To Tolerate Fault and Minimize Energy Using Hard Real Time Scheduling

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Abstract

In real time system the big issue was fault tolerance and energy efficiency. The main aspect in real time application was fault tolerance.TO transient the faults occurred in the system may be check by the approach of check pointing method. For minimum energy consumption we have to find how many check points are required .For less energy consumption in system such as sensor node require energy to operate. Faults occurs any time in the real time system that should be tolerated fault .In this paper we have to proposed a new check pointing methods in that the consumption of energy should be less .By using dynamic voltage scaling (DVS) technique which achieved the energy minimization in real time system.

Keywords

Energy minimization, DVS, Tolerance fault, Check pointing.

1. Introduction.

In today's scenario Real time application is the main factor. Many critical real time application such as control system, air traffic, space mission. The fault can be occurred in both such as hardware and software. Software faults can be detect the fault by checkpointing approach. A failure can be found in the system if it will detect on right time. Hardware fault can be detect by tolerating the hardware redundancy such as TMR (Triple modular Redudancy approach such as checkpointing). In embedded systems energy minimization has always been a critical design. DVS (dynamic voltage scaling) techniques are used to reduce the energy consumption for such systems. TO operating the system DVS saves energy with lower frequency and lower voltage. In DVS there has been lots of work . Most DVS is associated with task scheduling, and differentiate with two scheduling algorithms i.e online task or offline task.

Some following Points are:

- **Fault tolerant**

Fault tolerant describes a component designed or computer system so that,in the event that a component fails ,and a backup component or procedure can immediately take its place with no loss of service.

Fault tolerance can be provided with embedded in hardware, software, or by some combination. The operating system provides an interface that allows a programmer to "checkpoint" critical data at unknown value in software implementation. while in hardware implementation (for example VOS operating system and with stratus), the programmer does not need to be aware of the fault tolerant capabilities of the machines.

At a hardware stage, Tolerance fault is achieved by duplexing each hardware component. Multiple processor are "lock-stepped" together and their outputs are compared for correctness. The faulty component is determined and taken out of service when it occurs normally, but the machine continues to work as it is.

- **Real time application.**

A real time application is an application program that functions within a time frame that the user senses as immediate or current. Defined value should not greater than the Latency, which is measured in second. Whether or not a given application qualifies as an RTA depends on the worst case execution time (WCTE), the maximum length of time is set of tasks or defined task when required in hardware platform. RTAs use in the system are called real-time computing.

2. System Model.

In system model section, we first present the model of the system and the basic concept. In this paper, we considered a hybrid battery charging system using solar PV and

implementation. Using solar PV charging and utility supply charging the system should be based on real time algorithm. The scheduling of algorithm programmed in microcontroller which sense the voltage of the battery and generate the command to operate a relay which controls the supply availability and prevent from uninterrupt power supply (UPS) from this it will charge the battery. Besides the supply charging ,the charge controller supply the charging whenever the solar PV required. This system are design in such a manner to be useful in load shedding to intermittent this power supply.

A. Power model.

To dissipates the speed of independent power each processor required the switching power for eg. Subthreshold power leakage. Energy consumption should be reduced when the next period beginning until. The circuit should be on and clock runned for that there is necessary to consume the power. When the turning of processor is off the fraction of power is removed. In active mode supply voltage S, the total consumption power can be denoted as

$$P=P_{hib} + S^3 + P_{si}$$

B. Hybrid task.

In this method, to reduce the supply voltage copy of primary process should be run and for copy of secondary process was postponed. It also executed the low supply voltage. Here we select from this two copies which reduced supply voltage depend on the best time and maximum energy saving.

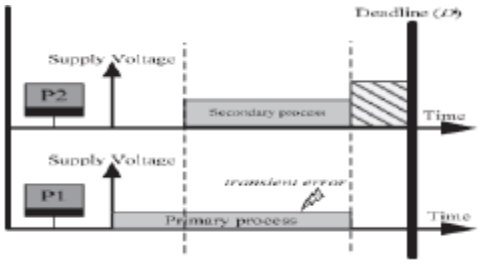

Figure 1. Hybrid task.

3. Previous Work

In the previous paper, in hard real-time systems, investigates fault tolerance and dynamic voltage scaling (DVS).The authors present quasi-static task scheduling algorithms that consist of offline components and online components. The offline components are designed the way they enable the online components to achieve energy savings by using the dynamic slack due to variations in task execution times and uncertainties in fault occurrences. The proposed schemes utilize a fault model that considers the effects of voltage scaling on transient fault [1] DVFS remains an important energy management technique for embedded platform, its impact on transient fault rates has been shown recently. In this paper, to use the DVFS technique optimally in order to achieve a given reliability goal for real-time embedded system we propose the Generalized Shared Recovery (GSHR) technique . In this method, we determines the optimal number of recoveries to deploy as well as task-level processing frequencies to minimize the energy consumption while achieving the reliability goal and meeting the timing constraints. For improving the prospects of DVFS compared with existing aware reliability power management frameworks . The resultant evaluation points to the close-to-optimal energy savings of our proposed technique[2] We present an integrated approach that provides fault tolerance and dynamic power. Adaptive checkpointing is then combined with a dynamic voltage scaling scheme to achieve power reduction. The energy-aware checkpointing method uses a dynamic voltage scaling criterion that is based not only on the slack in task execution but also on the occurrences of faults during task execution. [4]. In harsh environments, such as aerospace, and in industry Real-time computer systems are often used. For saving intermediate states of a task in a reliable storage facility Check pointing enables a reduction in the recovery time from a transient fault, on detection of a fault, and then, restoring from a previously stored state. For the execution time of the task. the interval between checkpoints should be effectively. TO reducing the interval between them reduces the reprocessing time after faults, cost execution, and by inserting extra checkpoints increases the overall task execution time have to associate checkpoints. Thus, the checkpointing overhead leads to an optimal checkpoint placement strategy that optimizes certain performance measures and a trade-off between the reprocessing time. Real-time control systems are characterized by a timely, and correct, execution of iterative tasks within deadlines. According to its specification over a period of time the reliability is the probability that a system functions. Real-time control systemfor chekpointing which reports on the reliability , where many errors can be found at the time of checkpointing. To find the optimal checkpointing strategy the reliability is used for a performance measurement. For single-task control system, the reliability equation over a mission time is derived. For finding the minimum number of checkpoints Real-time computer systems are used. To find the checkpoints effectively we have to consider the properties of the reliability jittering[14].

The main problem is how the fault tolerate in a system with less energy minimization with proper techniques. There Should be so many techniques to detect the faults in the real time system but there should be an appropriate method with

less time and less energy consumption to tolerate the fault sin the system. In this system we proposed a pipelining concept which code or decode by using real time scheduling algorithm.

4. Proposed Methodology

In this project, we are going to implement evaluation and selection of data consistency for hard real-time applications on multi-core platforms. We are using two sensors, temperature sensor and pressure sensor. Temperature sensor for measuring temperature and pressure is for pressure. Here we are using RTOS so that we are programming according to the priority, say temperature shows high value and pressure also shows high value for that we are giving priority for temperature and according to that a output can be shown.

Block Diagram:

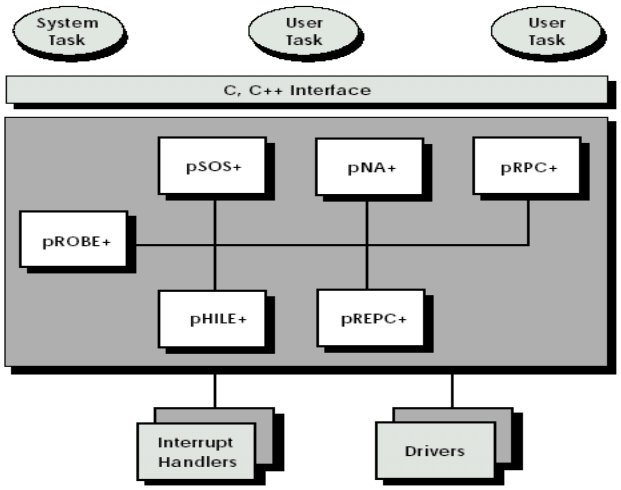

Figure 1-Psos Module architecture

This project deals with communicating a pSOS based system to an 8-Bit Microcontroller the AT89c51 through a serial communication standard called the RS232. The Microcontroller has several ports through which it can be made to communicate with various devices. This project has several uses in an industry which has several controllers can be made to communicate with a centralized pSOS system.

The Various Modules used in the project are

- pSOS
- Microcontroller PIC16F877
- RS232

PSOS

pSOS or proprietary silicon operating system is a High performance and Modular Real Time Operating system that is capable of performing several tasks and handles various External events very effectively. The pSOS environment can be programmed to suit the need of the application. In our application the pSOS modules pSOS+ and pHILE+ are used.

Microcontroller PIC16F877

The PIC16F877 is an 8-bit Microcontroller is based on the RISC architecture. The Programming for the Microcontroller is through C as well as in Assembly Language. The Microcontroller has Inbuilt support for RS232 Universal Asynchronous Transmitter and Receiver.

RS232

RS232 is a serial communication standard with speeds up to 115000bps. This serial communication standard is used in a variety of devices ranging from a simple microcontroller to a very high end DSP processor to a PC.

5. Results..

In this section we have to execute the code to obtain the results.

Source code

Source code:

```
#include<REGX51.H>
#include<INTRINS.H>
#define on 1;
#define off 0;
sbit m1_1 = P1^0;
sbit m1_2 = P1^1;
sbit m2_1 = P1^2;
sbit m2_2 = P1^3;
void delay(unsigned int val)
{
unsigned int i,j;
for(i=0;i<val;i++)
for(j=0;j<1275;j++);
}

void main()
{
P1 = 0xFF;
while(1)
{
//m1_1 = off;
//m1_2 = off;
//m2_1 = off;
//m2_2 = off;
```

```
m1_1 = on;
m1_2 = off;
m2_1 = on;
m2_2 = off;
delay(1000);

m1_1 = off;
m1_2 = off;
m2_1 = off;
m2_2 = off;
delay(500);

m1_1 = off;
m1_2 = on;
m2_1 = off;
m2_2 = on;
delay(1000);

m1_1 = off;
m1_2 = off;
m2_1 = off;
m2_2 = off;
delay(500);

m1_1 = off;
m1_2 = off;
m2_1 = on;
m2_2 = off;
delay(750);

m1_1 = off;
m1_2 = off;
m2_1 = off;
m2_2 = on;
delay(750);

m1_1 = off;
m1_2 = off;
m2_1 = off;
m2_2 = off;
delay(500);

m1_1 = on;
m1_2 = off;
m2_1 = off;
m2_2 = off;
delay(750);

m1_1 = off;
m1_2 = on;
m2_1 = off;
m2_2 = off;
delay(750);

m1_1 = off;
m1_2 = off;
m2_1 = off;
m2_2 = off;
delay(500);
}
```

6. Conclusion

In this section, conclusion of this paper are found that there are different types of methods to tolerate the faults with energy minimization. Our project is based on combination of both software and hardware, in that we can access the device on the same time. In the previous one we can execute only one device at a time ,this project we can use as multitasking processes based on real time scheduling algorithm to tolerating transient faults by supplying the source from fixed battery. we found minimum number of energy consumption by using optimal number of checkpoint.

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