A comparison between android and ios devices based on usability testing techniques

Siddharth Shah- 16BCE0247

Abhinav Kumar- 16BCE0460

Abstract- Mainly, two mobile operating systems are dominating the market these days android and ios. These two are often compared to find out which is better. We are conducting formal case study to compare these two operating system with respect to their usability and performance. A survey will be conducted and user reviews will also be taken into consideration by means of google form as well as personal interviews.With the completion of project, we will have data related to performance of both operating systems in various fields like their reboot time, their response to heavy applications like gaming, ease of use,learning curve to use the device , reponse to same application on different platforms etc. An analysis of these will be done and conclusions about the usability of both these operating systems under different circumstances will be provided. The study will comprise of different age groups and people from varying cultures and backgrounds

Index terms- android, ios, boot time, mobile applications, mobile operating system, usability testing.

1. Introduction

1.1 <u>IOS</u> ios is a mobile operating system created and developed by Apple Inc. and distributed exclusively for Apple hardware. It is the second most popular mobile operating system in the world by sales, after Android The iOS UI depends on the idea of direct control, utilizing multi-touch signals. Ios imparts to OS X a few systems, for example, Core Foundation and Foundation Kit; be that as it may, its UI toolbox is Cocoa Touch as opposed to OS X's Cocoa, so it gives the UIKit structure as opposed to the AppKit system.

1.2 <u>ANDROID</u> Is a mobile operating system (OS) currently developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smartphones and tablets. It has been the best-selling OS on tablets and on smartphones. In addition to touchscreen devices, Google has further developed Android for television, cars, and wristwatches, each with a specialized yet similar interface. Variations and forked adaptations of Android are likewise utilized on notebooks, diversion reassures, advanced cameras, and different hardware. Android was at first wrote by Android, Inc., which Google purchased in 2005, and divulged it in 2007, alongside the establishing of the Open Handset Alliance – a consortium of equipment, programming, and media transmission organizations gave to propelling open measures for cell phones.

1.3 Area Of Study - In modern times phones like android and IPhone have been leading the market , hence focus will be kept in understanding how are they different from each other and for different people in terms of usability from young age i.e for children to elderly people ,in the same way people from different cultures such as those who speak English

1.4 – **Parameters of Comparison** both the devices parameters like performance will be based on common factors like
1 boot time
2 restart time
3 Checking how same applications change in their performance since both platforms have

different operating systems hence different performance other factors like usability will 4 Gaming applications – since these are heavy files which require a lot of processing hence it is a good way to judge between the platforms 5- learning curve – understanding how hard is it to understand the devices for someone who hasn't used it before 1.5 Data Collect - Collection also be tested by extensively using surveys and data collection ,this will done from interviewing people of varying age and cultures ,both the platforms will judged on a scale of 1 to 10,1 being the lowest and 10 being the highest hence leading to understand the clear difference between both the platforms , google forms can also be used for getting insight of a lot of people

2. Literature review

First of all, since we are performing usability testing on mobile operating system, we must keep in mind that the mobile environment is different from desktop environment [1]. For example, while working on a desktop a user sits at the same place but while working with mobiles, concentration level of users very with the situation. So we must modify our usability testing methods accordingly.

Major part of the time spent by the users on mobile are on one app or other. Meanwhile, users tend to spend more time on same 5-6 apps they have been using frequently. So, while testing the usability of a mobile, its response to various apps should be our prime concern [3].

We are comparing the usability of android and ios and a lot of work has already been done in this field. According to Research on Android vs. iOS Security: A Comparative Study by Ibtisam [4] Mohamed Mobile device developers, designers have increasingly focused on security of the mobile phones. The massive adoption of mobile devices by individuals as well as by organizations has brought forth many security concerns. However, present security features may not be providing accurate and more powerful security

interface to the mobile user. In this factors that influence security within the Android and iOS platforms, are presented and examined to promote discussion, consider various factors that influence security on both platforms, such as application provenance, application permissions, application isolation, and encryption mechanisms.

According to Mobile Operating System: Analysis and Comparison of Android and iOS by Bharati Wukkadada and et. Al [7], after comparing the two OS's they both have their advantages and disadvantages. iOS require a specific type of hardware which can be difficult to obtain while Android can be developed on any hardware. And according to the cost of the phones, Android is much cheaper as compared to iOS while the error reporting feature is much better in iOS than in Android. Overall they state that the iOS is better than Android but Android is better in terms of cost and can be obtained by most of the people.

According to recent articles in popular technology websites, some mobile applications function in an insecure manner when presented with untrusted SSL certificates. These non-browser based applications seem to, in the absence of a standard way of alerting a user of an SSL error, accept any certificate presented to it. This paper intended to research these claims and show whether or not an invisible proxy based SSL attack can indeed steal user's credentials from mobile applications, and which type's applications are most likely to be vulnerable to this attack vector. To ensure coverage of the most popular platforms, applications on both Android 4.2 and iOS 6 are tested. The results of the study showed that stealing credentials is indeed possible using invisible proxy man in the middle attacks [8].

As smartphones continue to increase in popularity, understanding how software processes associated with the smartphone platform differ from the traditional desktop platform is critical for improving user experience and facilitating software development and maintenance. In this paper they focused specifically on differences in

bugs and bug-fixing processes between desktop and smartphone software. Their study covers 444,129 bug reports in 88 open source projects on desktop, Android, and iOS. The study has two main thrusts: a quantitative analysis to discover similarities and differences between desktop and smartphone bug reports/processes; and a qualitative analysis where they extract topics from bug reports to understand bugs' nature, categories, and differences between platforms. Their findings include: during 2011--2013, iOS bugs were fixed three times faster compared to Android and desktop; top smartphone bug fixers are more involved in reporting bugs than top desktop bug fixers; and most frequent high-severity bugs are due to build issues on desktop, concurrency on Android, and application logic on iOS. Their study, findings, and recommendations are potentially useful to smartphone researchers and practitioners [10].

3. Problem formulation

The main aim of this research is to compare and analyse the two different operating systems in mobile phones namely android and ios. Several data sources are applied that includes interviews, observations and literature. The idea is to collect relevant features of ios and android and then sort out the best features of each mobile phone. Finally, we try to analyse the collected data trough observation and reviews and present our results.

4. Methodology and implementation

In this project, we are performing usability testing on ios and android and aim at analysing which of the two platforms is better in various aspects. To achieve the goal we are performing various test which will cover different aspects like boot time, reboot time, response time, etc. To do so, the methodology will be-

4.1 Participants

Usability testing can be both subjective and objective. For subjective testing, we are conducting a survey among students of VIT University. Age group of our target is between

18 and 24. Smartphones are most popular among this age group and is used most extensively by them. So, they are most suitable for usability testing. We conducted the survey using a google form containing various questions regarding user review on their phones and ample number of responses will be recorded and analysed. The survey included questions based on their daily experience with the smartphones.

For objective usability testing, lab experiments will done. For example, experimental data will be collected on response time, boot time, reboot time, etc., of various android and ios devices and then the data will be compared.

4.2 Materials

For our lab experiments we included 5 android devices and 3 ios devices. The devices used different android and ios versions and were manufactured in different years. We included android devices with android versions 6.0.1, 7.1.2 and 8.1.0. The different android devices were launched in year 2015, 2016 and 2017. The ios versions used for the study included ios10.3.3 and 11.1.0. The ios devices used were launched in year 2015 and 2016.

For our subjective studies, which include user reviews, we used google forms and for analysis of the results we used different software from Microsoft like MS excel.

4.3 Procedure

We conducted our case study in 4 different stages which included laboratory studies, user reviews and analysis.

For stage 1, we conducted lab experiments which recorded the responses for boot and reboot time of the devices. We calculated our data at different battery levels. The data was recorded for three different battery levels i.e.

1) At full battery (more than 90%)
2) At normal battery (25%-75%)
3) At low battery(less than 15%)

Firstly, the data for boot time was recorded and then for reboot. So, the data for boot time was-

- At full battery power

Device	Android 6.0.1	Android 7.1.2	Android 8.1.0	Ios 10.3.3	Ios 11.2.5
Boot time (in sec.)	37.8	34.5	23.6	19.3	16.7

- At normal battery

Device	Android 6.0.1	Android 7.1.2	Android 8.1.0	Ios 10.3.3	Ios 11.1.0
Boot time (in sec.)	38	34.8	22.2	19.1	16.5

- At lower battery levels

Device	Android 6.0.1	Android 7.1.2	Android 8.1.0	Ios 10.3.3	Ios 11.2.5
Boot time (in sec.)	40.2	35.6	25.9	19.5	17.0

Similarly, we recorded the data for reboot time of the devices and the reboot time in different situation was-

- At full battery power

Device	Android 6.0.1	Android 7.1.2	Android 8.1.0	Ios 10.3.3	Ios 11.1.0
Boot time (in sec.)	71.2	60.6	55.2	34.1	30.7

- At normal battery

Device	Android 6.0.1	Android 7.1.2	Android 8.1.0	Ios 10.3.3	Ios 11.1.0
Boot time (in sec.)	71.0	61.2	55.0	34.5	30.2

- At lower battery levels

Device	Android 6.0.1	Android 7.1.2	Android 8.1.0	Ios 10.3.3	Ios 11.1.0
Boot time (in sec.)	75.9	68.1	59.2	35.0	31.2

In second stage, we performed usability testing by conducting survey using google forms. In our survey, we included various questions covering different aspects of the two platforms. The sample questionnaire is-

1. Which do you prefer when it comes to 'Theming'?
2. Which do you prefer when it comes to 'Texting'?
3. Which do you prefer when it comes to 'Calling Interface'?
4. Which do you prefer when it comes to 'Customization'?
5. Which do you prefer when it comes to 'gaming'?

And some other questions from different categories were included and responses were recorded from our target audience including people of age group 18-24.

In third stage, we compared similar applications on both the operating systems and analysed the ease of use in both the cases. But instead of comparing the store apps, we compared preinstalled apps on both the platforms. Most of the store applications have same interface for both the platforms and will not provide a justified usability comparison, it will be more of a performance testing. So, we selected and compared most important and commonly used pre-installed applications like browser, gallery, messages, mail, etc.

Android Marshmallow is a decent working framework. It is deficient with regards to a couple of things contrasted with iOS, yet the same can be said a different way. It is difficult to look at ease of use since Android is a working framework, and there isn't an authoritative form. The applications that come bundled with most gadgets can be separated

and contrasted with iOS effectively. Each one of them is middle of the road, and some are superior to anything any option in the Play Store.

IiOS needs numerous highlights that Android has, however its special features can exceed the inadequacies. iCloud and iMessage are two highlights that keep numerous individuals secured in the biological system, yet that will be examined in Round 2 of this portion. The applications all work, yet feel caught in 2007, with few noteworthy changes since their underlying discharge.

Finally, we will analyse the data and based on results from all the three stages of data collection.

5. Result and discussion

Based on our data collection following results were observed. The graph for performance of devices at different battery levels are as-

Boot time at different battery levels-
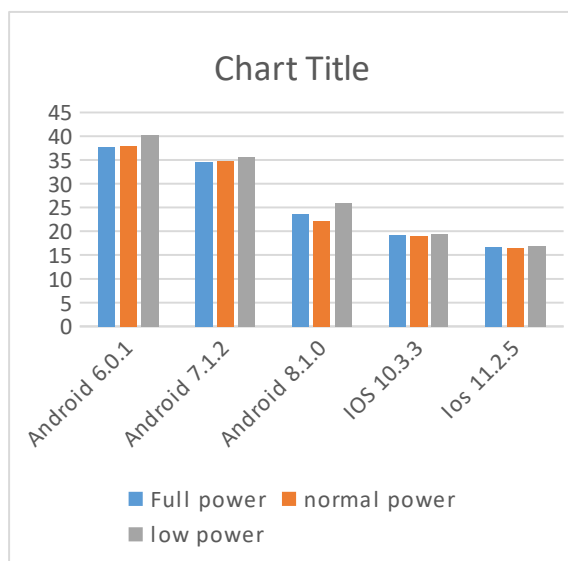
At any battery level the boot time is significantly low for ios devices as compared to android.

Also at lower battery levels the boot time for android devices further increases by nearly 3 sec. which is not observed in case of ios devices.

Reboot time at different battery levels-
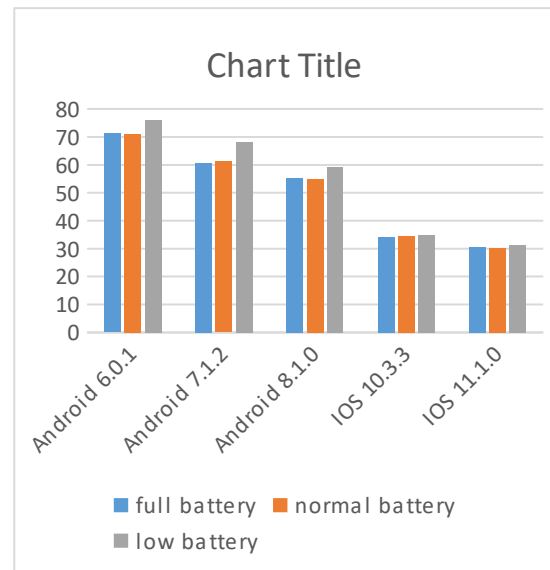
The reboot time is nearly half for ios devices as compared to android. And it is further decreased in latest version of ios i.e. ios 11.2.5.

The reboot time for android devices is further increased for android devices at lower battery power by nearly 6-7 sec. which shows that android devices perform poorly at lower battery levels.
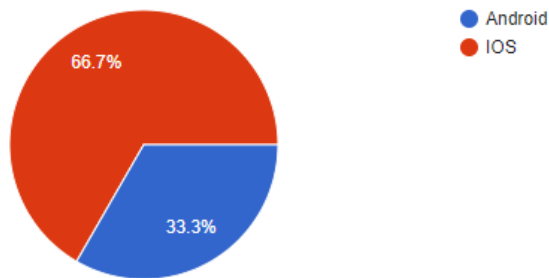
From the second phase of study where we conducted survey, different users supported different platforms for different aspects.

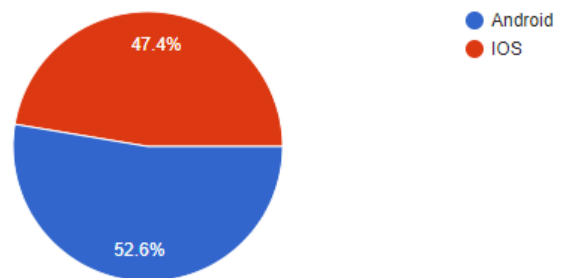Some of the aspects where people supported ios include-
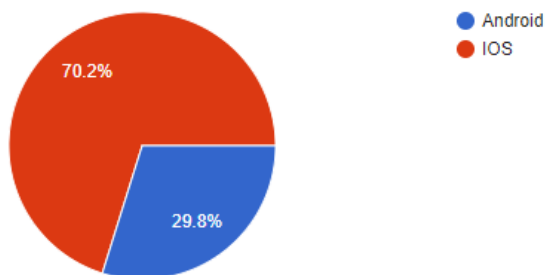
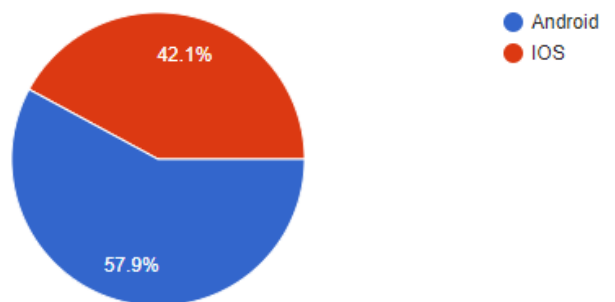- Theming
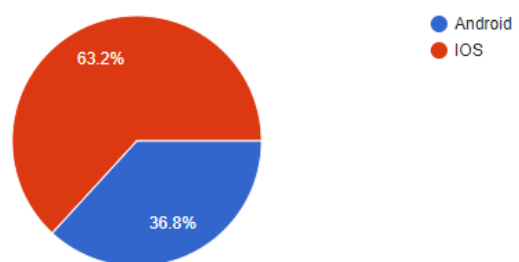
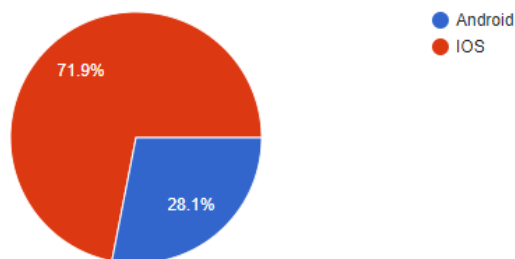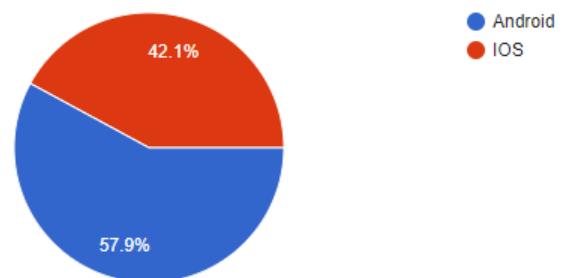- Texting

- User interface-

- Gaming

- AI

- Connectivity

Whereas, some of the aspects where users supported android devices are-

- Customization

In third stage, we performed usability testing on many pre-installed applications on both platforms and the results observed are-

- Browser vs Safari

In android the default program application that accompanies most handsets is usable. It doesn't surpass desires, however that is on the grounds that it doesn't need to. You can without much of a stretch download Chrome from the Play Store. Whereas in ios, safari is

one of only a handful few applications that has changed essentially since its presentation, it is speedy and dependable. iCloud tabs synchronize the sites you visit to the greater part of your Apple gadgets and iCloud Keychain match up the passwords too. It bolsters promotion blockers, something Android does not presently do. Not much else to state, but rather it is a decent application.

- Email application-

In android, it works, and it's a mail customer. There are still a lot of options, so it isn't an issue, however the application is alright and can deal with most email administrations. For ios, the application has not changed that much since 2007, but rather the few highlights it has function admirably for the vast majority. It is an essential mail customer, and that is about it.

- Gallery-

This application gets a handle on of place on current Android gadgets and most telephone or tablet producers supplant it with their own form. The application feels stuck in 2012, and it is essential contrasted with more up to date applications like Google Photos, which underpins moving down the majority of your photographs into the cloud cross-stage. I for the most part place this in an envelope and forget about it. Whereas, iCloud Photo Library gives the Apple Photos application an edge over the opposition. Worked in to the gadget, the majority of the photos taken can be put away on iCloud for nothing simply like Google Photos, yet its cross-stage similarity is inadequate. It requires utilizing the (as I would see it, wretched) icloud.com, and it feels impeded by an excessive number of restrictive APIs.

- Google vs Siri-

Google Now and every one of the advantages of having Google readily available is incredible. Presently on Tap, another element in Android Marshmallow is amazing and can look the web for things on your screen. This application is astounding. On the other hand, Siri is outstanding amongst other highlights on iOS. I utilize it day by day, however it has

begun to fall behind Google Now as of late. The greater part of its highlights can be repeated through Google, and it misjudges me more than it beforehand had. It isn't cross stage (yet) so the best way to utilize it is on the gadget itself.

- Contacts-

For android, it's contacts. It syncs with your Google account, so you never have to worry about losing your contacts. For ios, it's contacts. It adjusts with your iCloud account, so you never need to stress over losing your contacts (unless you change to Android).

- Messaging –

In android applications, it is tolerable, yet not awesome. Other informing applications have attempted to supplant it, and nothing is that momentous. Home bases is an awesome informing application, then again, yet can't fit in with your cell design like the first Messaging application. Ideally in more current updates it will be cleaned more. Whereas for ios this application is conventional, however has an executioner highlight, iMessage. You can message any Apple gadget with the Messages application (fabricated after 2010 running iOS or OS X) for nothing, and Facetime video call and sound calls.

- Maps –

Google Maps is most likely the best guide benefit on the planet. It has been attempted and tried throughout recent years, and is exact. Apple Maps is getting up to speed, yet with local coordination, Google Maps beats it by a great deal. Apple Maps has enhanced since the iOS 6 calamity in 2012, where it drove individuals to deserted roads and back streets. Today, it works nearly and additionally Google Maps, however is missing exact mapping in numerous provincial territories.

- Settings-

For android devices settings has enhanced a great deal finished the years. At the point when not limited by the gadget's maker, it gives a considerable measure of alternatives and enables you to introduce .apk records

appropriate from the gadget. And for ios, the application is presently accessible, and it helps route a tad. Nothing extraordinary, and the alternatives are, extremely, restricted.

- Clock, Calculator, Downloads, Calendar-

These apps do what they say, but nothing special on both the platforms.

- Find my phone-

For android devices, all you have to do is Google "Find My Android" and you can locate your device anywhere. Similarly, for ios devices, it works. I honestly utilize this a ton, and now, at last, it is web-accessible on icloud.com.

- Play store vs app store –

Android Market has completed a considerable measure of experiencing childhood lately. Designers are starting to consider the store more important, and Google has been Apple-esque with their application dismissal as of late. The most concerning issue with having such a significant number of gadgets is that a great deal of applications simply aren't perfect. For most, this isn't an issue, yet not having the capacity to get an application in light of the fact that your screen is too little, or if your telephone can't refresh to the following variant to get an application you truly need is goading. It isn't Google's blame, however it is an issue. It is hard to point an application at such a wide assortment of gadgets, such huge numbers of designers acknowledge their misfortunes and decide a statistic. On the other hand, the iOS App Store was released in 2008 and has had amazing designer bolster. Since the iPhone has dependably been a top of the line gadget, application designers realize that individuals that utilization the stage are all the more ready to spend higher ammounts of cash for quality. This drives the applications to be discharged on iOS first. Android has started to venture up the nature of applications, yet the strong client base and restraining infrastructure Apple has control of on their gadgets make it better than Google Play from various perspectives, however alternatives isn't one of them.

6. Conclusion-

Based on our study of usability of android devices and ios devices, we have come to the conclusion both the operating systems have their strong points and weak points. But if we have to choose one after overall usability testing, ios will be preferred over android.

Ios come with very simple user interface which can be learnt easily. Access to any application or service is much easier in ios as compared to android. Furthermore, Apple's AI- Siri provides a relatively much more efficient voice controlled interface. According to our survey, ios preferred over android in basic phone services like calling, texting and theming.

According to our results, gaming, customisation and connectivity are the only fields in which android beats ios. Majority of the smartphone users are not very much concerned about customisation. Gaming is popular among youths only. So, connectivity is the only real issue where ios lags behind.

Furthermore, performance of ios devices is better than android devices in terms of boot time, reboot time, response time, etc. That's why users find it more convenient to use.

References

1. Research on Android vs. iOS Security: A Comparative Study by Ibtisam Mohamed Ibtisam Mohamed, PhD Candidate Department of Computer Science University of Denver Denver, CO 80208, USA
2. Mobile Operating System: Analysis and Comparison of Android and iOS by Bharati Wukkadada and et. al K.J. Somaiya Institute of Management studies & Research Vidyanagar, Vidyavihar, Mumbai-77
3. Amalfitano, D., Amatucci, N., Memon, A. M., Tramontana, P., & Fasolino, A. R. (2017). A general framework for comparing automatic

testing techniques of Android mobile apps. *Journal of Systems and Software*, *125*, 322-343.

4. Gao, J., Bai, X., Tsai, W. T., & Uehara, T. (2014). Mobile application testing: a tutorial. *Computer*, *47*(2), 46-55.

5. Kortum, P., & Sorber, M. (2015). Measuring the usability of mobile applications for phones and tablets. *International Journal of Human-Computer Interaction*, *31*(8), 518-529.

6. Hubbard, J., Weimer, K., & Chen, Y. (2014, January). A study of SSL Proxy attacks on Android and iOS mobile applications. In *Consumer Communications and Networking Conference (CCNC), 2014 IEEE 11th* (pp. 86-91). IEEE.

7. Zhou, B., Neamtiu, I., & Gupta, R. (2015, April). A cross-platform analysis of bugs and bug-fixing in open source projects: Desktop vs. android vs. ios. In *Proceedings of the 19th International Conference on Evaluation and Assessment in Software Engineering* (p. 7). ACM.

8. Morris, J., & Mueller, J. (2014). Blind and deaf consumer preferences for android and iOS smartphones. In *Inclusive Designing* (pp. 69-79). Springer, Cham.

9. Benenson, Z., Gassmann, F., & Reinfelder, L. (2013, April). Android and iOS users' differences concerning security and privacy. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems* (pp. 817-822). ACM.

10. Oh, T., Stackpole, B., Cummins, E., Gonzalez, C., Ramachandran, R., & Lim, S. (2012, June). Best security practices for android, blackberry, and iOS. In *Enabling Technologies for Smartphone and Internet of Things (ETSIoT), 2012 First IEEE Workshop on* (pp. 42-47). IEEE.

11. Erturk, E. (2012, June). A case study in open source software security and privacy: Android adware. In *Internet Security (WorldCIS), 2012 World Congress on* (pp. 189-191). IEEE.

12. https://medium.theuxblog.com/the-10-commandments-of-usability-testing-for-mobile-apps-5d35afc615e7

13. https://usabilitygeek.com/usability-testing-mobile-applications/

14. https://www.nngroup.com/articles/mobile-usability-testing/

15. https://uxplanet.org/the-brief-guide-to-testing-mobile-interfaces-f880b0600474