Convergence of IOT in Tourism Industry: A Pragmatic Analysis

Convergence of IOT in Tourism Industry: A Pragmatic Analysis

Amit Verma[*], Vinod Kumar Shukla[#], Robin Sharma[#]

[*]HTMi Switzerland Dubai, U.A.E
[#]Amity University, Dubai, U.A.E

amit.verma@htmidubai.com, vshukla@amityuniversity.ae,
rsharma@amityuniversity.ae

Abstract: The term IoT commonly used abbreviation of 'Internet of Things' is trending and ascertaining the possible disruption in the tourism and hospitality industry. The industry is a complex interaction of several stakeholders and ancillaries working together for the experience of the tourist. It includes host government, local population, attractions, transportation, accommodation, food, and Beverages etc. tightly embodying the local trade, art, craft, festivals, religion, culture and many more. The tourist is the end consumer seeking experience and justifying with his Imagescape. The Imagescape could be different for the same destination in different people's mind. The destination management companies work in order to continue, refine, or modify the current destination image to increase the tourist flow. With the IoT, Big Data, blockchain technologies, the destination will become a closely monitored space for the behavior of tourists, shopping patterns, visitation to each attraction, time spend and monetarily benefits generated. The reports will lead to well-calculated decision making for destination management and development of tourism and ultimately impacting the GDP growth. The Tourism industry has always been witnessing the changes and has been upgrading its attire accordingly. There was a time when internet overwhelmed the industry with multiple upgradations and now the Internet of things is going to influence the industry and tourist vividly.

Tourism has been changing with the shifting technologies for several years and has shown multiple advancements to its operations and processes. Another technological trend of IoT is converting Tourism to the Smart Tourism and IoT is the core technology to transform the tourism industry with the help of cloud computing, mobile communication, blockchain, big data and artificial intelligence aligned to enhance the tourist experience. The hospitality industry is counted mainly on the utmost service standards and their executions with intangible characteristics. In such a complex industry, the innovative technology IoT has begun its influence to seek the customer's satisfaction, cost saving, and business profit. Apart from the personalized rooms, predictive repair and maintenance the IoT will be enhancing the guest experience as well through the Electronic Key Cards which is sent by the hotel on your mobile phone to access the room directly without wasting their precious time in the reception of hotel. The hotel may also charge the guest as per the removal of beers cans from the mini bar of the room without the additional run through of a staff.

The paper is crafted to identify the impacts of IoT on the tourism industry and proposes the model to streamline the industry with tourist's movement in order to analyze the tourist's experience completely. The Tourism industry is widespread and includes several stakeholders in overall channel of the tourist circuit. The industry is full of diversities and experiences in diversities. The trending technology may act as a thread to sew all in one comprising the experience and solve the issues of accurate data collection in the tourism industry. Fourth revolution technologies all together making an impact on the working of any domain, and hospitality and tourism industry is one of the front runners in implementing these technologies. The IoT has already started its impact all around the industry and tourism industry is thriving to match the pace to be smartly connected with its guests all the time in hotels transportation or attraction. The technology is still in the early stages of growth and implementation. The paper is divided into three sections of introduction, discussion on influence of Internet of Things technology in different fragments of tourism industry and the impacts of IoT concluded with a proposed model. The model presented in this paper analyzes the impacts of FIR technologies in particular of IOT in tourism domain.

1.0 Introduction

The IoT commonly used the abbreviation of 'Internet of Things' is progressing and ascertaining the possible disruption in the Leisure industry. The industry is a complex interaction of several stakeholders and ancillaries working together for the experience of the tourist. It includes host government, local population, attractions, transportation, accommodation, food, and Beverages etc. tightly embodying the local trade, art, craft, festivals, religion, culture and many more. The tourist is the end consumer seeking experience and justifying with his Imagescape. The Imagescape could be different for the same destination in different people's mind. The destination management companies work in order to continue, refine, or modify the current destination image to increase the tourist flow. With the IoT, Big Data, blockchain technologies, the destination will become a closely monitored space for the behavior of tourists, shopping patterns, visitation to each attraction, time spend and monetarily benefits generated. The reports will lead to well-calculated decision making for destination management and development of tourism and ultimately impacting the GDP growth.

1.1 The e beginning of Internet of Things (IoT)

The technology which is connecting devices to devices through the internet or cloud service by fitting the sensors into machines to collect and distribute data and make the analysis easier, accurate and in real-time. The devices are not only communicating the numbers but supporting brittle usage of machinery in industries, customer service in consumer-focused companies and overall analytics. As per the forecast report of statista.com, the mounted base of the Internet of Things devices will reach almost 31 billion worldwide till 2020 and the annually projected worth is more than 1,000,000,000 U.S dollars annually[1].

The automation has already revolutionized the industry and now the customer experience will be enhanced through personalization of automation and streamlining the industrial processes. The room temperature is altered as per the need of the customer and monitored to switch off and on to save energy and overall operational cost of the hotel. Similarly, the flight crew may get to know the anxiety level of the passenger to serve him better. Moreover, the pre during and after analysis of the processes in the industry like flight and room occupancy can help to avoid the loss, resource usage, and precise services.

To sum up the understanding with the definition quoted by ITU International Telecommunication Union in their Recommendation in framework and functional architecture "The IoT can be regarded as a global arrangement for the information society, empowering advanced services by communicating (physical and virtual) things based on prevailing and developing interoperable information and communication technologies (ICT)." [2].

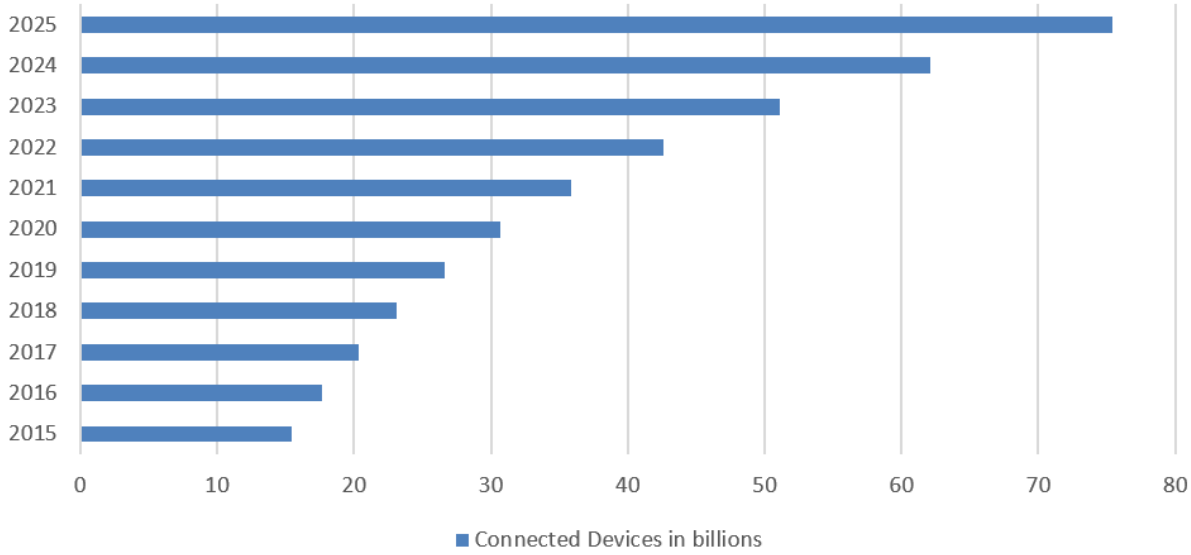

Fig. 1 – Chart: Number of Connected devices

The IoT is distinguished in two ways as per the usage in industry/ Business or consumer end, the difference is the devices where it is connected. The major areas covered in the IoT business are Production flow monitoring, Remote supply chain, building management, equipment management, Condition-based maintenance alerts, security frameworks, Healthcare, Retail etc. The consumer IoT are Home security, smart home, personal healthcare, Wearable technology, Personal asset tracking, remote appliances, and wireless devices. This would lead to the growth of connected devices worldwide as depicted in the Figure 1. The overall benefit of the IoT is a convenience for today's and analysis for immediate decision making and securing the future of the company and globe. For example, the conservation of energy, solar plants, and projects, conservation of water, pollution and waste reduction, green buildings, emission management and recycling.

2.0 Tourism industry

The tourism industry constitutes of multiple stakeholders and impacts the overall GDP of any country. The industry is vitalized through the recent technological advancements from time to time. The tourism industry includes the service from a travel agency to a museum or a train trip and flies along with the airplane and cruises with liners. The broad categorization has been made to express the impacts of IoT in the industry under following heads illustrated under in Figure 2. The Trains, Flights, Airport, Hotels, Travel, Restaurants (Kitchen), Destination and Tourist attraction. This section will briefly discuss the recent influence of the technologies in a particular part of the industry.

Fig. 2 –Broad Categorization of Services in Tourism Industry

2.1 Internet of Things – Trains (IoT Trains)

The trains are becoming smarter through the incorporation of data streaming and analysis from several sensors all across the train and its path that generates billions of data from each point per second with IoT technology adopted by SAS Analytics. SAS are leaders in analytics known for and further named the company on its successful program "Statistical Analysis System". The reliable real-time data is generated by 1000 locomotives across North America by using SAS to analyze data streaming from sensors per second concludes to a lot of data to keep the operation efficient, safe and reliable. [3]. The internet of smart trains works in many constituents of the business as communication system, service and requirements, smart infrastructure (monitoring maintenance, assets operations and surveillance) Information service (passenger, freight) and train Control (automation, safety, cybersecurity, signalling and efficiency) [4].

The Reliability of trains can be enhanced by advancing the usage of IoT is no longer a thought as Cloudmoyo (partner for Microsoft cloud and big data analytics) has proved its success through mountains of data and developing technologies like DDTC (Damaged and Defective car tracking) and ISS (interline settlement system) [5]. This is not only one to be showcased, many more railways have revolutionized themselves with IoT for example- Siemens has moved a step ahead with the help of IoT to guarantee reliability to the operation of the train for German national Train operator Deutsche Bahn, likewise in Russia and Spain [6]. Railnova a tech entrepreneur in rail with major clients like Eurotunnel, Lineas, DB Cargo etc. is planned to serve the industry with 4 billion Euro stock. [7].

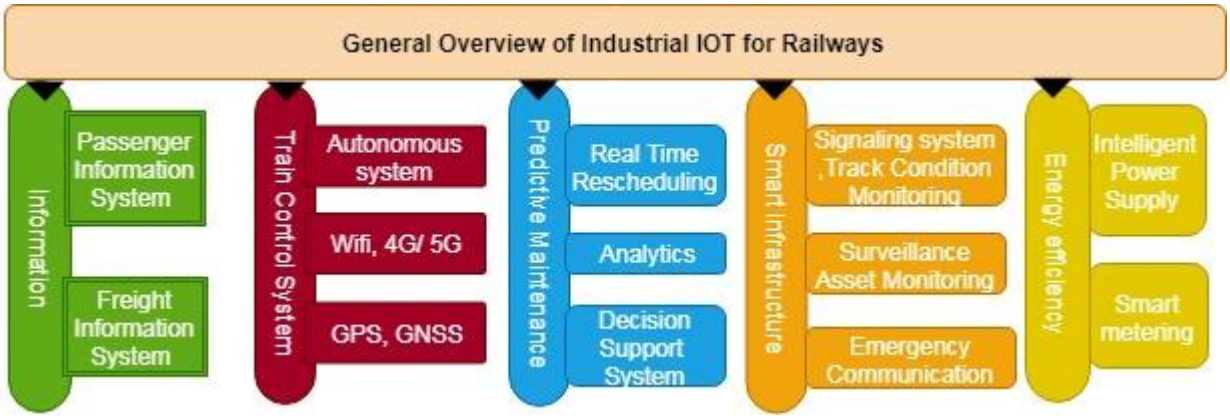

Fig. 3 – General Overview of Industrial IoT for Railways -Source:[4]

The overall impact of IoT in railways is substantial and has affected both the industrial and passenger front of the industry. The implementation is not just for the revolutionary attempts and trials; however, the technology has improved the safety, convenience and overall cost benefits with an effective and efficient railway system. The industrial IoT broadly have five heads divided into information, train control system, predictive maintenance, smart infrastructure, and energy efficiency as illustrated in the figure 3. The information of passengers and freight that keep the right information of load at all times and the (autonomous, Wi-Fi and GPS control system keep it connected for real-time rescheduling, analytics and decision support system for predictive maintenance. The smart infrastructure chipped with smart sensors and actuators of IoT technology will enable to communicate, control and monitor the track conditions, signalling system, surveillance, and emergency communication.

The current worldwide high-speed train network is spread across 46,483 km and major part fall is Asia with 36,372 km where China alone covers 31043 km of operational rail lines. Whereas the overall Europe network of high-speed rail lines network 9176 km and others hold 935 km. The overall under construction planned and long term planning high-speed rail network comes to 11,987 10,217 30,321 respectively. This constitutes the total of 99,008 km [8] of high-speed rail network that must be secured and loaded with all safety and high maintenance features.

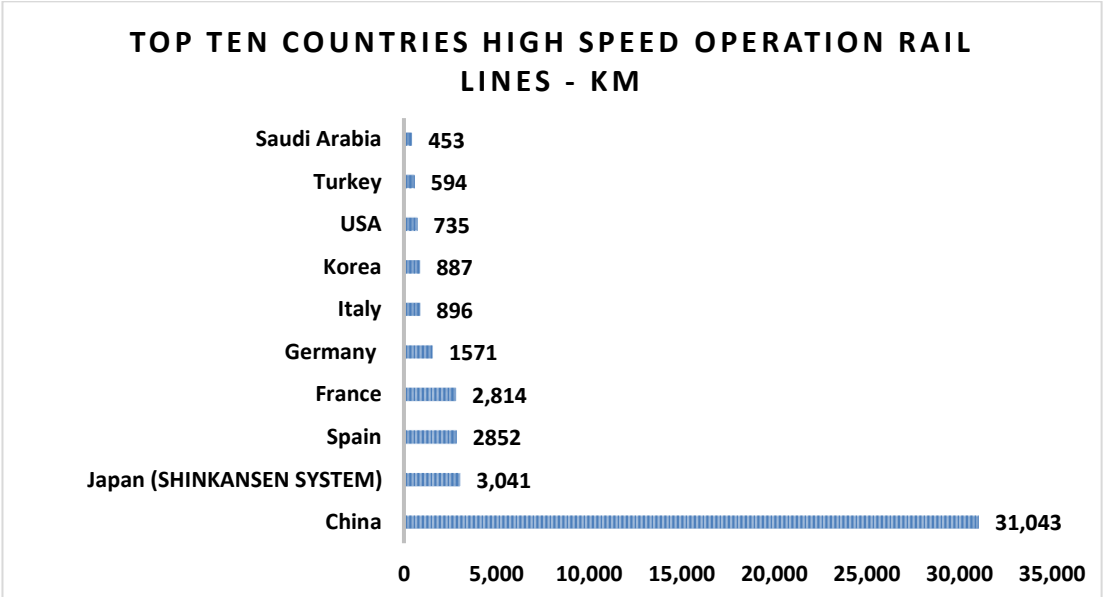

Fig.4 – Chart: Worldwide operational high-speed rail lines network in km – Top Ten Countries [8]

The Figure 4 represents the top ten countries with their high-speed rail network in kilometres that is operational and the approximate train speed in this network is around 250 km/h. China has secured the largest network and other countries seem to be quite far from achieving the numbers in near future though they have shown an incredible coverage as per their land sizes.

The D-rail, a Sweden based company has received one more award from the UIC Digital Awards at a conference (2018) in Paris for innovative monitoring of balises overhead electric, tracks, Wheels and Switches – on any railway network. The founder and CEO at D-Rail, Christoffer Hamin has been awarded for his ground breaking and innovative solution of infrastructure monitoring. [9]. The company like pro rail has implemented the sensor based IoT network for the passenger trains which identifies the quality of the track, noise, position movement and temperature, humidity etc. of the wheels and the dashboard of the train keeps the track of all these information. [10].

Similarly, the Voestalpine, an Austria based Railway Systems Company and a technology leader in innovation has provided a single source solution for all high-speed traffic requirements like high-speed overview, heat treated rails, modern turnout technology, setting signalling, monitoring and tracking technologies. [11].

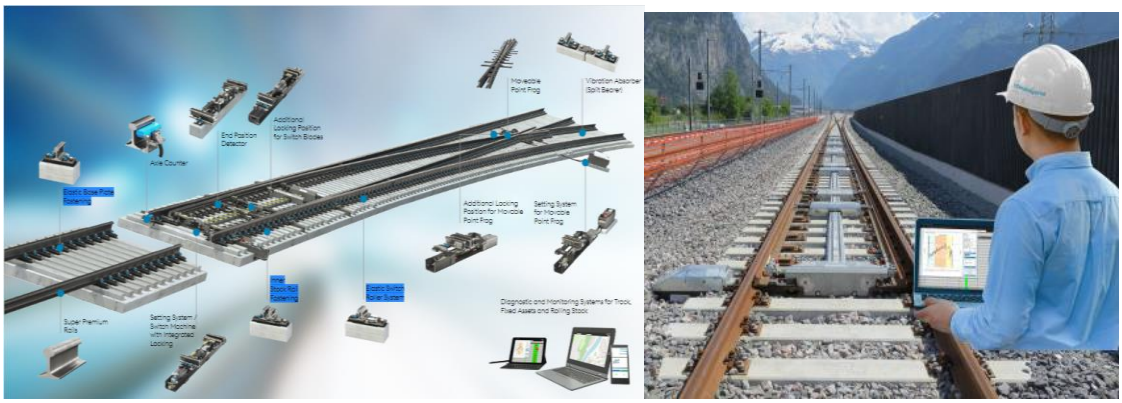

Fig.5 The innovative technologies implemented in the track [11].

2.2 Internet of Flights

The impact of IoT has revolutionized the aviation industry and still, multiple advancements are awaited to be implemented. The next generation Airbus (A380 Neo) is coming up with Ten thousand sensors installed on its wing. The Panasonic Company a major technology supplier to several airlines has started satisfying the demand of the advanced management of aircraft and its system (in-flight communication, four-dimensional weather prediction, Aircraft tracking service, etc.) and planned to ensemble 10,000 of airlines in upcoming decades with the advancement of IoT. Honeywell has used the data from the IoT sensors through software and identified the ways to reduce the fuel cost more than 5 percent per flight. The information of wind and temperature to pilot will improve the fuel performance significantly through the Honeywell's FMS datalink service. Moreover, the internet connectivity and in-flight video conferencing worldwide are added to 6000 new aircraft [12].

The worldwide leader in embedded software company Wind River integrates the IoT solution to reduce the overall operational cost of commercial aviation by utilizing the real-time device data for predictive maintenance and flight management. The real-time connectivity and data flow will maximize the efficiency and will benefit all parties through calculated flight paths reducing landing and take-off time.

Additionally by sharing the real-time scenarios like turbulence, the other can plan alternatives to avoid the route and save the consumption and customer's satisfaction [13].

The Airbus has tackled the issue of possible errors and their associated costs due to the complexity of process and components in a commercial aircraft by introducing the wearable technology and integrated sensors to tools and machines. Similarly, the Boeing has also aggressively have deployed the IoT in manufacturing to seek efficiency throughout the factories and supply chain. [14].

The Internet of things has changed the aircraft design, manufacturing, processes, avoiding the bottleneck and enhancing efficiency by real-time data and analysis. The analyst forecast the growth of IoT-Aviation market the CAGR of more than 19% till 2021 and market will reach to USD 14.23 billion [15]. The technology has evolved all the systems from manufacturing to the experience and have hugely impacted the airline industry. Over 80% of the airlines are focused on the personalization of the trip and 35% of the airlines have already allocated the budget for the IoT operations and 71% airlines state that they understand the benefits of IoT and 86% believe it will create a significant improvement [16]. As per the report from the GE published states that the maximum usage of the IoT will be 66% on the fuel and engine Monitoring detailed in figure 6.

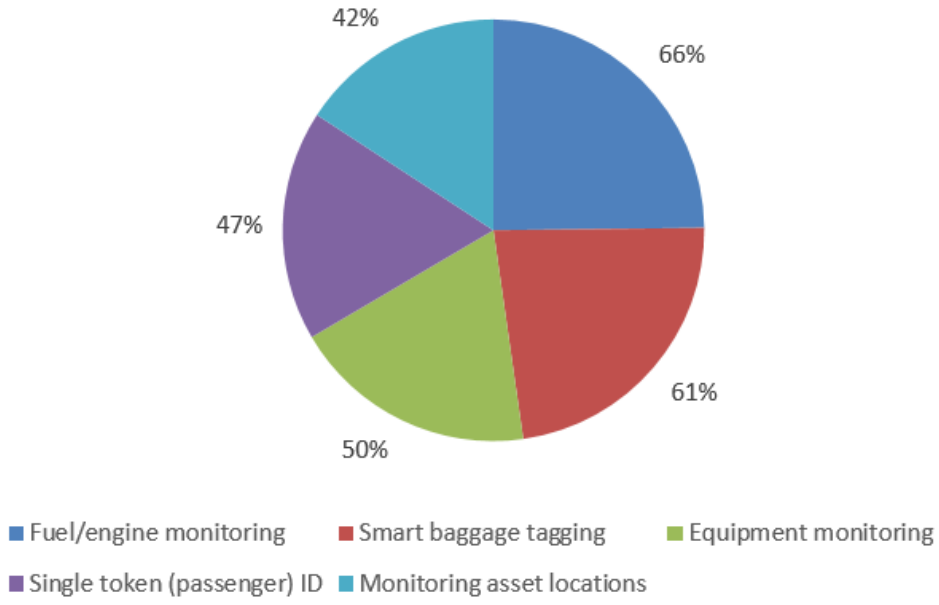

Fig. 6 – Chart: Usage of IoT in the Airline Industry

Delta Airlines have invested USD 50 Million in implementing the technology in real-time tracking of the baggage. 42% of airlines are considering the check-in as the first and 42 % consider it among the top 3 priorities of IoT revolution[17]. The Virgin Atlantic has gone way ahead to implement the IoT connected 787s where the sensors will be collecting a huge amount of data from the landing gear to the fuel consumption and almost all necessary processes of the aircraft to ensure the safe and reliable experience to the guest. Air Asia has also made an initiative to reduce the carbon footprint and save USD 50 million over the next five years by using the IoT based technology by GE Flight efficiency services. Likewise, the Qantas and JetBlue have provided customers with Virtual reality devices and IoT bases check-in respectively[18].

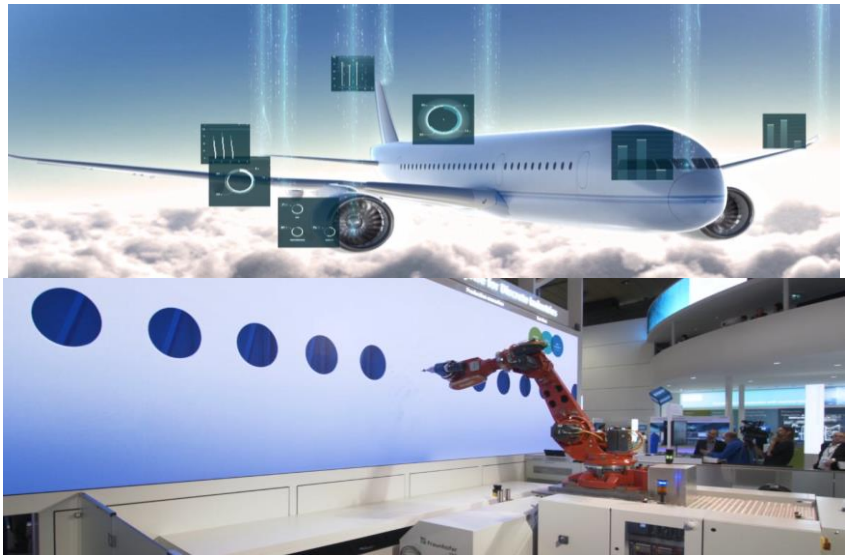

Fig. 7– (a) IoT and Aircraft data (b) IoT enabled tools for manufacturing. Source: [20].

The radical change through innovation has impacted the manufacturing, operations, supply chain and experience with improved products illustrated in figure 7. This will lead to a new set of business models. The IoT will make the factories well connected to the employee and the requirements of each product like the type of screw calling it precision manufacturing. This will be easier with the help of advanced tools that will be configured with the precise location tracking and innate details about the manufacturing such as pressure required on tightening the particular screw. The cost related to fuel consumption, maintenance, staff deployment etc. can be reduced and profit can be enhanced. The cost of a grounded Airbus 380 each day is USD 1250000 which can be easily reduced if the processes can be faster and preventive maintenance can be done. Such a transformation will be resulting in a new value chain system, where the service will be in the limelight [19].

2.3 Internet of Airport

As Airport council international ACI confirms the potential of IoT in airport and aviation industry through the operational improvements and data exchange among the stakeholders. Moreover, the data sharing among the collaborative stakeholders will enable them to take better decision leading to better customer service at passenger screening, checkpoint management, and identity management by real-time processing in the lanes and to the border and security agencies. [21] The technology is opening new opportunities in low cost for the air transport industry and is ready to transform many novel techniques such as improved connectivity to airplanes and baggage tracking etc. available globally and easy to deploy as well. [22]

The aircraft remote access in real time is just the beginning of the trend of connected capability and advance management of the airplanes with the help of higher capacity of the satellite. The utility will reduce the time spent at the airport by the passenger while checking out by transmitting the information from the flight about the passenger and making the smoother airport operations through facial recognition and virtual walls for physical security. The seamless travel, acute personalization, maintenance, and repairs are few of the initial rewards to the industry [23].

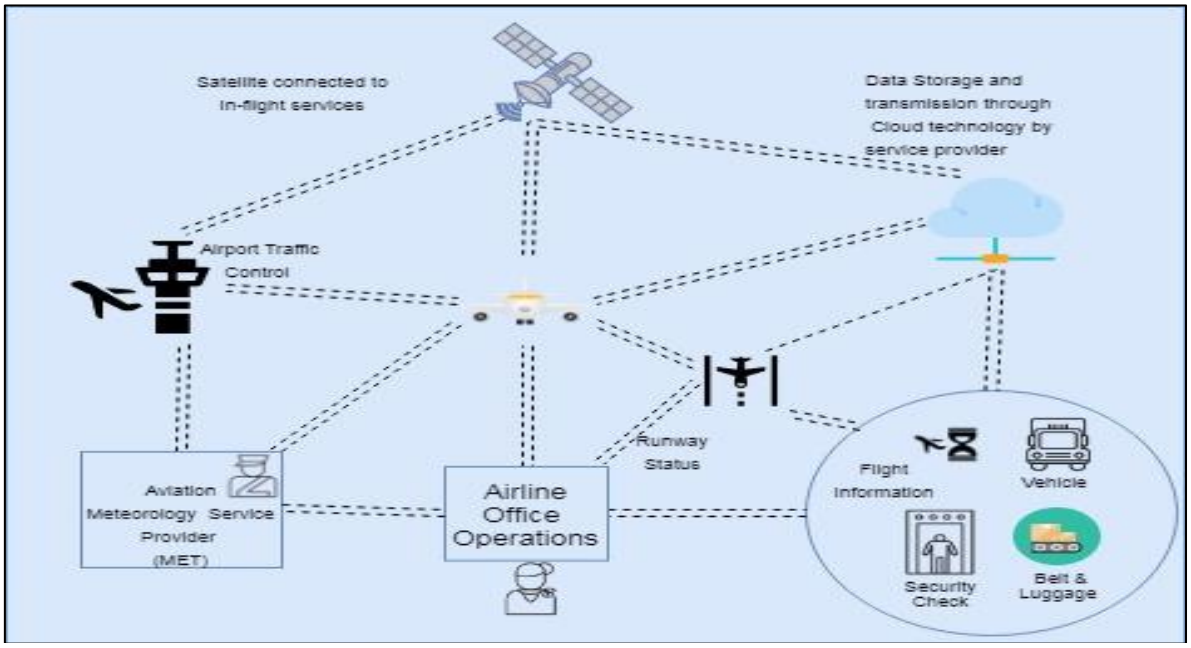

Fig. 8 – Sample of IoT connectivity in an Airport

The sensor-enabled wings of aircraft as portrayed in Figure 8 will convey the information and data through the satellite and cloud to the various stakeholders through the assistance of service providers to and fro, to the runway, ATC, Airline operators and airport utilizing the data for smooth operations and customer convenience in arrival and departure airports.

The London city airport has the first place in implementing the IoT to ensure customer satisfaction [24]. The Munich airport have recently extended the project of Siemens of Siemens Postal, Parcel & Airport Logistics (SPPAL), and have deployed the services to develop more connected digital airport for intelligent navigation of passenger flows, continuous tracking of baggage, and transportation that drive independently on airport grounds in addition to predictive maintenance for, and operation of, systems such as the luggage management and airport technology [25]. The Director of Information Systems, Miami International Airport (MIA, Mr. Maurice Jenkins stated that the implementation of IoT and innovative technologies in the airport to create the personalized experience through a single application [26].

The Miami International Airport in partnership with Lufthansa, CBP, and SITA have introduced a biometric exit through the facial recognition that provides the expected results in 99% percent of instances[27]. The biometric can be implemented through facial recognition, fingerprints, Iris, palm voice and others and hold a specific percentage of market share illustrated in the figure 9. Fingerprints are the topmost preferred method of biometric followed by eye scan and facial recognition worldwide. The palm, voice and other biometric characteristics remain 10, 13 and 15 percent respectively enabling accuracy, anti-spoofing, hygienic and cost effective as well [28].

.

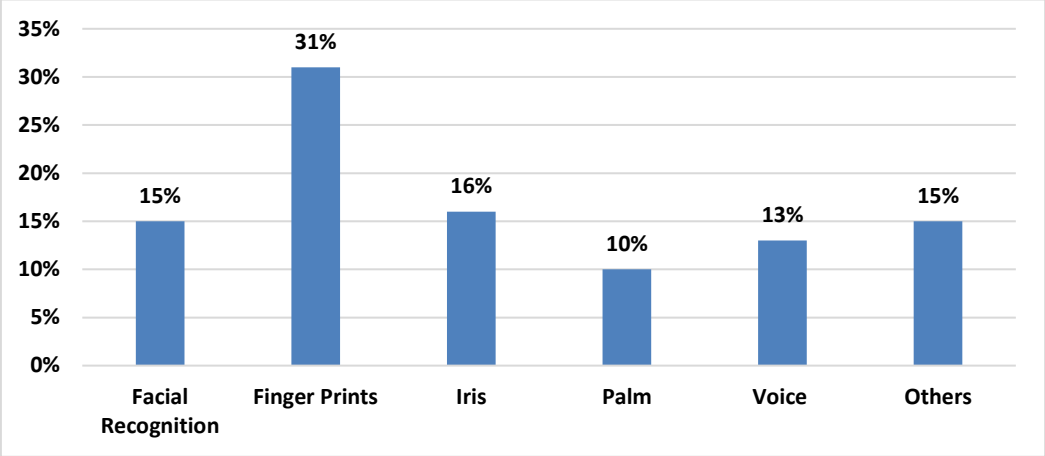

Fig. 9 –Biometric System in Market Source: [28]

The Abu Dhabi airport has implemented IoT and business intelligence through more than 450 sensors installed in 19 areas of two terminals for real monitoring of the data. This dynamic analysis of passenger flow, queue management, immigration etc. leads to increased efficient airport operations, safe and innovative airport keeping the highest priority for passenger convenience. [29]

2.4 Internet of Hotels

As stated in an article by Dr. Ajay Aluri West Virginia University “The IoT platform is the answer to scientific management in the digital life — a "shortcut" to get things done efficiently and effectively for both consumers and businesses”[30]. The boom in IoT Technology will boom the future of hospitality industry, it will get the competitive edge in the market and through the interconnection of devices (sensors, actuators, identification tags, mobile etc.) through the internet [31]. The IoT is no longer in the concepts and researches, though it very much in the industry and statistics is growing for the IoT enables processes, data, and outcomes. The Helsinki airport has installed sensors for tracking and self-service of the passengers and India has installed biometric identification on the immigration that is well connected with the airport and airlines for verification [32].

The hospitality industry is counted mainly on the utmost service standards and their executions with intangible characteristics. In such a complex industry, the innovative technology IoT has begun its influence to seek the customer’s satisfaction, cost saving, and business profit. Apart from the personalized rooms, predictive repair and maintenance the IoT will be enhancing the guest experience as well through the Electronic Key Cards which is sent by the accommodation provider on your smart phone to access the room directly without wasting their precious time in the reception of hotel [33]. The hotel may also charge the guest as per the removal of beers cans from the mini bar of the room without the additional run through of a staff.

The intrusion detection system can notify the passenger about the status of door and window and if something is not as expected will notify the guest to take necessary actions. The Safety of the guest and security of the hotel will be cost effective and will be one of the top reasons for customer’s selection. The guest’s health records and patterns (condition, medicine taking pattern, appointment etc.) can be monitored through the sensors and can be communicated in case of emergency to the hospital [34]. The Security of any hotel is an important feature and the needs a lot more investment and attention to keep the guests safe all the time. The IoT with the intelligent video can monitor the suspicious behavior in the footage of security camera of surveillance and can notify and seize the possibility of theft or intrusion [35].

The future smart rooms of Marriot are going to be fortified with revolutionary facilities of IoT with the collaborative efforts of Samsung. The mirror can turn into a screen and play the exercises at the scheduled hour and room can adjust its lights and temperature, as per the command from the smartphones. The shower can regulate the temperature of the water as per the requirements of guests and at the same time the leakage, status of Tank etc. can be reported to the staff for necessary actions [36]. The influence of IoT technology has already affected the industry by implementing the smart parking, swimming pool remote control, vent balancing between the rooms.

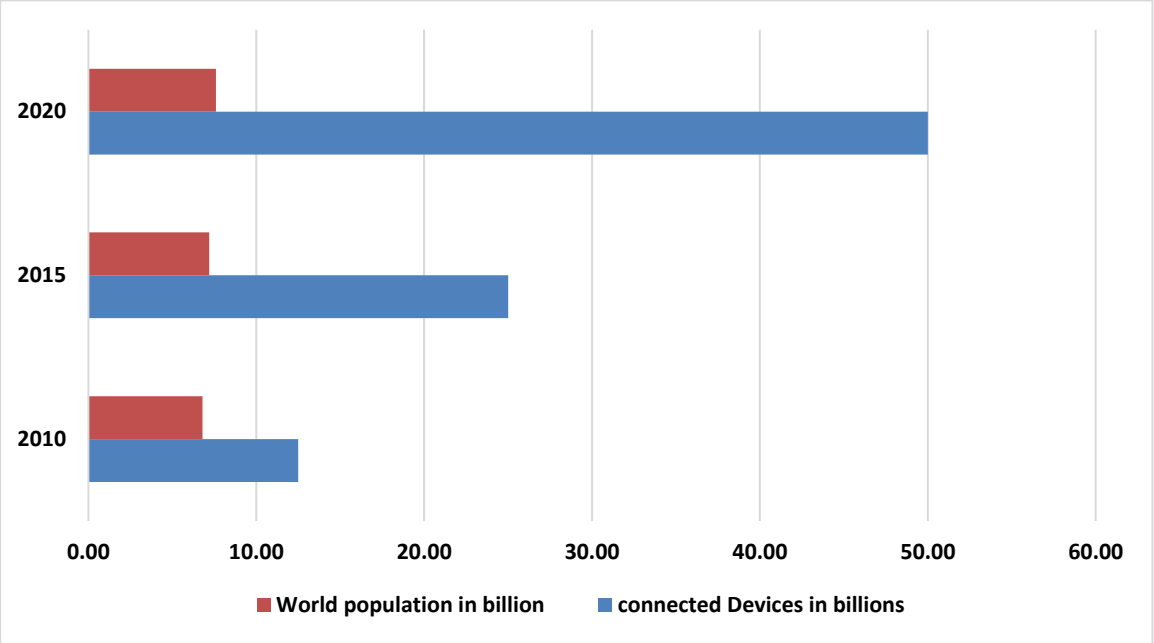

Fig. 10 – Chart: Growth of Connected Devices vs World Population

The data from the IBSG, April 2011 states that there are more connected devices than people in the world, illustrated in Figure 10 satisfies the need and evolution of the IoT technology [37]. As per the statistica. com the spending on smart cities worldwide in 2015 was 14.85 billion Us dollar and is expected to grow to 34.35 billion U.S Dollar till 2020 [38]. The hotel in Japan aims to be the most efficient hotel has got robots and robotic humanoid, a dinosaur and dolls to assist the guests throughout the hotel with the help of some human staff and technological innovation. The hotel has a robot to assist guests with their luggage and sensors to adjust the air conditioning as per the heat of guests body [39].

Fig. 11 – Hotels operating on robots and IoT functionalities. Source: Henn-Na Hotel [40].

IoT has made it a reality, today all imaginations with the help of actuators and sensors for vibrations, sound, camera, motion color, illumination, temperature, and humidity etc. is covering the entire stakeholders of the tourism and hospitality industry. All the stakeholders of any hotel (housekeeping, butler, chef, security, IT, front desk, valet, operations, manager and guests) are directly impacted through the evolution of IoT [41].

2.5 Internet of Kitchens

Restaurants and kitchens of star hotel or in any Tourism vicinity will be safe and healthy due to the IoT technology will not be the only reason for its popularity. Though it will also simplify the operations, reporting, certifications, the efficiency of each equipment, energy saving, HVAC [42], employee productivity, timely maintenance of equipment and supply real-time data to the monitor the services, execution, and satisfaction by connecting front and back end. Moreover, the influence of IoT is visible in the compliance with the food safety regulations, automate and standardize several key restaurant processes and monitor the condition and status of kitchen equipment. [43]. The IoT can improve the accuracy of inventories, reduce food wastes [44] and monitor the quality of food throughout all three stages of the food supply chain (from farmer's field to processing plants to stores and stores to consumer) via kitchens. China started implementing it in 2011 and the European Commission has also incorporated food safety and farming through IoT in the pilot project recently. [45].

As per the statistica.com, the knowledge of IoT of Kitchens is still not widely spread, only 21% of people are only carrying out the IoT projects in Food supplies. The food suppliers' state of knowledge of IoT is illustrated as under in the Figure 12 indicates the initial growth phase of the IoT based kitchen.

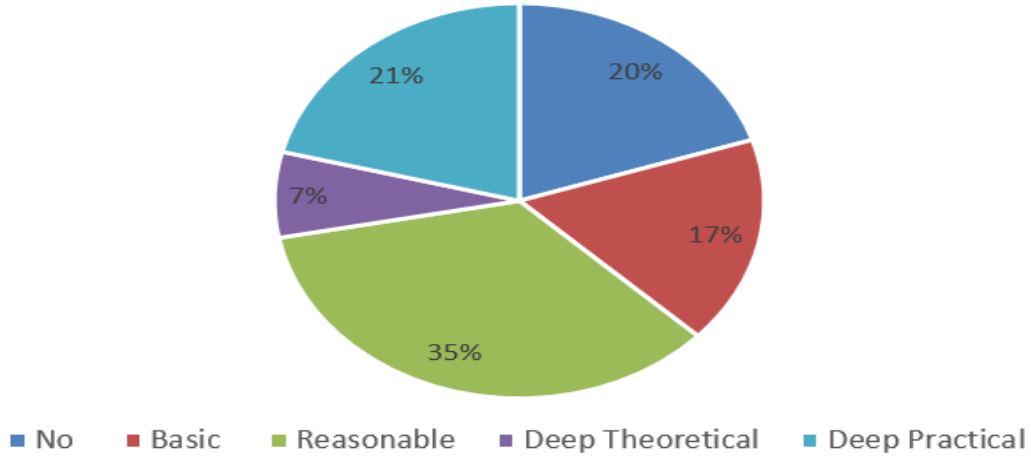

Fig. 12 – Chart: Knowledge of IoT among worldwide Food Suppliers.

The better knowledge of the convenience of IoT will benefit the complete supply chain management to reduce the expenses and increase the profit by a satisfied customer and improved efficiency. Moreover, it will assist in waste management and data-driven maintenance.

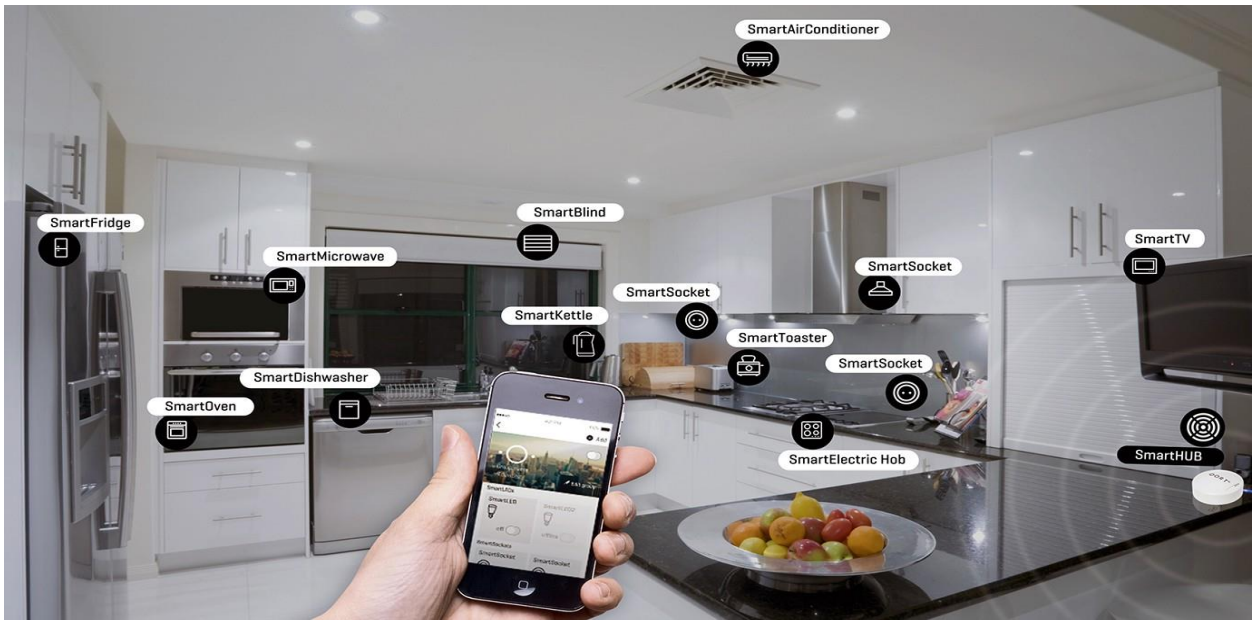

Fig. 13– IoT enabled kitchen Source: [46]

The image displays the future kitchen (figure 13) and that will be translated to a cost-effective and efficient operational restaurant setting which is no longer a buzzword only. Automatic order placing, inventory control, energy saving, and waste reduction are few examples of the environmental, social and economic benefits associated.

2.6 Internet of Destination

Tourism has been changing with the changing technologies for several years and has shown multiple advancements to its operations and processes. Another technological trend of IoT is converting Tourism to the Smart Tourism and IoT is the core technology to transform the tourism industry with the help of

cloud computing, mobile communication, the blockchain, big data and artificial intelligence aligned to enhance the tourist experience [47].

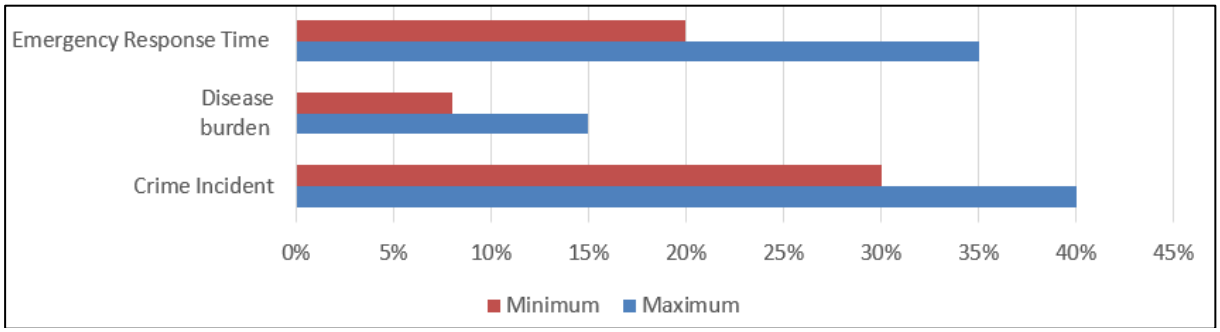

Fig. 14 – Chart: Quality of Life Indicator- Occurrence Basis

The smart cities are the cities which use data and technology to reach a decision to save time to avoid criminal activities, waste, and diseases. The growing smart cities and the usage of such technologies are a good reason to seek 70% of achievement of sustainable development goals. The smart cities are a viable method to promote an efficient and sustainable way to the needs of society. The technology is optimizing the infrastructure and serving a more connected, reliable and sustainable city. As per the report of McKinsey the resources and infrastructure of a smart city can be saved from 10 to 30 percent based on key quality-of-life indicator illustrated in figure 14 for crime disease and emergency responses. [48].

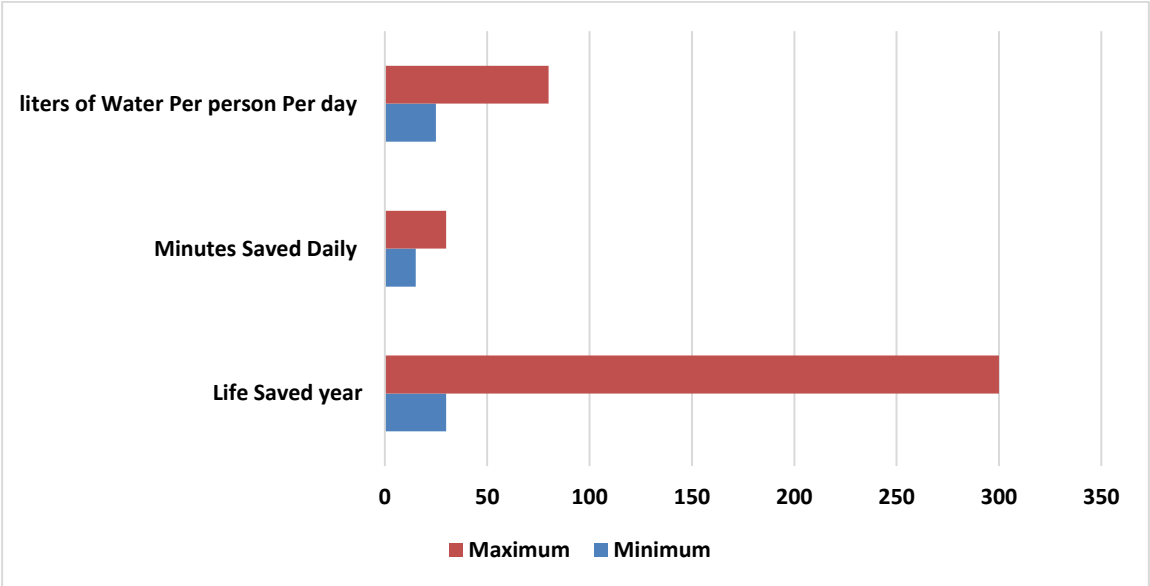

Fig. 15 – Chart: Quality of life Indicator- Day-wise

The quality of life is indicated to get improved with the usage of innovative technologies in the city not only through the convenience of the user but with the waste reduction and possibilities of a sustainable environment depicted in the Figure 15.

The combination of various services in a destination turns out to be a tourism activity if that include smart airport, smart airlines, smart travel, smart guests, smart hotels smart restaurants, smart utilities, and smart monuments make it smart tourism based on the IoT evolution. The tourist destination or smart tourist destination enabled with the IoT, sensors actuators will make the possibility of finding the details

on your smartphone about all what you need. The call for a taxi, the search for the happening place or silent location, safety security liking and disliking all can be conveyed to the manufactures or service providers to enhance the tourist's experience. The collection of right data from the right place and right analysis will provide a chance to use the information to be converted to knowledge and with the wisdom can plan for a better future. Moreover, these technological advancements will lead to the sustainability and managing visitors impacts to the destination resulting a smart tomorrow of the destination illustrated in Figure 16.

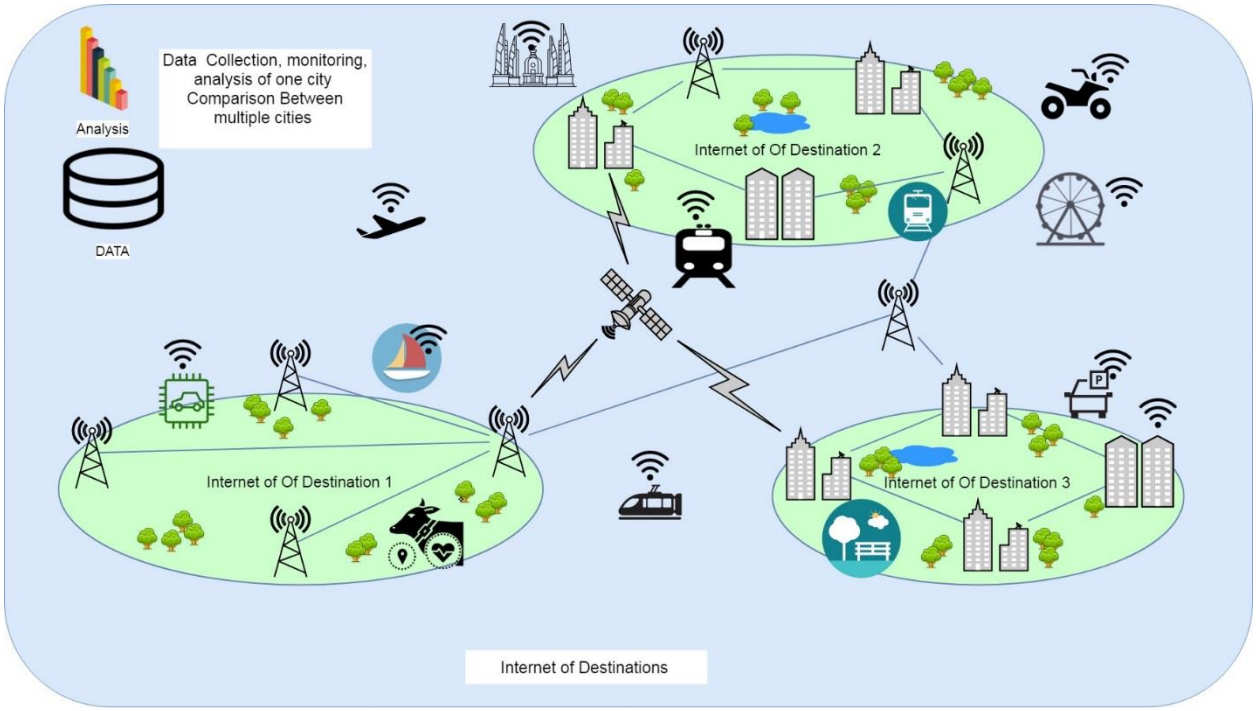

Fig. 16 – Internet of Destination

The technological advancement will enable the tourist to focus on the leisure and pleasure part of the destination besides arranging them. The activities where a group of people is involved like mountain tracking the connectivity may assure the complete leisure experience with the information of right place temperature and options of several services. The information about the traffic, parking, birds in wildlife parks, animals in the zoo, and shows in the auditorium all will be available with the choice of the tourist. This will allow tourist to locate the experience what he is looking for in a destination, for example, a green tourist to reduce the light water wastage and less carbon emission etc. or a religious tourist seeking a holy place attribute. Moreover, the sustainable goals will be met through efficient water saving, time saving, and lifesaving leads to the longer utilization of resources and additional time to focus on leisure and pleasure. At the same time, predictive maintenance will ensure the destination will not be decaying and can showcase it to the new tourists of the future.

The tourism will be exponentially growing with the age of smart city not just by witnessing the smart city infrastructure, however, the substantially reduced disease burden and crime rates in the reports will ultimately enhance the image of a destination and the emergency response will build a long lasting trust among the tourist.

2.7 Internet of Travel

The smart cities based on the IoT technology can control everything hence called at times as Internet of Everything is already providing self-driven taxi service in Singapore for a limousine experience which can be monitored by the business owner through tracking the car or the fleets and reducing the cost. At the same time smart parking and judiciously synced traffic indicators are dipping the travel period and waiting time as well as the real-time navigation alarms will interpret into the reduced fuel intake and profits to the company. This will let the city to develop smooth traffic less uncertainty and improved probability to allow tourist and tour companies to choose the destination. Moscow has implemented the smart traffic management tool and after accumulation of numerous thousand cars in the town, travel speed is still 13 percent better[48]. The on-demand door to door seamless mobility and high-quality public transits can enforce any city into a top tourist demand.

The automobile industry is also equally affected through the IoT, hence impacting the travel and tourism industry. The driverless car is no more imagination, however, today the car is well connected to process many verticals such as customer profiling, marketing, fleet management, infotainment road map, traffic accidents, guest's health monitoring, safety and maintenance of the car leveraging customer and enterprise focused. As per the IBM report by 2020 connected vehicles will generate 35 MB of data per second and can monitor the behavior of the driver as well about risk possibilities, and enabled connected services to provide the real-time information to the service providers [49].

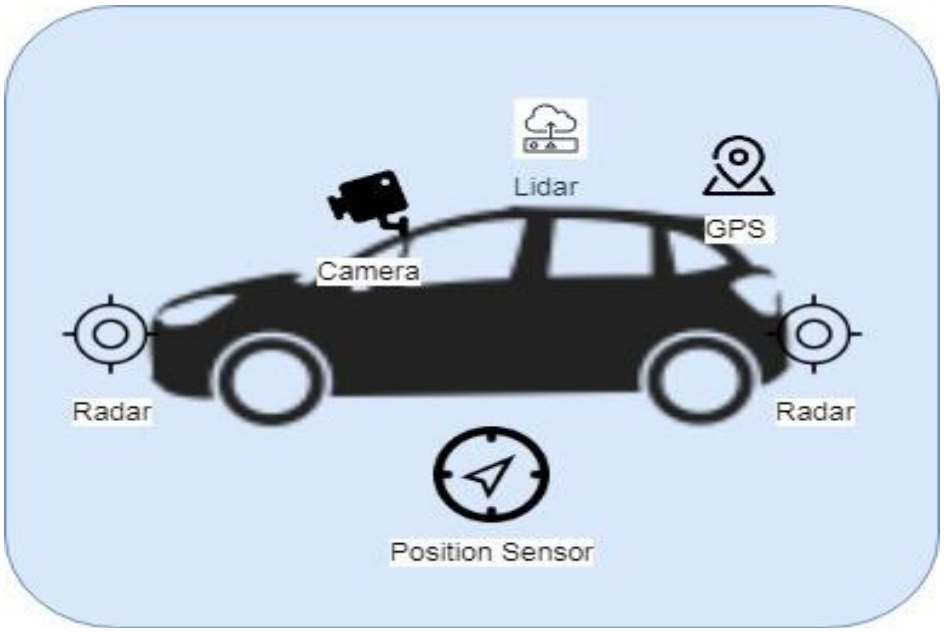

Fig. 17 – Internet of Travel

The IoT Enabled vehicles demonstrated in Figure 17 are based on the camera, Radar, Lidar, Ultrasonic sensors position sensors and GPS navigations that make the cat fully equipped for the self-driving on the roads[50]. The roads need to be networked for the same to be successfully implemented. Dubai in its Autonomous Transportation strategy has aimed to transform 25% of the transportation to automation mode by 2030 saving 22 billions of economic cost annually and environmental pollution by 12%. The overall 396 million hours will be enhanced in the individual productivity hours [51].

The countries and the manufacturers both are prepared for the autonomous vehicle the statistics from the statistics.com supports the statement by providing the list of twenty-one countries preparedness

based on the index score. The below figure 18 demonstrates the top ten countries ready for autonomous vehicles.

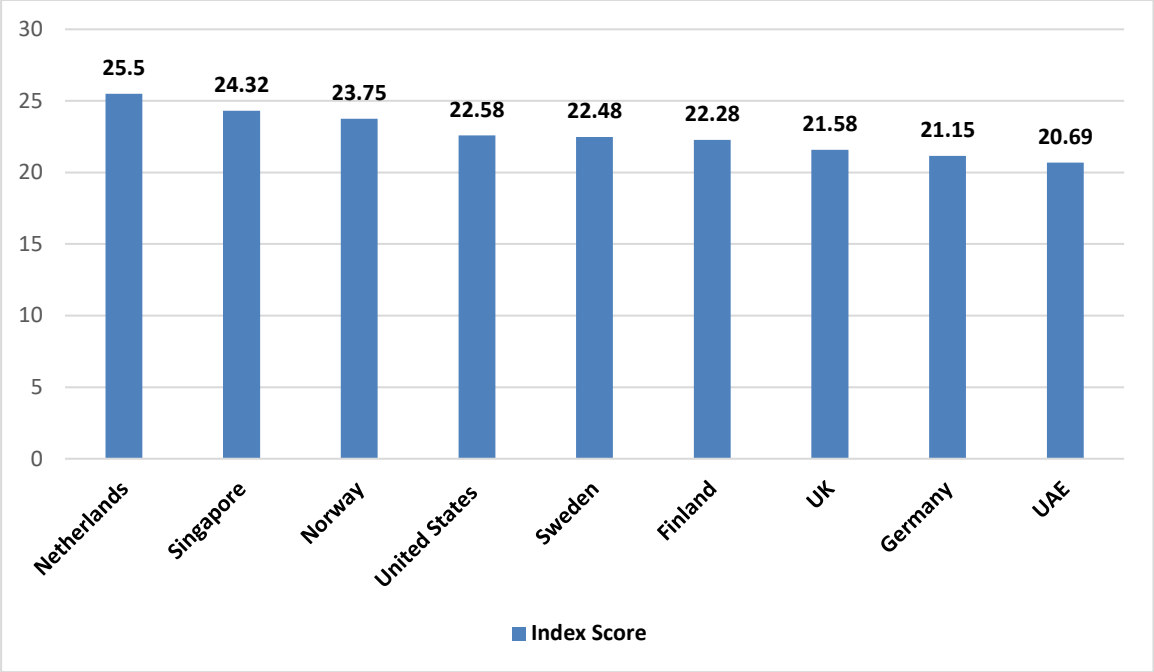

Fig. 18 – Chart: Preparedness for Autonomous Vehicle based on Index Score

Consequently, different car companies such as Nissan, Bosch, cruise GM etc. have also shown a leap in the growth of autonomous car manufacturing shown in Figure 19. The Waymo have completed the highest miles till 2017 and Cruise GM has maintained the next position.

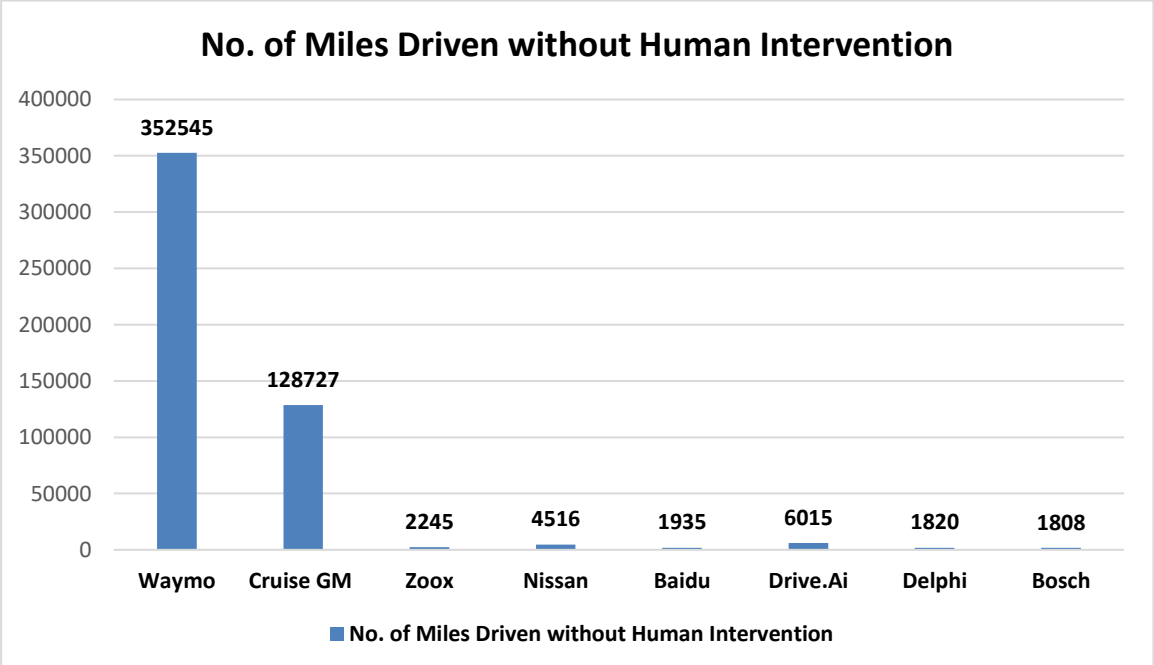

Fig. 19 – Chart: Company registered for autonomous test driving in autonomous mode. Source[52].

2.8 Internet of Tourist Attractions: A case of Museums

An attraction is a place of interest for which a tourist travels and seeks pleasure in leisure activities, be it a museum, theme park or monument of historical, cultural or religious importance. Almost all areas of tourism are advancing with the IoT, hence the attractions as well. The 24th edition of Museums of the World book that listed more than 55,000 museums in 202 countries and the Institute of Museum and Library Services has quoted 35144 museums only in United States [53]. The IoT can enable the asset monitoring inside the museum and visitors' feedback can be generated through the analytics of data and sensors like facial recognition etc. It will enhance the experience of the user through the abduction of heavy hearing aids and fidgeting with the devices by enabling the museum with user-friendly intelligent apps to assist the visitor. At the same time, the battery-driven displays and other assets can renew or updated through the sensor-enabled IoT technology [54].

The museums can enhance the experience of the visitor through providing the relevant, up to date detailed or precise information of the particular segment and exhibit as per the choices of the visitor and be at profit by saving the cost of operation through active analytics and usage of data accordingly. The same will be the case with all other attractions and theme parks which may reach closer to the user insight of attraction and fetch out a lot of data to understand and provide the desired products. The travel companies, Destination management companies or outbound agencies can remain connected to the passenger, guest, and visitor all the time and can notify them accordingly with the necessary and most relevant information and advertisement based on where they are. The location-specific information generated with the help of smartphones, IoT, sensors, and beacon technology will easily provide a huge amount of accurate data to be analyzed by the companies [23]. The IoT sensors can track the conditions of monuments and notify the changes as well.

The Director of IZI travel Dubai, Mr. Ummer Sahib, in a personal interview, said that IoT is the key to the tourism industry. Tourists can simply scan a QR code and listen to the exhibit in a museum. Similarly, for indoors, Bluetooth beacons can be used to detect the position of the handset and then guide the users indoor, using indoor positioning system. He added that is travels have published over 10000 tours for over 97 countries in 58 languages. They constitute 7000+ Outdoor tours, 2000+ Museum tours, 58+ Languages.

3.5+ Million Users, 97+ Countries, and 2000+ Cities. The Izi API can be easily integrated using izi amazon cloud platform. The platform is highly reliable, and audios can be streamed from the platform. Tourism departments and travel agencies who already have audio stories, they can simply publish it in izi platform or integrate izi API in their own apps and stream the audios directly through their app. This enforces the reality and the extent of usage of IoT around the world. The apps are connecting the world and reshaping the industry to smart Tourism industry.

3.0 Emerging Trends and Impacts

The discussion realizes that the data is playing a major role and the accurate analysis of such valuable data may result in the profit to both consumer and service providers. The below image shows the emerging value chain of the tourism industry under the four different layers connecting the industry at all levels to integrate the analysis in all possible verticals to achieve the maximum profit and satisfaction of tourist as well. The model will result in better understanding and the fine development of the product. The evolution of technology has always shown a new advanced surface of growth, and the internet of Things has converted the overall industry from manufacturing to experience analysis. This has developed a new value chain of the tourism industry proposed in the Figure 20.

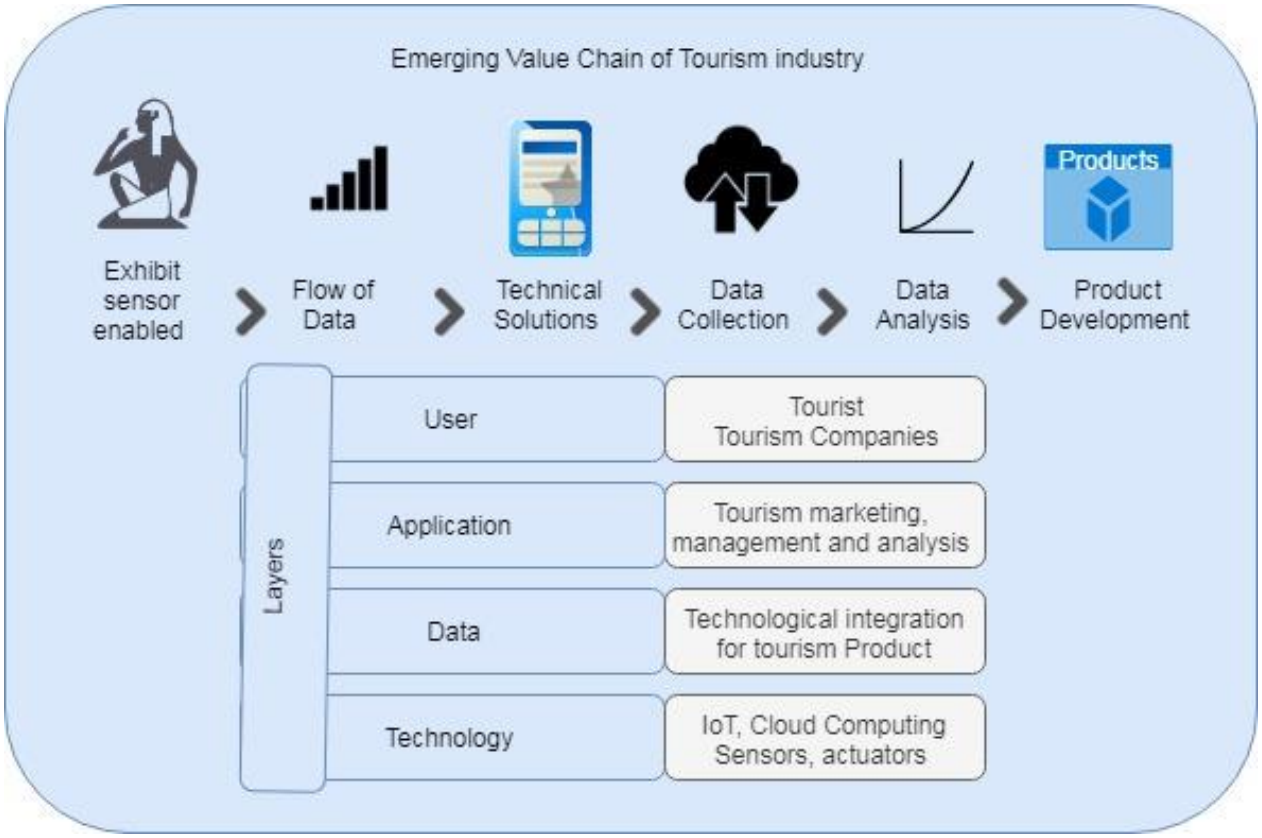

Fig. 20 – Emerging Value Chain of the Tourism Industry

The emerging value chain of each stakeholder will have a lot of valuable data and the combination of all together will result into a huge amount of accurate data that can be utilized for growth development and analytics of destination, tourist behavior, shopping patterns etc. The four layers of technology can be seen in the figure depicts the different verticals of the one process in each part of stakeholder.

As Ms. Carol Hay Director of Caribbean Tour in the UK states in her interview that technology is a great tool letting data management fully dependent on the technology and destinations can do a lot more of the planning of tourist destination with the visitor data. Ms. Hay continues focuses on the usage of IoT in every aspect of the value chain, from consumer buying cycle to the collection of data and analysis of data in the right way. Whereas Mr. Mustafa the Branch Manager of Al Safina Travel and Tourism, Dubai says, technology shifts have shown the changes in online reservations and that has made the buyer more informed and empowered. However, he stated that the move from the current to the highly technological IoT based or virtual reality etc. will impact the tourism industry in long run but will have to overcome several challenges in between.

The reviews from the industry people lead to the importance of technological advancement and the changes acknowledge the movement of value chain system of the tourism industry. To depict the overall industry advancement a model has been proposed under for tourism industry.

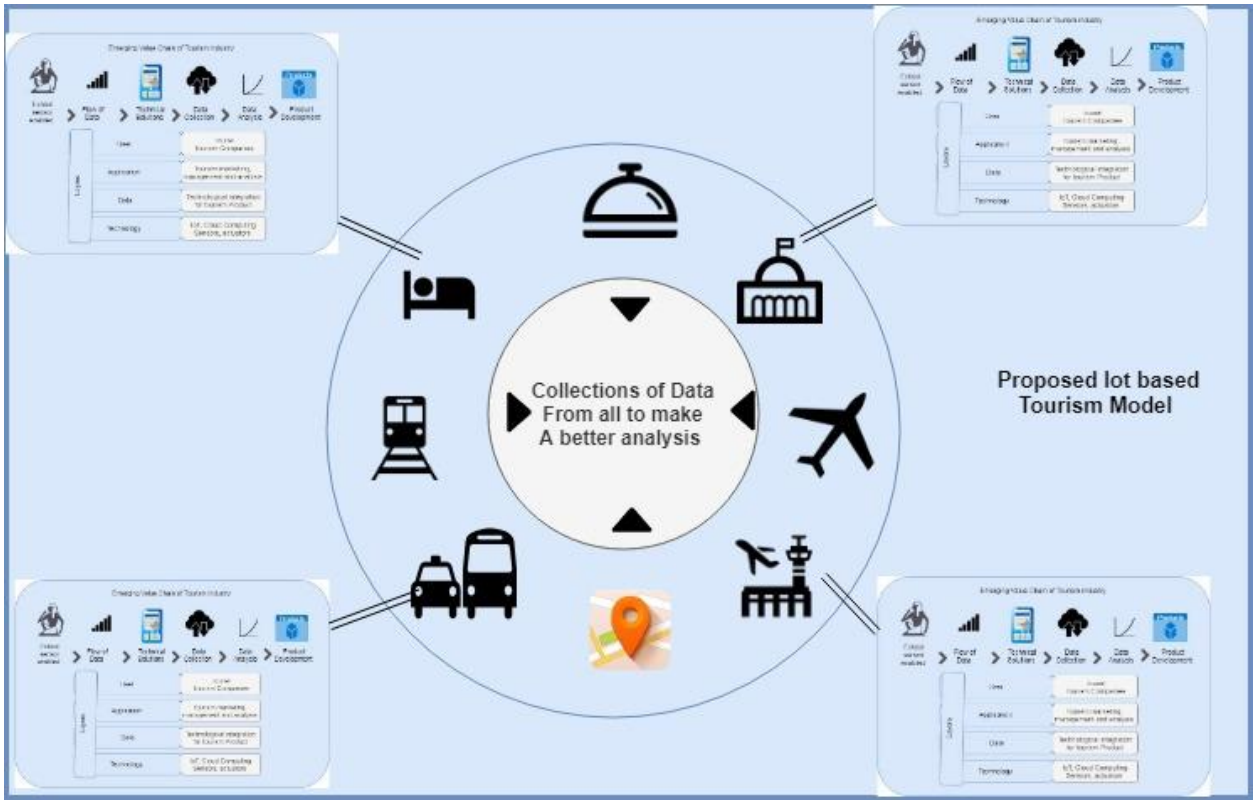

Fig. 21 – Proposed IoT based Tourism Model

The above model (figure 21) is the proposed IoT based Tourism Model that have shown the plethora of data to be collected from all stakeholder through the four-layer applications of the utility. The user will be able to get the details as per the choices of his own and the suppliers will receive the type of data they would be seeking through the application and technology layers. The cross-utilization of such data or the combination of such data at a city level would give a dramatic understanding of the tourist motive, buying behavior etc. The model will be sufficient to plan the future destination as per the need of the client. Such application will get the information to tourist, communication among supplier and consumer animal or bird monitoring, fauna-related information, marketing and storytelling about each and every attraction [55].

3.1 IoT – The future of Tourism

The IoT has already started its impact all around the industry and tourism industry is thriving to match the pace to be smartly connected with its guests all the time in hotels transportation or attraction. The technology is still in the early stages of growth and implementation. The importance of the data is very well known and the real-time data with the capability of analyzing comparing and scrutinizing as per the user categorical representation will give many folds of benefits to the industry. The enhancement of the smart cities and the airlines making it be bound necessarily to follow the growth of the industry.

This will be impacting positively and negatively to the industry and the process of transformation will be full of several challenges. The positive impacts are addressed throughout are accurate data collection, acute personalization user control, seamless travel, connectivity and smart solution to sustainability goals, energy saving, maintenance, repairs and detailed understanding of users through analysis of data in real time. The forecasting and estimation will not be based on old data but will be available for instant decisions in real time [56]. This will enhance the user's experience and efficiency of services and service providers will be benchmarked and quality can be easily monitored. The staff may remain more focused

on customer service in spite of keeping the count of the cans from the fridge of the guests' room in real time. This will deliver a higher standard of efficient, effective and flexible services through cost reduction by effective enforcement of regulations and calculated planning based on the improved forecasting and trend analysis in a transparent user empowered environment [57].

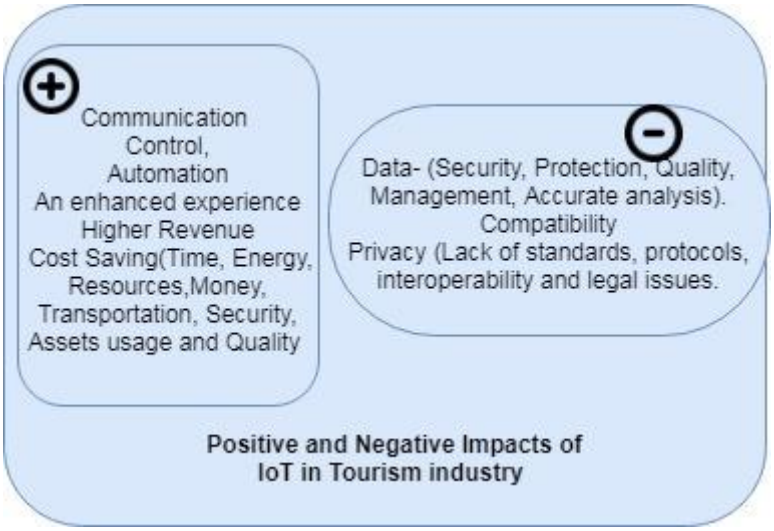

Fig. 22 – Positive and Negative Impacts of IoT in the Tourism Industry [58]

The above figure 22 indicates the positive and negative impacts. Whereas the negative impacts will be security of data by the cyber-attacks and security breaches, [59] technological and regulatory challenges with the data sharing [60] and collection, installation cost, and Interoperability, replacement of devices if any, harsh uncontrolled environment, self-sustainability of sensors, overdependence on sensors, [61]Data security, volume Data management, Data authenticity and pre-post during trainings and lack of sufficient knowledge [57]. The data will be on no use until unless it is being analyzed correctly and effective measures are taken to reach the desired requirements. The huge changes in the industry will bring the organizational structures to be altered and managed at pre and post installation to be effective. The transformation from current travel habits would require a well though change management to not just ruin the experience of travel by training IT tools and technologies to tourist [56]. This revolution requires a complete shift in the supply chain and user's adaptation, which still seems viable in smart cities, though improvements are visible and effective yet not possible unless all cities and village sites become capable of naming them under the hypes name of the smart city [47].

IoT is a good smart energy and resources saving tool for consumer convenience, products and enterprise categories [62]. The major drawback of a unique volume of data in a variety of shapes needs to be captured, analyzed and integrated in to a business sense needs a lot of business realignment at the stage of less developed standards and policies for possible breach in all layers (Process function, information, communication and device[63].

4.0 Future Work

The continuous improvement on the technologies are going to showcase connected devices to be the part and parcel of the industry and the data will be collected refined and further utilized by all stakeholders to serve the tourist with all of their basic and niche requirements. This will make the communication and identification of the requirement, understanding the behavior and shopping pattern of the tourist. The data if analyzed in the correct manner and required to be implemented in the right form may result in wonders in the industry. The aggressive implementation from all the stakeholders will provide a wider expansion to the industry in a more digitalized and connected way.

5.0 Conclusion

The tourism business revolves around the user requirements and to cater to the same, the latest trends and technologies act as an effective measure. The IoT technology is impacting multi-fold to the tourism industry and tourist are growing together with the mobility and flexibility requirement throughout the experience of travel and accommodation. The industry has started taking giant moves and it will soon be revolutionizing the overall cycle of operations. The end consumer who undergoes the experience known as Tourist, visitor or guests at different parts has already started expecting the services to be benchmarked and positioned in such an advanced way of IoT. This expectation and concurrent development will make these luxuries requirements soon a necessity.

The scope of technologies is translating into industries like Tourism and Hospitality to acumen the business feasibility and convenient service delivery. This opens a multifaceted branch of tourism for strategic business model with integrated technological implementation.

References

[1] "IoT: number of connected devices worldwide 2012-2025," Statista, 2019. [Online]. Available: https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/. [Accessed: 08-Jan-2019].
[2] "Recommendation ITU-T Y.2060 T-REC-Y.2060-201206-I!!PDF-E.pdf." TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU, 2012.
[3] J. Goodnight, "SAS creates for one reason - so you can turn today's most critical challenges into tomorrow's great decisions.," sas.com, vol. 2017, p. 32, 2017.
[4] Paula Fraga-Lamas, Tiago Fernández-Caramés, and Luis Castedo, "Towards the Internet of Smart Trains: A Review on Industrial IoT-Connected Railways," Sensors, vol. 17, no. 6, p. 1457, Jun. 2017.
[5] "How the Internet of Things (IoT) in Railroads is leading to data revolution," CloudMoyo, 19-Sep-2017. [Online]. Available: https://www.cloudmoyo.com/internet-of-things-in-railroads/. [Accessed: 10-Jan-2019].
[6] "How Siemens Is Using Big Data And IoT To Build The Internet Of Trains," Forbes, 2017. [Online]. Available: https://www.forbes.com/sites/bernardmarr/2017/05/30/how-siemens-is-using-big-data-and-iot-to-build-the-internet-of-trains/#1f4c3f5a72b8. [Accessed: 11-Jan-2019].
[7] Railnova, "About Us - Railnova," Rail fleet management, 2019. .
[8] I. U. of R. UIC Passenger Department, "high_speed_lines_in_the_world.pdf," 2019.
[9] Presskontakt, Info@d-Rail.se, and 073-675 70 65, "D-Rail awarded for life saving infrastructure monitoring," Mynewsdesk, 2018. [Online]. Available: http://www.mynewsdesk.com/se/d-rail/pressreleases/d-rail-awarded-for-life-saving-infrastructure-monitoring-2817441. [Accessed: 25-Feb-2019].
[10] "ProRail - Hightech-sensoren op reizigerstreinen meten de staat van het spoor," ProRail, Feb-2019. [Online]. Available: https://www.prorail.nl/nieuws/hightech-sensoren-op-reizigerstreinen-meten-de-staat-van-het-spoor. [Accessed: 25-Feb-2019].
[11] R. systems voestalpine, "Signaling Solutions - Railway Systems," 2019. [Online]. Available: https://www.voestalpine.com/railway-systems/en/application-areas/highspeed-traffic/signaling-solutions/. [Accessed: 25-Feb-2019].
[12] "The Aircraft's Place in the IOT Revolution," 2016. [Online]. Available: http://interactive.aviationtoday.com/avionicsmagazine/june-july-2016/the-aircrafts-place-in-the-iot-revolution/. [Accessed: 12-Jan-2019].
[13] "WP-IoT-the-internet-of-things-for-commercial-aviation.pdf," 2015. [Online]. Available: http://events.windriver.com/wrcd01/wrcm/2016/08/WP-IoT-the-internet-of-things-for-commercial-aviation.pdf. [Accessed: 12-Jan-2019].
[14] "The top 20 industrial IoT use cases," 2017. [Online]. Available: https://www.iotworldtoday.com/2017/09/20/top-20-industrial-iot-applications/. [Accessed: 09-Jan-2019].

[15] "Global Aviation IoT Market - Drivers and Forecast From Technavio," 16-Mar-2017. [Online]. Available: https://www.businesswire.com/news/home/20170316006066/en/Global-Aviation-IoT-Market---Drivers-Forecast. [Accessed: 26-Feb-2019].
[16] "Airline IT Trends Survey 2015 | SITA," SITA. create success together, 2015. [Online]. Available: https://www.sita.aero/resources/type/infographics/airline-it-trends-survey-2015. [Accessed: 26-Feb-2019].
[17] N. Vivion, "How airlines are using the Internet of Things « Sabre," 2017. .
[18] M. Drummond, "5 Great Ways Airlines Are Using the Internet of Things," 2016. [Online]. Available: https://w3.accelya.com/blog/5-great-ways-airlines-are-using-the-internet-of-things. [Accessed: 26-Feb-2019].
[19] C. European, "Industry 4.0 in Aeronautics: IoT applications," Digital Transformation Monitor, 2017.
[20] siemens, "Aerospace," siemens.com Global Website, 2019. [Online]. Available: https://new.siemens.com/global/en/markets/aerospace/home.html. [Accessed: 26-Feb-2019].
[21] "IoT - crucial to a smart airport," 2019. [Online]. Available: https://www.sita.aero:443/air-transport-it-review/articles/iot-crucial-to-smart-airport. [Accessed: 11-Jan-2019].
[22] "IoT connectivity - new solutions needed," 2019. [Online]. Available: https://www.sita.aero:443/air-transport-it-review/articles/iot-connectivity-new-solutions-needed. [Accessed: 11-Jan-2019].
[23] Martijn, "How the Internet of Things (IoT) can Benefit the Travel Industry," Revfine.com, 16-Oct-2018. [Online]. Available: https://www.revfine.com/internet-of-things-travel-industry/. [Accessed: 08-Jan-2019].
[24] B. D. C. CNN for, "london city airport internet of things," CNN Travel, 03-May-2013. [Online]. Available: https://www.cnn.com/travel/article/london-city-airport-internet-of-things/index.html. [Accessed: 26-Feb-2019].
[25] siemens, "Press Releases," 2018. [Online]. Available: https://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2018/corporate/pr2018030194coen.htm&content[]=Corp. [Accessed: 26-Feb-2019].
[26] SITA, The march of IoT: personalization - Maurice Jenkins. 2017.
[27] Feb 4 and 2019 | Stephen Mayhew, "MIA partners with CBP and SITA for facial recognition departures," Biometric Update, 04-Feb-2019. [Online]. Available: https://www.biometricupdate.com/201902/mia-partners-with-cbp-and-sita-for-facial-recognition-departures. [Accessed: 26-Feb-2019].
[28] D. Thakker, "Top Five Biometrics: Face, Fingerprint, Iris, Palm and Voice," Bayometric, 23-Jan-2017. .
[29] "Abu Dhabi International Airport takes a step further towards its digital transformation | Abu Dhabi International Airport," 2018. [Online]. Available: http://www.abudhabiairport.ae/english/media-centre/press-releases/2018/2018-05-06-Abu-Dhabi-International-Airport-takes-a-step-further-towards-its-digital-transformation.aspx. [Accessed: 26-Feb-2019].
[30] A. Aluri, "HITEC 2016 Special Report HITEC 2016 Special Report," https://www.mydigitalpublication.com/publication/?i=312968#{%22issue_id%22:312968,%22page%22:0}, 2016. [Online]. Available: http://www.mydigitalpublication.com/publication/index.php?i=312968. [Accessed: 12-Jan-2019].
[31] P. Kansakar, A. Munir, and N. Shabani, "Technology in Hospitality Industry: Prospects and Challenges," arXiv:1709.00105 [cs], Aug. 2017.
[32] "IoT benefits: how does aviation use the Internet of Things? Part 1 | IOT conference," 2019.
[33] Martijn, "How the Internet of Things (IoT) can Benefit the Hospitality Industry," Revfine.com, 01-Jan-2018. [Online]. Available: https://www.revfine.com/internet-of-things-hospitality-industry/. [Accessed: 13-Jan-2019].
[34] M. Diachuk, "Benefits of Using IoT in Healthcare - DZone IoT," dzone.com, 2018. [Online]. Available: https://dzone.com/articles/benefits-of-using-iot-in-healthcare. [Accessed: 13-Jan-2019].
[35] "How Video Surveillance and IoT Combine to Benefit Hospitality," Hospitality Technology, 2018. [Online]. Available: https://hospitalitytech.com/how-video-surveillance-and-iot-combine-benefit-hospitality. [Accessed: 13-Jan-2019].
[36] M. McMullen, "Checking In: The IoT Hotel Room of the Future," IOT Solution Provider, 29-Nov-2017. [Online]. Available: https://www.iotsolutionprovider.com/smart-building/checking-in-the-iot-hotel-room-of-the-future. [Accessed: 13-Jan-2019].
[37] D. Evans, "How the Next Evolution of the Internet Is Changing Everything," p. 11, 2011.

[38] "Global smart city spending 2015-2020 | Statistic," Statista, 2019. [Online]. Available: https://www.statista.com/statistics/757638/spending-on-smart-cities-worldwide/. [Accessed: 15-Jan-2019].
[39] "The New Approach to Hospitality: A Hotel Run by Robots," IOT Solution Provider, 16-Jan-2018. [Online]. Available: https://www.iotsolutionprovider.com/smart-building/the-new-approach-to-hospitality-a-hotel-run-by-robots. [Accessed: 26-Feb-2019].
[40] "OUR CONCEPT," Henn-na Hotel, 2019. [Online]. Available: http://www.h-n-h.jp/en/. [Accessed: 26-Feb-2019].
[41] D. Michels, "How the hospitality industry will profit from the IoT," Network World, 08-Aug-2017. [Online]. Available: https://www.networkworld.com/article/3214386/internet-of-things/how-the-hospitality-industry-will-profit-from-the-iot.html. [Accessed: 10-Dec-2018].
[42] "IoT: Food service industry meets technology in Arby's deployment," IoT Agenda, 2016. [Online]. Available: https://internetofthingsagenda.techtarget.com/feature/IoT-Food-service-industry-meets-technology-in-Arbys-deployment. [Accessed: 10-Jan-2019].
[43] "Cooking Up Value: How to Use the Internet of Things to Improve the Commercial Kitchen's Performance.," Accenture Mobility, p. 10, 2019.
[44] "Cooking with IoT in Commercial Kitchens," IOT Solution Provider, 07-Sep-2016. [Online]. Available: https://www.iotsolutionprovider.com/smart-building/cooking-with-iot-in-commercial-kitchens. [Accessed: 10-Jan-2019].
[45] "Internet of Things: Food safety apps set to emerge," IoT Agenda, 2016. [Online]. Available: https://internetofthingsagenda.techtarget.com/feature/Internet-of-Things-Food-safety-apps-set-to-emerge. [Accessed: 10-Jan-2019].
[46] "A Word Of Warning The Future IoT Might No Be This Neat Image From Nordic Semiconductor - Things In The Kitchen Pictures," 2019. .
[47] X. Wu, "Smart Tourism Based on Internet of Things," vol. 32, p. 5, 2017.
[48] "mgi-smart-cities-full-report.pdf," McKinsey Global Institute (MGI), 2018. [Online]. Available: https://www.mckinsey.com/~/media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/smart%20cities%20digital%20solutions%20for%20a%20more%20livable%20future/mgi-smart-cities-full-report.ashx. [Accessed: 14-Jan-2019].
[49] "IoT for automotive deconstructed," IBM Big Data & Analytics Hub, 2019. [Online]. Available: https://www.ibmbigdatahub.com/infographic/iot-automotive-deconstructed. [Accessed: 27-Feb-2019].
[50] "IoT in Automotive Industry: the Creation of Self-Driving Cars | SaM Solutions," 2018. [Online]. Available: https://www.sam-solutions.com/blog/iot-in-automotive-industry-the-creation-of-self-driving-cars/. [Accessed: 27-Feb-2019].
[51] "Dubai's Autonomous Transportation Strategy," Dubai Future Foundation, 2018. .
[52] "Infographic: Autonomous Vehicles Are Quickly Improving," Statista Infographics, 2017. [Online]. Available: https://www.statista.com/chart/13988/frequency-of-human-interventions-autonomous-vehicles/. [Accessed: 27-Feb-2019].
[53] "Government Doubles Official Estimate: There Are 35,000 Active Museums in the U.S.," Institute of Museum and Library Services, 19-May-2014. [Online]. Available: https://www.imls.gov/news-events/news-releases/government-doubles-official-estimate-there-are-35000-active-museums-us. [Accessed: 14-Jan-2019].
[54] E. Hornecker and P. Bartie, "Technology in Tourism: Handheld Guide Systems and Museum Technologies," http://www.ehornecker.de/Papers/TR-2006-1.pdf, 2006. [Online]. Available: http://www.ehornecker.de/Papers/TR-2006-1.pdf. [Accessed: 14-Jan-2019].
[55] O. Gcaba and N. Dlodlo, "The internet of things for South African tourism," in 2016 IST-Africa Week Conference, Durban, South Africa, 2016, pp. 1–8.
[56] oliver wyman, "The Internet of Things," p. 108, 2015.
[57] P. Brous and M. Janssen, "EFFECTS OF THE INTERNET OF THINGS (IOT): A SYSTEMATIC REVIEW OF THE BENEFITS AND RISKS." 2015.
[58] N. Angelova, G. Kiryakova, and L. Yordanova, "The great impact of internet of things on business," Trakia Journal of Science, vol. 15, no. Suppl.1, pp. 406–412, 2017.
[59] J. Pate and T. Adegbija, "AMELIA: An application of the Internet of Things for aviation safety," in 2018 15th IEEE Annual Consumer Communications & Networking Conference (CCNC), Las Vegas, NV, 2018, pp. 1–6.

[60] K. Kaur and R. Kaur, “Internet of Things to promote Tourism: An insight into Smart Tourism,” vol. 02, no. 04, p. 5, 2016.
[61] D. Evans, “How the Next Evolution of the Internet Is Changing Everything,” p. 11, 2011.
[62] “2019 IoT Products | Overview of the Most Popular Smart Home Devices,” Postscapes, 2019. [Online]. Available: https://www.postscapes.com/internet-of-things-award/winners/. [Accessed: 14-Jan-2019].
[63] S. Ganguli and T. Friedman, “IoT Technology Disruptions: A Gartner Trend Insight Report,” p. 17, 2017.