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Energy Consumption of Smartphone Using Multimedia Cloud Computing

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Abstract: ***With the wide range of development of smart-phones there is increasing demand in the consumption of the smart-phones. Due the advanced features, that the smart-phone possesses the consumption of battery increases. This paper focuses on the existing development and research in the field of saving the energy of smart-phones and the work carried according to the existing system. This shows how cloud is actually working and the consumption of energy by the smart phone.***

Keywords: Smartphone, offload, cloud, energy, soundcloud.

I. INTRODUCTION

Smart-phones are becoming more & more popular because of their unique design, lightweight & compact size. Their various features such as many useful applications like multimedia applications, games etc .and ease to carry from one place to another have added to their popularity. But these new features have created a new set of problems like limited battery capacity, processing capacity and memory capacity. Even after a lot of research & development done in recent times limited battery size is one of the major problems that has not been solved satisfactorily. In complete contrast development in other smart-phone applications like multimedia, games, GPS, etc .have occurred in leaps & bounds. For example, classic games like Tetris, requires less memory storage & processing capacity to operate. Due to this battery usage was less. In complete contrast recent games are very much resource intensive in terms of processing and data transfer rates, this causes a huge drain on batteries of smart-phones.

Let us consider a scenario where a customer purchases a smart-phone which runs an application consuming more processing power such as an addicting game & starts playing that game on his smart-phone. After a few minutes when the events in this game have taken an interesting turn and his Smartphone stops running the game because of low battery. This scenario is very frustrating for the customer.

But you would say that this example is only of games. Not everyone uses their mobile for playing games. So let's consider another scenario which would relate to the gravity of the situation. Consider an engineer working on a site and he is using smart-phone to make a video call to his boss. They are discussing about the implementation of a certain task in his project undertaking. Now suddenly he finds that his smart-phone is out of battery power. This situation is not only frustrating but could also cause loss and damage to the customer.

But the common thing that most of the customer uses is playing of audio, video on smartphones. As smartphone possesses this capability most of us use all possible multimedia features. Enabling and using multimedia features consumes more battery and thus the energy.

Here are some solutions to the problem that may save smartphones battery.

1.1 Solutions

1. Increase battery capacity – With the development of smart-phones, the problem the users face is the limited battery capacity. Research is going on to increase the battery capacity of smart-phone. But results are not very fruitful. Hence we cannot rely on increasing battery capacity for our power problem.

2. Increase the number of batteries. –Smart-phones are light weight and attractive but to increase the battery capacity we can increase the number of batteries attached in the smart-phones which will make the phone bulky in the mere future. Hence, no one would buy it. So this solution is also not a viable solution.

3. Not running apps which use more power – Using a smart-phone means utilizing the facilities available therein, which in turn consumes more battery. The solution to this problem is to running only those apps which will consume less power but it kills the purpose of the using the smart phone.

4. Offload it to a cloud – The best solution is to offload heavy tasks on the cloud. Offloading large computation to the cloud may save the battery usage. The solution to this problem is increasing the battery capacity. But as stated earlier battery capacity can only be improved to a certain extent. Here Cloud computing can come in handy. Cloud Computing can be used in multimedia operations to save energy.

II. LITERATURE REVIEW

During the literature survey, it was found that cloud computing plays an important role in reducing battery consumption of smart-phones and to backup user's data.

Cloud computing is a model for enabling ever-present, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Many people have focused to build frameworks to offload large computation on the cloud. Mobile computation offloading involves communication in between the real mobile device and the cloud. For mobile computation offloading to work we have to run same application on smart-phone as well as on the cloud. But the application is not present on the cloud, so we have to offload or copy the application on the cloud. This copy or "Clone" of the application that is used for offloading is referred as "off-clone ".

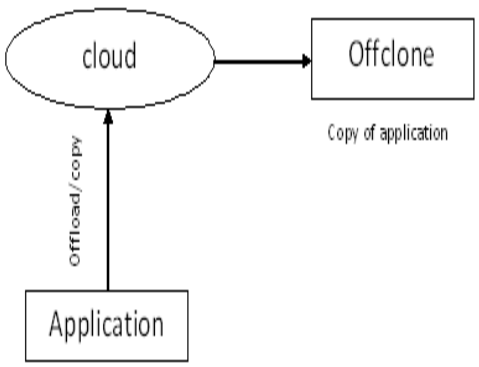

Figure 1 Offclone

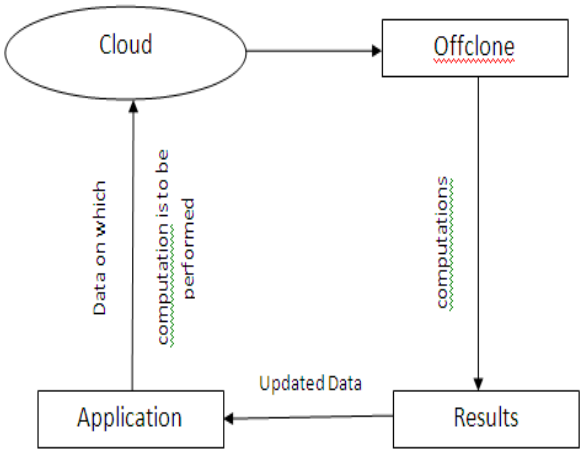

Figure 2 Flow Chart for working of Offclone

The clone used to backup user's data is referred as back-clone.

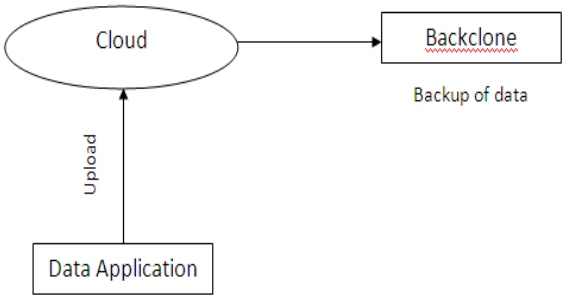

Figure 3 Backclone

III. Related Work

If we take a look around we see that there are many types of smart-phone users. Basically we are classifying the users on the basis of the types of software which they mostly use.

i) Video users

ii) Game users

iii) Audio Users

iv) Internet users

v) Regular users. (SMS audio call)

Most of the literature papers deals with a user which is all of the above i.e. it is assumed that the user uses all the applications (such as listening to music, surfing net, chatting, watching videos, etc) regularly and in equal proportions. But usually that is not the case. A person can listen to music for 1 hour and send SMS in 5 minutes only. What we are trying to do is to focus on a particular type of user and see whether performing computation on the cloud saves smart-phone energy for that particular user.

In our approach, we would be using soundcloud as cloud where we will be uploading all the media files on the cloud and then performing and playing media files via smartphones.Then calculating the power efficiency of the outputs on the device. For that it is divided into following four modules.

1. Creating a space on the cloud

2. Uploading media files on the cloud

3. Downloading the files on smartphone and playing

4. Calculating the energy consumption

1. *Creating a space on the cloud*

Cloud is used to store data that is to be used by user to perform his operations on the data. In this project soundcloud is used as a cloud service provider. This cloud act as a storage of required media files.

For this purpose we need to allocate some space on the cloud where it will be possible to store and retrieve information from the cloud.

2. *Uploading media files on the cloud*

For the purpose of uploading media files on the cloud some security is provided. security is needed so that unauthorized person should not access the information. To enable this feature it is provided with a login page so that user can login and upload the files on the cloud.

An additional feature that is a record button is being used in the player. This button is used to record a sound.It consists of two more buttons viz.start and stop.

The start button is used to start a recording as per the users action. While a stop button is used to stop the recording.as soon as the recording is over, the file is uploaded to the cloud.

3. *Downloading the files on smartphone and playing*

As the files are uploaded on the cloud, the aim is to download the file on smartphone and play it on smartphone.for this purpose I have created a player that first opens the login page and after entering the desired id and password it authenticates the user to log on to the cloud for its accessibility. Further we can download the files as per required by the user and then download and play it on smartphone.

4. *Calculating the energy consumption*

The last and the most important part is to calculate the energy consumption of smartphone. The energy is being calculated by multimeter by recording the voltage and current readings when the file is being played on the smartphone. The power consumption of the Smartphone was measured using Multimeter After measuring the voltage and current readings, energy consumption was then calculated using the formula:

$$\text{Power} = \text{voltage} * \text{current}$$

$$\text{Energy} = \text{power} * \text{time}$$

IV. System Model and Experimental Setup

The system consists of two major parts: smartphones and Multimedia cloud where both are connected to the Internet, as depicted in Fig 4

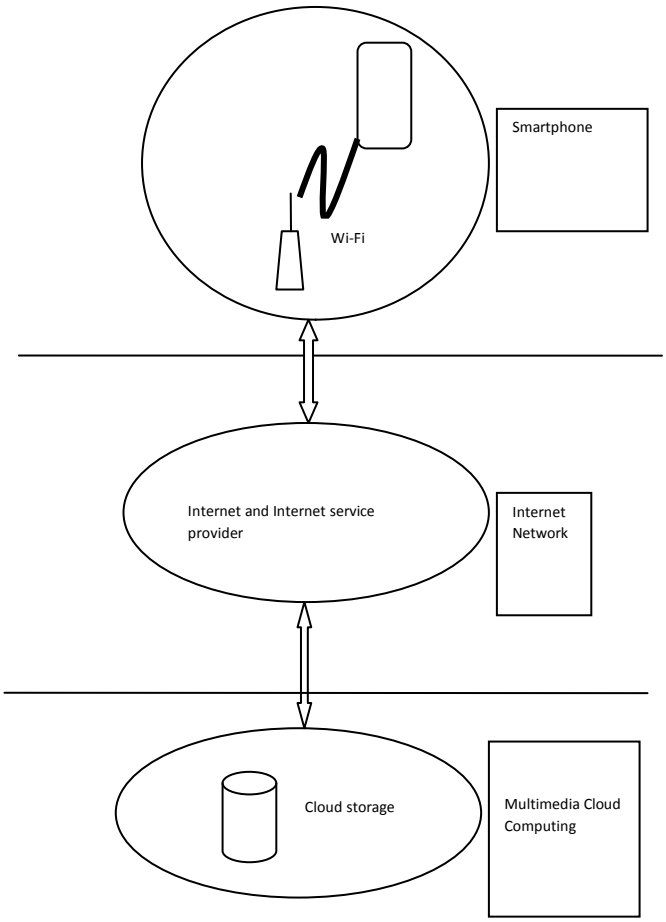

Figure 4 System Model

The smartphones are connected to the Internet through a WiFi. These smartphones provide all multimedia functionalities to the end users. For example, the user can play video or audio or a game , and capture images. The smartphone is connected to cloud.

Cloud storage allows user to log into cloud server and play multimedia files on smartphone.

Multimedia cloud computing enables user to perform multimedia operations on media files. It enables to play audio, video.

The downloading process need time as per the the speed of network connection.if the speed of internet is fast it gives ultimate results.

Based on system, we setup experiments as shown in Fig. 5

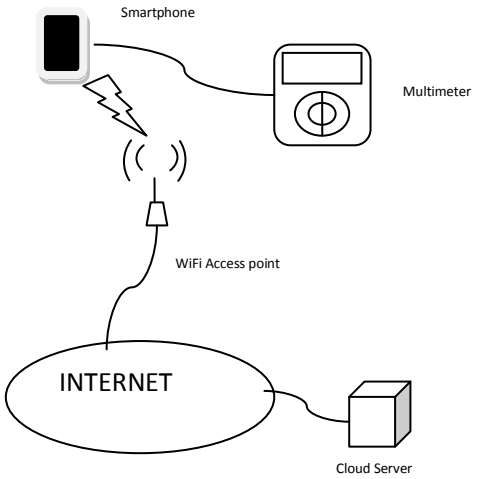

Figure 5 Experimental setup

The setup includes:

(i) Smartphone that runs desired multimedia application, store data, and uploads and downloads via the Internet

(ii) Internet service provider

(iii) Multimeter to measure voltage and current

The working principle of the project is as shown in figure 6

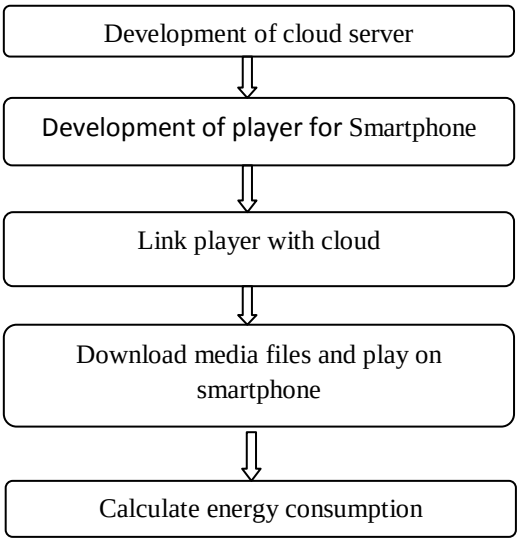

Figure 5 Flowchart

V. EXPERIMENTAL RESULTS

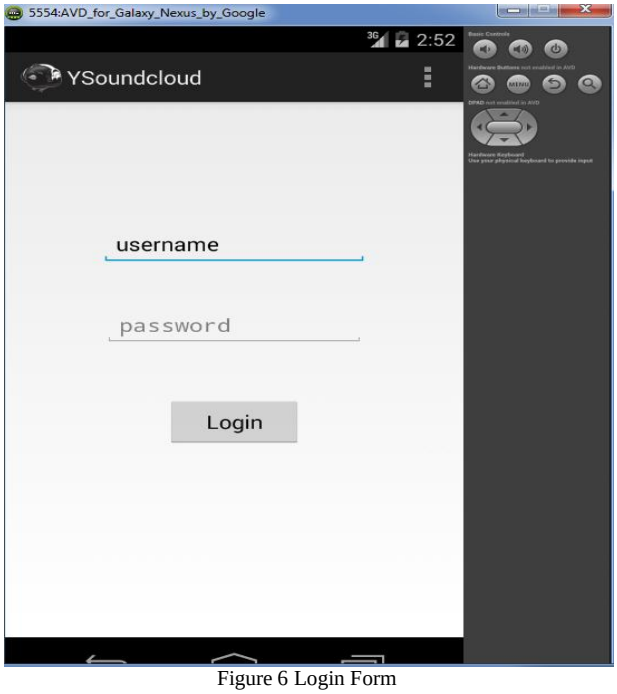

Figure 6 Login Form

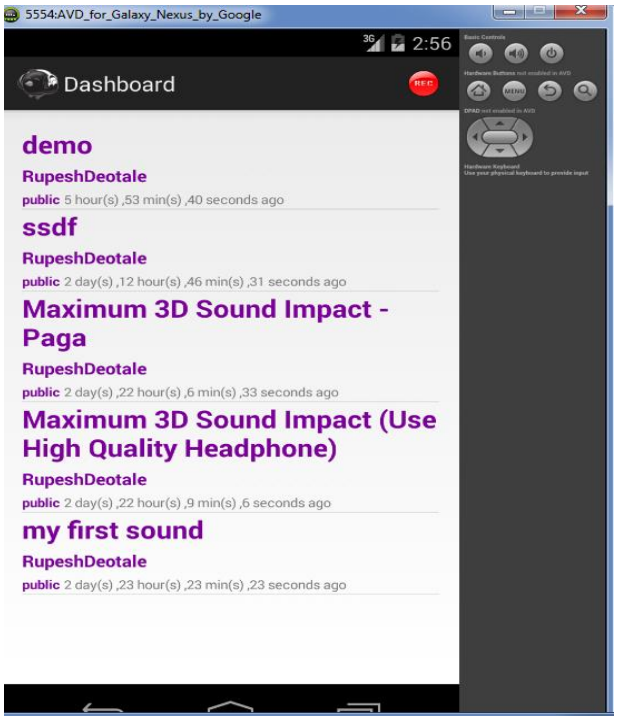

Figure 7 Dashboard

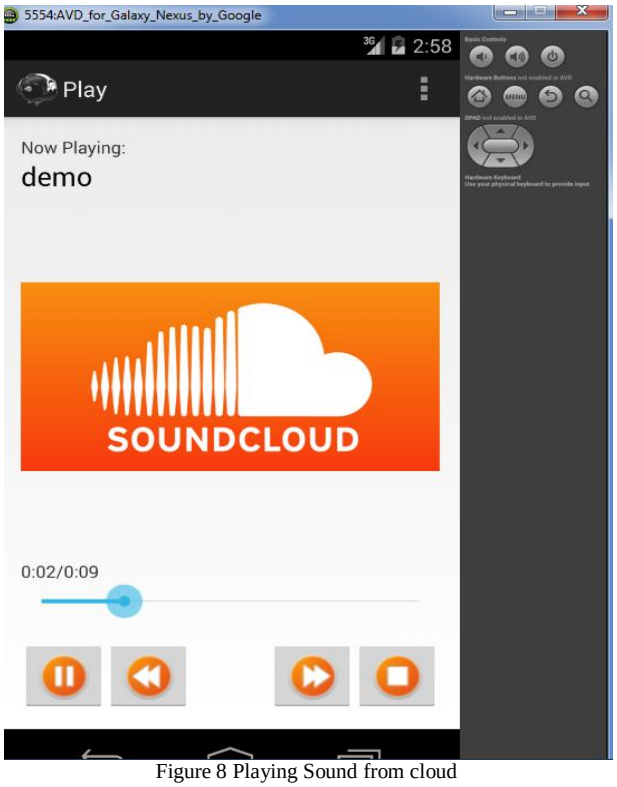

Figure 8 Playing Sound from cloud

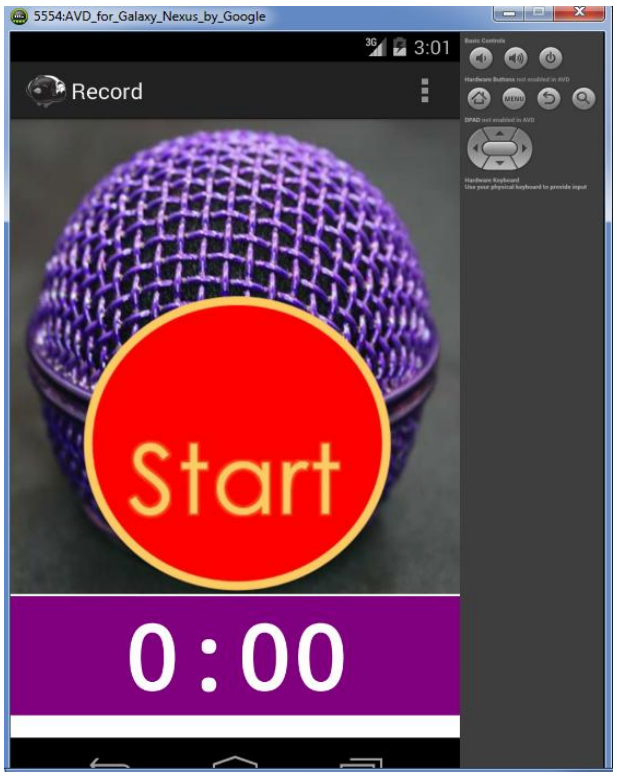

Figure 9 Sound record upload screen

Sr. No	Voltage reading (Volts)	Current readings(mAmp)	Power (mWatt)
1	3.81	0.171	0.651
2	3.92	0.168	0.659
3	3.81	0.178	0.678
4	4.12	0.183	0.734
5	4.23	0.181	0.765

Table 1 Readings at idle state

Sr. No	Voltage reading (Volts)	Current readings(mAmp)	Power (mWatt)
1	3.81	0.171	0.651
2	3.92	0.168	0.659
3	3.81	0.178	0.678
4	4.12	0.183	0.734
5	4.23	0.181	0.765

Table 2 Readings whe a song is played

VI. CONCLUSION

This paper reviews the existing development and research in the field of saving the energy of smart-phones. Offloading heavy tasks on the cloud may save the energy of smart-phone. Offloading heavy tasks on the cloud, allows large computation to be performed on the cloud, saving smart-phone energy as the computations are not performed on the real device. But if only playing of multimedia files will not save energy, as it depends upon the speed of the network connections. This paper further proposes the line of action which could lead to the solution of the problem of heavy battery consumption by the smart-phones if lage computations is to be performed on cloud.

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