All sensor subsystem brazens its sensed, combined data to that neighbour node which is linked to it in MST structure. Then a node of top most rank will convey the data of all nodes of the network to the base station. Nodes of tier1 continue to convey aggregated data to base station until all nodes of tier1 have energy superior than distinct threshold level. When energy level of all nodes of tier1 goes under distinct threshold energy then second part of this architecture will come into act; Nodes of tier2 will transmit data to base station and same process will be lifted to nodes of tier3. This process is known as TOP TIER SHIFTING. When all nodes of tier3 have energy under threshold energy then a new threshold is definite. This process is constant until threshold goes below dead energy, at that instant all nodes of network are dead so the network is presumed to be dead.[4]

Problem: creating an energy efficient broadcast network in Ad-Hoc for WSN

Accomplish an energy-effective distribution is specifically significant for Ad-Hoc WSN for the reason that devices are usually run by batteries with restricted eras. The minimum-energy broadcast problem is correspondent to problem of discovering slightest Connected Directing Set. Well-organized EMCDS doesn't worry them with node energy and transmission operations might flop if spread nodes are out of energy. MEBS with a changed type of EMCDS, & aimed at providing a well-organized arranging scheme with exploited network lifetime. EMCDS algorithm can find reduced CDS equated with associated works, and the MEBS can help to upsurge the network era by capably matching energy between nodes in the network. [5]

Techniques which we used in energy optimization:-
- Clustering and
- Direct Diffusion

Comparing over different parameters like scalability, energy efficiency, Reliability.

Clustering:-
When we are not used clustering then the communication channel is flat and the member node is directly communicating with the central base where they are using more energy. When we using clustering then we make cluster head and different member nodes. We make

hierarchical communication channel and member system send their figures to the cluster head and then group crown straight send their data to the sink node. [6]

Direct diffusion:-
In this technique we use different elements like benefits, data messages, inclines, & re-inforcements.
Interest message is basically a query which derive us what user want and in every interest element it contains explanation of a sensing duty that is supported by a sensor set of connections for obtaining data.
Gradient mainly creates a direction path with each node.
Then the sensor set of connections reinforces one or a small number of these paths.
In fixed dispersion, by using this attribute value pair's we named the data and the sensing is circulated overall the sensor network as a concentration for named figures. [6]

Basically direct diffusion involves two types of operation:-
In first operation, a sink node is request and broadcast interest messages which is routed towards the node in that region and overall sensor network. From sink node when the interest message is broadcasted to the network each node receiving interest and do caching for later use after that we compare the received data with the values in the interest. Between the sink and the source which use the gradients and interest paths are established.

In second operation: - the sink which receiving the interest messages send reinforcement interest messages to particular neighbours who delivered useful data. These neighbours reinforce the paths established that provided useful data and this process continues. [6]

Duplicate Suppression

Duplicate Suppression is simply a data aggregation function. In this when we sent data from source one to source two than the duplication of data will be filtered.
In this technique in- network data processing is used as routing technique. This is used to reduce the amount of data which we transmitted it will use an equal amount of energy on the entire network. We use this data processing technique because transmitting data requires more energy than processing the data.

PERFORMANCE ANALYSIS

When we compare the techniques with different parameters then the conclusion is:-

Scalability: - Clustering is more scalable than to Direct Diffusion and Duplicate Suppression because we can scale the number of nodes there is no limit.

In case of **Energy Efficiency** both the Direct Diffusion and the Duplicate suppression Clustering techniques are very good also Duplicate suppression is good for data redundancy.

In direct diffusion the energy of the network decrease because of sending and getting data in the network and then the node find the direct path and we use the gradient path. When we are using the path it also contributes to decrease the energy.

When we deploy the size of the network then with the help of direct diffusion protocol then automatically it will decrease the whole system energy practice and rise the life of the network...

When path selection is non-optimized then it beats an idealized outdated data distribution scheme like omniscient multicast.
These mechanisms are unchanging under the choice of network dynamics which is considered in this research paper.
Now, for achieving full potential we use directed diffusion and also the suspicious care has to be paid to the design of sensor wireless MAC layers. Even then clustering has better energy efficiency.

Reliability: - In case of reliability Direct Diffusion is good while in case of Duplicate Suppression and Clustering reliability is moderate. [6]

Problem1:-
How we find the shortest path.
Problem2:-
How we monitor infrequent events.

When we have to monitor the event which will be occurred in WSN then we use Efficient Event Detecting Protocol (EEDP). The region where the event occurs where each node broadcasts its primary detection and the result is used to make a final decision. Then the next hop will choose the final decision by using the underlying routing protocol and this protocol helps to forward a single alarm packet and also for considering the shortest path.
[7]

We used greedy algorithm for broadcasting and for selecting the shortest path for transmitting the data. After that the decision packet is routed that has a highest battery power and also which has closest to sink that will be selected as the next hope. This will be less number of the link failure velocity due to the node failure and also efficient energy will be consumed which improves the lifetime of the network. When we have to improve the reliability in the transmission of single alarm packet then multi copy scheme is used. [7]

By combining a large number of sensors node then it will be used to sense an event and this is called incident-driven WSN. Main purpose of this occurrence is to give exact notification of the events to the decision maker.
To monitor the infrequent events then an efficient event detection protocol is used.
Then the ability to pass on the sensor data and the place of an event to one a centralized sinks who is expected to perform real time processing and then helps to make accurate decision quickly.

Then the final decisions which are the alarm messages that will be delivered to the users in an energy capable and fast brazen method

Routing protocols in sensor networks has three types:-

- Proactive (table-driven) steering: - A periodically distributing routing tables maintains a fresh list of routes throughout the network by using the routing protocols.

- Reactive (on demand) routing: - Reactive routing protocol establishes a route on demand by flooding the set of connections with way apply for packets, which would generally cost less energy when compared with the earlier one.
- Geographical routing: - It steering principle that relies on geographic position information. [7]

Problem1:-
To increase the time of the network decreases the energy consumption of sensor node.
Problem2:-
Energy management is a dynamic problem in the scheme of wireless sensor networks.

Three mechanisms namely a detecting subsystem, subsystem of processing and subsystem of message in sensor nodes are:-
Sensing subsystem: - It is used for physical data procurement from the immediate environment.

Subsystem of processing: - this process is used to native data and to collect them we use the processing unit.
Subsystem of communication: - In wireless communication subsystem is done with the help of data transmission.

The energy essential for data detecting is larger than that required for data broadcast. Normally Energy saving practises mainly give attention on the detecting subsystem and the message transfer subsystem.

In this case both the basin and the device nodes are stationary. The parameters that are used in this is Duty Cycling, Data Reduction and Mobility. Now, the mobility as a different energy saving scheme to spread the system period. These methods are essential for all networking protocol and solution for improving energy. [8]

Duty Cycling:-

At the interval when communication is not active then the system will be switched off and it should be continued as soon as a new data packet becomes prepared to transfer or accept in this way nodes vary between energetic and snooze method dependent upon the network action this is called duty cycling.

So here use topology control which is used to finding the ideal subgroup of nodes and connectivity.

When the network redundancy spread then topology device is used to extend the system longevity.

This is mainly operated on active nodes as power management and this technique further subdivided into two categories:-
- Sleep/Wakeup Protocols this protocol goes on the top of a MAC Protocol generally in the network and the application layer.

- And the Protocol with Small Duty Cycle which is combined with the MAC Protocol itself. [8]

Data-Driven Approach:-

By keeping the sensing accuracy we reduced the number of sampled data within an acceptable range.
Energy consumption focuses with the help of data sensing of antenna nodes in two behaviour:

(i) Sample are excess: There shows us of no use energy utilization, even if the cost of sampling is insignificant because they result in not needed communiqué

Power utilization in these sensing nodes: This performing a few kind of operations this requires some energy. Main issues in this approach energy utilisation are high.

It has two techniques.
- Data-Reduction: - In this case the unwanted samples are reduced.
- Energy- Data Attainment: - Focus on sinking the energy spent by the sensing nodes [8]

Mobility-Based Scheme

In a fixed device network packets communicated from device nodes follow a multi-hop message path to the sink node. So some routes can get more burdened than others. Hence the nodes closer to the sink have to send extra packets so that they are more subject to early energy reduction. Mobility is used as a device to decrease the energy consumption.

Basically, mobile nodes can be of two types:-
- Network infrastructure: - their flexibility can be fully measured by the controller.
- Environments Part: - it may be not always controllable.

Mobility-based Approaches prepared by two structures:-

- Mobile-Sink: - The networks in wireless Sensor are basically mobile sinks mainly in a Linear Programming method which is used to improve the factors such as network life, energy consumption, etc.
- Mobile-Relay: - Message ferrying scheme is used. In this scheme we have a travel around in the network area and then collect the data from the source nodes and send them towards the end node. This scheme gives high achievement rate and also protects energy. [8]

Proposed Research Objectives:-

The main objective of our research is to reduce the energy consumption of sensor nodes which helps in increase the lifetime of sensor nodes and network. Provide an efficient energy

Solution based upon areas where more energy is consumed like data sensing, data processing, data communication, WSN-Cloud connecting network routing protocols, data management etc.

Methodologies Proposed:-

Parameters in our Proposed Method

- ➢ Energy efficient Routing protocol
- ➢ Energy Efficient Data management technique
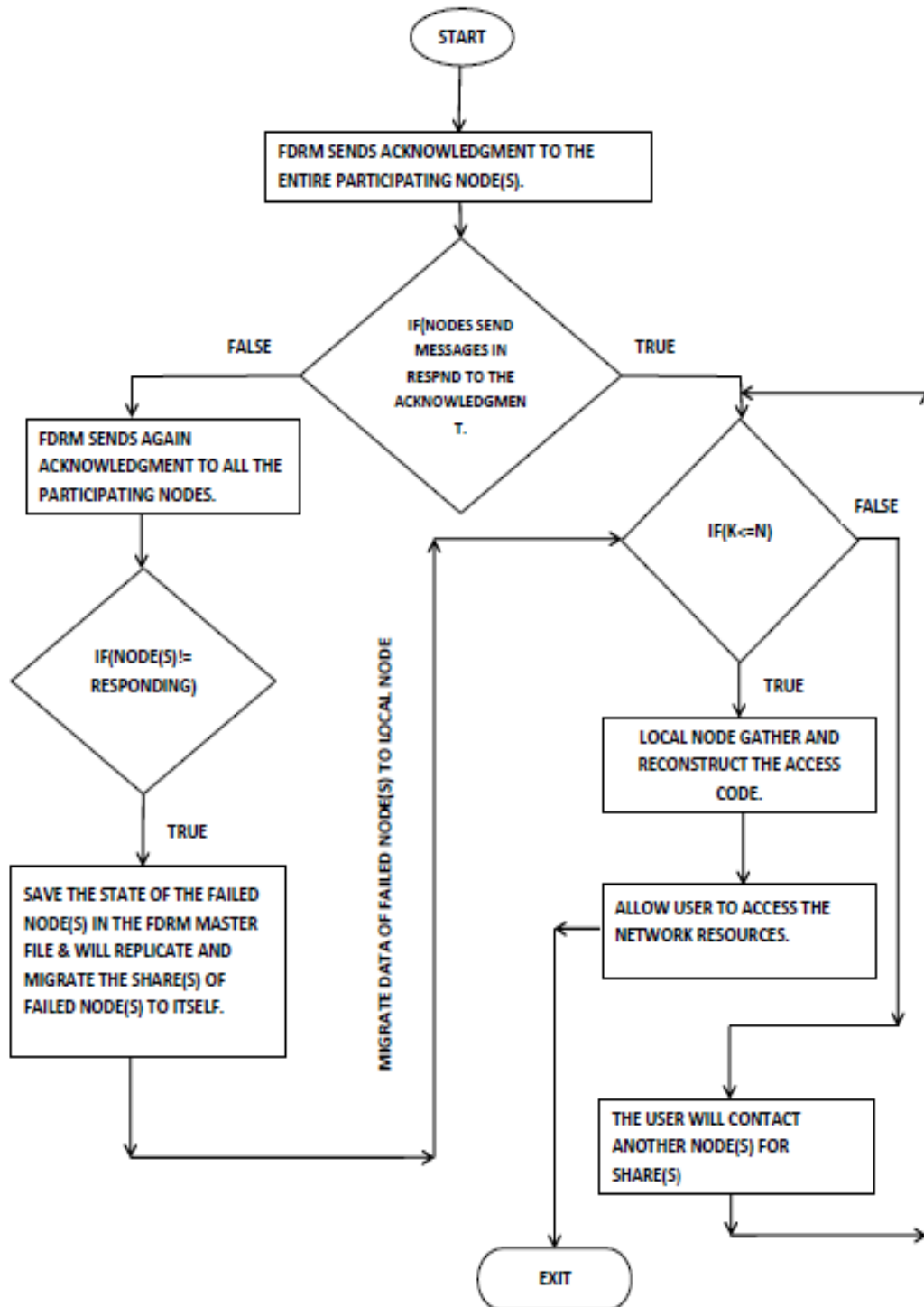- ➢ Energy Efficient route discovery system

Energy is one of the major concerns in WSN. The main objective of this work is to provide a new protocol which will make more reliable and efficient than previously In WSN Architecture; an efficient, secure and reliable service are provided by means of employing Fault detector and Replication Manager. Some of the other objectives of this study are as following.

- A FDRM (Fault detector and Replication Manager) is used to solve the problem if there is any kind of node failure occurred in the network.

- FDRM come into action if one of the node stop working and the whole secret share which is stored in that faulty node will migrate to FDRM.

- By using FDRM, the system will work without any interruption caused by node failure.

Methodology

1. Developing secure and reliable protocol for Energy efficient WSN is the problem definition for research work.

2. A protocol with FDRM (Fault detector and Replication Manager) provides reliability and security in case of failure in the network.

3. The proposed work will be implemented through NS2 simulator.

4. Finally report will be compiled using all the experiments and their result based on new proposed protocol.

Flowchart of the proposed architecture:

```
                              ┌─────────┐
                              │  START  │
                              └────┬────┘
                                   │
                                   ▼
                    ┌──────────────────────────────┐
                    │ FDRM SENDS ACKNOWLEDGMENT TO  │
                    │ THE ENTIRE PARTICIPATING      │
                    │ NODE(S).                      │
                    └──────────────┬───────────────┘
                                   │
                                   ▼
                    ◇────────────────────────────◇
     FALSE          │   IF(NODES SEND MESSAGES    │        TRUE
  ◄─────────────────│   IN RESPND TO THE          │────────────────►
                    │   ACKNOWLEDGMENT.           │
                    ◇────────────────────────────◇
```

FDRM SENDS AGAIN ACKNOWLEDGMENT TO ALL THE PARTICIPATING NODES.

IF(NODE(S)!= RESPONDING)

TRUE

SAVE THE STATE OF THE FAILED NODE(S) IN THE FDRM MASTER FILE & WILL REPLICATE AND MIGRATE THE SHARE(S) OF FAILED NODE(S) TO ITSELF.

MIGRATE DATA OF FAILED NODE(S) TO LOCAL NODE

IF(K<=N)   FALSE

TRUE

LOCAL NODE GATHER AND RECONSTRUCT THE ACCESS CODE.

ALLOW USER TO ACCESS THE NETWORK RESOURCES.

THE USER WILL CONTACT ANOTHER NODE(S) FOR SHARE(S)

EXIT

PROPOSED ALGORITHM

The following algorithm helps to provides security and reliability to user without knowing the fact that where the failure had occurred in the distributed cloud environment. The following are the keywords used in the proposed algorithm.

// K = minimum number of shares that are required to access the network resource(s).

// N = total number of nodes in the network/quorum of network that stored shares of Access Code.

// AC = Access Code is the combination of all shares

// LN = Local Node gather and reconstruct the Secret shares to allow user to access the network resources.

// FDRM = Fault Detector and Replication Manager supervises the entire network and come into action during any failure(s), node(s) failure, in network.

Step1: FDRM Sends Acknowledgment to the Entire Participating Node in the WSN architecture.

Step2: if (node(s) sends messages in respond to the acknowledgment)

   {

- **User asks for the shares held by the participating nodes in the cloud environment.**
- **All shares will be collected at LN and LN will reconstruct the AC.**
- **LN allows user(s) to access the network resource(s).**

   }

   Else

   {   // In case of failure, the FDRM will work.

- **FDRM will Sends again Acknowledgment to the Entire Participating Node(s).**
   **If (Node(s)! = Responding)**

      {

- **Save the state of the failed node(s) in the FDRM master file & will replicate and migrate the share(s) of failed node(s) to it and FDRM will send this Share of failed node to LN.**

      }

   }

NS2 Simulator

The network simulator NS is a simulator which is used create simulation of TCP, routing and protocols over wired or wireless networks. NS2 is the open source network as well as platform independent. It means it can be used on various platforms such Linux, UNIX and windows.
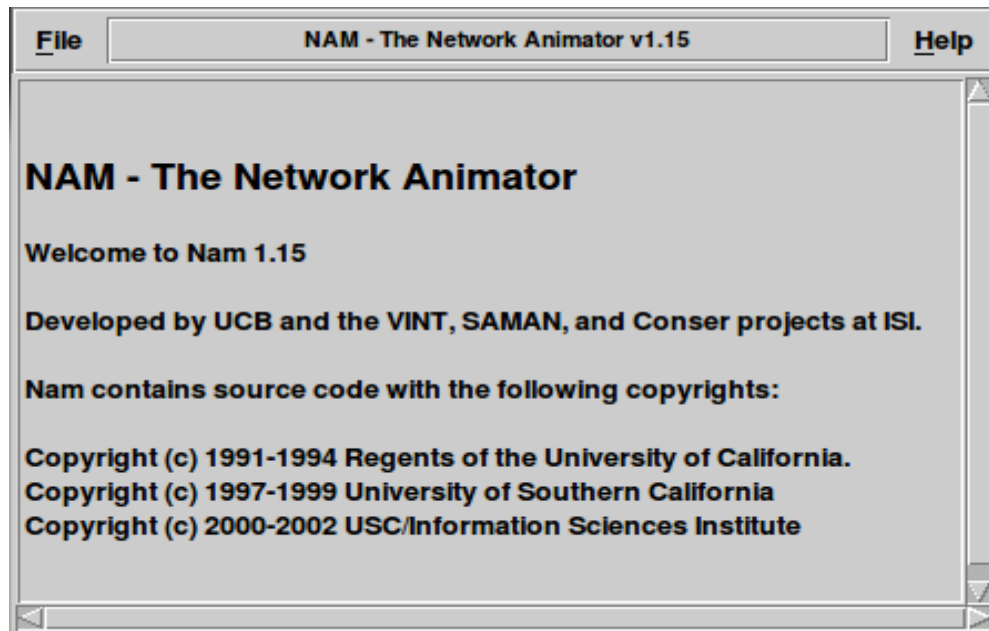
Future Scope:-

We can learn from present problems of WSN & Cloud Computing and we can consider above discussed problems for our future reference so we don't need to re-consider these problems in coming time of next era of WSN. Providing an Efficient solution for these problems mainly we are focusing on the problem of energy consumption which is limited that how we can increase the lifetime of sensor nodes and system network.

Summary & Conclusion:-

In above discussed reviews we mainly considered that how we are using Cloud Computing with WSN. How it is actually helping WSN to increase its data management in an Energy Efficient manner. We have taken some energy consuming problem of WSN based upon different parts of WSN Cloud Network like energy consumption problems in Data management, Routing protocols, Architecture design etc. We are researching in area of Wireless Sensor Network and Cloud Computing over Energy Consumption Issues.

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