VLSI DESIGN FOR A PSO-OPTIMIZED REAL-TIME FAULT-TOLERANT TASK ALLOCATION ALGORITHM IN WIRELESS SENSOR NETWORK

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ABSTRACT
The most complicated issues in a wireless sensor network are to distribute a task uniformly among the nodes of the sensor network. Rational distribution of sensing tasks would improve the lifetime of the sensor network and would even reduce the overall power consumption and the task will be executed within the given deadline. In this paper, we introduce a PSO-optimized Real-time fault tolerant algorithm (FTAOA) for WSN’s designed in VLSI to overcome the existing drawbacks. A P/B technique is adopted to overcome the faults in the sensor network and distribute the provided task rationally. The Discrete particle swarm optimization (DPSO) is constructed using the Binary matrix encoding form, which reduces the task execution time and saves the node energy by balancing the load on the sensor nodes. This can be achieved by developing an expression for Fitness function; this can even improve the scheduling effectiveness and system reliability. Primarily, FTAOA employs the P/B technique which uses passive backup copies overlapping methodology to monitor the mode of backup copies adaptively through scheduling primary copies early and backup copies delayed. The resources are well utilized, as tasks are allocated with high performance in terms of energy consumption, load and failure ration. The potency and efficacy of Fault tolerant mechanism can be examined through the final results.

Keywords: task-allocation, particle swarm optimization, fault-tolerant, fitness.

INTRODUCTION
The Wireless Sensor Networks (WSNs) are used to segregate information when provided with sensing tasks in the goal environment; they consist of a large number of sensor nodes which together form a sensor network. WSNs are used as real time applications for automatic systems, battlefield intelligence, geographical tracking and emergency response. In WSNs, one of the most important requirements is low power consumption. Sensor nodes are generally fabricated with irreplaceable power sources. To achieve computation capacity in sensors, Parallel processing method is employed. Task Allocation and Scheduling play two major roles in Parallel processing technique. The most urgent issues in WSNs are to assign a task to the most appropriate sensor node and balance the load of overall network simultaneously. In WSNs, the most complicated task is task allocation of sensor nodes rationally, reducing the overall power consumption while guaranteeing the task execution within the deadline by extending the network lifetime. An Inferior Task allocation scheme would lead to overload of nodes which in turn is harmful to the network; This in turn would result in each node working individually, which is not an energy efficient way. There are many constraints and complications of WSNs such as environmental problems, dynamic topology and instability of wireless link, there are further constraints linked to WSNs making it challenging to use the most optimized method for Task allocation. The necessity of Fault-tolerant terminology is high when considering the case of deploying WSNs in battlefield for surveillance and detection, where the fault tolerance must be high to compensate the instability, and because the sensed data is highly critical and it can be even destroyed through hostile actions. Hence, providing Fault tolerance mechanism is mandatory in such critical cases of application. WSNs are composed of different layers, with each layer having its own feature to coordinate the fault tolerance method. The most important layer is Application layer, which focuses on solving the series of applications provided by the sensing task with high reliability and by reducing information redundancy. Though most of the previous applications use data aggregation, which has many drawbacks like unstable output values, security conflicts; hence Application layer must be further developed by implementing even more innovative ideas. The primary/backup technique is one of the most reliable techniques used for fault tolerant mechanisms. It initially allows the copies to run on different nodes; there are two types of methods employed for backup here, the active mode is where the backup copy is generated simultaneously along with the primary copy and the other is passive mode, where the backup copy is generated only on receiving incorrect results associated with the primary copy. An acceptance test is performed to compare the reliability of both the nodes. The passive mode is more reliable mode compared to the active mode, as it saves the sensor node memory storage. The PSO method is used for better optimization of parameters in the methodology. The major contributions of the entire survey are summarized to be as follows:

- A novel real-time fault-tolerant mechanism is developed to be compatible with WSNs
- A P/B technique is developed which uses a backup copy as an alternative, if the primary copy fails
- The entire fault tolerance method reduces the node energy cost, execution time, error rate and helps in improving the network lifetime and reliability of the method.
• An acceptance test is performed to determine the reliability of the method and the simulations are obtained using VLSI techniques.

LITERATURE SURVEY

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<th>Title</th>
<th>Problem Aroused</th>
<th>Overcoming Method</th>
<th>Method Used</th>
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EXISTING METHOD

The basic constituent of task allocation theory is task, which is an entity to fulfill a specific provided function. In order to make use of system resources efficiently, the given task is divided into multiple nodes and distributed evenly for execution. Use of static single-hop cluster of WSNs was done in a two-dimensional field. There are few algorithms to solve the task allocation problem with less task execution time and energy consumption. A technique called adaptive intelligent task mapping combined with a scheduling scheme using genetic algorithm (ITAS) was proposed by Jin et al. A hybrid Fitness function was developed which extends the overall network lifetime by balancing load through collaborative nodes. An energy balanced directed acyclic graph (DAG) task scheduling algorithm was developed by Zeng et al and he gave a genetic algorithm (GA) integrating chromosome coding to find approximate optimal solution. A localized cross-layer task mapping and scheduling solutions for a dynamic voltage scaling (DVS) enabled WSN was proposed by Tian et al and he even modeled the wireless channel as a virtual node to execute communication tasks. An integer linear programming formulation and a polynomial time 3-phase heuristic in a single-hop cluster of homogeneous WSN was developed by Yen et al by considering the time and energy costs and by using DVS. However, their system model is quite different from this model. In our model, the sensor nodes are randomly distributed along the sensor field, let n tasks be distributed among n sensor nodes in order to reduce the task execution time and energy consumption. Once the source node is fed with the task to be distributed throughout the network rationally, the source node distributes the task among the sink nodes and then sinks nodes distribute the sensing tasks rationally in their respective sub networks. In case the source node or the sink node fails during task execution then it would result in the failure of entire network. This would in turn, reduce the systems reliability and efficiency.

PROPOSED METHOD

Particle Swarm Optimization technique is a recently developed which has many advantages over other optimization algorithms, it can be implemented easily and it has a quick ability to converge with good solutions. It is even used to preserve population diversity to avoid premature convergence problem. A recent study has proven that PSO can solve as many optimization problems as GA (genetic algorithm). Hence PSO is indeed a powerful and vital optimization technique used relatively. WSN has various issues such as node deployment, localization; energy-aware clustering, data aggregation, and topology control are often formulated as optimization problems. PSO method is employed to overcome the WSN issues mentioned and achieve better results compared to the existing method. In this paper, we employ a PSO method and then propose a FTAOA algorithm to be used in the WSN environment. According to FTAOA algorithms flow chart, the sink node initially collects the previous gathered task information from the task queue and then collects the new task, after collecting the new task, it generates the position and velocity simultaneously in the WSN environment. According to FTAOA algorithms flow chart, the sink node initially collects the previous gathered task information from the task queue and then collects the new task, after collecting the new task, it generates the position and velocity simultaneously for one generation of DPSO, it then begins with the series of operations of task allocation and then checks for the terminal condition; if the terminal condition is met then it continues with the next iteration or it publishes tasks and waits until the terminal condition is met. If the primary version is executed successfully, then irrespective of the backup mode assigned, the backup mode is not executed. If the mode of the backup copy is passive then it is executed only when the primary copy fails. The sink node waits for the acknowledgment of the primary copy and after a period of time if doesn’t receive it, it executes the backup copy.

CONCLUSIONS

In this paper, we develop a novel real-time Fault-Tolerant algorithm which is PSO optimized. The tasks are assigned with priorities depending upon their earliest deadline. We develop a P/B technique which executes a backup version if the primary fails, so that the task is...
executed without a network failure within the deadline. By employing FTAOA method taking task execution time, saving network consumption, balancing network load and improving deadline missing ratio and system reliability cost as optimization goals and by employing a binary matrix encoding form, we construct a DPSO method to solve the task allocation problem and design a utilization function to evaluate comprehensive performance of nodes. We perform various extensive simulations to test the betterment of the proposed method compared to the existing method. Here we use VLSI because the method extracts appropriate results and it is extensively used around the world. We use Modelsim for simulation and XilinxISE language for coding the FTAOA algorithm.

**SIMULATION RESULTS**

COUNT simulation shows the sensor node numbering, that means the position of the iteration in a task queue.

SHIFT simulation here shows the method of distributing the tasks among the sensor nodes. Shift registers are used to shift tasks from the source node to other nodes in the sensor field.
FINAL SIMULATION shows us the final output of the entire PSO Optimized Fault-tolerant system in WSNs, regarding error rate, simulation time, network lifetime.

Graphical comparison
REFERENCES


