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Abstract

Over past many years we have analyzed the tremendous growth in computing system. Most of the systems are performing on timing constraint which make real time systems more important. Real time systems also become so essential due to advancement in the embedded technology. The performance of these systems depend on their logical and operational output as well as the time of the result generated. If a system is generating logically correct result after missing the deadline then the system is said to be failure. This failure may occur due to a transient or intermittent fault arrives in the system.

The problem to meet timing constraint with fault tolerance in time critical applications, can be removed by applying a suitable real time task scheduling algorithm.

In this research work, we first designed a fault tolerant real time scheduling algorithm to optimize the number of checkpoints required for fault tolerance in the system. Energy is also a major concern in an embedded device. We then focused our research towards energy minimization in real time systems. We designed an algorithm for fault tolerant task scheduling in real time systems with minimum energy consumption. We used the traditional DVS approach for minimizing energy consumption by scaling voltage and frequency level.

Life time of battery operated real time device is also an area of improvement, so we focused our research towards those battery enabled devices which are working in remote areas. We, then designed task scheduling algorithms for real time devices using both DVS and EDF with energy harvesting approach. We designed static as well as dynamic scheduling algorithm for energy harvesting real time devices and increased the life time of system.

We designed a fault tolerance scheduling algorithm using multiple execution to achieve desired results in real time cloud. In this algorithm, a task is executed multiple times and a voting machine decides the reliability of the results. To achieve more reliability, accuracy and feasibility, the tasks are being scheduled in cloud environment. Experimental results show that the proposed technique is more reliable and feasible as compared to existing approaches. Cost of the proposed algorithm may increase if four or more replicas of same tasks are executed. This approach is more reliable in critical environment where cost barely matters.

We also designed a fault tolerant real time scheduling algorithm for IoT based energy harvesting systems. Simulation results shows that the designed algorithm work more efficiently in energy harvesting conditions. We implemented the designed algorithm on Arduino Mega2560 and Jetson TK1 board and found that the proposed approach is work efficiently on NVIDIA Jetson TK1 than the same of Arduino Mega2560.

Our simulation results shows that designed algorithms are better than the existing Algorithms such as EDF, LPEDF, and MFDVS. The feasibility is increased with minimum energy consumption in designed static and dynamic algorithms. The simulation results shown are very promising that the task scheduling feasibility in our designed algorithms is more than the same of EH-EDF, LPDVS, MFDVS. We also found that the simulation results performed on Jetson TK1 board are more efficient that the same on PC and RTOS.