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# Review and Comparative Studies on Mobile Operating System

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Abstract-Smartphones are the substantially commonly used device in this era everyone on this earth has a smartphone and they use it to perform daily tasks like using different applications and socializing. Smartphones are portable devices with the latest technology so users can easily keep them instead of having a PC or laptop. An OS (operating system) is an extremely common factor thathelps devices to work because it acts as the agent between the operator and the hardware. There are numerous operating systems existing for mobile phones and they are providing different features. There are different gains and losses of mobile phone operating systems. All diverse operating systems hold different market shares and companies are trying to provide new features to their clients as well. The objective of this analysis is to accomplish a comparative study on divergent operating systems utilized in smartphones and their different features. The furthermost generally adopted operating systems are iOS by Apple, Android by Google, and windows phone by Microsoft. The smartphones operating systems that are peak commonly in use are iOS (Apple) and Android(Google) as they are the marathons but android is seen as the greatest used operating systemin smartphones due to its rich features. In this article common mobile operating systems are coed on the basis of different available features.
*Keywords: Operating system, smartphones, Mobile, android, iOS, Windows*

## I. INTRODUCTION

New technologies are developing every year to grow the industry and different industries provide new features to their clients [1]. Now, mobile phones have greater penetration in the lives of ordinary people and can serve as an important tool for marketers and a platform for mobile marketing communication [8]. Today, the use of mobile phones can be compared with computers. Modern mobile phones have all the functions that computers have. It has become an enormous concern for individuals and businesses. Following the success of desktop computers and portable computers, the latest market trends indicate that the use of smartphones that can perform most of the computing tasks that personal computers can perform on their own is rapidly increasing. It changed the way of doing business [23]. People used to go to the bank or office to do their tasks, but now they can easily complete it with their mobile phone. It can be seen that in the past few years, wireless technology has been highly developed. As the performance and capacity of wireless communication systems increase exponentially, information can be easily accessed using mobile devices [29]. In the past few decades, smartphones have changed our lives in ways far beyond what the media has experienced before. Mobile phones have become a necessity for many people all over the world. Smartphones are very important and useful communication tools for people of all ages. Almost one in two adults owns a smartphone, and in developed countries, this proportion has risen to two-thirds. Nowadays, many people spend more than 5 hours on these devices every day [33]. Smartphones have been fully integrated into our lives [37]. It is undeniable that the prominence of mobile phones in our daily lives and events is endless. The reason for this is that a massive transformation is taking place because mobile phones are now not only the usual communication devices before. Smartphones are gradually replacing personal computers. Smartphones can provide users with many services, just like traditional personal computers. Besides, smartphones also provide users with a wide range of functions, such as personal records storage, financial transactions, online actions of government services, and web browsing. Due to these causes and the causes mentioned in the sales of smartphones, it has achieved a high record worldwide. [27]

The continuous growth of innovative technologies and interfaces has led to the development of the mobile industry. Mobile consumers have moved from their elementary phones to smartphone technology. Today, industrialists are tapping this prospective market. It can be seen that the company is emerging an operating system for target customers, aiming to provide customers with unique and competitive features and user interfaces [11]. All of this is possible due to the innovation of mobile operating systems.

OS is the software liable for the supervision of computer hardware and software resources and providing extensive service area for computerprograms. OS is the basic module of the system software in a computer system. Applications often involve an operating system to run [19] There are many types of operating systems running nowadays e.g. multi-user, multi-thread, multi-processing, real-time, multi-task, and general-purpose operating systems [24].

The operating system is held responsible for providing interfaces between all the software and hardware components of the system and acts as a platform through which humans can interact with mobile phones [4]. Operating systems control mobile devices with OS such as Windows or Linux, which are console computers. It could be run on mobile devices, e.g. mobile phones, smartphones, PDAs, and handheld computers [24]. With the increasing enthusiasm of customers for mobile phones, we often feel confused when choosing the best mobile phone in their minds. Hundreds of brands have different operating systems that can provide customers with numerous functions. We see that various mobile companies provide different mobile operating systems with different functions in terms of competitive advantage [1]. Mobile operating systems manage the hardware and software of mobile devices, similar to computer operating systems. The previous mobile operating systems were simple because they supported limited mobile phone functions. Now, a mobile operating system is a kind of software that provides an environment in which mobile device users can execute applications conveniently and efficiently [32]. Mobile OS has undergone the same development as mobile phones and is now the most important part of separating mobile functions from each other. In recent times, mobile OS is gaining remarkable growth. Analysts are optimistic about more potential progress in the coming times. In today's market, mobile phones of various brands have different operating systems [35]. Until 1992, Mobile OS was an implanted system. The preliminary stage of the smartphone Mobile OS is applied to Palm's top equipment such as PDA. By 2000, Symbian became the foremost modern mobile OS on smartphones. By 2002, BlackBerry had welded the smartphone field. It was not until 2007 that Symbian was widely welcomed by people.

It was a mobile OS before Apple and Google launched their particular versions of Mobile OS [8]. Smartphone vendors build special operating systems for their products [27].
There are many types of mobile phone operating systems, such as Apple iOS, BlackBerry OS, Nokia's Symbian, Google Android, and Microsoft Windows Phone OS. Most of them are open-source programmable programs [2]. Now we can connect with anyone anywhere in the world. We can also use these portable devices to access the Internet. All of these use unique operating systems to provide users with what they want. The most popular companies that are committed to improving the user's smartphone experience are Google, Samsung, Microsoft, Apple, and Nokia. All smartphones that exist today use a certain technology and provide multiple functions. These functions vary depending on the operating system used in a particular smartphone [4].
During the operation of the smartphone, the mobile phone operating system is always running, because it runs and manages all the components, programs, and applications common to the smartphone [2].
Android is a mobile OS centered on the Linux kernel, presently established by Google Inc., with a user interface based on direct manipulation. Android is mainly deliberate for touch screen mobile devices such as tablets smartphones and has a user interface dedicated to Android TV, Android Auto, and wristband Android Wear. The touch input used by the operating system roughly corresponds to the actions in the real world, such as sliding, tapping, and manipulate objects on the screen, and a virtual keyboard [19]. Android is the first open-source, Linux-based modern mobile phone platform. In android, whenever a user wants to install any application, first provide its description and permission request list so that it can be reviewed before installing or canceling the installation. If he or she finds that the license is too many or offensive, it is an installation [26]
iPhone iOS is a mobile OS established by Apple Inc. for mobile devices produced by Apple. The operating system was originally established for the iPhone and far along expanded to be executed on other Apple devices such as iPod, iPad, and Apple TV [30]. In addition to buttons with different shapes, the iOS application system also relies on a multi-touch system. Its main feature is its closed source code with open source components and the operating system is relatively stable and secure error[2].
The Windows Mobile operating system was established by Microsoft Corporation for use in smartphones and mobile devices [29]. Windows Phone OS is the successor to the Windows Mobile platform, which is based on the Windows CE kernel and started with the operating system Pocket PC 2000 [30]. The smartphones that are most common Android, iOS Windows mobile, and are Blueberry. The fast and increasing number of smartphones Google Play applications and Apple stores have facilitated and facilitated Impelled tech practitioners to help develop applications to succeed in the markets, consistency [31].

## II. LITERATURES SURVEY

There are so many smartphones in use these days. The findings indicate that the multiple applications of smartphones in daily life are correlated with distinct expectations of smartphone capabilities. To establish new data collection and analytical systems through different networks and different environments, researchers should relate this to the principle of "big data" (e.g., everyday living and travel). Besides, to truly appreciate the true nature of daily use of the smartphone and its effect on the tourism experience, a normative model should be developed and evaluated to take this into account, it is thought that the structure presented here offers a valuable platform for creating a much richer understanding of tourism experience and mobile technologies [37].
The Mobile Phone is now the safest computer to operate on for improved connectivity and contact. But the entire handset is built with the latest trends [38] in mind. Mohanad Ali Meteab Al-Obaidi and others have researched the need to know the types of operating systems before understanding the functionality and characteristics of mobile programming languages since a programming language is consistent with an operating system. The operating system and the types of mobile application programming languages will be addressed on this basis since each type of operating system has its compatible programming language. Mobile operating systems are known as platforms for mobile operators. There are various kinds of operating systems for mobile phones (such as Apple iOS, Google Android, BlackBerry OS, Symbian for Nokia, and Microsoft Windows Phone OS). Many of them are programmable programs that are open access [2].
Two concentration indexes, the Hirschman-Herfindahl Index and the Four-Firm Concentration Ratio were analyzed to study the demand for mobile operating systems. Their growth in the period 2007-2015 demonstrates that, since then, tight ownership has been a hallmark of this sector. A fall in HHI around 2011 marks the transition from Symbian's supremacy to Android's present dominance. At present, over 99 percent of new computers are equipped with the four dominant operating systems. However, the emerging holding is highly imbalanced, as Android alone holds a share in the latest smartphone market of more than 80 percent [3]. The research states that it is assumed that the ever-growing dependency on smartphones is still increasing. Android and iOS, however, are said to be the leading smartphone operating systems due to their distinctive offerings in every aspect [4]. The article suggests that, unlike consumers in the developing world, the public from states with a high HD index continues to usage smartphones built by Apple Inc. Androids marketed and used in developed markets in emerging countries are not in the equivalent price range as Androids. Androids are built for the middle class and clash with iPhones in the high-middle or luxury class. Androids use the same apps which are well built to provide decent features for photo/video production. Further study will concentrate on identifying the causes for cultural, economic, and social variations in the purchasing behavior of smartphones[7].
Teena Bagga, Aparna Goyal, and Sanjeev Bansal prove that, when they team up with other smartphones OSs, the Android ought to be wary about all the forthcoming rivalry it might get from branded phone producers. Google could operate harder in delivering its smartphone solution to the marketplace or face losing share to the growing success of iOS and Windows. The standard course of action for most cell phone vendors is the desired user features of mobile phones together with the smartphone brand and mobile OS brand at a reasonable price point. Mobile

OS, such as Windows, can work harder on creating tailored applications to fit the application level required for mobile OS, such as Android.
Device manufacturers need to recognize the value of mobile OS on their handset, which in many age groups and qualification groups is perceived to be an influencing purchasing factor and encourage their mobile OS, if not established, then make their approach to mobile phone features. By making them mindful of the mobile OS brand and how women can tailor it to their needs, mobile manufacturers and mobile OS makers alike can draw more female mobile users. Android can need to strive to promote the speed of processing between different ages. Results reveal that consumers are increasingly moving from conventional Symbian mobile OS to a further user-friendly GUI, there is a strong indication of the revolution in the mobile phone sector. Indian consumers can pay “Rs. 10,000 to Rs. 20,000”. The look and sound of the phone is still a significant factor for them, along with functionality, but the notion of loyalty to mobile handsets is dwindling. The notion of devotion is not restricted to the cell phone arena, which also includes the mobile OS. Less than 30 percent will stick with their current smartphone OS as per the results. Some major variations have arisen in the sample when considering the demographic expectations of controlling variables in mobile buying choices, which can provide a marketer with experience and comprehension of what offering is to be given to whom [8].

The study indicates that Tizen OS was found to be the most powerful mobile operating system of the three well-thought-out in terms of dependability of the core modules and components during the implementation of the technique to the mobile OS. In terms of the rate at which errors are observed, Cyanogen Mod is the lowest-performing Iso. Sailfish does best in terms of the potential to find glitches [9]. In the essay, Hadeel Tariq Al-Rayes discusses Android as an open-source operating system established by Android, Inc., which is now kept by Google, Inc. while Linux has been industrialized by Linus Torvalds and several others as an open-source operating system under the GNU project. Android is designed for desktops/laptops/servers, while Linux is established for handheld Internet computers and mobile phones. The Android operating system has its own C library, called Bionic, while the GNU C library is used for Linux systems. The Android systems use nonvolatile storage as a replacement for exhausting drives whereas the typical Linux systems use magnetic drives. The Android systems have their power manager although the Linux systems use APM and ACPI to manage the power [17]. The study shows that the security holes, loopholes, or vulnerabilities are one of the same things which can be proven as a threat to each Smartphone operating system that is involved today. The study reveals that one of the same items that can be proven as a challenge to each Mobile operating system that is involved today is security flaws, bugs, or weaknesses. Such security risks can be minimized to cease to exist, although certain counter-measures can minimize them. While numerous OS vendors are working on these security holes, a new threat is added every day which leaves the device susceptible to attackers. Any countermeasures have to be taken to reduce these attacks by way of device weakness [20]. A robust functional overview of the key mobile-based collaboration operating system is provided in this article. Android is greatly advanced in collaboration functionality, but the concern is that stability is lacking. IOS solves the security dilemma on its own, but through third-party applications, it takes care of the users' collaborative needs. The mobile OS based on Windows 7 is still well advanced in graphical user interface features, but it lacks the robust interactive features of the mobile OS that are the hallmarks of today's smartphones [23].
Researcher Vikas Kuchhalit and others note that most telecom firms use the Symbian operating system. Symbian provides greater utilization of memory than the three other operating systems. The Windows Mobile System is greater than the other three operating systems in terms of download space. It is easy to write the code for the Symbian operating system since its source code is available in the common language C++ [24].
During the fourth quarter of 2014, we find from competitive research and market share analysis that Android and Windows Phones are superior to other OSs. Android collects 80.7 percent and is today the world's best mobile OS. We may use it as an instructional platform as well. The consumer can conveniently run third-party software from marketsand also from insecure sources due to Android as an open-source operating system. As a consequence, it has more or fewer weaknesses that lead to malware attacks such as viruses, worms, spyware, adware, and Trojan horses. Thus, before downloading an update, we suggest detecting malware as well as contrasting Linux, iOS, Symbian, Blackberry, Windows Phone, WebOS, Ubuntu, and Firefox Mobile OS in terms of security [26].

Android took the lead and dominated the two-race iOS revenue. This may be clarified by characteristics different than the defense. Android is not narrow to a single handset, it is the operating system for multiple devices and the first one to be sold (Samsung devices) is equivalent to iOS that only runs on Apple devices. The Android paradigm is firmly dependent on the permission-based framework and other frameworks hereditary from Android elements, such as the Java language and its core OS, i.e. On Linux. IOS appears to be better than Linux, but the latter is struggling to keep up with the current upgrading. The war against extortions is seen more like a real obstacle for Android than for iOS. The high proportion of malicious products attacking Android is even higher than the iOS hack. The wide use of Android smartphones in theworld and the transparency aspect may explain this. For Android, the accessibility of solutions and anti- malware products is better than for iOS. Both of the two scores in the contrast was won by iOS. Finally, Android is the precursor in the market competitivenessrace, but the stockholders of Android's inventions should make further security efforts to continue pre- running because iOS remains a strong strategic

competitor and has a primary priority on the introduction of security technology [27].

The author states that Android's percentage market share is 81.3 percent, Apple iOS 13.4 percent,Microsoft Windows Phone 4.1 percent, Blackberry 1 percent, and Apple iOS 7 has huge amounts of new features to make your iPhone, iPad feel shiny and renewed all over again. Apple is making every attemptto make iOS 7 a solid update to an impressive OS and to keep up with industry competition. Google Android 4.4 KitKat OS is the finest mobile or smartphone OS in the world currently and 81.3 percent of consumers use Android 4.4 KitKat OS from the market share survey during December 2013. Microsoft plans to announce Windows 9, which is the latest edition of Windows Update. Microsoft announced that this latest version of Windows would be released very soon in April 2015. This latest Window 9 operating system will follow all the faults of Windows 8 and Windows 8.1 recently launched and add a range of new features to make easier usage of the OS [28].

The writers say that Apple and Android have appreciably begun in the industry. The armies of software developers who produce mobile appsare vital to the future of this market's expansion, and the development of mobile device stores. Ecosystems that will allow access to content and applications through devices are already being developed or allowed by the most sophisticated competitors [29]. Android OS, about 70 percent worldwide, has the bulk of the marketplace share, while Apple has the highest share of the benefit. Apple's operating system is also the first in the Android vs iOS vs WP cost-effectiveness series. The volume, as well as the quality demands from official shops, are other important aspects. The absenteeism of software associated with iOS OS and Android OS is Windows Phone OS. IOs varies primarily from Android and Windows Phone in that both the operating system and the end software are developed and operated by the same company, Apple, and since there is no license to run the iOS operating system on hardware products that are not manufactured by Apple, you cannot get an iOS operating system to operate on another computer. This is a drawback, as this OS is not portable on other companies' handheld devices [30]. The research paper reveals that almost 10 years ago, Symbian was the dominant operating system; its flaws contributed to the transition to Linux,iOS, Blackberry OS, and Windows mobile. It is also the most used OS in the world, as Android will run on all smartphones. Java ME is the leading environment for apps operating on mobile devices, but since it doesn't have layers of sophistication, Qt gets more attention as days pass. Select an apt and stable smartphone OS. When selecting the operating system based on their working design or personal preferences, programs have certain priority characteristics. It's user-friendly, high security, skilled gestures, different skills, official events, entertainment, scan, news, etc. [35].

The researcher says that of all the other smartphone operating systems, the Android operating system is now becoming the strongest. You will use all Google services using one operating system, namely "Android." Its capabilities are quickly supplemented by Android models. So most of the users prefer Android mobile phones, and it is the best OS of all other OS like windows, iOS. iOS 4.4, the most common version of Android, is (kitkat). Android provides the framework with stability, but IT also has security restrictions [36].

Table 1 shows us comparision of basic mobile operating systems.

Table 1 comparind mobile Os

| Operating systems | Developer | Year | Latest version | Market share | App store | Main languages |
|---|---|---|---|---|---|---|
| **Android** | Google Inc. | 2008 | Android 11 | 84.8% | Play store | Java |
| **iOS** | Apple Inc. | 2007 | iOS 14.4 | 15.2% | App store | Objective-C /Swift |
| **Windows Phone OS** | Microsoft Co. | 2010 | Window 8.1 | 0.4 | Windows phone store | C# |

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VII Methodology

In order to undertake an ethical hacking review, which is the purpose of this report, we performed an SLR according to the methods suggested by Kitchen Ham and Charters. This approach consists of: arranging, executing, and reporting phases in which there are many stages in each process. It consists of three levels.

3.1 Planning/organization

As mentioned in the above overview, the preparation process began by defining the need for this analysis, as well as setting the targets to be reached. We determined the key goal of the analysis in this process and carried out the following tasks that clarified each move in detail.

3.1.1 Recognition of the necessity for a review

We identified in Step 1 that there was no proper SLR in the area of mobile operating system. The aim of this SLR is to explain and summarize the ccomparative study of mobile operating systems .Determining that mobile operating system is crucial. Any of this is useful for future studies. Therefore, due to the findings of the previous tests, we calculated the need to execute an SLR.

3.1.2 Indicate the research question(s)

The overarching aim of this SLR is to identify and review studies relating to ethical hacking principles conducted between 2012-2020. To attain a more accurate and systematic view of this subject, the foremost objective was divided into succeeding research issue. This analysis clearly needs to keep the door open for potential updates.

In order to achieve the objective of this analysis, four key questions were described as follows:

**RQ1**: What is the significance of mobile operating system?

**RQ2**: What are the different features in mobile operating system to make it standout?
**RQ3**: Which mobile operating system in mostly utilized theses days?

3.1.3 Recognizing the appropriate bibliographic databases
The available digital libraries were scanned for the appropriate papers as per the research questions: Google Scholar, Science Direct, IEEExplore Digital Library, ACM and Springer. The foremost motive for choosing these digital reference libraries were; they accumulate studies associated to the fields of computer science and technology they index articles from numerous publication channels like journals, conferences, books and workshops. In this article, the explorations were narrow to articles published in the 2005-2021 journal and conference proceedings.

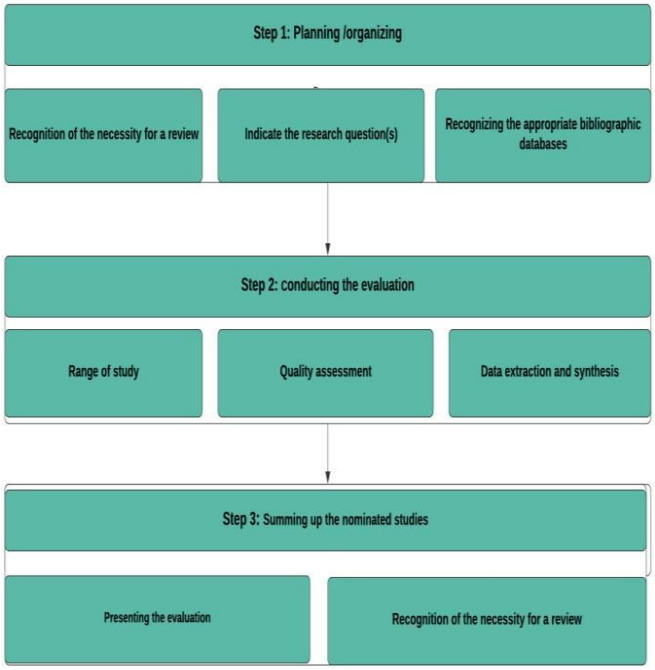



**Figure 1 SLR steps and events**

3.2 Conducting the evaluation
The massive coverage can be generated by the search string, but it is a fair scale. Consequently, the key words matching the study questions were extracted for the fortitude of the search string and the synonyms linked to the main terms were identified. To merge alternative meanings, the Boolean OR was used and the Boolean AND was used to connect the key pieces. The entire search string collection was planned as follows:
((("operating" AND "system") OR "OS") OR ("smartphones" AND "os in smartphones") OR ("mobile OS " AND "Types of mobile os") OR ("Andriod OS" AND "i OS") OR ("Windows phone" AND “features in mobile os")
3.2.1 Range of study
We revised the paper's abstract, introduction and conclusion/finish. We picked those that were written in English among the papers received and that fulfilled minimally one of the following measures: Studies should elaborate distinction between hackers and legal hacking.

- Papers which elaborate mobile operating system.
- Papers that the discusses features in mobile operating system
- Reports discuss the mostly utilized mobile operating system .

The investigator conducted a manual check of the search string results and found that advanced settings such as IEEExplore were required for some of the online databases. The researcher wants to apply to the search string alternate terms and phrases.
The requirements for inclusion and omission for this SLR are based on study questions.It is important to identify inclusion and exclusion requirements in order to choose only appropriate documents. As follows, the inclusion conditions are:

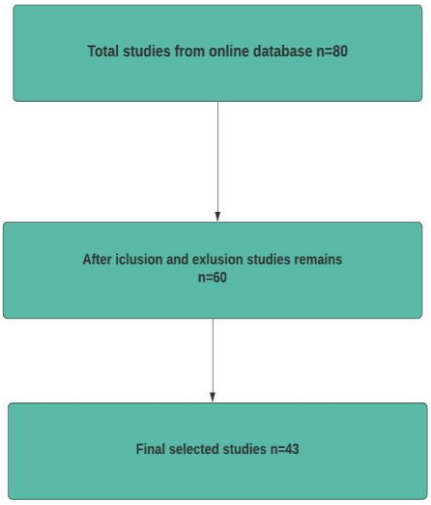
- In English, all articles must be written.
- From 2012 to 2020, all articles must be written.
- All records must concentrate on mobile operating system and its categories.

Before being considered for the next step, each of the papers is screened into exclusion criteria. For this SLR, the exclusion requirements are as follows:
Articles which have not been written in English.

- Duplicate areas of study.
- Papers that comprehend only opinion pieces, perspectives, studies on development or partial findings.
- Articles with fewer than three pages.
- Papers that do not report any scientific analysis in their study.

**3.2.2 Quality assessment**
Quality testing is typically designed to evaluate appropriate and impartial research. Therefore, in order to refine our search results and ascertain the relevance and rigorousness of the applicant papers, we determined more or less of the quality assessment metrics. As follows, the questionnaires for quality evaluation is based on other SLRs

i. Are the research's objectives and priorities explicitly stated?
ii. Is the research design clearly specified? Yes/no/partial.
iii. Have the researcher(s) properly carried out the process of data collection? Yes/no/partial
iv. Did the researcher(s) have adequate evidence to confirm their outcomes and conclusions? Yes/no/partial
v. Does the experiment require comparing other techniques? yes/no




3.2.3 Data extraction and synthesis

A data extraction procedure was introduced to answer the research questions in order to gather the appropriate data from the chosen documents.

RQ1: To response this research question significance of mobile os is identified.

RQ2: Is there diverse features in mobile operating system to make it standout?

RQ3. To answer this question, mobile operating system use need to be identify?

To synthesize the collected data and to address the study questions, various techniques were active. A narrative synthesis approach was used entirely to address research questions. In addition, based on research concerns, visualization techniques were applied

Features of mobile devices:

Currently, the usage rate of mobile phones is high, and the same expectations are also high. Many daily activities have been replaced by personal computers and mobile devices, so the corresponding user expectations have also increased. The following are features that are highly used by mobile devices.

- Search Information
- Visit social networks
- Access to local information and services
- Search for videos
- visit website
- Entertainment
- Shopping
- Wifi, Bluetooth and GPS connection
- Travel information.

ANDROID

Android is mainly designed for touch screen mobile devices, such as smartphones and tablets. Computer with dedicated user interface for Android TV, Android Auto and Android Wear. The touch input used by the operating system corresponds to real-world actions, such as sliding, tapping, pinching, and reverse pinching to manipulate objects on the screen and virtual keyboard [19]

Features

Android 4.4 kitkat has many updated features, such as full-screen album art, improved multitasking, calling, messaging, productivity, performance, email, immersive mode wireless printing, and priority contact, improved caller ID, integrated SMS, MMS and Emoji keyboard on Google.

- Full screen album cover
- call
- Messaging
- Productive forces
- Improved multitasking performance
- Wireless printing
- Email
- Emoji on the Google keyboard [28]

**Android Applications**

Although Android technology is more and more widely used on various devices, the most common hardware that uses this platform is a mobile phone. A large number of developers regularly write applications for Android smartphones, including games, social networks and business modules. There are a variety of free Android apps, including games and productivity titles, and paid apps are more common. Thousands of developers have used Android technology because it can be downloaded for free, which provides software developers with the opportunity to sell their works to consumers [1]. The android application is at the top of the Android software stack. These include native applications and third-party applications. Native apps provide basic Android implementations, such as SMS client apps, dialers, web browsers and contact managers. Developers and programmers will further install third-party applications during debugging/testing and after users purchase equipment [26].

Reliability and security:

Android is a well-known operating system, developed by the Open Mobile Alliance led by Google, and a competitive mobile operating system. It is a well-known fact that Android is an open-source OS. Both parties talked about the details of Android's security features.

Security features include:

- request for access
- Component protection
- Signed application
- Memory Management Unit
- Type safety

Finally, Android OS inherits the security of Linux. Inheriting two basic mechanisms, you can port the operating system interface (POSIX), which creates a sandbox to protect different applications from conflicts and interleaving.

IOS APPLICATIONS

App Store is a digital distribution platform for mobile applications developed and maintained by Apple for iOS OS. With the App Store, users can browse and download applications developed using the Apple iOS OS SDK. The application can be downloaded directly to a device or personal computer with an iOS operating system. The App Store contains many high-quality apps, which are usually worth the money. As of February 1, 2015, the App Store has more than 1.4 million applications and more than 75 billion downloads. In view of its features, the iOS operating system is one of the success factors of

the iPhone in the global market. The competitor of iOS is the Android operating system provided by Google [30]. Each iOS application is actually composed of one/multiple threads. Each application starts with only one thread, and this thread has the obligation to run the main functions of the application, but the application may have an additional thread to perform very specific functions [32].

FEATURES Windows OS**:**

The Windows 9 operating system will be a meaningful notification that can be started multiple times, etc. Microsoft will focus on the needs of Windows users, Windows Phone, and Xbox.

- Restored start menu
- Extended battery life
- Improved synchronization between Windows
- Metro application in window mode [28]

Features of Windows Mobile:

- It includes functions such as the current date, time and email to be displayed on the screen.
- It includes ICS (Internet Connection Sharing) function, which allows connected computers to share Internet connections via USB and Bluetooth.
- With multi-tasking capabilities.
- It also includes the function of the file system.
- It includes the function of MIDI (software for ringtones) [24].

Security**:** Windows operating system mainly pays attention to devise encryption, data encryption, data leakage prevention, and digital signatures.

Device encryption**:** Complete internal storage encryption to protect information. It is built on the Windows BitLocker architecture.

Data encryption**:** It helps provide privacy and authentication between two communicating parties that have exchanged shared secrets.

Data Leak Prevention (DLP): Information Rights Management (IRM) helps prevent intellectual property leakage. It helps protect emails and documents on the phone from unauthorized distribution. [35]

ISSUES:

There are some prerequisites for clients that require Windows and cannot make up for wasting time. The following issues are documented below:

- The chicken and egg problem, where limited key applications attract fewer users, and developers are hardly interested in development with limited or no users.
- The number of potential customers is limited. It used to be Nokia, but now it is HTC and Microsoft, but it is necessary to provide obvious potential customers.
- Although Windows is still struggling to stand out in the market, Android and IOS have established their own characteristics in the market.
- Although Windows Phone has performed well in the low-end market, it has gradually proven that it is a low-end stage, which will further limit the requirements of its designers.

SECURITY MEASURES NEED TO BE ACCOUNTED IN OS:

Major mobile security measures need to be taken in mobile operating systems.

- Authorization
- Equipment management
- Identity and access management.
- Data management
- recording
- Personnel and facility management
- Network access control
- Software verification
- Patch management

When choosing operating system-based mobile, consumers can verify that the required security features are available on their devices. Device management includes operating system configuration, software patches, data management, etc. User-based access activities must be enabled [35].

**Android vs iOS:**

Compared with iOS, Google has adopted a different strategy. InGoogle Market, the supervision of content and applications is not strict, and sometimes it may lead to failure. It also creates a positive competitive environment and provides opportunities to get more applications and choose among them. However, Google also providesa 30% application commission for third-party providers [7]. For every consumer, Android is universal, cheap and reasonably priced. Due to different manufacturers, the Android smartphone product line has become quite extensive. The spread of innovation on Android is different from that of the iPhone. Smartphone price categories, technical parameters, and manufacturers are also different. The usual cheap basic models are customized for low- and middle-income consumers. [7].

Overall comparison general:

From comparative analysis and market share analysis during the fourth quarter of 2014, we have found that Android and Windows Phones are superior to others OS. Android gets 80.7% and is the best “Smartphone OS in the world today. We can also use it as an Educational tool. Due to android as an open-source operating system, the user can easily install third-party applications from markets and even from unreliable sources. Due to this, it has some limitations which lead to malware attacks like viruses, worms, spyware, adware, and Trojan horse [26].

**Results** :

The findings discuss three basic types of operating systems that are widely used: Android, iOS, and Windows. With the support of the world's largest App store, iOS offers a wide range of functionalities needed in everyday life, making it a simple choice for customers. Android, on the other hand, has a faster-growing App Store and already has the largest App Stores to provide a plethora of routine apps. When it comes to user convenience, iOS has a very user-friendly interface, making it a popular choice among users. Android, on the other hand, isn't far behind. As a customer, price is the most important consideration for everyone. In terms of costs, Apple is much more costly than Android and Windows. Android, on the other hand, has a range of models that are supported for both low-cost and high-end smartphones. Making it more approachable to people from all walks of life. But now things are changing. Android is quickly gaining popularity as the smartphone user's pulse.

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