Context Adaptation for Energy Savings in Mobile Applications

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Abstract

Communication devices are evolving rapidly, with features that are increasingly complex and require high battery power consumption. Scheduling tasks according to the situation is presented as one of the most promising solutions to meet the needs of smartphone users and maintain the autonomy of these devices. The objective of this project is to create a framework that identifies and defer energetically costly actions when the system reserve is at a lower than expected level and that is able to define when to perform these actions at their maximum performance or in an economical way. When analyzing complete cycles of battery discharge (from 100% to 0%), it is verified that the framework, when in automatic optimization mode, presents an expressive energy saving, which on average is close to 33%. When it is considered a dynamic scenario in which the user can partially recharge the device throughout the day, the economy reaches 91%.

Key words:

Energy, Context, CASES.

Introduction

The power consumption of smartphones has grown faster than its energy storage density. The proposal of the system created in this work is to optimize energy consumption by implementing a framework capable of scheduling and adapting its tasks according to the context faced by the device.

The system created, CASES (Context Adaptive System for Energy Saving), works by scheduling non-urgent tasks and executing them more economically according to the current level of energy in the device.

The CASES system action is based on deciding when and how to perform other operating system tasks. For this, CASES performs readings of the battery and GPS sensors to trace the battery's standard discharge curve, and from this it is known the device's energy consumption rate (when the energy of the device is spent only for keep it connected). With new readings of these same sensors, we can verify that the cellphone, now under the execution of tasks, is consuming more energy than the standard and take measures like delaying the execution of certain tasks and / or executing them in an economical way. In addition, crossing GPS readings with standard discharge profile information can tell us whether the user is with the device at home (where it usually recharges) or is on the street, for example. While at home, the system can allow itself to perform energy-intensive tasks, as the device is likely to be recharged - even partially.

Results and Discussion

The algorithm used for the system is simplified and shown in image 1.

The tests and measurement of the provided savings were obtained by sampling the device's battery level in complete discharge cycles (100% to 0%). The comparison between the standard discharge cycle of the device (when it discharges only by being active) and the discharge under the performance of tasks optimized automatically by CASES is shown in chart 1.

Image 1. Pseudo algorithm of the system.

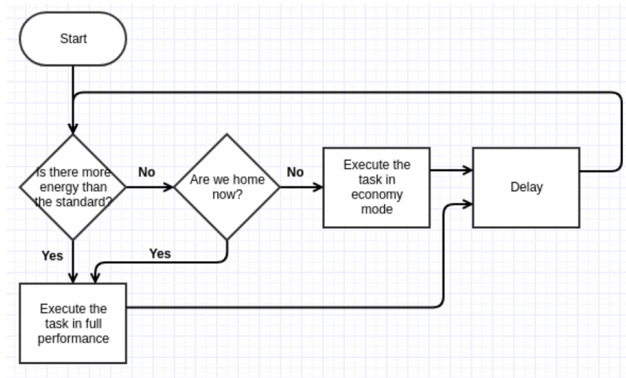
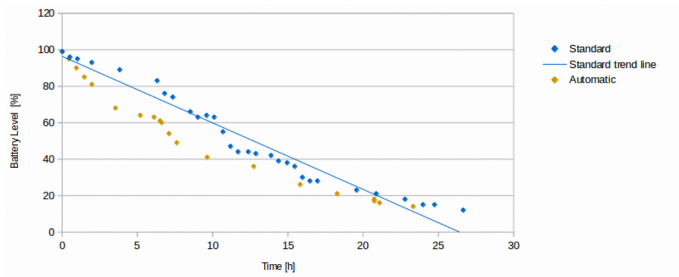


Chart 1. Comparison between device default and auto mode.



We can note that the economy is close to 33%. Measurements performed in another scenario where the user recharges the device throughout the day, allowing us to perform tasks during this action, show savings of up to 91%.

Conclusions

The results of this work showed that it's possible to achieve significant savings through the scheduling and selection of tasks in a context sensitive way. It is important to emphasize that the achievement of this research consisted not only in ways to save energy, but how doing it without the user realizing a significant loss of performance of the device.