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AN MOBILE AGENT BASED MEMORY MODEL TO PROVIDE EFFECTIVE COMMUNICATION IN WSN

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ABSTRACT

The energy efficiency is the foremost requirement of a sensor network. The network life, communication and the QOS are the factors that all are affected based on energy requirements of a network. To improve the network life there are number of existing routing mechanism to improve the QOS. In this present work, cache improved WSN architecture is defined. According to this presented architecture we have defined a mobile agent with some memory specification. In this work, a radial movement of this mobile agent so that the direct access of this mobile agent to each sensor network can be performed. The available memory in this agent node is limited so that the page replacement approach is also defined in this work based on the requirement frequency of a particular data value. Now when some node required some data, instead of performing the communication from source node, it will request for the data to the mobile agent. If the mobile agent is in range and avail the data, it will provide it immediately otherwise the data will be transferred from the source node. The presented model is implemented in matlab environment and the obtained results shows that the presented work has improved the network communication as well as network life.

KEYWORDS: Page Table, Agent Based Model, QOS, Page Replacement, Centralized Model

INTRODUCTION

Agent based approach is considered to be the most advantageous one usually. Mobile agents are dynamic and intelligent programs that can migrate through nodes (Harrison, David & Kershenbaum, 1995). Each mobile agent has its own code and execution state. After its injection, the mobile agent performs autonomously. When the agent reaches a sensor node, it runs its instructions. To achieve its goal, a mobile agent can move or clone itself to another sensor node or interplay with other agents. Mobile agent is a special kind of software which can execute autonomously. Once dispatched, it can migrate from node to node performing data processing autonomously, while software can typically only execute when being called upon by other routines. Franklin and Graesser provided a formal definition of agent in [10].

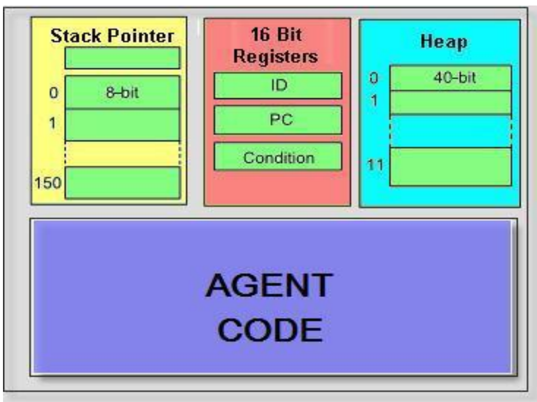

Figure 1: Mobile Agent Architecture

Here figure 1 is showing a standard architecture of Mobile agent. As we can see, the mobile agent is defined as a program that is maintained in the form of stack and to execute these statements a stack pointer is been used. The memory is presented in the form of heap. This this presented model, this heap memory is been used as the page table for the system. To perform the internal operations the agent is also having the registers.

Adaptation to environmental changes and wireless reprogramming are two important challenges for WSNs. Assume a WSN is primarily deployed for intrusion detection in a building. Civil defense authorities may want to reprogram the network to detect fire or gas leak in an emergency situation. Installing all these applications at once is not flexible, manageable or scalable. Mobile agent middleware addresses this problem. It provides dynamic reprogramming of WSNs by allowing new agents to be injected where old agents die. Mobile agent middleware support adaptability and mobility. Shared memory model of the tuple spaces/tag spaces enables one agent to insert a tuple which contains a data and another agent to retrieve this data later. This feature allows coordination of agents to perform a common task in a highly decoupled fashion. This model provides scalability of the middleware. In section 2 of this paper, the agent based work defined by other authors is discussed. In section 3, the presented research proposal is discussed and in section 4, the results driven from the system are presented. In section 5, the conclusion drawn from this work is shown.

REVIEW OF LITERATURE

Lang Tong, et al. (2003) proposed an architecture for large scale low power sensor network referred to as sensor networks with mobile agents (SENMA) in order to gain in energy efficiency. SENMA exploit node redundancies by introducing mobile agents that communicate opportunistically with a large field of sensors. The key feature of SENMA is the addition of mobile agents that shifts processing complexities away from sensors. The addition of mobile agents shifts computationally intensive tasks away from primitive sensors to more powerful mobile agents, which enables energy efficient operations under severely limited power constraints. As a result, SENMA offers considerable advantage in energy efficiency over the flat ad hoc network architecture. The proposed SENMA architecture is based on two propositions that are sensor network specific. The first is that, given the scale of the network and the low complexity of each sensor, it is impractical, if not impossible, to rely on sensors to organize the medium access control, to discover and maintain routes, to store and relay packets, to encode and decode. The second proposition is that the inherent node redundancy in such dense networks must be exploited. S. R. Madden, et al. (2003) discussed about the design of an acquisitional query processor for data collection in sensor networks. Acquisitional issues are those that pertain to where, when, and how often data is physically acquired (sampled) and delivered to query processing operators. They discussed simple extensions to SQL for controlling data acquisition, and showed how acquisitional issues influence query optimization, dissemination, and execution and also evaluated issues in the context of TinyDB, a distributed query processor for smart sensor devices, and showed how acquisitional techniques can provide significant reductions in power consumption on our sensor devices. Q. Li, et al. (2003) proposed the related work in mobile agent route planning, in the robotic community regarding robot navigation. They proposed a series of algorithm to decide the safest path for a mobile robot must take to reach its destination. Obstacles are sensed by a sensor network and the safest path is computed at the sensor network as well. The mobile robot is then safely guided by the sensor network to its destination. In particular, they propose to use a combination of artificial potential fields and dynamic programming. Artificial potential fields compute the risk level at every node. Hairong Qi, et al. (2003) has been proposed Mobile agents for efficient data dissemination in sensor networks. They gave a mobile agent (MA)-based distributed sensor network (MADSN) for collaborative signal and information processing, which considerably reduces the sensory data traffic and query latency as well. However, the introduction of a mobile agent (MA) leads to a new computing paradigm, which is in contrast to the traditional client/server-based computing. The MA is a special kind of software which visits the network either periodically or on demand (when the application requires). It performs data processing autonomously while migrating from node to node. Arkady Zaslavsky (2004) described that mobile agent paradigm is a useful and important technology enabling pervasive and ubiquitous computing. Context awareness drives adaptability of pervasive computing systems. It is asserted that mobile agents capable of discovering, extracting, interpreting and validating context will make significant contribution to increasing efficiency, flexibility and feasibility of pervasive computing systems. Min Chen, et al. (2005) gave the mobile-agent based energy-efficient proposal in order to reduce the information redundancy and communication overhead. In this approach, mobile agent is exploited at three levels (e.g. node level, task level, and combined task level).

At the Node Level application redundancy eliminating by MA assisted local Processing. At the Task Level spatial redundancy elimination by MA assisted data aggregation. At the Combined Task Level communication overhead saved by MA assisted multiple tasks data concatenation.M. Chen, et al. (2011) introduced MA migration during data gathering in WSN's for reducing power consumption and thereby increasing the networks lifetime. The main issue when using multiple MA's is grouping the nodes, so that MA's hoping between the nodes in a group consumes as little energy as possible. This feature is achieved by devising new agent migration algorithms which produces an agent migration itinerary. It was based on the assumption that network of WSN nodes is represented by a totally connected graph, for which we calculate a minimum spanning tree and generate the appropriate number of agents which is equal to vertices coming out of the root of the spanning tree. Since this algorithm has a flaw when mobile agent (MA) hops between nodes have smaller weight in compare to hop from the source node, its modification proposes a new algorithm which uses a balancing factor that balances the generated spanning tree.

PROPOSED WORK

In this present work, we have defined an agent based memory model architecture to provide the centralized memory to the network system so that the network communication will be reduced and the network life will be improved. The presented model is defined with the mobile agent, the agent is defined as a program and the memory specifications. The memory available in mobile agent is in form of external heap memory that is available in this work as the shared page table. The whole memory is represented in the form of pages and a single page represents the request performed by the user to retrieve some data from some other node.

The mobile agent is capable to manage this memory or the page table. For this, the agent is defiend with some integrated program. This program is divided in two parts, first to accept the user request and check the page table contents, if the page table contains the user request data then avail these contents to the user. If the contents are not in page table, then perform the analysis on this request based on the frequency of request on particular data and execute the page replacement algorithm if required. The complete working model of the presented work is defined here

- Define a Sensor network with N Number of Nodes, One base station and Mobile Agent
- Divide the network in M number of clusters and identify the cluster head for each cluster under the parameters of energy and distance.
- Identify the Center position for the network and the specify the radial path for the mobile agent.
- Define the moving agent over the circumference of radial path so that the easy access to the nodes will be performed.
- Perform the communication over the network in traditional way.

- As some request is performed, send the request to mobile agent. Mobile agent will check the requested contents in page table. If the contents are present then avail these contents to requested node.
- Update the page table respective to the frequency values for each page.
- If the requested contents are not in page table then look for the available space in page table.
- If the space present then sent request to the source node and required contents.
- Load these contents to page table as well as send to the request node.
- If the contents are not in page table and the space is not present then perform he frequency analysis on these pages.
- Based on this analysis identify the requirement of page replacement algorithm, if the algorithm is required to execute then perform the page replacement.
- Update the page table

Perform this whole procedure for N number of rounds and analyze the communication and the energy parameters for the network. The page replacement algorithm used in this work is given as under

Algorithm

Step 1: Define the Agent with limited memory of size N Pages

Step 2: Accept the sensor node request called Pagei

Step 3: if count(inputpage)<=N

{

Include the Page in Queue

}

Step 4: else

{

If Pagei BelongsTo Queue

{

Frequency(Pagei)=Frequency(Pagei)+1

}

Step 5: Else

{

5.1 Find the Low Frequency Page From Cache called LFrequPage

5.2 If Count(LFrequPage)=1

{

Replace this page by pagei

}

5.3 Else

{

Find the Recently Visited Page called RecVisited from LFrequPage and replace it in cache by pagei

}

}

}

Step 6: Exit

RESULTS

The presented work is implemented in Matlab environment under different scenarios. The scenario used in the system is defined in table 1.

Table 1: Network Scenario

Parameters	Values
Area	100x100
Number of Nodes	100
Base Station	50,50
Mobile Agent	Radial with 20 Radius
Initial Energy	.5 J
Transmission Energy	50 nJ
Receiving Energy	50 nJ
Forwarding Energy	10 nJ
Page Table Size	3

The output driven from the system under these parameters is given as under

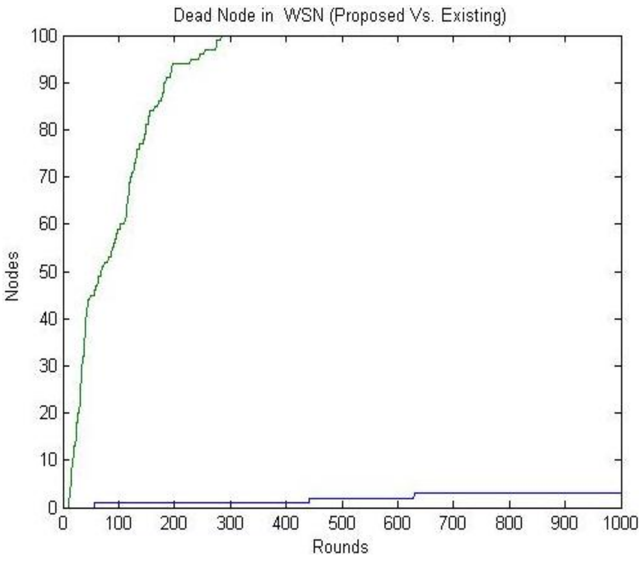

Figure 2: Network Life (Dead Nodes)

Here figure 2, is showing the analysis of existing and proposed work respective to the dead nodes. The existing work is without the mobile agent specification. As we can see in this proposed work, the network life has been increased.

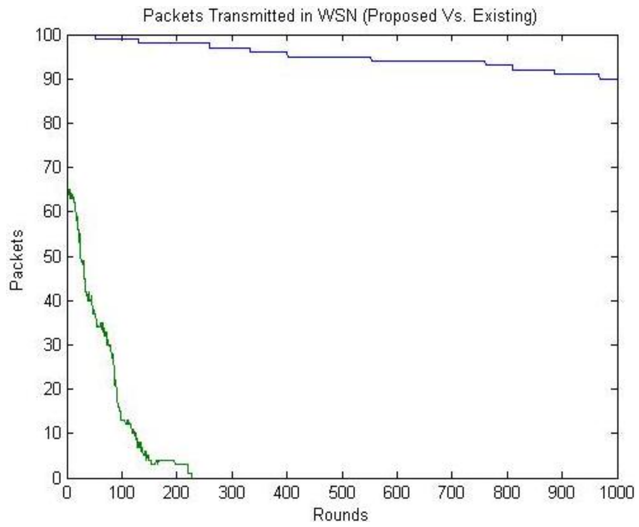

Figure 3: Network Communication

Here figure 3, is showing the analysis of existing and proposed work respective to the packet transmission over the network. As we can see in this proposed work, the network communication is increased.

CONCLUSIONS

In this present work a mobile agent based memory model architecture is defined. The obtained results show that the presented work has improved the network life and the network communication effectively.

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