SMART AIRPORT – STRUCTURE AND ELEMENTS

Ph.D. Eng. Euring Dragoș POPA ¹, Andrei POPA ², Ph.D. Eng. Mirela-Maria CODESCU ³

¹ AGIR, Bucharest, Romania ² St. UPB, EE, Bucharest, Romania, ³ ICPE- CA, Bucharest, Romania

REZUMAT. „Smart Airport” este sintagma ce definește conceptul de Aeroport inteligent în sensul adaptării cerințelor pasagerilor și a mediului economic pentru transport marfă, la funcționalitatea acestuia, cu respectarea elementelor de siguranță și securitate a acestora. Luăm în evaluare infrastructura, punctele de control, sistemul de control pasageri-bagaje-marfă, punctele de informare fixe și rețelele de comunicații interne ale aeroportului precum și conexiunea smart prin tehnologii integrate a acestora cu similaritățile unui oraș inteligent.

Cuvinte cheie: aeroport inteligent, infrastructură, comunicații.

ABSTRACT. „Smart Airport”, is a concept which is defining new technologies in matters of passenger's services and economical medium for cargo, by respecting aeronautical safety and security elements. The main points are the infrastructure, checkpoints, passengers-luggage-cargo control system, info points and internal communications of the airports and also smart connections with technologies similar with the smart city.

Keywords: Smart Airport, infrastructure, communications, city.

1. INTRODUCTION

1.1. IoT Basic Elements

The definition of Internet of Things is „a proposed development of the internet in which everyday objects have network connectivity, allowing them to send and receive data”.

IoT is offering advanced connectivity solutions for devices and systems in a more advanced way than the machine-to-machine (M2M) communications and it covers a variety of applications. The interconnections starts from small smart objects (phones, wearables, sensors, etc.) to smart grids and expanding to areas such as smart cities.

The main applications for IoT are:

- Media: targeting of consumers and data-capture.
- Environmental monitoring: using different sensors we can monitor air/water quality and also improving earthquake or tsunami warning systems.
- Infrastructure management: the main point of this management is represented by monitoring and controlling urban and rural infrastructures like: wind farms, bridges, railway tracks. Usage of IoT devices will improve incident management, emergency response coordination, quality of service, up-times and reduce costs of operation in all infrastructure related areas.
- Manufacturing: Using IoT intelligent devices and systems are improving the speed and quality of manufacturing production in real-time.
- Energy management: IoT devices and systems bring the energy management to a new level, integrating sensing and actuation systems will optimize energy consumption as a whole. The future predictions are that all forms of energy consuming devices will be integrated and will be able to communicate with the power supplier in order to effectively balance power generation and energy usage.
- Medical and healthcare: Remote health monitoring and emergency notification systems are just two of the most important systems that will be integrated in the IoT. The devices used in this application can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers.
- Building and home automation: IoT devices can be used for monitoring and controlling mecha-
nical, electrical and electronic systems used in various types of buildings.

- Transportation: Applications of the IoT extends to all aspects of transportation systems (vehicle, infrastructure, driver/user).

1.2. Smart Airport IoT Elements

As air traffic grows, airports need to adapt to the requirements and to become more entrepreneurial and proactive to changing aviation dynamics.

Most of the airports, nowadays are considered „multi-nodal” transportation hubs for people, information and trade.

The goal of the smart airport is to make systems and processes digitally aware, interconnected, infused with intelligence and simple to access by everybody.

Predicting capacity demand, providing enhanced passenger travel experience, improving operational process efficiency, improving staff productivity and ensuring security and safety are just a few of the smart airport targets.

The main idea is to create an integrated system, unified and ready-to-use digital platform for the airports to become informed and intelligent.

The airports are currently implementing isolated solutions based on the concept of the smart airport. But working on individual solutions will not lead to the smart airport, all the implemented concepts should be designed to be introduced in the unified system of the smart airport.

As an example, passenger touchpoints will not be based on the same principle of the key information interchanges at check-in, security check or boarding.

Instead of this simple principle, it will be used a real-time and continuous connection to the passenger, that will permit the access of the information anytime and anywhere.

Those capabilities will enable all the airport stakeholders – airlines, security, operations, concessionaires and other service providers to engage the passenger with relevant information and offers. The direction of those conversations is to be more personalized, media-rich and valuable.

2. INFRASTRUCTURE OF THE SMART AIRPORT SERVICES

In Fig.4 it is described a proposal from T-Mobile for an Airport Passenger Experience Platform.

It starts with Airport Main Systems like:
- Terminal Operations Management Systems – TOMS
- Slot Allocation Management Systems – SAMS
- Ground Handling Management System – GHAMS
- Airport Collaborative Decision Making – A-CDM
- Parking Information and Flightradar 24 (Live Air Traffic Data).

All those systems are managed in an unified interface that has Travel Information Enriched Repository, Intelligent Collecting & Event Processing (this part of the interface is very important because as it is mentioned earlier, the goal is to have personalized data), Real-Time Activity Streaming (one of the main goals of the Smart
Airport) and Passenger Predictive Analytics & Monitoring Platform.

At this unified interface are added the Retail Systems and GPS/WLAN/Beacon Localization. In the end at the user (passenger) this infrastructure delivers Information, Guidance and Value.

This Smart Airport experience allows an End-to-End customer communication from leaving home until entering the airplane. The airport gain full benefits out of digitalization, it gets the focus to their customers.

A few examples of the functionalities:
If a flight is delayed the restaurants and the shops near that terminal will send their offers to passengers of that flight.
The passengers will always be informed about how many persons are at the check-in, what is the waiting time and what is the fastest way to the gate.
Value added services are represented by vouchers when passing by selected shops or discounts.

This infrastructure is based on four main points:
• Smart Airport System;
• Mobility;
• Payment;
• Customer loyalty.

Track & Trace technologies for tracking the checked-in luggage will be used.
Social networking sites are used for influencing the buying patterns of a passenger at the airport. It will be used as media and opinion-influencing platform for information related to airlines, food, shopping, travel, etc.
Processing luggage touch-less through sensing devices and intelligent systems will be an important step.

Check-in, security, payment, etc. will be achieved through sensors, connectivity, smart phones and automations. Those self-service systems and smart parking systems are enabling a hassle-free travel.

One of the most important parts of the Smart Airport is represented by the Integrated Airport analytics across disintegrated systems to slice and dice the data in order to analyse past performance and predict future performance.

Challenges and Solutions

There are a few important challenges for the classic airport that the Smart Airport will solve with new technologies and ideas.

➢ Dissatisfied Passengers. The main points of the solution to this challenge are: Touch-less self-services with no wait time, timely event notifications, on-demand contextual info delivery.

To solve those points the used technologies are: e-services & mobile services, location-based personalized info delivery on user devices and automated barcode/RFID/Sensors systems.

➢ Declining Share of Aeronautical Revenue. To solve this challenge the passenger spending at the airport should be improved with promotions/targeted offerings and the retail planning must be optimized and based on the real-time passenger flow information.

The technologies used are Analytics – CCTV Video and Social Networks, integration of non-aero services, bluetooth and wi-fi access points to geolocate passenger concentration points

➢ Increasing Competition. To achieve this there are three main points: continuous innovation, improved marketing and brand building, improved airport rating.

The key technologies are exactly the main ideas of the smart airport: technology innovation models, portals for smartphones, analytics for performance and improvement

➢ Outdated/Unreliable IT

This is the most often problem of the classical airport. The solution is the smart airport. On-demand IT resource & services, integration of airport systems, automation and self-service on end user

2.1. Sensors, Communications and Technologies

The sensors, connections, collaborations, mobility and analytics are the key of the smart airport.

Digital cameras are used for monitoring passenger queues at check-in, security check points and parking areas. In the designed smart phone applications, geo-location will be used for reducing passenger congestion.
devices, those are the solutions. The technologies are based on multi-channel collaboration and cloud, automations (Sensors/RFID/Wireless/Smart gates, etc.), airport analytics/predictive information, airport mobility/augmented reality.

2.2. Airport interconnectivity

For most passengers, the travel experience starts with a form of transportation to the airport. Minimised travel times and a reduction in the environmental footprint were highlighted as the key drivers in determining choice, whilst the ultimate goal is for greater integration in terms of interconnectivity

- Between different physical transports;
- Of processes, passenger luggage handle improvement;
- Of data, so that service providers can adapt to the new requirements.

Studies revealed what passengers would like to see in the airports in the next five years:

- Passenger transport:
  - Recognise passenger is delayed in traffic – automatically rebook flight;
  - Driverless vehicles in the airport;
  - Inductive charging for cars and all airport located vehicles;

- Check in:
  - Bypass terminal entirely – premium travellers check-in offsite, pass through security en-route;
  - Biometric (face recognition and iris scanning) and/or genetic information used to check-in passengers automatically upon airport entry;

2.3. Future projects

- Passenger transport:
  - Recognise passenger is delayed in traffic – automatically rebook flight;
  - Driverless vehicles in the airport;
  - Inductive charging for cars and all airport located vehicles;

- Check in:
  - Bypass terminal entirely – premium travellers check-in offsite, pass through security en-route;
  - Biometric (face recognition and iris scanning) and/or genetic information used to check-in passengers automatically upon airport entry;
3. Smart phones, social media, airport sensors and new applications will generate exponential growth in data. New artificial intelligence knowledge-management tools, such as predictive analytics, will enable the generation of powerful new insights and identify emergent trends and patterns.

4. Tomorrow’s airport will be a complex environment passenger-centred, being based on collaboration and innovation. This means critical roles will emerge around deep customer engagement, complexity management, partnership working and innovation delivery.

5. Constant scanning of the long-term horizon will be critical to identify and assess emerging trends, forces, developments, ideas and weak signals that could have a direct bearing on the airport environment.

6. Effective management of a complex, distributed and potentially outsourced information and communications technology infrastructure will be a core competence required across the smart airport.

7. Rapid technological change, rising service expectations and the demand for free high-speed wireless connections are pushing up the cost of upgrading and maintaining the airport IT infrastructure.

3. CONCLUSIONS

1. Smart airports will have to use multiple intersecting digital and automation technologies that have to converge in solving the new technology challenges.

2. To deliver a genuinely customer-centric experience, the smart airport partners will need to go beyond data sharing and ensure extended collaboration, from strategic planning through to operation decision-making. The same data will be shared and enriched by various users – including the passengers themselves – who will control the level of access to their personal information.

4. REFERENCES

SMART AIRPORT – STRUCTURE AND ELEMENTS


Despre autori

Ph.D.Eng. Euring Dragoș POPA
SETEC-AGIR, Bucharest, Romania

Electrical engineering, board systems for aviation, independent technical expert and consultant – SETEC AGIR. E-mail: tudodei@yahoo.com

St. Dragos D. POPA
UPB-IE, Bucharest, Romania

UPB student at Electrical engineering-Power electronics and drive, pda.dragos@gmail.com

Ph.D.Eng. Mirela-Maria CODESCU
ICPE-CA, Bucharest, Romania

Senior researcher – CP 1, independent technical expert and consultant, National Institute for R&D in Electrical Engineering ICPE-CA. E-mail: mirela.codescu@icpe-ca.ro