Embedded Systems and RTOS

Case Study Assignment - Report

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Title of the Paper Balancing Performance and Power Efficiency in Embedded Systems.

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Industry Name: Silicon labs (Semiconductor company)

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Summary of the Paper:

Developers need to find a balance between the performance of the microcontroller and the power used by it to produce an optimized embedded system. However, in many cases to achieve such high targets the capability along with the reliability had to be compromised. Such compromises can affect crucial areas such as analog sensing, the communication of microcontrollers, and the algorithmic processing. Problems such as power consumption may arise if analog sensing is used in a place where there is more moisture. Such problems may lead to an embedded system that is not robust in nature. Few designs can be made with the fewer features as consumption limitations need a decrease in processing time at an active state.

Developers can however lessen the after-effects of such compromises by selecting a 32-bit microcontroller that is suitable for high performance and can also run at low-power. Specific firmware upgradation can also be used so that the microcontroller can maintain a uniform system performance by reducing a lot of current consumption. A few techniques have been discussed in this paper for reducing the power consumption and increase the performance of an IR based remote controller.

The first and foremost thing to attain such goals is to create a power budget which includes how to keep the microcontroller in the lowest power possible and to go to sleep mode whenever the microcontroller is at rest. The execution of different algorithms like the digital filtering should have the fastest clock speed so that it can meet all design necessities. Whereas processes

like the transfer of byte through a serial interface should have slowest clock rate for the achievable design. The developers have to understand the process and time dependent tasks and then find out a firmware which can help the microcontroller to work smoothly. Based on these factors the developer will then be able to decide the average power consumption. The power budget will help to understand the type of battery which will be required for such condition and also help in choosing the correct microcontroller.

Now comes choosing of a correct 32 -bit microcontroller. A microcontroller is needed that is capable to deliver the required performance without surpassing the low power consumption requirement. Such 32-bit Microcontroller mainly includes a cutting-edge power management block that is designed to attain performance low in power and also has an on-chip 16-bit CDC (capacitance to digital converter). Serial interfaces and RAM are also present that has sufficient performance margin to be ready for reprocessing when used in more advanced type applications.

A real time clock with a self-oscillating feature without a need of a crystal oscillator can be used which can save the current that would be required to excite the oscillator if functioned externally. In many microcontrollers, many real time clocks are forced to go in the wake-up state when the alarm trips. This results in unnecessary re-setting of the firmware which may take more time to execute. The only way to solve this is the firmware can fork the process to reduce the time.

The ideal job of a microcontroller is to run algorithms on the newly sampled data on a clock that completes this process in a matter of seconds. The various process and time dependent tasks should be handled in the same manner as the task handled in the sensing block. It is always preferred that the system goes into a low power state so that when the algorithms are running, they get executed quickly.

Balancing power and performance have always been a difficult task for developers. But Silicon Labs have made it possible by creating a microcontroller called the SiM3C1xx which achieves all the requirements mentioned above while consuming least current. However, there are still optimizations that need to be made for accomplishing a balanced power and performance which can be rectified in the near future.