# iTour: The Future of Smart Tourism

By A. K. Tripathy, P. K. Tripathy, N. K. Ray, and S. P. Mohanty

*Abstract*—**Smart tourism is an example of the important components of smart cities. However, in many cities, insecurity, safety, fraud and unavailability of proper information about resources are the biggest hurdles towards independent mobility. The tourists' issues can be overcome by proactive participation of local citizens to help tourists as well as by the cooperation between citizens, city administration and tourists. As a result, a number of components of a smart cities can be strengthened, from the sustainable mobility in tourism development to economy development. It is very challenging as it requires a combination of societal input and advanced smart and effective tools. This article presents viable Internet of Things (IoT) based solution as a framework for tourist independent mobility, called iTour. In the process, this article analyzes the difficulties in initiatives and lessons, exploring possible roles of IoT.**

## I. Smart Cities and Tourism

The concept of smart city has evolved with technology centric evolution based on Internet, mobile services, Wireless Sensor Network (WSN), smart technologies, and Internet of Things (IoT) [1]–[3]. The key elements of a smart community are the proactive participation of citizens in public life and the ability to create new ways of association between citizens and city administrations. In recent years, many initiatives have been taken with different aims and objectives [4]–[6]. It is envisioned that the integration of advanced tools and technologies and societal engagement that can provide the best opportunity to deal with some of the hurdles.

Tourist independent mobility in many countries is a paradigmatic example for a smart city [7]–[9]. Independent mobility of tourists is limited in many countries due to several reasons. Some of the major reasons include: (1) lack of trust in the ongoing tourism services, (2) lack of security support, and (3) fraud prone tourist places. The countries with various physical, religious and social diversities become preferable places to visit for tourists. But due to the above mentioned reasons, tourists limit their travels to such countries. As a result, tourism industries are affected severely. Tourism management plays an important role in making smart city more effective [10]. The proposed iTour has the ability to establish a new era for smart city functioning. This can overcome challenges in the existing tourism management system. Further,

iTour involves a large variety of stakeholders including city administrative officials and volunteers. The proposed iTour has been illustrated in Figure 1.



Fig. 1. iTour using Internet-of-Things (IoT).

## II. The Issue of Independent and Sustainable Mobility of Tourists in Smart Cities

A key requirement of tourism has been to attract more and more tourists from different parts of the world. However, insecurity, fraud, lack of proper transportation and communication facilities are the major concerns. Moreover, the safety concerns in the tourist places have restricted independent mobility of tourists [11].

Tourism is an important component in the revenue of a country. For example, in India the tourism plays a major role in the economical growth. Directly and indirectly, it provides millions of employments. However, it was recorded that in year 2013, the number of tourist visits in India was less than the tourist visits in cities like Bangkok and London. This may be due to the many reasons such as (as depicted in Figure 2): (1) lack of trust on hotel and travel agencies, (2) lack of support from government the private bodies, (3) insecurity in tourist places, and (iv) unavailability of real time help centers [11]. These things need to be addressed properly in order to attract the tourists.

There are lot of concerns for a tourist while visiting to unknown places. It is due to the lack of realistic information, security and other concerns discussed previously.
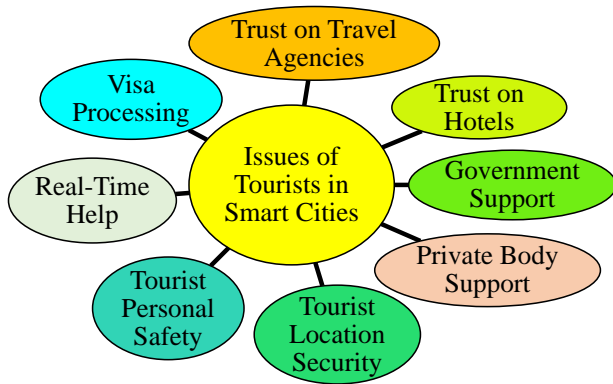
Fig. 2. Selected issues of tourists in smart cities.

For this reason people prefer to travel the known places where they feel safe and comfort.

One of the major obstacle in tourist independent mobility is the lack of social awareness about the technologies such as IoT based applications. Many initiatives have been introduced by the tourism departments. But due to the lack of awareness, those initiatives are not been utilised as expected.

Considering the above facts, we introduced a framework for tourist independent mobility based on IoT. It facilitates all stakeholders where they can easily avail the required services such as access information and manage the tourism services like hotels, public and private transports, traffics, and local volunteers.

## III. THE ROLE OF IoT TO ENHANCE INDEPENDENT AND SUSTAINABLE MOBILITY

The tourism problems can be overcome with the use of information and communication technology, particularly by the IoT. The role of IoT in tourist independent and sustainable mobility is depicted in Figure 3.
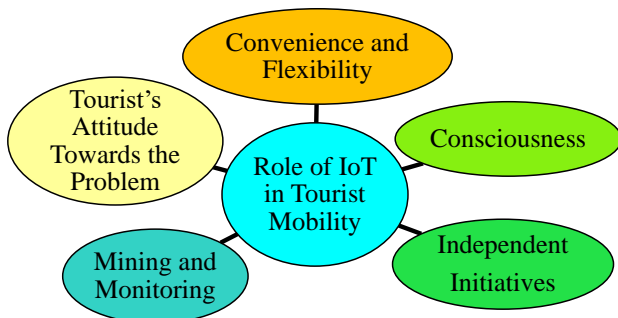


Fig. 3. Selected roles of IoT in independent and sustainable mobility of tourists in smart cities.

*a) Convenience and Flexibility:* IoT can be used for convenience and flexibility in tourism domain. It can integrate various tourist services. All stakeholders

through IoT enabed devices can communicates among each others. IoT based services and applications can make tourism resources such as: roadside smart machines, police control room (PCR) vans, and mobile services more convenient. IoT can also provide these tourism resources more secure and reliable.

*b) Consciousness:* By the help of social networks and IoT, the awareness for tourist mobility in smart cities and other tourist places can be improved. For example, the information about hotels, and tourist places can be integrated in a smart map. This smart map can be helpful to all stakeholders such as: traffic police, tourism office, transport services, and hotel services to exchange information. This facilitates an inclusive support that allows tourists to connect with the real time support team, explore all the probable options to their needs and take knowledgeable decisions.

*c) Independent Initiatives:* IoT can helps different stakeholders in the detection, design and operation of new ideas on tourist independent mobility. It not only facilitate to investigate for initiatives and join them, but also suggest new initiatives, to evaluate and comment on them.

*d) Tourist attitude towards the problem:* IoT solutions will help improving tourist responsiveness towards the tourism problem. Further, it can be used for the design of real time model of allocating social scoring. This social scoring approach will attract and involve all stakeholders. These processes encourage participation and forthright behavior through virtual and real incentives. This approach will also increase the effects and duration of the engagement of all stakeholders in independent mobility campaigns and enhance their sustainability in time.

*e) Mining and Monitoring:* Further, the tourism ministry and government authorities can take the help of data mining and monitoring mechanisms to make the system effective [12]–[14]. Mainly, the tourism mobility, volunteer availability, pattern in volunteer involvement, pattern of emergency help request, etc. can be mined and monitored. Based on the output of the mining and monitoring process, adaptive steps can be taken for betterment of the system.

## IV. iTOUR - THE PROPOSED FRAMEWORK FOR TOURIST INDEPENDENT MOBILITY

This article presents a framework for "Tourist Independent Mobility" called iTour. The iTour platform is driven by a set of novel ideas, taking into account of all stakeholders requirements and needs. It combines the IoT techniques and tools to use the services and data available on the way. Further, it allows easy, faithful

coordination and co-operation of available resources. It makes the use of information exchange to make tourist life easy. Further, the possible resources which can contribute to the tourism ecosystem has bee identified.

### A. Resources and their Involvement

The iTour Resources and their involvement is shown in Figure 4. In the tourism independent mobility framework, most of the resources which are needed are pre-existing. If anybody wants to help tourists, there is a trust gap between a tourist and local volunteers due to the fear of getting trapped by dishonest people. Even if there is trust, in some cases there is insufficient information, equipments for connection and cooperation between them. Therefore, the aim of the framework is to identify such resources and provide them a suitable platform using IoT solutions (iTour). It is a easy way of coordination and cooperation in the tourism ecosystem, with some level of authentication.
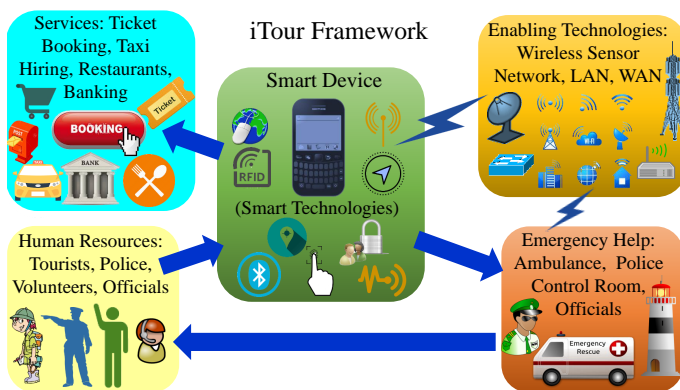


Fig. 4. iTour resources and their involvement through IoT.

Further, the IoT solutions can be used to analyze the functioning of the system to provide proper feedbacks from time to time to make it adaptive. Real-time monitoring of the system by iTour can help in handling crisis situations and can improve effectiveness of system as well. The available resources those can contribute to iTour are broadly classified as *Human Resources* and *Non-Human Resources*.

*a) Human Resources:* Based on the interactions, the people who can contribute towards the improvement of tourism management system and promotion program can be identified. These are the set of people involved in the tourist management system to help the tourists are categorized as Human Resources. Such a collection of stakeholders includes the *public employees* such as officials from home department, tourism department, transport department, police department, PCR van incharge, post office, and bank. It also included the *private partners* such as hotel managers, vehicle drivers,

socializing spot managers, and cultural event managers. Volunteers such as on-road tourist helping volunteers, cultural exchange centers, and human interpreter, are also a part of this.

*b) Non-Human Resources:* In tourism management system, both human resources and non-human resources need to be coordinated. These non-human resources need to be connected to iTour to make the life of tourist and tourist support team more comfortable. The iTour framework consists of integration of IoT solutions such as sensors, GPS, WSN, smart devices, smart map, Internet and different types of services. IoT enbles these objects to connect and exchange data using wireless protocols.

*c) Services:* The iTour provides different types of services. Booking tickets in hotel, reserving the seat in a taxi, searching for essential services such as banking, guide, restaurants and fooding, and posting. can be done through the smart devices. Morever, smart devices support user authentication and security. It also provides emergency services such as ambulance, fire brigade, and police. In emergency situations such as theft, road rage, and medical emergency, the user can use these services.

### B. iTour Working Principles

Each human actor involved in iTour are provided a *Smart Device*. Each smart device is uniquely identified by the means of identification. It also has the provision of authentication by the help of fingerprint sensors. With this device, the actor can easily communicate to iTour and other users within the range. The private partners will go through a background verification and then they will be provided with a smart device. All the stakeholders will be connected to the iTour by the help of smart device. All smart devices are GPS enabled and equipped with internet and other services such as RFID, smart lock, bluetooth, smart map, and sensors.

The iTour deployed in a WSN environment. It is assumed that nodes on the WSN relaying on central entities such as base stations or access points. However, the node deployment can be ramdom or structure depending upon the application area. With the help of the authentication and location information that are collected through the WSN and smart device, the iTour will provide various functionalities such as smart map, real-time mining and monitoring of iTour services. The *Smart Map* consisting of following functionalities: (1) resources at a glance, (2) trace volunteers and resources, (3) real-time travel assistance, (4) volunteer map, (5) vehicle map, and (6) emergency help. Different types of actors involved in the iTour framework are represented with a unique symbol. These symbols and their meanings are given in Table I.

TABLE I
MAP SYMBOL CHART.

| Symbol | Meaning |
|---|---|
|  | On road volunteer |
|  | Road side shop owner volunteer |
|  | Volunteer who can contribute some time with tourist for help |
|  | Police control room (PCR) bike for help |
|  | Police control room (PCR) van for help |
|  | On road police for help |
|  | Traffic police for Help |
|  | Tourist |

*1) Resources at a Glance:* This map can only be viewed by iTour manager, Tourism department, Home department and other government officials. Using this map one can view all resources at real time on the city map. The mining and monitoring reports are available in this view. The monitoring component can monitor the effective use of resources like average response time to a tourist request, volunteer density near tourists, tourist density at a particular place, immediate instruction to nearby volunteers to support in case of emergency. The view of this map is shown in Figure 5.
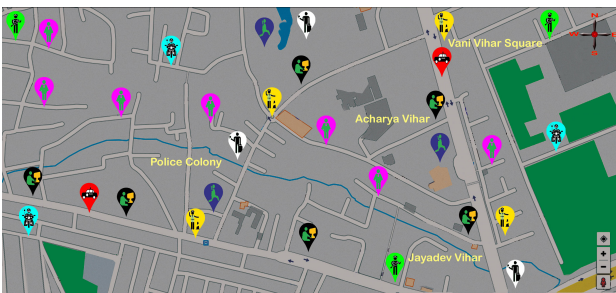
Fig. 5. Resource view at a glance for administrators in iTour.

*2) Trace Volunteers and Resources:* With the help of this, the tourist can view nearby volunteers. The volunteers may include on-road volunteers, road-side volunteers, local volunteers and public officials on duty. One can get instant assistances from any of the nearby volunteers. Before communication, there will be a both side fingerprint authentication process by the smart devices. In a similar view, one can trace resources like po-
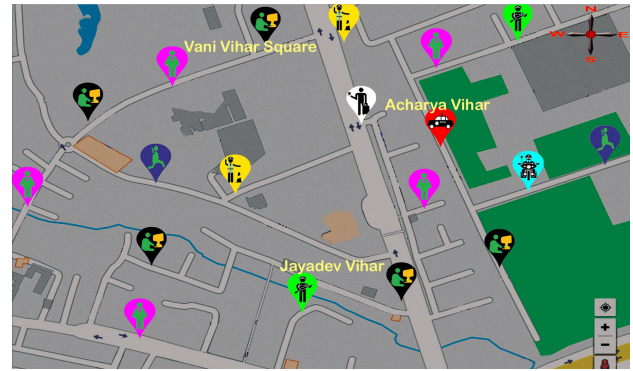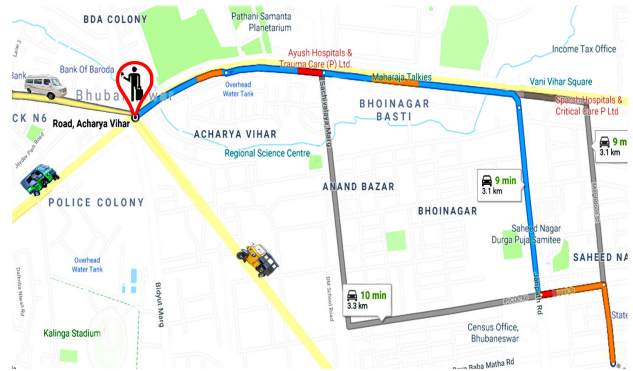
Fig. 6. Trace volunteer map in iTour.

Fig. 7. Trace vehicle map in iTour.

lice station, post office, bank, hotel, restaurants, shopping mall, and socializing spots. Also there is a possibility of online communication through smart devices. The view of this map is shown in Figure 6.

*3) Real Time Travel Assistance:* In this view, a tourist can ask for a travel plan from one place to another place. The map will show some of the best possible options available at that instant for that request. The user can select one of them to view in detail, such as class of vehicle, price per distance, availability of tickets, direct/connecting travel service, response time, and turn around time. If the choice matches, then the available service will be displayed on this view and the tourist can plan accordingly. By comparing the options, the tourist can book the vehicle or reserve a seat in vehicle. The view is depicted in Figure 7.

*4) Volunteer Map:* In this view, a volunteer can view the details of a tourist. When a volunteer receives a request from a tourist, he can verify the details through this view.

*5) Vehicle Map:* In this view, the vehicle in-charge will set the starting and ending point and its route on the smart map. The on-road sensors will automatically update the current position of the vehicle. This will be used by the iTour to provide vehicle assistance. This can

be also used for ticket booking.

*6) Emergency Help:* With this view, the tourist can use this help option in case of emergency situation. When the help option is pressed, the tourist smart device is connected to all emergency services such as police control room, hospital, and tourist department. The authority can take necessary steps as per the need of situation.

## V. CONCLUSIONS

Tourism is one of the major component of economy growth of many countries in world. Due to the lack of coordinated services, tourism has suffered a lot. In this article, an IoT framework called iTour has been presented which was implemented Java. In iTour, the smart citizens can participate in tourism development. It enables the city administrator accountable towards the cooperation and coordination of tourist daily life in a city. It can also use data mining techniques to prepare the city for future tourism. The effectiveness of iTour is being proven through in-depth evaluation in a smart city by involving all stakeholders.

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