Smart Air-Travel Framework

Anita Jaware, Vaibhav Dhage (Guided by)
Computer Science and Engg.
Sau.Kamalatai Gawai Institute of Engg. and Tech.
Draper, Amravati India
anita.jaware@gmail.com

***Abstract*— Smart Air-Travel Framework is a technological revolution that represents the future of airline travel and its development, which depends on dynamic technical innovation in a number of important fields, from RFID to bio-metrics**.

I. INTRODUCTION

Smart Air-Travel Framework is a technological revolution that represents the future of airline travel and its development, which depends on dynamic technical innovation in a number of important fields, from RFID to bio-metrics.

This day, some of the discussed approaches are leveraged in some of the technically advanced geographies, but there are still a lot many which still rely on manual or sub-optimal technical intervention.

The paper discusses how various electronic and telecommunication technologies can be simultaneously leveraged to build a solution which not only can be accurate in terms of the output of a stage, but can highly improvise the processing throughput of the overall Passenger Air Travel process.

The list below is a glance through the new-age technologies which have been used to design the overall conceptual solution. These have been discussed in details.

- **RFID (Radio frequency identification)**

This paper discusses how to use the emerging Radio Frequency Identification (RFID) technology to ensure a higher level of security and also to handle the enormous number of luggage that comes to the airport. It will ensure a better level of security by incorporating RFID passport, Real time checking of passenger details with the homeland database, Automatic security alerts etc. This paper also focuses on the challenges and concerns for the proposed system

- **Bio-metrics**

Biometrics is the automated recognition of people based on biological and behavioral traits and it is being tested as a security measure in several airports.

- **Neural Networks**

A neural network is a powerful data modeling tool that is able to capture and represent complex input/output relationships. The motivation for the development of neural network technology stemmed from the desire to develop an artificial system that could perform "intelligent" tasks similar to those performed by the human brain.

- **Global Positioning System**

The Global positioning system is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S Department of Defense and is used to determine the user's position based on his earth co-ordinates.

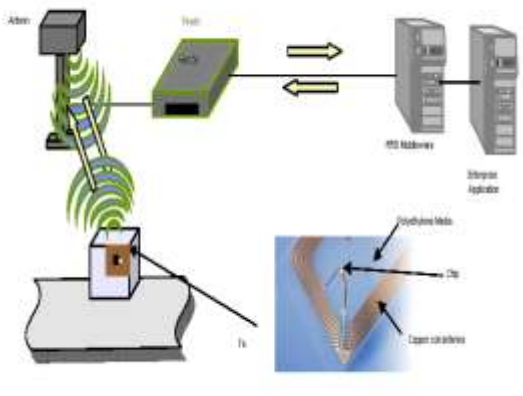
II.TECHNOLOGIES FACILITATING THE AIR-TRAVELER

RFID

Radio Frequency Identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders and RFID readers. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennas. Passive tags require no internal power source, whereas active tags require a power source. The purpose of an RFID system is to enable data to be transmitted by a mobile device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application 1. So it doesn't require an established line of sight and correct orientation with a scanner like Barcode readers. RFID uses radio signals to exchange data between a tag (also known as a transponder) and a read/write device (commonly called a reader or interrogator). Tags consist of a wireless chip and antenna that are housed in a label or other protective casing and attached to the item that is to be identified. The tag may be active, which means it has a battery to power its own transmission, or passive, which transmits using power received from the reader in the form of electromagnetic waves. Active tags have longer read ranges making them appropriate for asset management and real-time location systems (RTLS). Passive tags have a shorter read range and are smaller and less

© 2016 IJAIR. All Rights Reserved

expensive than active tags making them the tag of choice for most supply chain applications.



• Uses radio waves or micro waves for quick & automatic identification
• Detection/data transfer is contact-less and doesn't need line of sight
Tags can store data and help maintain historical information

Biometrics.

In Biometric passports (e-passports), the chips will store the same information that is printed within the passport and will also include a digital picture of the owner. The passports will incorporate a thin metal lining to make it more difficult for unauthorized readers to "skim" information when the passport is closed. Modern finger print identification systems take a digital scan of a person's fingertips and records its unique physical characteristics, such as whorls, arches, loops, ridges and furrows. Fingerprint data is either stored as an image or encoded as a character string. A security screener checks the identity by scanning the fingerprints and comparing it with those stored in a central database.

Some fingerprint ID systems also measure blood flow to the finger, so that a fake finger can't fool the system

Neural Network

Neural networks find application in airline travel in voice-recognition:-

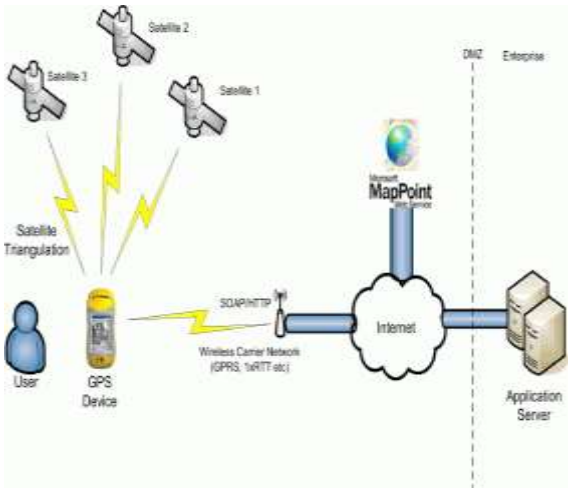
First: we digitize the speech that we want to recognize; for telephone speech the sampling rate is 8000 samples per second.

Second: we compute features that represent the spectral domain content of the speech (regions of strong energy at particular frequencies). These features are computed every 10 msec, with one 10-msec section called a frame.

Third: a neural network (also called an ANN, multi-layer perception, or MLP) is used to classify a set of these features into phonetic-based categories at each frame. Fourth, a Viterbi search is used to match the neural-network output scores to the target words (the words that are assumed to be in the input speech), in order to determine the word that was most likely uttered.

Global Positioning System

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.



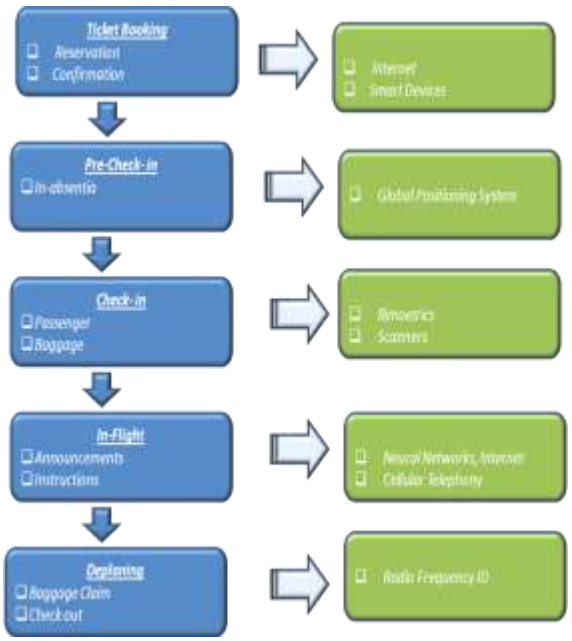
The figure above illustrates the functioning of the GPS device

© 2016 IJAIR. All Rights Reserved

III. Traveling the Technology way- How does it tie together ?

The Block Diagram below provides a schematic of how does each technology support the phase of passenger air travel process. This is further explored in detail in this section.

Travel Phase to Technology mapping



Ticket Booking

Reservation

Stephen and Cathy, living in Chicago are on their way to meet their son in Florida. The couple has not seen their grandson, John from when he was born, and is taking with them a plethora of toys and dresses to meet their beloved grandson.

Confirmation

Stephen gets a confirmation on his PDA about his trip including the PNR number and the terminal at which he will have to board .He does not carry his ticket –he just takes his passport and baggage

Pre Check-in

Entering the airport

The smart-car at the entrance gives Stephen and Cathy a fast and easy entry into their terminal

The couple is able to navigate to the terminal by making use of the GPS mobile that they have, the feature is called the **"Bird View".** The Global Positioning System (GPS) is a satellite-based navigation system that turns the smart phone all at a sudden into a powerful navigation system. The turn-by-turn voice instructions and on-screen directions guides them from the current position (Entrance of the Airport) to the destination (Terminal) The map can be displayed in night colors to keep a clear view on the road even when they are walking in the night or in bird view to display the map as you would see it if you could fly like a bird

Check-in

Passenger check-in

Stephen and Cathy come to the airport with a passport. The navigator in Stephen's

Mobile directs him to the desired terminal

a. The passport, which they have, is an e-passport. The RFID tag in the passenger's passport contains the personal details including a digital image and any restrictions imposed on the passenger

b. When the passenger moves towards the check in area, the RFID reader at the entry point activates the RFID tag of the passenger's passport

c. The reader reads the personal details including the digital image. Also a camera kept at the entry point takes a snapshot of the passenger

d. The reader forwards the details to the Impact Check, which checks for a matching between the image from the passport and that from the camera

e. The security software also checks for any restrictions imposed on the passenger by analyzing the data from the passport

f. It also checks for any restrictions by querying the homeland security database and the security database of the country from where the passenger is traveling using a web service

g. If any anomalies are found the security software will alert the airport staffs with passenger's details including the photo

h. The security software also keeps the passenger details in an encrypted format in the database

© 2016 IJAIR. All Rights Reserved

Boarding Pass

Stephen has already selected his seat as he did the check-in through his PDA. Since Cathy was busy shopping when Stephen was checking-in at home she has to move to the personal check-in point. So Cathy now moves to an ACCI (Automatic Check In, pronounced A-x-s-i) to collect the boarding pass and also to check in baggage if any. Once she gets the boarding pass, she gets to see the seat availability and choose her seat

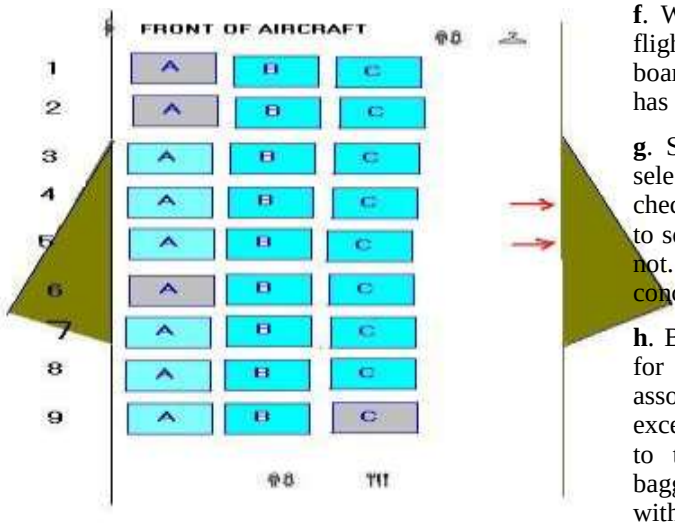
a. If a seat is available, it is color-coded and labeled with a letter. Unavailable seats are grayed-out letter you want in the 'desired seat' field (like 17B) and you're ready to go

b. The check in at ACCI will validate the user by any of the existing methods; say by a credit card/debit card etc. After which the user types in the PNR or the confirmation number to get the boarding pass

c. At this point the ACCI will query the security database of the destination country for any security restrictions imposed on the passenger.

d. If there are any restrictions the ACCI will alert the security staff with the passenger details

e. Else the ACCI will check whether the passenger has to check in any baggage or not. Based on the passenger's selection they will be supplied with a boarding pass containing a RFID tags.



Baggage Check-in

After getting their boarding pass, Stephen and Cathy check-in their baggage which has an RFID tag. After passing the screening, they find that their red suit- case is over-weight by 3 kegs. Stephen throws a 'See-I-told-you' glance at Cathy. Smiling, he took out Cathy's Georgette Hoyer collection and stuffed them into her handbag. Both of them knew she wouldn't find time to read… but there was no use arguing with Cathy!

a. After collecting the boarding pass the passenger moves to an automatic baggage check in area as they have baggage to be checked in. After keeping the luggage over a machine controlled tray they show the boarding pass to a very short range RFID reader which reads the unique id along with the route and other passenger

details (such as seat number, destination etc.) from the boarding pass

b. Since the couple has selected the option to check in any baggage the RFID tag in the boarding pass will contain a unique id which identifies the passenger's baggage other than the basic information that has to be there in the boarding pass

c. If the baggage is within the permissible weight limits, the baggage system will affix a RFID tag else the baggage is rejected and comes out via the conveyor. Insert picture

d. Now the automatic baggage system will affix a RFID tag to the passenger's baggage which contains the unique id in the passenger's boarding pass and also the routing information

e. Later on, the conveyer system will transport the baggage to the appropriate jet way using an RFID enabled system from where the baggage will be moved to the flight

f. When the old couple is going to get in to the flight an RFID reader at the jet way will read the boarding pass and will check whether the passenger has selected for a baggage check in

g. Since the system finds that the passenger has selected for a baggage check in, the system will check in the automatic baggage check in database to see whether the baggage has been checked in or not. Thus the system ensures passenger-baggage conciliation

h. Before the flight leaves, the system will search for any baggage onboard without any passenger associated. If any such baggage has been found, the exception handling system will send a notification to the security staff and also will locate the baggage. This avoids any security issues associated with a baggage onboard without a passenger

© 2016 IJAIR. All Rights Reserved

In-flight travel

In-flight announcements

As the flight is about to leave the airport, the couple hears the take-off instructions from the captain. Since the voice of the captain is at a neutral accent it makes it really Simple for the couple to understand what he's trying to say

a. Neural networks helped in obtaining the Neutral accent at the cockpit and enable Passengers listen to the captain's instruction in the desired language

In-flight entertainment

Stephen and Cathy had a real good flight; Stephen watched one of his favorite Julia Roberts' movies, "Erin Brockovich", while Cathy, after giving up reading some 2 pages switched to listening to music, while sending mails to her friends back home.

a. All the hotels share a common database. The hotel authorities upload the food that the customers ordered and the music requested by them onto a common repository through a web service. The frequently heard songs and desired food are tracked continuously all around the globe and maintained in the same web service. All the airlines and hotels share this central common repository. The Airport caterers prepare food on a case-by-case basis after viewing the web service.

Check-out

Baggage Claim

Stephen and Cathy collect their baggage from the carousel. Surprisingly they get both their baggages in a matter of 10 minutes

a. Once the flight reaches the destination, the baggage delivery system will move the bags to the carousel, which also is done through a RFID enabled conveyer system.

b. Upon reaching the carousel the baggage delivery system will display the passenger name and the seat number associated with that baggage in a monitor

c. If the system finds that the destination of any baggage doesn't match the airport, it will read the RFID tag affixed in the baggage and will check for the appropriate destination. The airport staff will be updated with the baggage details and then they can route that to the appropriate airport in a short period of time

d. Then through a web service the system will update the correct destination baggage delivery system about this baggage's status. And when the passenger comes to collect the baggage at the carousel the system will display the mismatch details

Leaving the airport

The old couple marches towards the exit and board the departure terminal.

a. When the couple moves out of the airport they pass through a security exit gate

Which has an RFID reader. (They were told that they have to carry their boarding pass with them until they leave the airport)

b. The reader at the gate reads the baggage's unique id in the boarding pass and will check whether the baggage, the passenger is taking out have the same unique id. This avoids any passenger going out with a wrong baggage. If any such case was found the security staff will be alerted with the passenger details

c. Also even after a certain amount of time if any baggage is left out at the carousel, The system will alert the security staff with the baggage detail …

As Stephen and Cathy come out of the terminal, Peter waves out to them. Beside him was 5-year old John…his innocent face sporting a cute smile! A surge of happiness swept through Cathy…It just seemed like yesterday when she had dropped Peter at school…how time flies… There are some things you cannot keep track of…for everything else…there is RFID

IV. MARKET OPPORTUNITIES

The technologies mentioned in Technology offer immense potential to passengers, manufacturers and the airline industry. However, for these ground-breaking innovations to grow from idea to specific product or application for the mass market, a difficult process of commercialization is required, involving a wide array of players including standard development organizations, national research centers, service providers, network operators,

and lead users Baggage tagging trials are already ongoing, or are planned, for a number of international cities including ***Hong Kong*** and Las Vegas. Paris has a joint trial with Amsterdam. ***South Korea's*** Asian airline is running a six-city trial. In all of these trials, the purpose of radio frequency tagging is to prevent baggage mishandling and loss. However, some high-volume airports are trialing RFID to decrease times for passenger check-in. While there are several ongoing projects, mass adoption at airports is hindered by the cost of tags, which will be disposable The global spend on RFID labels for Item level tagging alone - mainly - will be around $0.09 billion this year and is expected to go up to 1.75 billion in 2017 provided the price collapse doesn't go beyond 5 cents and there is worldwide demand.

© 2016 IJAIR. All Rights Reserved

V.CHALLENGES AND CONCERNS

Building on the potential benefits offered by the Internet of Things poses a number of challenges, not only due to the nature of the enabling technologies but also to the sheer scale of their deployment. Technological standardization in most areas is still in its infancy, or remains fragmented. Not surprisingly, managing and fostering rapid innovation is a challenge for governments and industry alike. Standardization is essential for the mass deployment and diffusion of any technology. Nearly all commercially successful technologies have undergone some process of standardization to achieve mass market penetration. One of the most important challenges in convincing users to adopt emerging technologies is the protection of data and privacy. Concerns over privacy and data protection are widespread, particularly as sensors and smart tags can track users' movements, habits and ongoing preferences. When everyday items come equipped with some or all of the five

senses (such as sight and smell) combined with computing and communication capabilities, concepts of data request and data consent risk becoming outdated. Invisible and constant data exchange between things and people, and between things and other things, will occur unknown to the owners and originators of such data.

To promote a more widespread adoption of the technologies underlying the Technology, principles of informed consent, data confidentiality and security must be safeguarded. Moreover, protecting privacy must not be limited to technical solutions, but encompass regulatory, market-based and socio-ethical considerations. Unless there are concerted efforts involving all government, civil society and private sector players to protect

these values, the development of the Technology++ will be hampered if not prevented. It is only through awareness of these technological advances, and the challenges they present, that we can seize the future benefits of a fair and user-centric Technology. The concern, however, is that if we are not aware and careful about the potential abuses of such technologies early on, we may fail to incorporate them at a time when the laws and mores of such a system are still developing, ultimately suffering the consequences later on.

One can damage simply the antenna. With larger RFID transponders one can recognize the spirals of the antenna clearly in the radiograph. If one splits it in a place, the RFID transponder does not function any longer

An electromagnetic impulse on transponders and antenna destroys these likewise and makes it useless. As example One can try prevent that the RFID transponders receive their energy. Here one can take for example the battery out, or put the RFID transponders into a Faraday's cage. If RFID do not couple over electrical fields, but inductively, the screen requires housings from magnetic materials such as iron or MU-metal.

In the IEEE Conference OF Pervasive Computing 2006 (Percom) in Pisa scientists presented a method around Andrew S. Tanenbaum, how, by manipulated RFID chips the baking databases can be compromised by RFID systems. They call their work world-wide first RFID virus of its kind. This representation is regarded however meanwhile designed of different places as too theoretical

VI. Conclusion

With intense pressure to function profitably and heighten security, the aviation industry must turn to new technology like RFID that can complement existing bar code technology to find the improved operational processes it needs to continue operations in a more competitive environment. RFID technology is already used thousands of times each day at airports around the world to identify employees, unlock doors and open parking gates. Implementation of RFID dramatically increases efficiency and lowers operational costs, avoids cost of lost baggage & delayed planes and points to a positive ROI.

The development of Technology will occur within a new ecosystem that will be driven by a number of key players. These players have to operate within a constantly evolving economic and legal system, which establishes a framework for their Endeavour's. Nevertheless, the human being should remain at the core of the overall vision, as his or her needs will be pivotal to future innovation in this area. Indeed, technology and markets cannot exist independently from the over-arching principles of a social and ethical system. The

Internet of Things will have a broad impact on many of the processes that characterize our daily lives, influencing our behavior and even our values. For the airline industry, Technology is an opportunity to capitalize on existing success stories, such as mobile and wireless communications, but also to explore new frontiers. In a world increasingly mediated by technology, we must ensure that the human core to our activities remains untouched. On the road to the Internet of Things, this can only be achieved through people oriented strategies, and tighter linkages between those that create technology and those that use it. In this way, we will be better equipped to face the challenges that modern life throws our way.

© 2016 IJAIR. All Rights Reserved

References

[1] P.D. Devries, "The state of RFID for effective baggage tracking in the airline industry", International Journal of Mobile Communications, vol. 6, iss. 2, pp. 151-164, 2008.
[2] T.S. Rangarajan, A. Vijaykumar, and S.S. Suraj, "Stop getting strangled by your supply chain", Forrester Research, 2004.
[3] H.C.W. Lau, W.T. Tsui, C.K.M. Ho, and A. Ning, "Development of a profit-based air cargo loading information system", IEEE Transactions on Industrial Informatics, vol. 2, no. 4, pp. 303-312,
[4] IATA Cargo 2000 website: http://www.iata.org/whatwedo/cargo/cargo2000/Pages/index.aspx. Retrieved 30 Nov 2011.
[5] J. Schumacher, M. Gschweidl, and M. Rieder, "EURIDICE – An enabler for intelligent cargo for the logistics sector", Journal of Systemics, Cybernetics and Informatics (JSCI), vol. 8, no. 2, pp. 18-28, 2010.
[6] The iSURF project (February, 2011), [Online]. Available: http://www.srdc.com.tr/isurf/
[7] S.P. Lu, Y.H. Wu, and Y.T. Fu, "Research and design on pallet-throughout system based on RFID", in Proc. IEEE International Conference on Automation and Logistics, pp. 2592 – 2595, 2007.
[8] B.K. Son, J.H. Lee, K.L. Park, and S.D. Kim, "An efficient management algorithm for gateway readers in the warehouse", in Proc. MUE '07 International Conference on Multimedia and Ubiquitous Engineering, pp. 130 – 134, 2007.
[9] S.W. Jeon, M.Y. Choi, G.H. Kim, and B.H. Hong, "Localization of pallets based on passive RFID tags", in Proc. 2010 Seventh International Conference on Information Technology: New Generations (ITNG), pp. 834 – 839, 2010. [10] EPCglobal Inc., "EPC radio frequency identity protocols class-1 generation-2 UHF RFID protocol for communications at 860 MHz –
[10] **http://www.impinj.com/blog/**
[11] http://www.iaito.co.in/

© 2016 IJAIR. All Rights Reserved