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DEVELOPMENT OF iOS: A REVOLUTIONARY TRANSFORMATION AND THE FUTURE

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ABSTRACT

This letter is all about the analysis of first ever operating system that changed the entire era of mobile phones. The study also shows the continuous upgradation of iOS and its amazing contribution in different technologies. We researched how iOS is most secured and different from other operating system with an overview of journey of Apple Inc. The expansion of iOS with its wide scope and the properties which differentiate iOS have also been discussed in our study. Also, we have tried to explore how iOS is upgrading its versions at certain period of time and adding new technologies and features like face recognition, merging software with hardware including the concept of machine learning, how iOS is most secured mobile operating system and what makes it so, what makes iOS different from other mobile operating system like Android and others.

Key words: Apple iOS, Mobile Computing, Industry 4.0, Face Id, Bionic Neural, Future Technology

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1. INTRODUCTION

As the technology evolving, the requirement is also increasing with same proportion as new devices. iOS is the first to provide internet, messaging, phone calls, music and touch screen. It provides convenient interface and highest security to its user which attract peoples to buy the iPhones. iOS also supports developing technology or platform like IoT (Internet of Things), Industries 4.0 etc. which is playing a crucial role in present time. Before starting with Apple

iOS we first should have to know how the journey of this revolutionary operating system started. These all started in 1976 inside a small garage in Los Altos, California with the three highly committed people towards their goal and their names are “Steve Jobs”, “Steve Wozniak” and “Ronald Wayne” [1]. The journey from a garage to now revenue of US $260.174 billion and one of the most successful multinational technology company in the world whose logo is one byte eaten apple and the name of the company is ‘Apple’. This company stands alongside with the world’s other grand and the world biggest technologies Companies like Microsoft, Amazon, Google, and Samsung and also give tough competition to them. Apple’s first product was a computer named Apple 1 which was without case and keyboard and designed by the Wozniak that launched in the market at Homebrew Computer Club [2], and its successor was Apple II in 1977 which consist of case and keyboard along with floppy disk drive [3]. In 1980, IBM launched his first computer which gave tough competition to the Apple then Apple use GUI for their future products and then released two computer Apple free and Apple Lisa which was fail in the market and after 4 years Apple released his best computer which modify the vision of people saw computers forever on January 24th 1984, Steve Jobs introduced the Macintosh to in front of large audience which responded with great appreciation and applaud lasted for minute and after a few years its successor was Macintosh IC and Macintosh SE [4].

Figure 1 Apple Inc. LOGO

After so many failures & ups and downs, Apple launched his best portable laptop iBook in 1999 with a Wi-Fi-card which is finally separated into the MacBook and MacBook Air [5]. In March, 2001 Apple introduced Mac OS X but the main problem was that it was slow and lacked some important features with scarcely any software for it, the second release 10.1 and now the present software is Mac OS 10.15 which was much faster and had more support [6]. The second product which was introduced by Apple was iPod [7] which was fabulous due to its easy functionalities in comparison to other audio players at that time.

Figure 2 Apple 1 model

On January 9th of 2007, a single revolutionary product by combining three things a widescreen iPod with touch controls, a mobile phone and a breakthrough internet communications device and the name of device is 'iPhone' which was introduced by Steve Jobs and launched in June 29, 2007 [8] which created great revolution in the mobile world, the iPhone is the first mobile with multi-touch screen facility, ignores unintended touches and multi-finger gestures which is run on 'iPhone OS' a well sophisticated operating system which is written with the help of "C", "C++", " Objective-c", "Swift" and "Assembly language" that was 5 years ahead of any other devices at that time because it has awesome features like multitasking, networking, syncing, low power consumption, security, video, audio, core animation, cocoa, graphics, Desktop class application and networking and many more features which was not have any other devices at that time like Nokia, Blackberry, Motorola, Palm Treo and these all mobile have keypads but Steve jobs wanted to remove keypads in iPhone to provide better touch and large screen experience to the users, So 'iPhone OS 1' is the first operating system of iPhone whose successor is ' iOS' in 2010.

2. WORKING PRINCIPLE OF IOS

2.1. Journey from iPhone OS 1 to iOS

In iPhone OS, initially no third party application were allowed to run in the phone and there were only few applications inbuilt in phone without App store and a very essential application which is also not supported by iPhone OS that it did not have Adobe Flash Player that was a very famous web media used to create internet apps, websites, web browser video player but still at that time no other mobile have that much off applications and the users never experienced because Apple were developing the iPhone's hardware and software from scratch while its outcomes to be the great since the iPhone software would be superbly amended for its hardware and provides a user experience that no one had ever on a mobile device.

Figure 3 iPhone OS 1

On 10th July 2008 App store launched in iPhone which consist of five hundred application initially and after two years iPad has been released which has a big screen as compared to iPhone for the purpose of web browsing, media consumption, and reading after that in June 2010 Apple changes iPhone OS to 'iOS'. iPhone OS was not capable to handle much programs so Apple upgrade their 'iPhone OS' to' iOS' which program to handle huge amount of programs which suitable for iPad and new series of iPhone. The latest iOS version is iOS 13 whose main hardware platform is ARM architecture. Whenever there is any update in iOS

or addition of some new features then Apple provides software updates immediately in each and every device of Apple which run on iOS.

Figure 4 iPhone iOS

Here one of the best feature of iOS which makes it different from any other software is that it keeps its each and every applications in a different and in separate shell because of that one app a different and in separate shell because of that one application does not interfere to the other application, iOS is designed like that because if by chance virus comes along with an app it does not able to harm other applications which is a great idea developed by Apple and this feature is not available in any other operating system. In 1994, IBM launched first virtual assistant in their smart phone 'Simon' and after IBM, Apple released their virtual assistant initially on 12th October, 2011 in iPhone 4s whose name is 'Siri' written in Objective–C which is liked by users very well [9]. The virtual assistant of iPhone 'Siri' can be able to do lots of work by only recognizing of voice command by the user like it can launch apps, set alarms, make calls, can tell about weather, send messages, emails, Access function in Apps, it can play music whatever user want to listen, it can search anything on internet whatever user want to search, so these are the main feature of Apple Siri and it now run on various products of Apple like iPhone series, iPad family, Apple watch, Macintosh, Apple TV and in iPod touch. After Apple other companies like Google released its voice assistant in 2016 [10], 18th March powered by artificial assistant, Cortana created by Microsoft released on 2nd April 2014, Alexa developed by Amazon and released in November 2014. Bixby by Samsung announced in 2017, 20th March [11]. As there are various voice assistance comes into play after Siri but still it was found in a survey which is conducted by Microsoft that Apple Siri along with Google assistant used most by the US for finding and purchasing products which shows that how much it is still popular among the various voice assistant.

One of the drawback of Siri is that it only run on iOS operating which of Apple products but Google assistant run on various platform like Android, iOS and supports in different mobile companies which Siri not do so.

Figure 5 Features of Apple

2.2. Comparison of iOS with other Operating System

One of the features as discussed earlier that it keeps its applications in different or in a separate shell which further not disturb the other application. The other property of iOS which make it different is that it is a proprietary software it means that it does not provide its source code to the users or other developing teams for any kind of modification [12], it can be done by only Apple developers' team which make iOS very well and most secured operating system as compare to other operating system like Android, Tizen, Plasma mobile, Ubuntu touch and due to the reason that it is most secured OS of mobile that's why it is little expensive as compare to other OS.

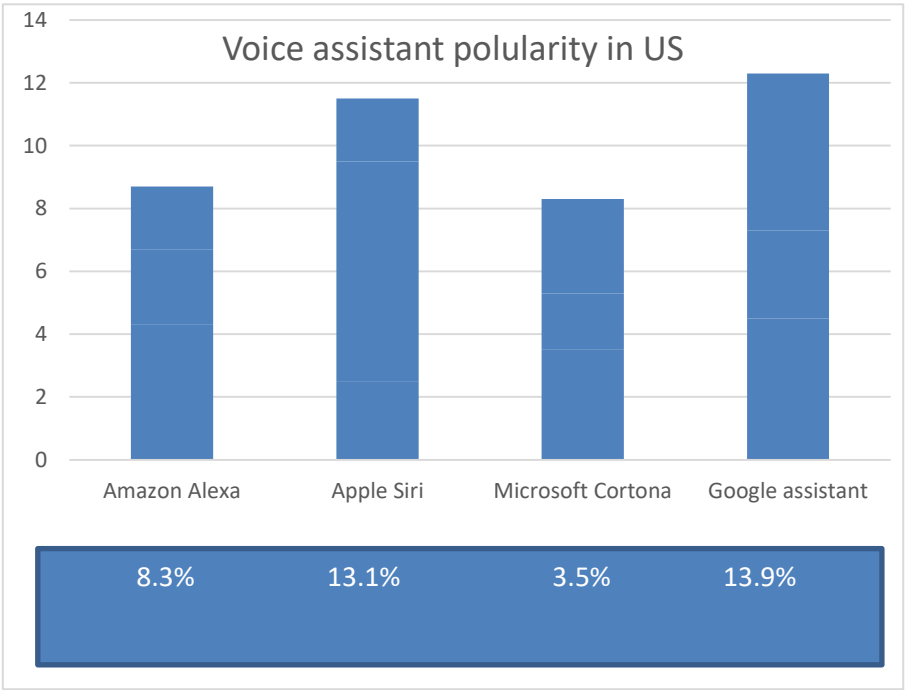

Figure 6 Voice Assistant Popularity in US

As Android is an open source operating system which provides source code to the users and anyone can develop their application and run it on Android mobile after launching in Android 'Play store' or also it can run directly in android mobile without launching or verified by the google play store which is not a good thing for security point of view [13] because hacking may possible through a simple APK file when it run in the android device after send by an unknown person or black hat hackers on the other hand as we know about iOS that it's applications are only develop by Apple developers team so no other person can make their own application and run in the iOS and because of that hackers cannot be able to hack iOS easily like Android mobile phones because each and every application of iOS is developed by Apple Inc. and after verification it only available through Apple app store not from any other unknown source. As Apple iOS is expensive compare to other mobile phones instead of that it is the second most operating system used in the world after the Android.

Android is the first most used software in the world because it runs in various mobile companies like Samsung, Nokia, Vivo, Oppo, Redmi, Xiomi and many more but this option not comes with iOS [14], iOS runs only in Apple devices so this is one of the limitation of iOS because it is expensive and does not provide options for the user in other companies that's why many people cannot afford to purchase it or not be able to experience the awesome iOS iPhone. If we talk about the brand value of the tech companies then many times Apple top in the list, it is because of that Apple never compromise with its price if only five out of 20 people able to purchase the iPhone then it sell only 5 iPhones, Apple never decrease its price to sell their products because the security which is provided by Apple is not comparable to any other companies and Apple always manage to build an atmosphere of exclusivity and royalty around their goods that is why it attracts the customers.

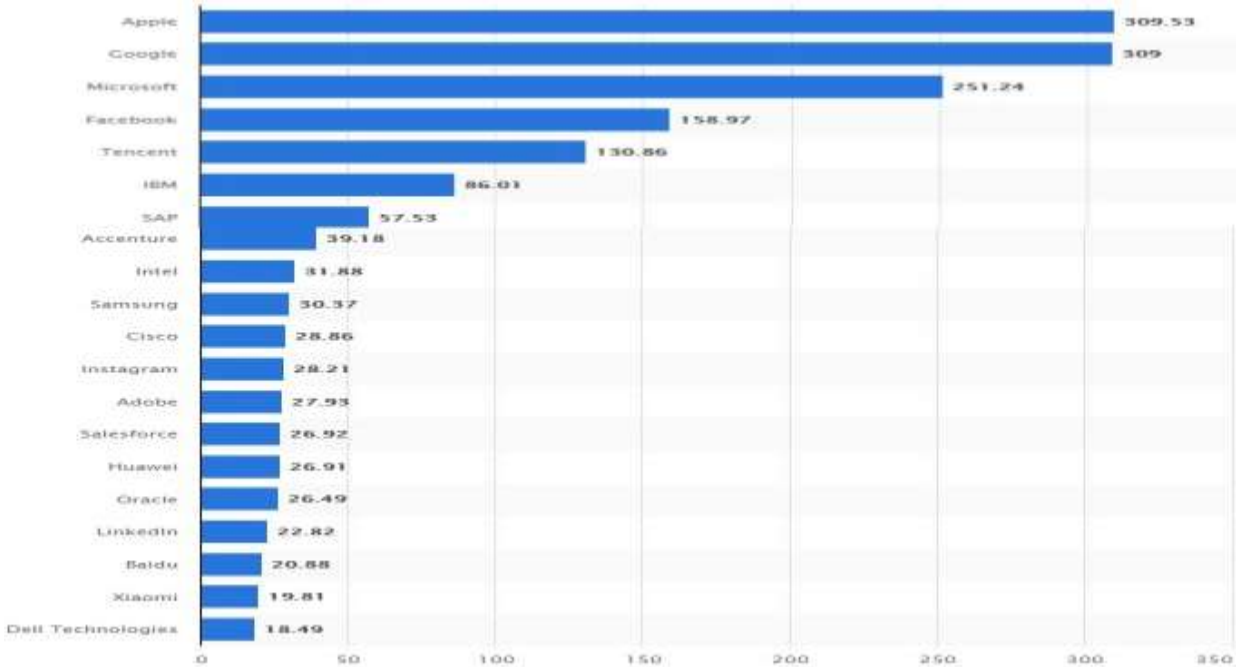

Figure 7 Brand Value Graph from Statistics collected through earlier research

As in the graph shown we can see that among various multinational tech companies Apple's brand value top in the graph because of its services and features. In 2017, on 3 November Apple released its new phone iPhone X which creates new revolution in the mobile industries due to the reason that it comes with a new feature in its iOS which 'Face ID' unlock system which was first introduced by Apple Inc. As iOS is already a well secured operating system but Face ID technology makes it more strongest secured operating system ever which protects the information on iPhone X and its upper version very well.

Apple iOS has its own browser, maps which name is Safar Browser and Apple maps respectively but it also support other browsers and maps but not as default. iOS don't have any widgets whereas Android have many but iOS has a video calling app which name is 'Face time' and that runs in only Apple products. Apple always add some new feature in iOS in certain period of time.

2.3. Apple iOS Collaboration with 'Face ID' Technology Hardware

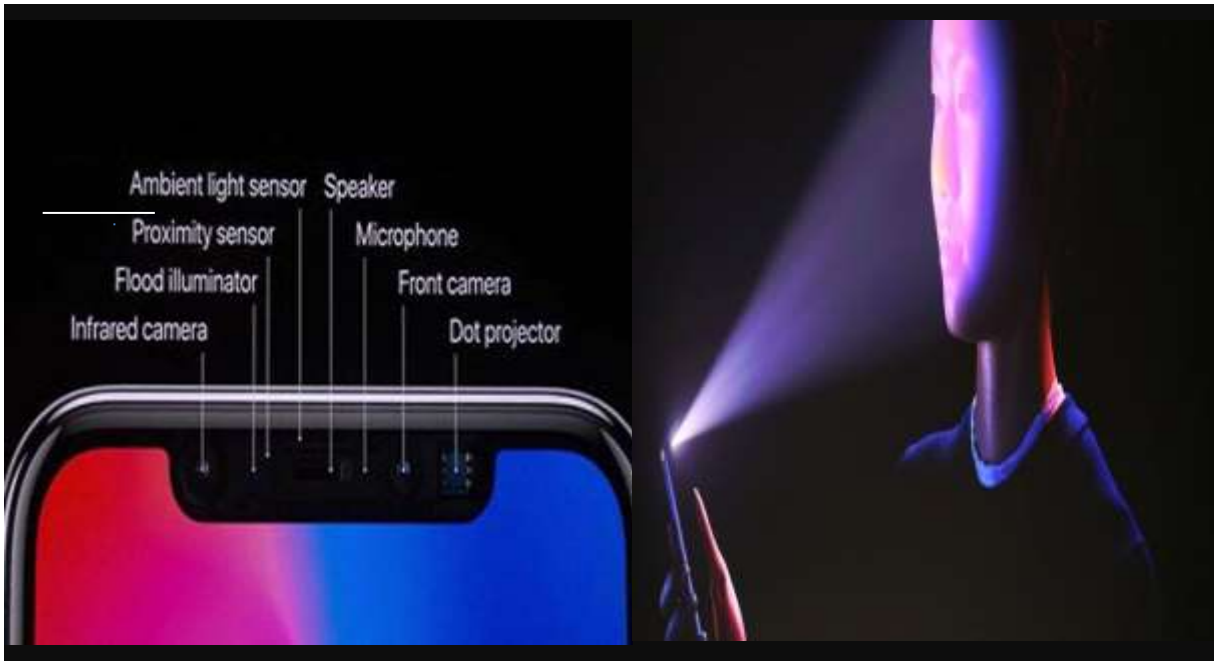

Figure 8 Depth Camera Area

Face ID technology works very simply just person have to look at the iPhone and after that it recognizes and unlock the phone. In this effortless and simple approach to unlock the iPhone Apple created the most advanced technology in his history [15].

As in the above figure, the upper part name called 'true depth camera' system which is powered by 'state of art' technology, depth camera consists of infrared camera, dot projector, Microphone, speaker, Ambient light sensor, Proximity sensor and flood illuminator, these are all combined in the area of 'True Depth Camera' system. Now let's see little bit how it works, whenever user glance at iPhone it detects the face with the help of flood illuminator and the infrared camera takes an infrared image, the 'dot projector' projects over thirty thousand invisible infrared dots and then infrared image in the 'dot pattern' are push through neural networks to build a mathematical model of the user's face and then it check or match the mathematical model that user set up earlier to match for unlock the device and these all happens in real time which is amazing. The Apple Inc. developers developed several neural networks to make the awesome Face ID which also involve the concept of machine learning. Apple Inc. is the only one which first built neural engine which name is 'A11 Bionic Neural engine' [16] a specialized hardware for face recognition built for specific set algorithm of machine learning which is a great collaboration of hardware with software 'iOS'.

2.4. An Overview of IoT (Internet of Things) with iOS

As technology enhance rapidly day by day and IoT is one of the major outcomes of enhancement. Before knowing how is iOS related with IoT let's see little bit about IoT. IoT (Internet of Things) is a methodology or technique in which each and every device can connect with each other share or transfer data with the help of internet and those devices also

consists of sensors which helps to reduce the human interaction with the devices [17]. This technology ease the way of living and makes the world smart. The various field in which IoT spreading its wings are wearables, smart industries, smart home, smart city, agriculture, automotive.

3. CHALLENGES IN FRONT OF DEVELOPERS IN CREATING IOS APPLICATIONS

While developing the applications of iOS the developers face some challenges that are as follows:

3.1. Application Compatibility with various iOS Versions

As Apple always releases new versions of iOS every year. Each and every versions have new features, technical upgradation so iOS application developers have to update the applications to counterpart upgraded standards of newest versions. Implementation of the latest iOS version helps to bring huge users. The developers need to select various iOS devices to check the applications compatibility then they detect and find issues and solve them frequently. Apple Inc. stopped providing to support 32-bit architecture and shift to 64-bit architecture so developers need to optimize older iOS applications and make applications compatible with newest versions.

3.2. Storage and Memory Limitations

As there are many devices of Apple and all comes with the different storage capacity and memory so while developing an application for one particular versions it should be necessary that developers have to keep in mind that this application should be run in all other devices very smoothly because of varying in memory capacity of different devices. There are various applications and games which consumes lots of memory so users are unable to run those games and application though the mobile with latest versions. So the developers need to keep these things in mind while creating an applications.

3.3. Beta Testing

Beta testing is one of the major part of the Apple Inc. in which all the applications that are developed should have to pass in this test before make it live in App Store of iOS. In this testing the Beta users run and check the application's functionality and also try to find out the bugs, breakdowns and issues while running the application. So iPhone developers scan the maximum failure and faults in advance, and fix the breakdowns, bugs, remove the issues before make it live in iOS App Store.

3.4. Apps Security

iOS operating system and its applications are best knowns for its high level of security and Apple never compromise with its security. It is one of the major responsibility of the iPhone Application developers that they use proper data encryption to avoid data loss, protects the application from black hat hackers and vulnerabilities. It is one of the most challenging work for them.

3.5. iOS App Store Approval

Till now there are around 2.2 million apps available in the iOS App Store but to make one App live at App store is not an easy task. There are several rules, criteria and guidelines which an application have to full fill each and every protocols to live in App Store. Apple Inc. continuously modify their guidelines so developers also have to update them self that they are

not going to miss some set of the rules and regulation by an application otherwise it frequently reject by the App Store.

3.6. Battery life Challenges

It is also one of the biggest challenges for the developers. The users are not well satisfied with those applications which consumes battery a lot so users immediately uninstall those apps so developers have to take care that the apps does not degrade the battery life by optimizing the apps and also have to avoid exhausting specification in order to minimize battery consumption.

3.7. UI/UX Design

Among various reasons one of the reason that users opt iOS is because of clean design and user friendly interface. So while creating iOS application developers have to keep the design and graphics in that way which is convenient for the user to handle.

4. CONCLUSION

We conclude that how the journey of the massive company Apple Inc. starts from a small garage by taking initiative with a computer to one of the most successful mobile company in the world with various ups and downs in the ways. We also gone through how iPhone OS became iOS and what was the reason behind it, how iOS is upgrading its versions at certain period of time and adding new technologies and features like face recognition, merging software with hardware including the concept of machine learning, how iOS is most secured mobile operating system and what makes it so, what makes iOS different from other mobile operating system like Android and others. We have seen an overview of IoT (Internet of Things) and its applications in various field like agriculture, smart home, smart industries, smart automation and wearables which is a creates great revolution in the world as well as in the technology and also conclude how iOS spread its wings and contributing in this technology from their side in IoT and in Industry 4.0 as well which includes smart factories shops etc. and finally we have seen the challenges faced by the developers while creating the applications and what are the important things that developers should have to keep in their mind. So the overall outcomes of these are that iOS is continuously upgrading, updating, enhancing and serving its best to the world and spreading its wings to the other technologies.

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