

# Influence of Smart Devices and IoT Applications in Tourism: A Survey Analysis

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**Abstract.** The tourism is the exercises of individuals travelling to and remaining in spots outside their native surrounding for leisure, business, education, medication or any other purposes for not more than one successive year. The fundamental needs of a tourist are comfortable accommodation, reservation and other online services, foods, tour guide / language guide to relevant places, maps and security measure. These activities are nourished with information and communication technology with including, smart hand held devices, smart wearable devices and IoT devices. This paper figure outs which group of devices in ICT impacts (helps) tourists and tourism industry via literature survey analysis. This study shows that, wearable devices are mostly suitable for tourism depend on the factors used to analyze. Since these types of devices are useful in tourism in different circumstances in its own way with few drawbacks. When functionalities of these devices are combined, the drawbacks can be mitigated.

**Keywords:** Tourism, IoT, ICT, Smart Devices, Smart Wearable Device

## 1 Introduction

Tourism is a process of moving one place to another place at least twenty-four hours for the purpose of Business, Education, Medical and other relevant activities. Most people all over the world desire tourism with the various purposes such as entertainment, gaining knowledge, social, professional contact, and for relaxation. Almost every person having this tourism related activities at least one time in his or her life time. The new era of ICT provides massive support to tourism industries by connecting smart devices into tourism. Smart phones and smart devices are increasingly used by most of the user all over the world, approximately 5.1 billion users are having mobile phone for different needs . Internet of Things (IoT) is one of foster technologies in contemporary which connecting smart physical devices and objects with internet for sharing real-time and provides most efficient data. The IoT always provides smart outputs like smart cities, smart home and smart connected things [2].

Tourism is one of the important and one the vast profitable domains around the world, thus these industries must look after tourist in safe and satisfying manner for attracting more tourist into the country. Normally a fundamental need of a tourist is comfortable

accommodation, reservation and other online services, foods, tour guide / language guide to relevant places, maps and security measure.

The aim of this paper is to explore how smart devices and IoT impact among tourism industries and tourist, what kind of services are provided by those devices and application for having tourist activities easier, the advantages and disadvantages of having this kind of tools as a survey analysis.

## 2 Literature Review

### 2.1. Smartphones and Smart Devices in Tourism

As reported by [3] and [4] that, tourists can share whole experience of their journey and contact with their family as real at anytime and anywhere according to the their wish by smartphone and other related apps with the help of concept of smart tourism. Also indicated by [5] that, wearable devices like Google Glass, Apple iWatch, fitness bands are also playing major roles in tourism.

[6] conveyed that, the wearable devices in tourism used by tourist for checking the health conditions, dieting purpose, changing the plan according to their wishes, checking the status of sleep, and contact with their family and friends.

As described by [7] that, smart wearable devices are allowed tourists to connect with the internet, with other devices and environment through sensors, these information like environment and human condition could be shared through wireless, as a consequence tourists can aware on that particular environment, current situation, they can have better condition and can make some counter measures according to that [8].

As stated by [9] that, tourists use vision, audition, Taste, Haptic, Somatic and Moment sensors embedded with wearable smart devices which are collecting the environment and tourists related information via specific sensors and the output data of the sensors, which support tourists in decision making process. For an example, when it collects the environment related data like whether and other important information, the tourist can mitigate or avoid the danger and he or she could try somewhere else instead of that [10], [11].

Also reported by [11] that, with the help of smart devices and application, a manager of the organization can monitor the number of the tourists, the time which they are coming to the particular area can be gained from remote location, hence the manager can understand on time and can attractive the tourists by different approaches. This shows the advantage to local people and they could gain profit and eventually it can be identified that from this, smart devices and smart tourism not only give advantages for tourists but also the local people or workers and organizations too.

Also from another study that, data produce from human life with the help of smart devices deliver vast influence in traveler's behaviors and destination [6]. Also as indicated by many study that, Smart devices and Mobile devices changing the method of traveling by connect with other traveler's with the help of sharing experience one to others [3], [12]-[15].

As described by [9] that, human senses are most important entities to decide a place of the tourists and these sensing ability nowadays depending on smart devices like, vision will be captured by Camera and Google glass, hearing Microphone and some apps like ear bud, to smell, electronic noise, for taste electronic tongue, to touch silicon finger and Analysis the Temperature Thermoelectric bracelet are using by the tourists, thus the senses identify from the smart devices, are significant substances to decide a tourist place and these smart devices are incredibly influence into tourism industries [16].

Also reported by [17] that, technologies connected with social networking and mobile devices are creating new platform for business in between tourists and local marketers and

also provide the tourists destination locations with the help of decision making by observing social Medias from smart devices.

As stated by many studies and authors that, smart mobile devices are allowing tourists to connect with others, providing well-educated and travel-related information like information exploration, navigation, social networking and travel reporting. And also some study says that these activities are done by wearable devices like glass very quickly rather than phones [18] [19]. Tourists can have a better solution either by using mobile phone or wearable devices in case of traveling and other relevant tourist activities.

In addition to this, tourists used mobile phones for examine travel related information [20], acquiring travel services [21],[22], booking hotels for staying[23]-[25], improving travel related experiences[26],[27], having their vacation more effective and efficient by saving time.

A study from [28] revealed that, most of the user using mobile for getting travel relevant information. Another study from Jelena Dorcic et al that, most of the mobile users provide most personal information to different mobile application while using it, hence it does risk to the particular user and it influences in different industries like tourism, education, medical and other relevant areas [29]. And also from [30], It obvious that, some mobile applications like hotel apps, provide negative influence and privacy problems to the tourists. And similar research conducted by [31] conveyed and confirmed that, in case of tourist mobile applications negatively impact the tourist with privacy issues.

[32] said that, tourists are enthusiastic to using the mobile games in different locations to improving their experiences when the mobile application is useful and support with the particular environment where they are dealing with.

A new study from [33] explained that, tourists are nowadays adapting and using near-field communication (NFC) method for variety of intentions, and indicated by [34] that tourists use iPhone by using NFC for payments to hotel activities.

As believed by [35] that, smart phone usage in contemporary became an addiction and habit to its user thus influences tourists to use phone while traveling meanwhile another study from [36] said that, consistent smart phone usage does not directly impact a tourist to travel related activities.

As conveyed by [37] obvious that, tourist uses smart phones for communication, social networking activity, information acquisition, information search and entertainment. And also from [38] we are able to identify an interesting point that, with the help of smart phone and other smart devices, tourists are mostly desire to use social Medias for overcoming some issues in case of crisis and some other travel relevant difficulties. Thus we are able to understand that smart phone and smart devices are highly influence in tourism industries not only for arranging piloting services but also tackle some drawbacks.

In generally tourist desire more efficient and relevant information [39], in that respect of checking hotels and arranging schedules. The said activities have been enriched by the smart devices and mobiles applications [40]. Smart phones and smart devices provide excitements, inspirations and in some case it is shaping the tourists' experiences in considerable manner [41],[42].

In addition, a study states that, most of the tourists do go offline in a rare occasion only. Being online constantly impacts the human mood in vacation time [43]. Thus smart phone provide positive and negative impact in tourism concurrently.

New technologies of smart phones and smart devices (AR application, Virtual reality and some gaming technologies) are highly providing helps to tourists in necessary and needy situations. Also from [44] that AR application helps to tourists by providing multi-language skills and easy access process.

A study from [45] conveyed that, mobile technologies provide important solution in case of disasters and calamities situation by sharing the information via relevant apps hence tourist can decided their counter measures action by evacuation from that specific areas.

Mobile tour guides help tourists (bikers and cyclist) to guide their destination and the duration to reach the spot. Thus tourist could be making efficient arrangement of their trips [46]. [47] states that, mobile devices are providing solutions for finding out the dry beaches to the tourists by web-based applications, so a tourist can use those apps and can make preparations accordingly.

As indicated by [48] that, a wearable device in tourism can shape the trip in case of tourist's negative thought by interaction and control their interactions with tourism spots.

Smart phone's GPS application provides navigation services and interpreter applications services remove the language barriers in between two parties in an efficient way during the trip [49].

In the research of [50] regarding the Quick Response (QR) code that, Tourists are very much like use this QR code and it is one of the better and popular solutions among tourism. The QR code is being used by tourists in many places and this code used as loyalty card in hotels among tourists these days.

A study from [51] mentioned that, reasons for limited tourists' activities by using mobile and smart devices are, insufficient trust in tourism services via devices, security breaches in online tourist services and applications, and also fake information about tourist places. Hence a tourist can limit the tours and operations with the help of smart devices.

#### **Examples for Smart Wearable devices:**

**Smart watch:** It is a portable device which is designed to be worn on a wrist. These smart watches also like smartphones use touchscreens, offer apps, and often record your heart rate and other vital signs. The Apple Watch and Wear OS (formerly Android Wear) models prompted more consumers to appreciate the usefulness of wearing a mini computer on their wrists. In addition, specialty smartwatches for outdoor activities often supplement other, bulkier devices in an adventurer's tool kit. Therefore, it will be considerably helpful in tourism as it includes GPS tracker as well [52].

**VR-Virtual Reality:** Virtual reality has exploded in recent years, with increased availability of virtual reality headsets as home entertainment products. While much of the excitement has focused on video games, businesses and marketers have also made use of the technology, especially in terms of interactive 360-degree images and videos. It is one of the most promising tech trends for tourism-related companies, because it allows them to digitally transport customers to a virtual recreation of a specific place. This affords hotels the opportunity to showcase their rooms, reception areas and even local tourist hotspots on their website, in order to encourage bookings. Other examples might include interactive virtual maps or VR hotel tours/ 360 video tours to present your hotel upfront [53].

**Augmented Reality:** Augmented reality is similar to virtual reality, but involves augmenting a person's real surroundings, rather than replacing them. One of the major plus points of this particular technological trend is that it is cheaper than VR, with users requiring only a smartphone or tablet device which has access to the internet. Through graphical overlays, those in the tourism industry can greatly enhance the customer experience, providing customers with valuable information or even pure entertainment. For instance, apps can allow for photographs to be augmented through filters and effects. Details about local destinations can also be displayed as a customer points their smartphone at them, providing information at the exact time that it is most relevant [54].

**Smart Glasses:** Smart glasses are worn on the face like traditional eyeglasses but are packed with technology to display information that's literally within eyesight. It might sound uncomfortable or hard-to-read at first, but the text gets scaled up or down so your eye can easily read it, and optimized resolution helps account for distance. Smart glasses will benefit cultural heritage sites through the overlay of digital content into visitors' direct experience. Visitors are enabled to view and appreciate paintings naturally without the disturbance of the mobile phone, while smart glasses can provide information when desired for a better experience. As well as this feature are used in Museum to get information detail without disturb others [55]

## 2.2. IoT (Internet of Thing) In Tourism

IoT applications are another supportive application to the tourists and tourism which can connect smart devices. In case of emergency of any tourist, they are unable to get help from others with fully trusted mode and some cheaters stages their fraud actions while they do help. [51] suggested a solution called iTour. These IoT iTour application have several components and each component provides services by connecting smart devices from tourists. The components in iTours are Human Resources like hotel manager, divers, interpreter and so on, Non-human resource like sensors, global positioning systems (GPSs), Wireless sensor Networks (WSNs), smart maps, the Internet, and other different types of services. Further, services like banking, guides, and restaurants are also added. These three components of IoT applications help the tourists in making their each and every activities which are necessary to them without any fear. Here every service and every device are connected with each other with the help of wireless sensor networks. In unpleasant situations or any emergency situation all services will be in the tourist place by passing all necessary data to the nodes. Tourism industry has been influenced by various type of IoT devices including the following:

**Travel card:** Is the smart card to automate the payments for all tourism process. Which can be customized according to tourist selected packages, used in all transport services, shopping mall, hotel, restaurants and etc. Further all details of tourist such as personal, credit card and contact details are to be provided by the travel card provider.

**Electronic Key Card:** Is an electronic card used to check-in and check-out process in hotel such as SPG. These electronic cards send to tourists' smart phone, which is automatically notify to the relevant hotels' staff when tourist check-in or check-out, further it helps to avoid waiting time in front desk as notifies about tourist movement in hotel environment.

**Portable Translation Device:** Is a smart device, percept users' voice, convert it into text, and then those text is translated into required languages' text. Finally, these converted texts are delivered to tourist in voice format.

**Smart Luggage:** Is a typical luggage for normal usage but all operation is automated. Over the last few years, smart luggage has gained massive popularity among business-travelers, frequent travelers, and other tech-savvy individuals. Further, it is providing digital weight indicator, hand held device charger, GP tracker and prevent identity theft using RFID.

[56] developed a concept with Ecosystem for tourism activities. In that system, Tourist can get the services from tourism suppliers and they will provide the services with the help of IoT and connected smart devices through Networks. Most of the services can be gained from these systems and tourist get more satisfaction and excitement through this.

Normally tourist having big issues in traveling are security and privacy, by considering both issues tourist limit their activities though they have some advantage through it but from a study of Saber Talari et al said that, IoT provides it security of its user by Trust, Privacy and Data of user in confidentiality manner with the help of Security layers and measures in IoT application thus a tourist cannot be fear to use IoT devices and application like in smart phone and untrusted application[57].

Traditionally IoT applications and devices are provide real-time information instead of up to date information, and IoT's most of the applications are automation which will have necessary things in time manner and provide data real time thus a tourist can be ready and aware whole situations[58].

### 3 Comparison and Discussion

#### 3.1 Smart Phone Vs Smart Wearable Devices

**Table 1.** Some performance of Smart devices and Smart devices in tourism

<b>Services and Performance of Smart phone and Smart Devices in Tourism</b>	
<b>Smart Phone</b>	<b>Smart wearable Devices</b>
Sharing Experience and Contact family as Real Time	Contact with family
Examine travel related information	Checking the health conditions
Acquiring travel services	Dieting purpose
Booking hotels for staying	Checking the status of sleep
Provide enthusiastic	Identify environment and have measures
Gathering Travel information	Gathering Travel information
Provide near-field communication (NFC) Service	Support in decision making process
Information acquisition	Monitor tourists and support to make profit
Information search	Help others by sharing experience
Entertainment	Decide place where tourist want to go
Helps to information exploration, navigation, social networking and travel reporting	Helps to information exploration, navigation, social networking and travel reporting
Help local marketing in business	Help local marketing in business
Influence in traveler's behaviors and destination	Influence in traveler's behaviors and destination

Table 1 shows the summarization of some of the performance or advantages of smart devices in tourism according to the papers reviewed. Apart from table 1, these devices are used by tourists for navigation services, checking services of particular place, language translation, situation checking like enclose disaster, GPS services for finding location in efficient manner and planning the place using that GPS by considering time.

While focusing on disadvantage side, we are able to identify very few number of or negligible amount of drawbacks from tourists when compare with performance from smart devices. Here the most important problems of tourism by smart devices are privacy issues, do

not get responses from emergency situation and using smart device while in the trip it may spoil the vacation schedule.

Privacy issue is one of the major problems in contemporary most of the smart phone and smart devices where users have been experiencing. To overcome this smart device user must go with the trusted application and devices but the critic is, how user can find whether the application and devices are trusted or not? Thus, the privacy issues in smart devices are inevitable and need to find a solution to overcome this.

Getting the response from emergency situation is another major issue in current situations, in case if they don't get any help while in emergency situation arises, there is a possibility to loss their life as well. Hence this issue cannot be solved either posting something in the social networking Medias or following someone in social networking. To solve this issue the tourist must connect with some systems which must be responding during crisis. But this is white elephant by only working with smart devices and some application.

Bad experience of tours will be solved when it would be replaced by interesting places and phenomenon in tourism activities.

### **3.2 Smart Devices Vs IoT**

In case of IoT from the literature review, all devices are connected with the internet with the help of IoT application. In case of emergency like accident, health problem, losing any important belongings and also if any emergency situations, all necessary data are being passed to the cloud with the help of wireless sensor network (WSN) in emerge manner. For an example if a tourist meet with an accident the data is passed to the hospital server via cloud and IoT application, thus a doctor can make prior arrangements before the patient arrive to the hospital and all the previous health records of the patients can be monitored by doctor before giving treatment and also emergency ambulance services could be made from IoT application to the accident spot, so a tourist can be safe. More than this, it is possible tackle a crisis situation or any problematic condition by using IoT application in tourism.

Meanwhile using smart devices without connecting IoT applications can be provided partial solution to the tourist but not the whole. For an example, A tourist follows another tourist's experiences as tourist guideline from social networking medias, when the guider forget to post a specific point in some point, the tourist get stacked and need some more assistance to overcome this, but in case of IoT with smart devices all solutions are getting without any additional assistance.

According to Table 2, several factors were analyzed related to the three types of devices which are being used in tourism. In user-friendly factor, IoT device got "SA" because, these types of device have very specific functionality than other devices. Smart phone got "A" because of the wide screen and sophisticated Graphical User Interface (GUI). According to Cost bearable characteristic, all devices got average "N", the reason is all types of devices are having huge amount of model types and versions, different model has different cost. In case of battery performance, IoT devices are processing only specific functionalities and it does not have sophisticated screen hence it got "A", meanwhile in smart phone several applications are running in background most of the time as well as it includes bright and powerful screen hence battery is discharged very quickly. In the case of Durability, IoT devices clinch the top place since most of the devices are fixed permanently in particular place and wide lifespan. In compare to IoT devices, the durability is lesser in wearable devices and smart phone respectively.

**Table 2.** Comparison of Characteristic between Technological Devices

<b>Characteristics</b>	<b>Smart phone</b>	<b>Wearable Devices</b>	<b>IoT Devices</b>
User Friendly	A	N	SA
Cost bearable	N	N	N
Battery performance	D	N	A
Durability	D	N	A
Performance	D	A	SA
Accuracy	A	A	SA
Handy	N	SA	N
Speed	N	A	SA
Memory Capacity	SA	A	D
Pairing	SA	A	SA
Privacy	N	N	N
Security	N	N	A
Versatile feature	SA	A	D
Offline Access	SA	A	N
Travel Guidance	SA	A	N
Connectivity	SA	N	N
Information Richness	N	N	SA
Communication	SA	A	N

SD-Strongly Disagree; D-Disagree; N-Neutral; A-Agree; SA-Strongly Agree

When consider the performance characteristic in smart phones there are several applications running in RAM and it get loaded while it is running at the same time in IoT devices are having very less amount of memory and it runs only specific operation obviously. In the sense of Accuracy of the device, IoT devices secure the maximum accuracy in compare with rest since IoT devices sense Realtime data for operations. When consider the easiness of handling, obviously wearable devices are very small in size and handling those devices are very easier than other two devices. In the sense of the speed, as discussed in performance wise earlier, smart phone executes most of the applications in background, meanwhile wearable devices and IoT devices are made for specific operation, therefore those two devices are speedy than smart phone. In the factor of Memory Capacity, obviously Smart phones are having very big memory capacity than other two devices. IoT devices are very specific purpose devices therefore, the devices require very less memory capacity.

In the sense of pairing factor, all three types of devices are capable to connect with nearby devices. Here privacy is at the grey area and privacy is very important factor when it is considered the electronics devices, though it is impossible to show gapless of privacy among various devices which are being discussed. In the context of security among the devices which are being analyzed, in IoT devices the functionality is very small and specific, therefore hacking and other unauthorized activities are comparably very less. Even though, smart phones and wearable devices are having several security features such as password lock and biometric lock, if those devices are connected to the internet, it is very easy to hack those devices. Thus, those devices are got neutral (“N”) in security analysis. In versatile feature, obviously smart phones and wearable devices are used in multi-purpose while IoT devices are used to specific purpose, therefore in this factor analysis, smart phone secured the “SA”, “A” for wearable devices and “DA” for IoT devices.

When we consider Offline Access, it is obvious that smart phone and wearable devices are having several offline applications. But most of the IoT devices do not have large memory



therefore the devices are sending data to server, so connectivity is very important in IoT devices. This research is based on tourism, Travel Guidance is very important factor in the sense of tourism. Therefore, accessing Google Map, GPS access and etc. are very important in tourism industry. Smart phones and wearable devices include GPS access and Google map; thus, we got the above result for the factor Travel Guidance. Connectivity includes Internet connection, WiFi connection, BlueTooth and Infra-Red. Some IoT devices are having Infra-Red only such as travel Card and Electrical Key, but most of the wearable devices and smart phones are having all connectivity. When we consider the factor Information accuracy, IoT device are getting current data from environment changes and then processed information will be resulted. But Smart phones and Wearable devices are getting data and information from the Internet as secondary data. Since it is coming from the Internet, it is unreliable. Communication between two terminals (system-system, system-human, and human-human) is essential in tourism. But in the sense communication between human-human, the IoT devices are not suitable for communication except wearable devices and Smart phone.

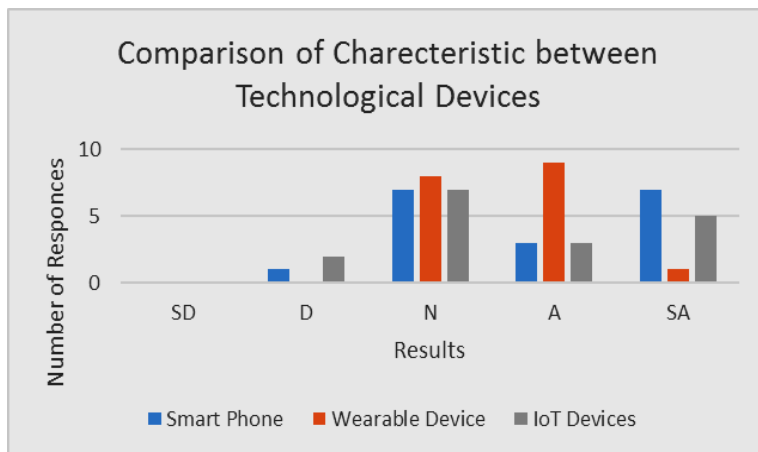


Fig. 1. Comparison of characteristic between Technological devices.

## 4 Conclusion

Tourists and tourism industries obtaining major advantages of using smart phones, wearable devices and IoT applications. Each device is providing its services into tourism industry in its own way. Even though, all the devices are used in tourism, this study for explore which type of devices are mostly useful in tourism. Thus, these types of devices are useful in tourism, few devices are not suitable for some situation. From this study, it has been derived that wearable devices are mostly suitable for tourism depend on the factors are used to analyzed in this study. Tourists are always moving from one place to another so that, mobile devices are most suitable for them. Even though, the smartphone is mobile type device, in the sense of battery performance the wearable devices are having high lifetime of battery, as well as battery charge will be reduced quickly because of two reasons such that, smart phones are having high brightness and sophisticated widescreen and more applications are executed as background process. Since these types of devices are useful in tourism in different circumstances in its own way with few drawbacks. When functionalities of these devices are combined, the drawbacks can be mitigated

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