

# The Battery Drain Issue

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**Abstract—** Smart phones have evolved remarkably over past few years and are becoming more capable day by day. Today people are using them to listen to music, watch videos and movies, browse social media, surf the web, play games, read, reply to emails, and make phone calls. One aspect of the smart phone that has been lagging is battery, and the only real solution is to either get a device with a huge battery or take advantage of phones with fast charging capabilities. We aim to analyze the critical level of this issue by gathering data from a selected user base. However, there are few things one can do to prolong the battery life and one of them is to make use of battery saving applications. In this paper we present with an application named Battery Doctor, that has a variety of features which ensures to always get the most out of the device. This application can shut down background applications, dim the screen and shut down unused functionalities such as bluetooth to significantly improve battery life and boost performance. Battery Doctor lets users to easily view how much power various applications are consuming, and accurately forecasts how long the battery could last with different features turned on or off. Additionally, it keeps the battery healthy by notifying users when to start and stop charging. In this paper we include our study about the problems of battery by doing user research and carry out usability test on the application to analyze the results.

## I. INTRODUCTION

Many people rely on mobile devices as part of their daily lives. From keeping themselves updated, entertaining themselves to staying in touch with the world and completing minor tasks both personal and professional, mobile phones play a very crucial role. These important devices get their energy from their batteries. In such cases, battery drainage can lead to unproductivity, unable to complete tasks and frustration as one needs to find a charge source everywhere. This paper aims to draw a conclusion as to how significant is this problem to the most common users.

## II. EVIDENCE OF PROBLEM

Researchers have spent significant time of trying to analyze the battery usage in phones. The areas of analysis are spread across analyzing the operating systems and their individual variations to the hardware specifications of the models.

A security research firm Wandera<sup>[1]</sup> did an extensive research on the updating of the IOS from IOS 10 to IOS 11. Despite the difference being minor it was concluded that the IOS11 drained battery in half the amount of time after the update. Low key recommendations were made to help preserve the battery but did not have a significant impact of stopping the

battery drainage.

Major companies like Samsung, Motorola, LG have their own forums with issues related to their phones. Most of the forums have posts related to issues with battery drain, proving that battery drainage is indeed a persistent problem that users are facing.<sup>[2]</sup>

## III. RELATED WORK

Various aspects of the mobile phones are under scrutiny to provide an acceptable solution to this problem. Phone applications on the user side have been launched to tackle this problem in a natural setting environment. On the other side researchers are putting more effort into changing hardware specifications and making software updates in order to reduce the impact of this issue.

### A. Software Research

Students at the Wayne State University conducted case studies which refer to the smartphones idle time to the case where applications are still running in the background causing a drain on the battery of the phone. An attempt was made to understand the exact impact of these applications on the battery.<sup>[3]</sup>

Claims based on how display, background apps and battery saver applications play a role in good energy management have been made by various article writers.

Power hungry apps have also been analyzed extensively to provide a solution for this problem.

### B. Hardware Research

An attempt to provide the breakdown of power distribution to CPU, memory, touchscreen, graphics hardware, audio, storage, and various networking interfaces was made by the students of NICTA and University of New South Wales. The power consumed by each hardware component was determined. They develop a power model of the Freerunner device and analyze the energy usage and battery lifetime under many usage patterns.<sup>[4]</sup>

Research on the impact of the 2G and 3G network usage for mobile phones battery life was taken up by group of students from various universities as part of an IEEE research paper. The results imply that mobile phones should switch the network in dependency of the service used to save the maximum amount

of energy. They analyzed that this handover consumes energy in their measurements. [5]

#### IV. USER RESEARCH

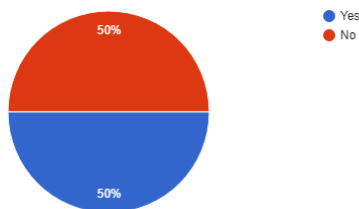
A questionnaire was developed as part of the data gathering for user research. The questions aimed at collecting general data about the user base and the participants. The following questions were asked: -

- WHAT PHONE DO YOU USE ANDROID OR IPHONE?
- HAVE YOU EXPERIENCED ANY ISSUES RELATED TO BATTERY DRAINAGE ?
- HOW OFTEN DO YOU CHARGE YOUR PHONE EVERY DAY?
- WHAT APPLICATION DO YOU USE THE MOST IN YOUR PHONE?
- HOW LONG DO YOU USE YOUR MOST UTILIZED APPLICATION?
- HAVE YOU EXPERIENCED ANY TROUBLE CARRYING CHARGER OR POWER BANK EVERYWHERE YOU GO DUE TO BATTERY DRAINAGE?
- WOULD YOU PREFER BUYING A NEW PHONE OR DISCOVER EXISTING SOLUTION?

##### A. Questionnaire Results

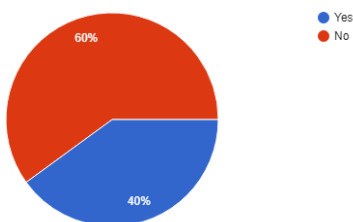
Have you experienced any issue related to battery drainage in your phone?

20 responses



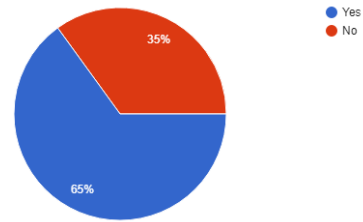
Do you carry your a power bank or extra battery always?

20 responses



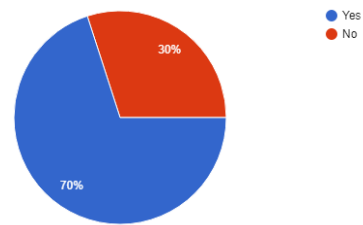
Do you change your phone settings such as decreasing the screen brightness in order to save battery life?

20 responses



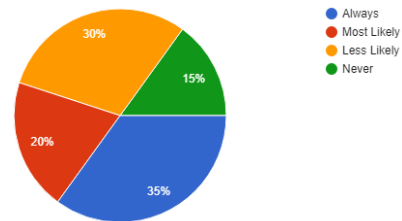
Do you know about the default battery saver mode in your phone?

20 responses



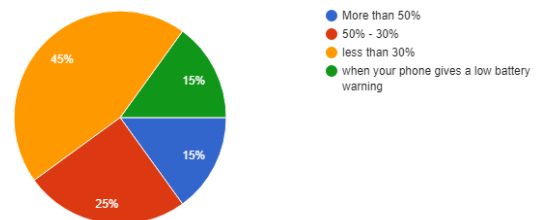
Do you charge your phone overnight?

20 responses



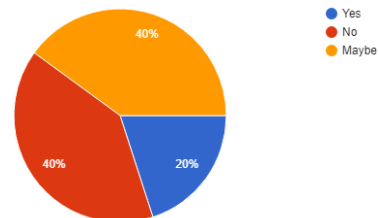
At what battery percentage do you feel you need to charge your phone at?

20 responses



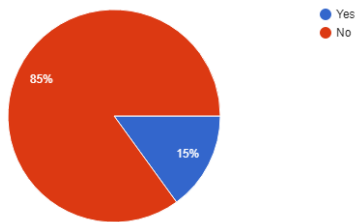
Are you satisfied with the existing solutions for prolonging the battery life?

20 responses



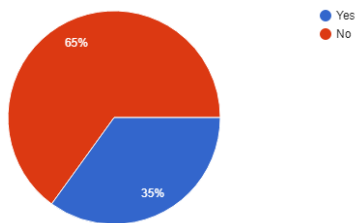
Do you use any battery saving applications available on app store or play store?

20 responses



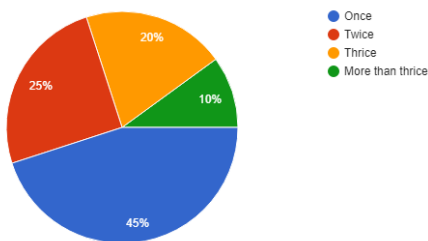
Do you use the default battery saver mode in your phone?

20 responses



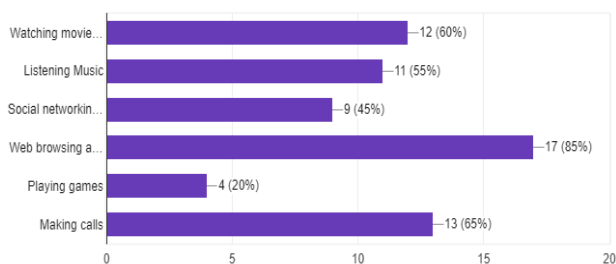
On an average how often do you charge your phone every day?

20 responses



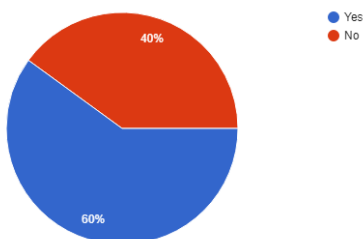
What do you use your phone for the most?

20 responses



Have you ever analyzed which application is causing the maximum battery usage in your phone?

20 responses



## B. Questionnaire Analysis

- We Found out that, on average 8 out of 10 people face Battery Drainage Issue.
- We gathered and analyzed Data For 2 different OS (IOS and Android) and came to conclusion that both OS have Drainage Issues however most Issues are faced by IOS users.
- We found out that, on average IOS users Charge their Phone 4 hours every day, whereas Android users every 8 hours.
- However, IOS users have found out that their Battery lasts longer on Standby than Android Users.
- 8 out of 10 people find it annoying to carry charger or external power bank with themselves.
- The main Reason for Battery Drainage is the use of Heavy apps which Rely on Mobile Data and Network such as Facebook, Snapchat, Calling etc.

## C. Interview

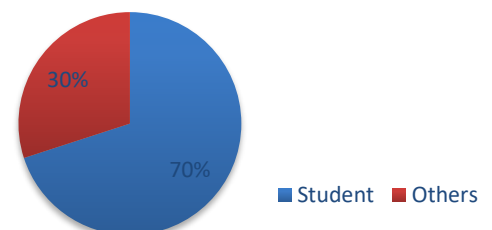
The main aim of the interview was to find out who faced the most problem with battery drain, the causes and reasons for their issues and most of all to find the similarities between users who rated the problem on a similar scale. The interview questions were semi structured since it helped to delve deeper into user experiences and their thoughts on this issue. The mode of recording the data was through notes.

Pre-planned questions:

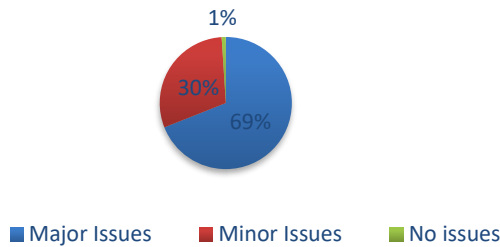
1. Which type of OS does your phone have?
2. Experience with battery drain.
3. Extent of use of battery backups and savers
4. How much access to charging points?

## D. Interview Results

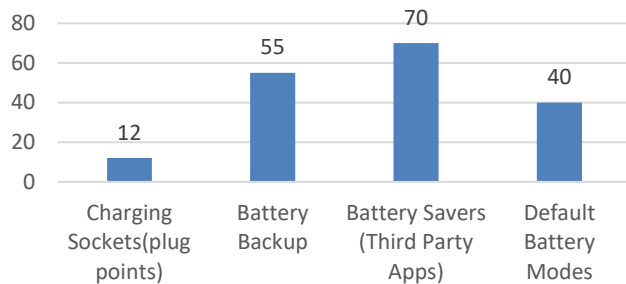
### Categories of users interviewed



Number of people who have had major issues with battery drain



Percentage of people having problems depending on access to a charging source



#### D. Interview Analysis

- People without frequent access to charging points complained the most about battery drainage as an issue.
- Some of the students mentioned unable to wait for the phone to charge completely due to time constraints.
- Backup chargers are not popular due to having issues with carrying it, not having places to keep it and forgetting to charge it / take it along.
- People do not depend on third party battery apps much since they don't believe that they work.
- Many of the students face battery issues during their personal time due to lack of chances to charge phones repeatedly.
- Most people were able to give general experiences that they have on and off while some mentioned specific experiences which created major issues for them.

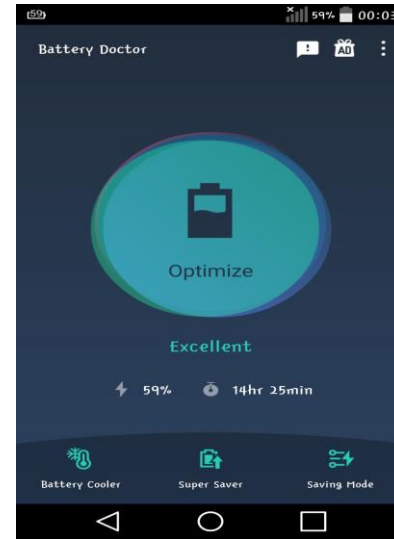
#### V. USABILITY TEST ANALYSIS

To find solutions related to drainage of battery we came up with a decision that would help determine and analyze the core reasons behind the problem and give an in-depth information about the drainage issues. An application called 'Battery Doctor' was selected for this task.

There were three tasks designed for Usability testing:

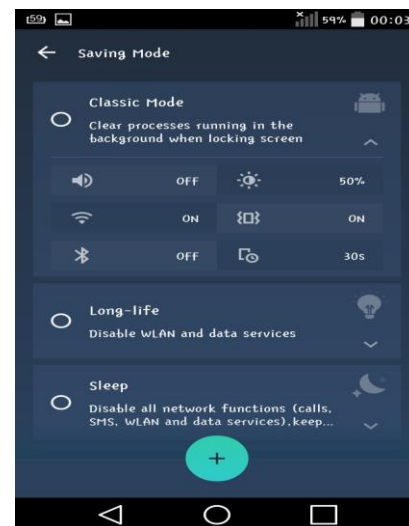
1. Explore Battery saver mode.

2. Explore Super Saver feature and explore battery details (Power Management).
3. Cool down battery using Battery cooler feature.



Figure(a): Illustrates different features available in the application.

The first task involved users exploring the battery saver mode. There were three default types for users in this mode namely (Figure b) classic mode, saving mode and Long-life mode. Each had their own specifications and ways to minimize consumption of battery. Along with this mode there was an additional option for users to create their own battery saver mode by selecting which features to enable and disable.



Figure(b): Illustrates three default types of battery saving modes.

Second task involved users to explore battery details which lets you easily see how much power your applications are consuming, and accurately forecasts how long your battery could last with different features turned on or off. Additionally, it keeps your battery healthy by notifying you when you should start and stop charging. The task also involves users to explore super saver feature that analyzes various applications that cause

battery loss and to optimize them by shutting down those applications if not being used.

The final task allowed users to go through the battery cooler feature which analyzes the temperature of the battery and reduce the temperature to an optimal level on a single click by closing the applications and software that operate heavily on device hardware unnecessarily.

#### A. Summary of Usability Test

- Most users were pleased with the UI and features of the application.
- Most users found super saver as an important feature, as it analyses unused applications that consume battery power and shut down those applications to improve the battery life.
- The tasks covered most of the functionalities of the application. So, the participants became comfortable with application and appreciated the ease of using the application.
- Few users found the feature of super saving and battery cooler to be similar. So, these two features can be integrated into a single component.
- In all certainty, majority of users were positive about using application as the application was easy to use and it addresses the battery draining issue to major extent.
- Few users detected a small bug in application, whenever they tried to cool down the Phone using application, there was a lag which caused the phone to freeze for few seconds. However, this was not a big issue and can be fixed.

### VI. CONCLUSION

Battery drain is one the major issues that has been persistent throughout the evolution of mobile phones. While most people have become used to it since they have been dealing with this issue since a long time, it still causes frustration and often major troubles when such a relied facility is disrupted at peak times. The questionnaire helped us analyze general usage patterns of mobile phones and the battery drain levels it causes. Although people who uses their phones only for basic things like phone calls and text messages have less complains regarding this problem but almost everyone has an issue with it.

Some of the existing solutions like using the default battery modes in the phones have not instilled any confidence in the users as such. Many of them do not know about it. For most of them who do, they don't have much confidence in the effect of those modes on the battery. Often these modes also restrict the phones functionality which makes them useless in many cases.

The other solution that this paper had focused on is the third-party battery applications. Most of the people have qualms about even trying them since they believe that the application itself requires power to keep running, aiding in battery drain rather than helping to increase the battery life.

There are other areas which can be analyzed to minimize the battery drain. Apart from hardware assessment which is an ongoing research area, software applications can be analyzed further to change behavior according to the battery levels. Battery drain is a problem which is being treated as one that can be adjusted with due to lack of choice by most people but requires serious attention.

### VII. REFLECTION

#### A. Learning Experience

Among various user experiences we chose to work on battery drain in mobile phones since it is a user experience that has been experienced by everybody at some point of time. Having personal experience with this issue made us curious to find out the extent to which other people have also faced this issue. Our data gathering allowed us to analyze the extent to which this issue has affected people. It helped us set a base for our surveys and information. Further the semi-structured interviews that we conducted gave us an insight to the various problems and experiences that individual users have had pertaining to battery drains in their phones. Some gave us personal experiences while others spoke about general situations that caused discomfort and in some situations major troubles.

We decided to work with the Battery Doctor application which is present in both Android and IOS platforms. Most of our user base had not heard of this application and were keen on exploring it. The tasks we defined for our analysis gave us an idea as to how people approach a design, their expectations and requirements from a user interface and the different approaches people take towards a UI.

#### B. What can be done differently?

We could have expanded our user base to include a defined number of users from various categories. Our data gathering interviews can be expanded more to include data to give a deeper insight as to the extent at which this issue affects people. We can explore usability tests by giving more tasks and performing deeper analysis on it.

### REFERENCES

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