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**Aggressive Voltage and Temperature Control for Power Saving in Mobile Application Processors**

**Abstract:**

DVFS is a widely used methodologyfor reducing the power consumption of mobile devices. This schemeinvolvesfrequency scaling in accordance with a specific governor and the establishment of anoperating voltage to be paired with frequency. Incorporated into the settings for operating voltageis a guardband that ensuressafe processor operation even at the worst conditionsofon-chip temperature. Typically, the processor temperature remains at a normal range (i.e., not the worst),hence the voltage guardband set to guarantee safe operationis overly protected. In this paper,we propose a temperature-aware DVS (T-DVS) that aggressively reduces voltage guardband.We explore the opportunity to provide minimum operating voltages for frequencies at different temperatures and realize a dynamic voltage control scheme that reduces power consumption. The T-DVS manages temperatureso that it remains in the“green zone” where maximum voltage gain is enabledfor power-efficient operation. We validate the effectiveness of the T-DVS under various thermal conditions by using mobile application processors and differentoperating scenarios. Experimental results show that the T-DVS leads to power gain without degrading performance regardless of thermal conditions and chip characteristics. By examining the real-world applications of and off-the-shelf smartphone, we show that the voltage gains generated bythe T-DVS results in battery lifetime increment.

**Existing System:**

In most cases, voltage settings encompass a *guardband*that ensures stable execution under various operating conditions, such as temperature, voltage noise, IR drop, and circuit aging. Given that a guardband is set conserva-tively to support worst-case operating conditions, itcan serve as an excessenergy source in cases whereinthe aggressive addressing of power issues is required in mo-bile devices.Voltage reduction with guardband optimiza-tion is therefore an effective means of power reduction.

**Proposed System:**

We confirm that temperature-aware guardband volt-age reduction is feasible on the basis of observations of the temperature–voltage relationship.

 We propose thegreen zone concept and validate its efficacy for power reduction.

 We implement a prototype T-DVS system, and evalu-ate its effectiveness through various experiments us-ing off-the-shelf AP chips and smartphone.