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Studying the Energy Consumption in Mobile Devices

Mohammad Tawalbeh[a*] , Alan Eardley[a], Lo'ai Tawalbeh[b]

[a]*Faculty of Computing, Engieering and Science, Staffordshire University, Stafford, UK,*
[b] *Computer Engineering Department, Umm Al-Qura University,Mecca, Saudi Arabia*

Abstract

In the last few years, it is noticed that mobile smart devices are becoming very essential component of our daily life. The smart phones can do a variety of very useful jobs. In addition to make calls, they can be used to create and share multimedia files, run very useful applications and do data processing. But those devices suffer from some limitations including limited storage and processing capacity and short battery life time due to energy drain which is noticed to be increased when running applications that require intensive computations on the mobile devices. In this paper, the literature is searched for related work, and the power consumption is measured experimentally for different components of two common brands of smart phones, namely, Galaxy Note3 and Sony Xperia Z2. The measurements are done using applications that measures the power consumed in each component of the phone. The obtained results are presented to get more accurate understanding of how these components participate to the overall power consumption of the smart phone. Also, this work can be used in the future to propose better techniques to reduce the energy consumption by the smart phones.

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Keywords: *Mobile device; Energy Consumption; Wireless Networks*

*Corresponding author. Tel.: +966-562-779-233; fax: +966-114-569-452.
E-mail address: eng.tawalbeh@gmail.com

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1. Introduction

Nowadays, many people around the globe are using smart phones for various tasks other than just making calls. The smart phones are used to create and edit multimedia files (audio and video), access the social communication websites, navigate for the destination using GPS, and run more complex and useful applications. Charging these devices might not take a considerable amount of power, but those devices are energy hungry when they are used [1]. The mobile devices are very popular nowadays because they offer for the user computation environment and useful tools and facilities anywhere and anytime [2]. This 'mobility' is the significant features of those devices were the user can continue his/her work simply regardless of the location, at home, at office, or travelling.

Among the main limitations of these smart phones is the energy consumption. This problem will become more serious in the next few years due to the tremendouns usage trends of these smart phones [3]. In addition to that, the usage of these device to acces the Internet, imposes extra traffic on the networked servers and resources and increases the power consumption. So, there is a need for major improvements in resources management to increase the effeciency and reduce the energy consumption.

There are different components that consumes different amounts of energy in mobile devices and in the smart phones. There are the traditional components such as the Central Processing Unit (CPU), Light Emitting Diode (LED) and Operating System (OS). Adding to that, the new components embedded in the smart phone such as GPS, 3G and Wi-Fi technologies that are integrated in the smart phones and consume a considerable amount of power [4].

In this paper, we will measure and analyze the power consumption of many components of two smart phones brands to obtain better understanding based on real measurements on how these components contribute to the overall consumed power by those smart phones. The remaining of this paper begins by literature review in Section 2. In Section 3, energy saving techniques in Mobile Computing are explored. The experimental results are shown in Section 4, and Section 5 concludes this paper.

2. Literature Review

Considering the impact of the applications workload on the energy consumption in smart phone, an energy-aware scheduling algorithms for different application workload was developed [5]. Another research studied the relation between the consumed energy while transferring data and the strength of the wireless signal [6]. They suggested a new power model for WiFi and 3G that takes in consideration the impact of strong/poor signal on the power consumed by the wireless components embedded in the smart phone.

The authors in[7] measured the power consumption of connection and data transmission over 802.11 wireless networks. They reached to the conclusion that handset, the devices context, and the OS are among the many factors affecting the optimal choice of data transmission strategy.

Since Mobile devices are used widely with cloud computing to form what is called mobile cloud computing, the research in [8] and [9] presented techniques for energy optimization in mobile cloud computing. In the same context, a a detailed study about resilience and efficient mobile cloud computing was made in [10]. In [11], the authors proposed a model that allocates jobs of certain applications to be executed in the smart device and sends other jobs to be executed at the cloud.

3. Energy saving techniques in mobile computing

There are many energy saving techniques for mobile devices. One of the main techniques is the offloading. Executing complex applications in mobile devices increases the energy consumption. Offloading mechanisms have been proposed to transfer offloaded tasks execution from a mobile device to a computational infrastructure (cloud for example) to reduce the energy consumption and the local execution time at the mobile device [12,13]. To determine the effect of offloading, the authors in[14] proposed a middleware called MACS "Mobile Augmentation