Micro-Project Report
"Depicting Features of Mobile Operating System"

1.0 Rationale

Our project is Depicting Features of Mobile Operating System. In recent times the smartphones and the tablets have taken the world by storm. These mobile devices are having a significant impact on our lives and are in fact redefining the way we access information and communicate with others.

This is due to not only the hardware but the specialized software that these devices run and most importantly, their operating system (OS) known as Mobile Operating System. Just like a PC can run on different OS's or different versions of the same OS, most of the smartphones also runs on various Mobile Operating Systems which is the backbone of the whole functioning of the mobile device. In this paper, we focus on the characteristics of mobile OS, evolution of mobile OS, various categories of it, market share they possess in the globe, a comparative study on various mobile OS's features. The final section of this paper addresses the issues and challenges associated with these mobile OS.

Mobile operating systems (OSs) are installed on mobile devices such as smartphones, tablets, and portable media players. Mobile OSs differ from ordinary computer OSs in that they must manage cellular connections and are configured to support touch screens and simplified input methods. Mobile OSs tend to have sophisticated power management features as well, since they are usually not connected to a power source during use.

2.0 Course Outcomes Integrated

a) Understand Android OS, gradle, Android Studio.
b) Debug Android Application
c) Develop UI based Mobile Application using Android Studio.
d) Design application for Mobile using various sensors.
e) Design and develop an application using Database.
f) Adapt to learn new mobile technologies.

3.0 Literature Review

1. Pre-1993 :-

1973–1993 – Mobile phones use embedded systems to control operation

1.1 **1993–1999:-**

1993:- April – Pen Point OS, August – Apple 1994, March – Magic Cap OS, August – The first smartphone.

1996 :- March – The Palm Pilot 1000 personal digital assistant, August – Nokia releases the Nokia 9000 Communicator.

1997 – EPOC32 first appears on the Psion Series 5 PDA.

1998 – Symbian Ltd 1999, June – Qualcomm's pdQ becomes the first smartphone with Palm OS.

2 **2000s**

2000 :- The Ericsson R380 is released with EPOC32 Release 5, marking the first use on a phone of what's to become known as Symbian OS.

2001 :- June – Nokia's Symbian Series 80 platform is first released on the Nokia 9210 Communicator, September – Qualcomm's Binary Runtime Environment for Wireless (BREW) platform on their REX real-time operating system (RTOS) is first released on the Kyocera QCP-3035

2002 :- March- BlackBerry, June- Microsoft's first Windows CE , Nokia's Symbian Series 60 (S60) platform October – The Danger Hiptop

2003 :- Motorola 2005, May – Microsoft announces Windows Mobile 5.0., November – Nokia

2007 :- January – Apple's iPhone with iOS, February – Microsoft May – Palm November – Open Handset Alliance

2008 :- February – LiMo Foundation, June – Nokia October – OHA releases Android July – Apple releases iPhone OS 2 October – OHA releases Android November – Symbian^1

2009 :- January Intel announces Moblin 2, Palm introduces webOS , February Palm, Microsoft announces Windows, May – DangerOS 5.0, June – Apple releases iPhone OS 3 with the iPhone 3GS, November – Nokia releases the Nokia N900

3 **2010s**

2010 :- February- MeeGo Samsung introduces the Bada OS, April- Apple releases the iPad (first generation) with iPhone OS 3.2 HP acquires Palm in order to use webOS

,May – Microsoft Kin ,June – Apple releases iOS 4 ,July – Microsoft Kin, September Apple releases a variant of iOS Symbian^3 is first released on the Nokia N8. The Danger Hiptop line and DangerOS, November - Nokia assumes full control over Symbian Windows Phone OS is released

4 **2011**

February - Android 3.0 (Honeycomb) Nokia abandons the Symbian OS Nokia abandons the Symbian OS, April – BlackBerry Tablet OS ,July- Mozilla webOS 3.0, August – HP announces that webOS, September- MeeGo After Nokia's abandonment of MeeGo, October- Apple releases iOS 5 with the iPhone 4SNokia releases the Nokia 808, August – Samsung September – Apple releases iOS 6 2013 :- January – BlackBerry

5 **2014** :- February - Microsoft releases Windows Phone 8.1

6 **2016**: - February – Microsoft

7 **2017**: - April – Samsung officially launches Android-based Samsung Experience

8 **2018**: - February-Samsung releases Samsung Experience 9.0

9 **2019** :- January Microsoft announces that support for Windows 10 Mobile, June- Apple announces iOS 13, watch OS, September-Apple releases iOS 13

10 **2022 :-** In september 7 Apple announced iphone 14 and 14 pro max with ios operating system

4.0 Actual Procedure Followed.

4.1 Mobile Operating System

4.1.1What is Mobile Operating System?

A mobile operating system, also called a mobile OS, is an operating system that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices. The mobile operating system is the software platform on top of which other programs, called application programs, can run on mobile devices.

A mobile operating system (OS) is software that allows smartphones, tablet PCs (personal computers) and other devices to run applications and programs.

A mobile OS typically starts up when a device powers on, presenting a screen with icons or tiles that present information and provide application access. Mobile operating systems also manage cellular and wireless network connectivity, as well as phone access.

Fig 3.1 Mobile Operating System.

4.1.2 Issues and Challenges of Mobile Operating System

Issues and Challenges Multiple Mobile OS's poses various challenges. In this section we elaborate the common fundamental issues and challenges of the Mobile OS:

1. Mobile OS design suffers from usability and interoperability problems.

2. Hardware and software configuration management.

3. Content delivery for various smartphones operated by various service providers is difficult Introduces the possibility of the configuration errors, bugs (in both the OS itself and in the applications, it runs), viruses and other malware.

4. Adaptability of applications on various Mobile OS's. Designing of an app for more than one mobile OS requires more than one design and every mock-up has to be intuitive for the specific groups of users (specific to OS).

5. Personalization is considered to be biggest challenge as it is the key enabler for the success of the OS.

6. System integrity

7. Power management

8. Continuous Connectivity

9. User Interface designs for various mobile apps.

10. Approach for positioning of apps for Navigation by various Mobile OS is difference

4.1.3 Features of Mobile Operating System

1. **Near Field Communication (NFC)**: - Most Android devices support NFC, which allows electronic devices to easily interact across short distances.
2. **Alternate Keyboards**: - Android supports multiple keyboards and makes them easy to install; the SwiftKey, Skype, and 8pen apps all offer ways to quickly change up your keyboard style.
3. **No-Touch Control:** - Using Android apps such as Wave Control, users can control their phones touch-free, using only gestures.
4. **Automation**: - The Tasker app lets you not only control app permissions but also automate them.
5. **Wireless App Downloads**: - Accessing app stores on any mobile device can be frustrating, but iOS makes it a little more difficult—download an app on your computer, and it won't sync to your mobile device until you plug in and access iTunes.
6. Easy to use: - The graphics should be attractive. The buttons and features should be easy to use. moreover, the functionalities should not be very complicated. Features should be powerful and useful.
7. Good app store**: -** An app is one of the basic parts of an Osgood and useful apps forms an important part of an OS. The apps should be simple and interactive.
8. Good battery life**: -**Power is one of the main requirements of a smartphone. They require power for processors sensors etc. Therefore, the battery holds a very important role. Smartphones power usage keeps on increasing therefore, a good battery backup is very essential.

9. Data usage and organization**: -**An operating system should focus on controlling the data and network usage. It should keep the limit and requirement in focus. Secondly, the organization of data related to to-do lists, calendars, alarms, reminders etc is very important. A good OS should keep this data in a very organized and safe manner. Moreover, the data should be readily and easily available.

4.1.4 Components of a Mobile Operating System

1. Kernel

A kernel is the core/heart of an OS. It contains all the functions and operations to manage the working of OS.

2. Process Execution

The OS executes various process so that the statements will execute and connect the application program to the hardware. Whenever a process executes it uses memory, space and other resources as well.

3. Interrupt

Interrupts are basically used be the hardware devices to communicate with the CPU. It is basically a signal which the device generates to request the CPU. Moreover, whenever an interrupt occurs the CPU temporarily stops executing its current process.

4. Memory Management

It is the management of the main or primary memory. Furthermore, whatever program is executed, it has to be present in the main memory. Therefore, there can be more than one program present at a time. Hence, it is required to manage the memory.

The operating system:

4.1 Allocates and deallocates the memory.

4.2 Keeps a record of which part of primary memory is used by whom and how much.

4.3 Distributes the memory while multiprocessing.

5. Multitasking

It is performing more than one tasks at a time. The OS allows the user to work wit more than one process at a time without any problem.

6. Security

The OS keeps the system and programs safe and secure through authentication. A user id and password decide the authenticity of the user.

7. User Interface

GUI stands for Graphical User Interface. As the name suggests, it provides a graphical interface for the user to interact with the computer. It uses icons, menus, etc. to interact with the user. Moreover, the user can easily interact by just clicking these items. Therefore, it is very user friendly and there is no need to remember any commands.

4.2 Types of Mobile Operating System

Nowadays there are some different types of mobile phone operating systems used in the smartphone.

4.2.1 Android:

Android is the most advanced and feature rich operating system at present. It offers every kind of feature any user would demand. Moreover, the features which Google gives are just awesome. You will not believe the out of every four smartphones, three will be powered by Android mobile operating system. And due to the strong sales, Android operating system account for 75 percent which is greater than 57.5 percent in the third quarter of last year.

- **Features: -**

1) Near Field Communication (NFC)

Most Android devices support NFC, which allows electronic devices to easily interact across short distances. The main aim here is to create a payment option that is simpler than carrying credit cards or cash, and while the market hasn't exploded as many experts had predicted, there may be an alternative in the works, in the form of Bluetooth Low Energy (BLE).

2) Alternate Keyboard

Android supports multiple keyboards and makes them easy to install; the SwiftKey, Skype, and 8pen apps all offer ways to quickly change up your keyboard style. Other mobile operating systems either don't permit extra keyboards at all, or the process to install and use them are tedious and time-consuming.

3) Infrared Transmission

The Android operating system supports a built-in infrared transmitter, allowing you to use your phone or tablet as a remote control.

4) No-Touch Control

Using Android apps such as Wave Control, users can control their phones touch-free, using only gestures. Have messy hands but need to turn off your screen or change a song? Simple. This could prove especially useful if you're driving, so you can keep both eyes on the road.

5) Automation

The Tasker app lets you not only control app permissions but also automate them. Do you only want your location services to be active during the day? Want to create a customized way to start your music—for example, with a voice command and at a certain volume? Tasker can help.

6) Wireless App Downloads

Accessing app stores on any mobile device can be frustrating, but iOS makes it a little more difficult—download an app on your computer, and it won't sync to your mobile device until you plug in and access iTunes. Using the Android Market or third-party options like AppBrain, meanwhile, let you download apps on your PC and then automatically sync them your Droid, no plugging required.

7) Storage and Battery Swap

Android phones also have unique hardware capabilities. Google's OS makes it possible to remove and upgrade your battery or to replace one that no longer holds a charge. In addition, Android phones come with SD card slots for expandable storage.

8) Custom Home Screens

While it's possible to hack certain phones to customize the home screen, Android comes with this capability from the get-go. Download a third-party launcher like Nova, Apex or Slide and you can add gestures, new shortcuts, or even performance enhancements for older-model devices.

9) Widgets

Apps are versatile, but sometimes you want information at a glance instead of having to open an app and wait for it to load. Android widgets let you display just about any feature you choose, right on the home screen—including weather apps, music widgets, or productivity tools that helpfully remind you of upcoming meetings or approaching deadlines.

10) Custom ROMs

This is a big one. Because the Android operating system is open source, developers can tweak the current OS and build their own versions, which users can download and install in place of the stock OS. Some are filled with features, while others change the look and feel of a device. Chances are if there's a feature you want, someone has already built a custom ROM for it.

- **Advantages and disadvantages**

Advantages: -

1. Millions of apps**: -**Users have a vast choice to choose which apps they need. Apps are categorized into topics and every topic has large number of apps to download.
2. Third-party apps also supported**: -**You can also install third-party apps. These apps can be downloaded from different websites.
3. Notifications are nicely displayed**: -**All the notifications of apps, messages, emails, low battery are displayed nicely. Users can access the notification by just sliding from top to bottom. You can also see the notifications in lock mode.
4. Sharing of internet among devices**: -**With a mobile hotspot, you can share your device internet with other devices or with PC. This can help saving money also.

Disadvantages: -

1. Apps run in the background**: -**In the older version of Android, most apps always run in the background and come to foreground as they wish. But in new version of android apps cannot automatically come to foreground. As some apps run in the background then it consumes mobile battery and your device battery vanishes quickly.

2. Developers have a tough time**: -**Learning and developing android apps is hard because there are a variety of screen sizes and to make app adaptive to all screen sizes is challenging for the developers. Developers have to write more code and is difficult to troubleshoot the app for final delivery. It is also difficult to make complex apps and doing advanced animation is hard.

3. Low specification mobiles run slow**: -**As android is a very large operating system that consumes lot of storage and some default apps also comes with operating system so low specification devices run slow. If you install many apps in these devices then your mobile will become unresponsive or heat up quickly.

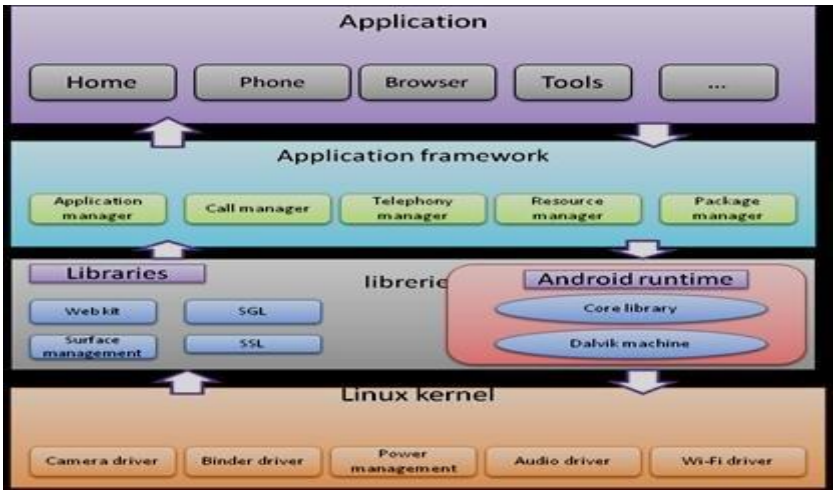


Fig 4.2.1 architecture of Android Mobile Operating System.

4.3 APPLE OS:

Apple, the company which created a revolution in the smartphone industry is now at the second spot. Apple always preferred the quality and that's why APPLE **OS** was always preferred by people. Moreover, **Apple's share** was increased from 13.8 percent to **14.9 percent** in the third quarter as compared to that in last year.

4.3.1 Features: -

1. Full Screen Apps: - The Apple user can run multiple full screen apps and switch between them.
2. Mission control: - It merge the expose and space functions. Expose means managing the open window and space means groups the application windows together.
3. Multi touch gestures: - It allow Switch between multiple full screen apps.
4. Auto Save: -This can save our work automatically.
5. New mail app: -This includes search tokens and conversation views.
6. Resume: -It give information about what we were doing and where we are, at the time of launch an app in Lion.

4.3.2 Advantages and Disadvantages: -

Advantages: -

1. Very stable**:** my personal Mac laptop has been running for 15 days (from when the last MacOS patch came out) and I use it for everything. It has 3 displays, and many apps running, including Windows running in a VM and gets moved around wherever I go (it's a MacBook Pro).
2. Very easy to use: users are not required to read a manual before using MacOS - in fact, when you buy a new Mac it comes with a single sheet that just tells you how to plug it in to the electricity. I have never met a non-technical person who is unable to use a Mac and I have never met a non-technical person who prefers Windows.
3. From a user perspective MacOS is more secure than Windows**:** MacOS does not prompt you unnecessarily for acceptance of actions - if it asks it really means it and if MacOS asks for your Administrator authorisation and you were not expecting it then just don't enter it. Also, most of the common Microsoft attacks don't effect MacOS, even the ones that target Microsoft Office where you have it installed.

Disadvantages: -

1. It is not exactly the same as Windows, which means that if you ring up someone for technical support (such as your telephone provider) they may insist on telling you to do things like, "click on the START button", or "disable your antivirus software" even if you tell them you don't have a PC.

2. Luckily you can just ignore everything they say and just say, "yes, done that" because none of what they are checking for can possibly be effecting you anyway. If always makes me laugh when the person on the phone tells me to reboot my computer (to make the internet work again) and I tell them, "yes, done it" and they are surprised at how quick it was (not even a Mac can boot in 1 second).

3. Some companies/organisations still assume every user will have a PC and they write their web-sites with the expectation that the users will only be using Internet Explorer and Flash.

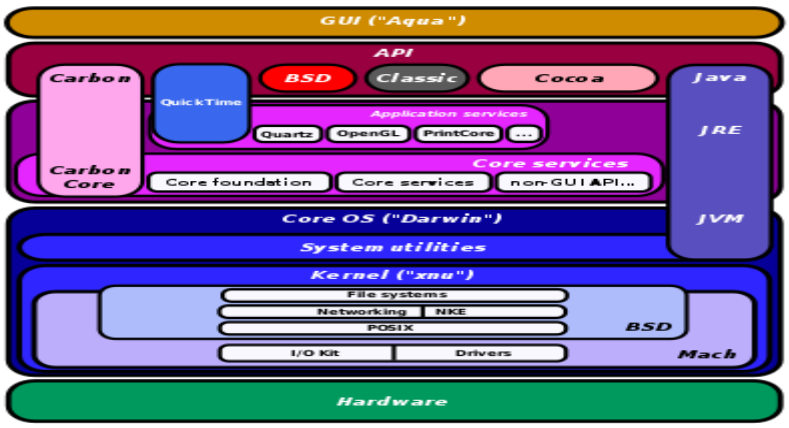


Fig 4.2 Architecture of Apple OS Mobile Operating System.

4.4 Blackberry

Blackberry is definitely liked by Youth. And therefore it maintain its position in the top 3. Last year, Research in Motion's Blackberry operating system accounted for about 9.5 percent share in the third quarter but is now 7.7 percent in the third quarter of this year. BlackBerry 10 is a proprietary mobile operating system for the BlackBerry line of smartphones, both developed by BlackBerry Limited (formerly Research In Motion). BlackBerry 10 is based on QNX, a Unix-like operating system that was originally developed by QNX Software Systems until the company was acquired by BlackBerry in April 2010.

4.4.1 Features

1. Controls: - The touchscreen is the predominant input method of BlackBerry 10, in addition to hardware keyboard for devices that have one.
2. Multitasking: - When a user returns to the home screen from within an application, the application is minimized into a so-called "Active Frame".
3. BlackBerry Hub: - BlackBerry 10 collates emails, SMS/MMS, calls and notifications into the BlackBerry Hub.
4. Miscellaneous: - A virtual keyboard with support for predictive typing and several gestures.

4.4.2 Advantages And Disadvantages

Advantages

1. Excellent Connectivity (Messengers viz BBM, yahoo, talk, WhatsApp work seamlessly)
2. Amazing email client (can also sync with your enterprise server)
3. Most user-friendly qwerty keyboard (easy typing)
4. Very fast and snappy

Disadvantages

1. Battery life not great in some models
2. Camera quality not great
3. Application support is bad
4. Almost all models have similar utility and features.

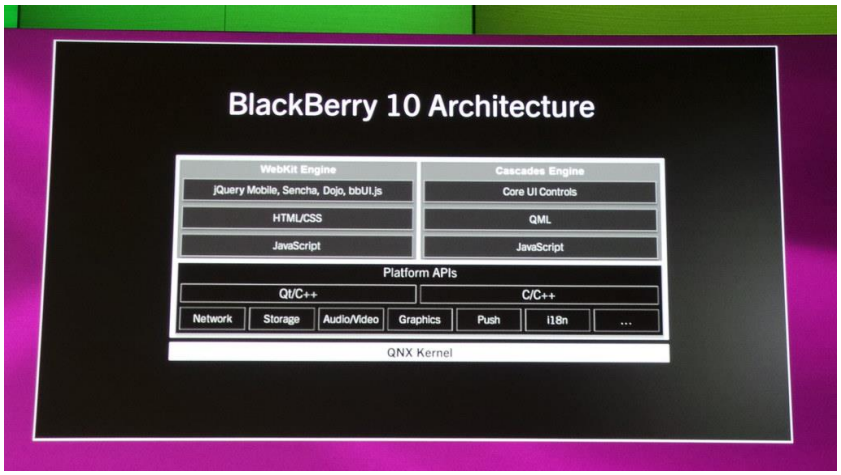


Fig 4.8 Architecture of BlackBerry 10 Operating System

4.5 Windows

Windows Mobile is a discontinued family of mobile operating systems developed by Microsoft for smartphones and Pocket PCs.

4.5.1 Features :-

1. Greater Start Screen personalisation Microsoft in an attempt to offer more customisable options to Windows Phone users, has added 'Start background' feature that allows users to add an image to the tiles on the Start screen of the device.
2. Action Centre for notifications Microsoft has finally launched one of the most awaited features on Windows Phone platform, the Action Centre. The Windows Phone 8.1 update brings the Action Centre to all Windows Phone-based devices which will show notifications for calls, messages, emails, apps and others.
3. Word Flow Keyboard Another big addition in the Windows Phone 8.1 has been the introduction of the Word Flow Keyboard, which is a Swype keyboard-like feature for

Windows Phone users. The Word Flow Keyboard allows users to glide over the display and type words.

4. Skype Integration Microsoft has also upgraded the Skype integration in Windows Phone devices with its latest Windows Phone 8.1. Now, the new Skype app for Windows Phone 8.1 comes with dialler integration that allows a user to switch a regular call to a Skype video call with a click of a button.

4.5.2 Advantages and Disadvantages :-

Advantages

1. Support for all hardware As windows OS is used by 95% of users so most of the hardware vendors make drivers for windows.

2. Ease of use All versions of Microsoft Windows have something common in it which makes users easy to shift from one version to another.

3. Software support Windows platform is best suited for game and software developers.

4. Plug and play feature Most hardware can be detected automatically by plug and play feature.

5. Desktop and touch screen Windows 10 is made for both touch screen devices and desktop computers.

Disadvantages

1. **Virus attacks** Windows have a high amount of hacker attacks. The hackers can easily break windows security.
2. **Most of the software is paid** Most windows programs are paid e.g. games, graphics software (Photoshop), download manager (IDM) and other popular software are paid.
3. **Rebooting a system** If your system becomes slow in performance then you have to reboot it.
4. **High price** Linux OS is open source and is free to use for everyone but windows OS has paid

license and you cannot use windows OS legally free.

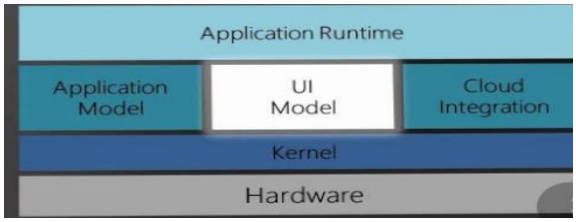


Fig 4.5 Architecture of Windows Mobile Operating System

4.6 Symbian:

Nokia's favourite operating system Symbian took the fourth spot. It is now obsolete and does not interest anyone. But for small budget phones it is definitely a good deal

4.6.1 Features

1. Real-time**:** It has a real-time, multithreaded kernel.
2. Multimedia support**:** It supports audio, video recording, playback and streaming, and image conversion.
3. Platform Security**:** Symbian provides a security mechanism against malware. It allows sensitive operations and can be accessed by applications which have been certified by a signing authority. In addition, it supports full encryption and certificate management.
4. Internationalization support: It supports Unicode standard.
5. Client-server architecture: It provides simple and high-efficient inter-process communication.
6. A Hardware Abstraction Layer (HAL): This layer provides a consistent interface to hardware and supports device in dependency.

4.6.2 Advantages And Disadvantages

Advantages

1. Symbian OS provides open platform to enable independent technology and software vendors to develop third party app.
2. Symbian allowed impressive battery life.
3. Symbian required lower hardware requirements.

Disadvantages

1. Symbian OS is dependent on Nokia
2. Major drawback of Symbian os is it provided a late response as compared to ios and Android.
3. The touch of Symbian use devices are not as smooth as compared to ios and android devices.

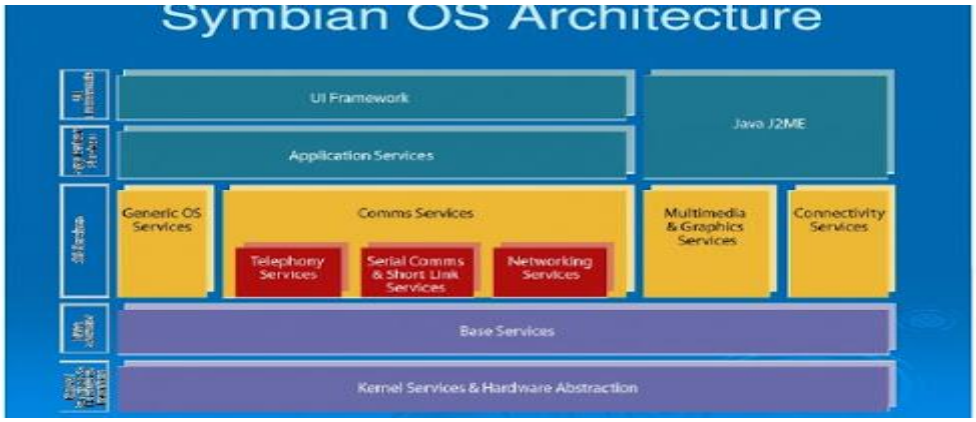


Fig 4.6 architecture of Symbian Operating System

4.7 Mobile Application Development

Mobile app development is the act or process by which a mobile app is developed for mobile devices, such as personal digital assistants, enterprise digital assistants or mobile phones. These applications can be pre-installed on phones during manufacturing platforms, or delivered as web applications using server-side or client-side processing (e.g., JavaScript) to provide an "application-like" experience within a Web browser. Application software developers also must consider a long array of screen sizes, hardware specifications, and configurations because of intense competition in mobile software and changes within each of the platforms. Mobile app development has been steadily growing, in revenues and jobs created. A 2013 analyst report estimates there are 529,000 direct app economy jobs within the EU then 28 members (including the UK), 60 percent of which are mobile app developers.

As part of the development process, mobile user interface (UI) design is also essential in the creation of mobile apps. Mobile UI considers constraints, contexts, screen, input, and mobility as outlines for design. The user is often the focus of interaction with their device, and the interface entails components of both hardware and software. User input allows for the users

Fig 4.7 Mobile Application Development

to manipulate a system, and device's output allows the system to indicate the effects of the users' manipulation. Mobile UI design constraints include limited attention and form factors, such as a mobile device's screen size for a user's hand(s). Mobile UI contexts signal cues from user activity, such as location and scheduling that can be shown from user interactions within a mobile app. Overall, mobile UI design's goal is mainly for an understandable, user-friendly interface. The UI of mobile apps should: consider users' limited attention, minimize keystrokes, and be task-oriented with a minimum set of functions.

5.0 Actual Resources Used

S. No.	Name of Resource/material	Specifications	Qty	Remarks
1	Computer system	Lenovo Intel core i3 10th gen	1	
2	Books	Operating system by Dr.Rajendra Kawale	1	
3	chrome	https://www.techtarget.com	1	

6.0 Outputs of the Micro-Projects

Comparison of mobile operating system

Feature	iOS	Android	Windows phone	Blackberry OS	Firefox OS	Mer	Tizen	Sailfish OS	Ubuntu Touch
Company	Apple,inc	Open handset alliance/Google	Microsoft	Blackberry ltd.	Open web device compliance review	Linux foundation	Linux foundation, Tizen association, Samsung, Intel	Sailfish Alliance,jolla	Canonical ltd. And ubuntu community
Current Version	7.1.2	4.4.4	8.1	10.2.1.3247	1.2	1.2.0.10	2.2	1.0.7.16	1
Current Version release dates	April 22,2014	Dec 9,2013	Apr 14,2014	jun 25,2014	Dec 9,2013	July 12,2012	Nov 9,2013	Jun 9,2014	Mar 13,2014
License	Proprietary EULA except for open source components	Free and open source. Often bundled with proprietary apps	Proprietary	Proprietary	Free and open source mainly the MPL; Apache	Free and open source	Free and open source except proprietary components	Free and open source except proprietary components	Free and open source mainly the GPL, except proprietary components
OS family	Darwin	Linux	windows CE 7/windows NT 8	QNX	Linux	Linux	Linux	Linux	Linux
Supported CPU architecture	ARM	ARM, MIPS, x86	ARM	ARM	ARM, x86, x86_64	ARM, x86, MIPS, x86_64	ARM	ARM,x86,x64	ARM,x86
Programmed in	C,C++,Objective C,swift	C,C++,Java	7+:XNA(.NET C#), Silverlight,native C/C++ 8+:XNA (.NET C#), VB.NET,Silverlight, native C/C++, WinRTP(XMLA), DirectX	C/C++;Native SDK,C++/Qt: Cascades SDK, HTML5/Javascript/CSS:Webworks SDK, ActionScript: Adobe AIR, Java:Android runtime	HTML5, CSS, JavaScript, C++	C++	C++	C++,QML,	Web apps: HTML5(+Unity Web API) Native:C,C++,QML
Package manager	iTunes	APK	Zune software	Blackberry Link	Firefox Packaged Apps	rpm+yun+zypper	RPM package manager	RPM package manager	Click packages and dpkg

OS family	**iOS**	**android**	**Windows**
	Darwin	Linux	Window CE7,Window NT8
Architecture	**iOS**	**android**	**Windows**
	This operating system includes a kernel that interacts with drivers, the kernel, and the UI.	Components (App Layer, libraries, runtime and Linux Kernel)	is composed of many layers. I used layers to visualize it. This layer is used to model and manage cloud-based applications. The storage, network, and security layers are all used.
Vendor	**iOS**	**android**	**Windows**
	Apple	OpenHandset Google, Alliance	Microsof
User Interface	**iOS**	**android**	**Windows**
	The program must be loaded and viewed	UI is highly configurable	GUI(graphical user interface) .
Developed in (Programming language)	**iOS**	**android**	**Windows**
	C, C++, Objective –C, Swift	C, C++, Java	C#, VB.NET, F#, C++, JScrip
App Store	**iOS**	**android**	**Windows**
	App Store	Google Play	Windows Phone Store
License	**iOS**	**android**	**Windows**
	Proprietary	Open source	Proprietary
Security	**iOS**	**android**	**Windows**
	Hard to crack	Softest to crack	Windows OS does data encryption
Voice Assistant	**iOS**	**android**	**Windows**
	Siri	Google now	
Side loading	**iOS**	**android**	**Windows**
	Done by installing Xcode7	Available	
Environment (IDE)	**iOS**	**android**	**Windows**
	XCode(Apple), Appcode	Eclipse(Google)	Visual studio
Source Model	**iOS**	**android**	**Windows**
	Closed	Open	Closed
Memory Utilization	iOS	android	Windows
	Automatic counting, no garbage collection	The Memory Management Unit and the SOC (System on Chip)	A flash memory used to store a Virtual Memory is known as ROM/RAM. Memory alone can execute programs.

The mobile work is still evolving and keeps growing in future.Even though there are so many operating system in the market android is the leading player in the market followd by ios operating system as shown in the graph below .android os has also large number of apps compare to ios operating system

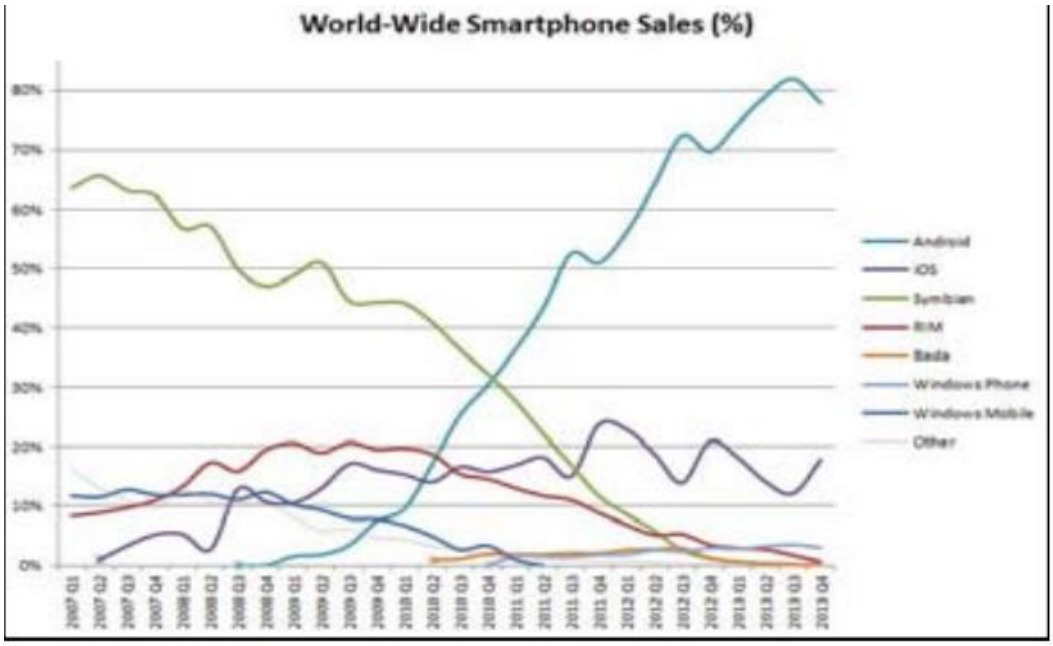
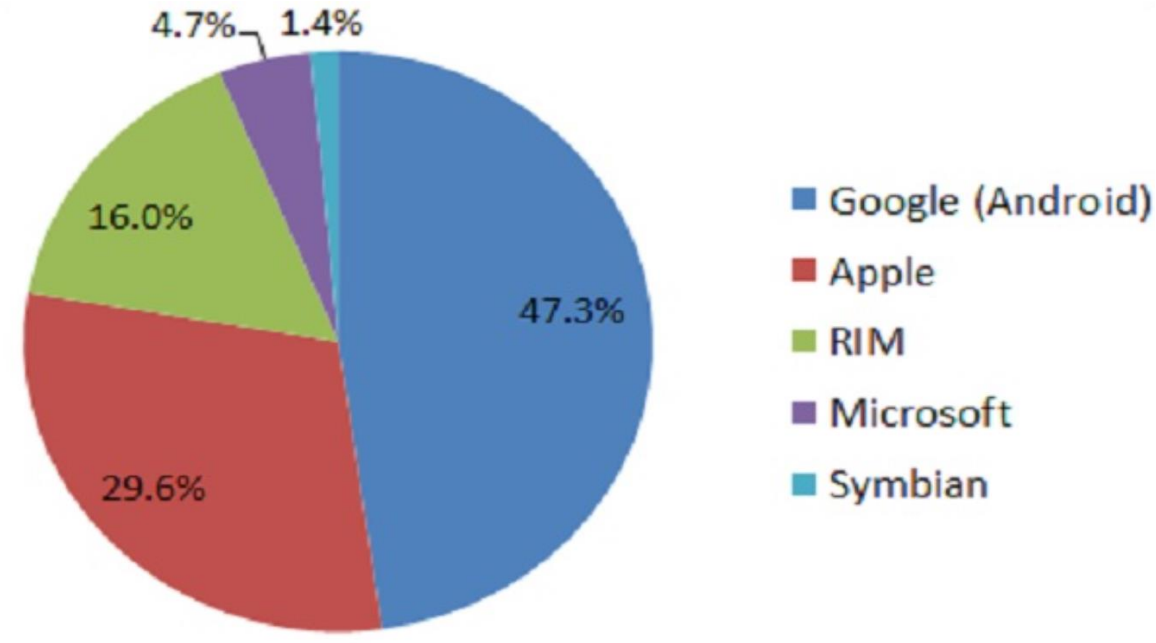


Fig. 5: World Wide Smartphone Sales (%)



7.0 Skill Developed / learning out of this Micro-Project

1.we have learn about functioning of mobile operating system.
2.we have learn different types of mobile operating system .
3. we have learn about features and architectures of different types of mobile operating system
4. we have learn about the market of mobile of operating system

8.0 Applications of this Micro-Project

A mobile operating system (OS) is software that allows smartphones, tablet PCs (personal computers) and other devices to run applications and programs. A mobile OS typically starts up when a device powers on, presenting a screen with icons or tiles that present information and provide application access.

A mobile operating system (OS) is the software that allows mobile devices like phones, tablets and other smart devices like wearable technology to run applications and other programs. Most mobile operating systems only work on specific hardware. For example, an iPhone runs on iOS and a Google Pixel runs on Android.

9.0 Area of Future Improvement

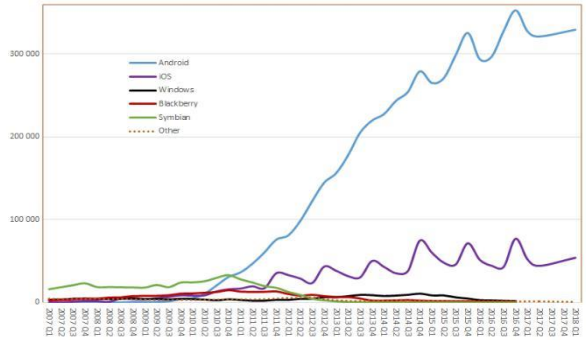
Market Share

In 2006, Android and iOS did not exist and only 64 million smartphones were sold. In 2018 Q1, 383.5 million smartphones were sold and global market share was 85.9% for Android and 14.1% for iOS.

The range of measured mobile web use varies a lot by country, and a Stat Counter press release recognizes "India amongst world leaders in use of mobile to surf the internet"(of the big countries) where the share is around (or over) 80% and desktop is at 19.56%, with Russia trailing with 17.8% mobile use (and desktop the rest). Smartphones (alone, without tablets), first gained majority in December 2016 (desktop-majority was lost the month before), and it wasn't a Christmas-time fluke, as while close to majority after smartphone majority happened again in March 2017.

In the week from November 7–13, 2016, smartphones alone (without tablets) overtook desktop, for the first time (for a short period; non-full-month). Mobile-majority applies to countries such as Paraguay in South America, Poland in Europe and Turkey; and most of Asia and Africa. Some of the world is still desktop-majority,

On October 22, 2016 (and subsequent weekends), mobile showed majority. October 27, the desktop hasn't shown majority, not even on weekdays. And smartphones alone have showed majority since December 23 to the end of the year, with the share topping at 58.22% on Christmas Day. To the mobile-majority share then of smartphones, tablets could be added giving a 63.22% majority. While an unusually high top, a similarly high also happened on Monday April 17, 2017 with then only smartphones share slightly lower and tablet share slightly higher, with them combined at 62.88%. Formerly, according to Stat Counter press release, the world has turned desktop-minority of October 2016, at about 49% desktop use for that month, but mobile wasn't ranked higher, tablet share added to it to exceed desktop share.



8.1 Market Share Of Mobile Operating System

10.0 References

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