

# Survey on Internet of Things (IoT) : Tools and Technologies

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## ABSTRACT

Now days, to live in a very much digitalized smart world, everyone is in need of different electronic gadgets, which are so smart to give any required information immediately. This smartness sounds significant because of Internet and Android Technology, which births to smart gadgets like Smart Phones, Smart Hubs, Smart TV's etc., which are, used everywhere. Internet of Things (IoT) also has a boom in the industry that helps to provide the smartness for different things. To provide the smartness for the different gadgets, the Android is supportive platform available which give the challenge for the App Developers to develop the Android based Apps for IoT. With respective of this, in this paper, a review study is done for understanding the IoT, its tools and technologies required to develop the Android based app for IoT.

**Keywords:** IoT, Android, Media stream OS, Raspberry kit, Tools, Technologies etc.

## I. INTRODUCTION

Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the Internet. The 'thing' in IoT could be an object that have assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. Internet of Things can connect embedded devices in various systems to the Internet. The devices can be controlled anywhere as these are represented digitally. The connectivity then helps for ensuring more ways of increasing efficiency, and improving safety and IOT security. The following sections introduce the Internet of Things (IoT), its scope.

### 1) Internet of Things (IoT)

Imagine a world in which every device in the home, workplace and car are connected and the user by sitting on his chair can monitor and control such devices. A world where the lights automatically turn on when the car approaches the driveway, the coffee

starts brewing when the morning alarm goes off and the front door automatically unlocks when approached by a member of the household, but stays locked when a stranger arrives on the front step. Such world of things, which are connected, to each other can be organised, monitored and controlled by the user called as Internet of Things. Currently, the "Internet of Things" is not a second Internet rather it is a network of devices, connected to the Internet [1]. The user uses the Internet technology to search the everyday information on Google, to upload the images and to connect with friends. Internet is a network of products having their own IP addresses, which connects to each other to automate the simple tasks. So the phenomena "Internet of Things (IoT) used by the user to forms the world of IoT.

### 2) Scope of IoT

Internet of Things can connect devices embedded in various systems to the Internet. IoT is transformational force that can help the companies

to improve their performance through IoT analytics and IOT Security to deliver the better results. Businesses in the utilities, oil & amp, gas, insurance, manufacturing, transportation, infrastructure and retail sectors can reap the benefits of IoT by making more informed decisions, which will aided by the torrent of interactional and transactional data at their disposal. IoT platforms can help the organizations to reduce cost through improved process efficiency, asset utilization and productivity. With improved tracking of devices or objects using sensors and connectivity, they can benefit from real-time insights and analytics, which would help them to make smarter decisions. The growth and convergence of data, processes and things on the internet would make such connections more relevant and important, creating more opportunities for people, businesses and industries.

This survey paper is distributed in respect of the different sections. The section II specifies the tools and technologies used in development of Apps for IoT. The section III gives the focus on the Android platform and languages used for development. The section IV makes the comparison of the devices connected through IoT and apps.

## II. IOT TOOLS AND TECHNOLOGIES

1. Raspberry Pie 3.0 B+ / Arduino: It is a device, used as a Microcontroller. The embedded devices will be connected through the microcontroller. It is a small microprocessor, which made with combination of IO pins, memory unit, various ports, and ICS. The processors and has connectivity features like Wi-Fi, Bluetooth, etc.
2. Media Stream Operating System: This operating system used to stream media data over the IoT devices. This is an open source operating system, designed and developed using Java, which can be customizable operating system. The Kodi, OSMC are the popular and widely used operating systems.

3. IR Sensor: IR sensor used to transmit and for fetching signals frequencies over the air medium.
4. AVG Connector: Such types of connectors used to convert the media signals into the HDMI, AV, Micro HDMI ports.

## III. ANDROID PLATFORMS AND LANGUAGES

1. Java: It is a most popular high-level language used to develop platform independent applications. Now days, it is used widely because its features like robustness, security, distributed programming environment, supportive features for network programming, etc. To develop the applications for the embedded devices, the Java language used because of its rich sets of functions supportive for cross platform.

2. Kotlin: Mobile Application Development uses the Kotlin, which is designed and developed as an industrial – strength object oriented programming language. This is statically typed programming language runs on the Java virtual machine and can be compiled to JavaScript source code. Through this language, it will be possible to interoperate with Java code and can be dependent on Java code written using the existing Java Class Library, such as the collections framework. Kotlin is fully supported by the Google on the Android Operating System and provided through the Android Studio 3.0 IDE package.

3. Python: It is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. Guido van Rossum during 1985- 1990, created it. Like Perl, Python source code is also available under the GNU General Public License (GPL). This language used for Mobile Application development.

## IV. COMPARISON AND DISCUSSION

**Use of IoT in world:** IOT is an emerging technology, which is trending right now in the world; Millions of

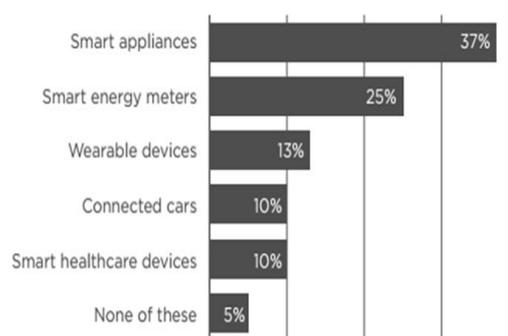
devices are connected through IOT. As per estimated report suggested by 2020, More than 1 trillion devices will be connected to IOT Technology. According to Gartner report, by 2020 connected devices across all technologies will reach to 20.6 billion. The following Figure No.1 gives the scenario the number of devices connected in the world of IoT.

YEAR	NUMBER OF CONNECTED DEVICES
1990	0.3 million
1999	90.0 million
2010	5.0 billion
2013	9.0 billion
2025	1.0 trillion

**Figure 1.** Year wise growth in the number of devices connectivity

Hewlett-Packard did a small survey in which they found and estimated the rise of connected devices over the years and the results are surprising. These devices will bridge the gap between physical and digital world to improve the quality and productivity of life, society and industries. With IoT, catching up Smart homes is the most awaited feature, with brands already getting into the competition with smart appliances'. Wearables are another feature trending second on the Internet Worldwide. With launch of Apple i-Watch and more devices to flow in, these connected devices are going to keep us hooked with the inter-connected world.

A survey conducted by KRC Research in UK, US, Japan and Germany the early adopters of IOT has revealed which devices are the customers more likely to use in the coming years. Smart Appliances like thermostat, smart refrigerator are most liked by the customers and are seem to change the way we operate. The Figure Number 2 shows the percentage of usages of smart devices.



**Figure 2.** Percentage of Usages of Smart Appliances

If you are wondering what impact, will IoT have on the economy then for your information as per the Cisco report IoT will generate \$14.4 trillion in value across all industries in the next decade.

### IOT Casting Devices in Market:

#### 1. Apple Airplay:

Airplay is the wireless display standard used by Apple. Airplay allows you to stream video from an Apple device like iPhone, or Mac onto a TV. Airplay from Apple is quite flexible as it can be used for mirroring (i.e., to mirror the contents of a device onto the TV or display), or streaming using Safari or QuickTime player. For example, user can play a video in an app and use the playback controls on their iPhone to control the video on their TV. Even if user use the playback controls on their iPhone's, they will not appear on their TV. Airplay streaming is smart enough to stream only the content user want to see on the display and it is supported only on Apple devices.

#### Google Chrome-Cast:

A Chrome-Cast is a Google product, which was made to counter Miracast and AirPlay. The Chrome Cast receiver can be plugged into your TV's HDMI port and it uses something called the DIAL (Discover and Launch) protocol. ChromeCast is a true streaming device that does not merely mirrors users smartphone or laptop screen to the display unit (TV). For example, to stream via ChromeCast you have to open an app on user's smartphone or laptop – say YouTube. The user tell YouTube to play a video to

their Chromecast, which then connects to the Internet and plays the video, allowing user to control its playback via the app on their smartphone. Thus, whatever user do on their smartphone display will not be displayed in the TV screen as Chromecast connects to the Internet and streams the video itself. The user can then control playback as usual on your smartphone.

#### **Amazon Fire sticks:**

The new Amazon TV stick is the latest trending casting dongle, with features that are no less to the other dongles in the market. The design is sleek and stylish just like memory card stick, and come with a remote to operate it. It is revolutionary product but it makes browsing experience even better. Just as any other dongle Amazon fire TV stick allows searching for videos, music, games and photo browser. There features are worth for the price that user pay in and they have their own user interface. Special voice control software Alexa that assist the user to command the browser e.g. fast-forward 2 minutes.

### **V. CHALLENGES OF DEVELOPMENT OF IOT BASED APP**

To develop app based on IoT, the App developers need to give focus on the usages of communication approaches used for connected devices such as how the typical mobile will connected via Bluetooth, Wi-Fi or 3G/4G service, versions of the software for available with respective of the operating system like iOS, Android, and Windows. Therefore, for developing the app for IoT the following challenges needs to works out for the developers:

1. **Security** – While developing IoT based apps or applications, security is the most significant challenge need to work out. Because in an Internet as the number of connected devices goes on increasing, the exploitation of user data issue will goes on increasing. This can increase the possibility of exposing the user data for theft. To

deal with this issue, there is requirement to consider the cost vs. security trade-off associated with scale factor of deployment of IoT based app.

2. **Connectivity** – When devices recognized as the IoT devices, with respective of connectivity challenge, these devices will not be connected via 3G or 4G services. In such cases, developer needs to understand the approach establish to provide the connectivity between the app and gateway or standalone device. This phenomenon requires the identification of different protocols required for data networks and Wi – Fi connectivity. So with respective of connectivity issue, the app developer should have matured plan about the utilization of the capabilities needs to be added to the mobile app.
3. **Platform** – This is main issue needs to worked out while developing the IoT Apps since most of the developers does not familiar with the look of the IoT compatible apps. To develop the apps, if the web-based platform will not be suitable, then the app developer needs to develop new software. Therefore, IoT Apps Developer has to adopt their self with the world of IoT devices so that they can deliver the customizable products in the domain of the simulated devices.
4. **Open Source Tools and Technologies** – as the IoT becomes popular, the many companies like Google, Microsoft are offering wide range of features to start the App development. Mobile app development service providers are also sharing their programs so that the app developers can use it as an open source tools in their development process.

### **VI. CONCLUSION**

In today's technological world, the change is happening everywhere in terms of the physical as well as logical things. This change is accepted and applied by the app developer's community to become a smart and to survive in the world of changing technology to deliver the smart solutions to the society. This

changing technology is right now spelled by one of the word as the “Internet of Things”. Therefore, the app developers who are interested to develop the apps based on Android Technology for IoT need to understand availability of the tools, technologies and languages for IoT. So during this survey, the main focus is given on understanding of the IoT, scope, IoT casting devices used in the market, and its challenges along with the Android platform and languages.

## VII. REFERENCES

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