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Internet of things (IoT) to make commercial avionics and aerospace smarter for aviation industry: An executive perspective

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ABSTRACT

A huge system of interconnected devices has changed the way we live our lives every day. In the field of aeronautics, IoT could also be the link that develops new developments and allows the digital aviation age to flourish. This article explains how IoT is used in aircraft and discusses a variety of cabin use scenarios.

Keywords— Avionics, IoT, Connected Cabin

1. INTRODUCTION AND SURVEY

Simply put, this is the concept of basically connecting any device with an on and off switch to the Internet (and/or to each other). This includes everything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and almost anything else you can think of as shown in figure 1.



Fig. 1: Overview of IoT

This is not only a roadmap to boost this day-to-day life but also for more businesses and also small companies in, including the aviation industry. And, furthermore, it is easy to just imagine how. With the addition of increased solutions such as the construction of the components, major facts can be considerably improved, not to mention the autonomous logistics offerings while using defective and shrewd gadgets.

Dysfunctional elements could be diagnosed in the middle of the air and indicated on the ground when a restore element can be constantly built and dropped by a specific autonomous car or vehicle, as well as drone, in this recovery section.

There is no doubt that the above-mentioned circumstances are not completely real, but many other IoT software programs

generally. According to Deloitte's survey, 90 percent of air carriers' commanders expect for the next three years to reap spectacular benefits in accordance with 37 percent previously started to tinker with improvement in IoT in order to avoid increased bills.

The testing of IoT with technological know-how is the beginning. The true test for aviation middle management could be to support a large IoT environment: this usually involves exceptional modifications in the functional and additional corporate structure of several aircraft, so that you flourish.

Dr Arjan de Jong [1] heads up the Netherlands Aerospace Centre's Aerospace Systems Division, which deals with ways to improve the safety, efficiency and effectiveness of the aviation industry. In his explanation, IoT implementation has a triple challenge: we believe that three major challenges lay ahead, the first being safety, with the implementation of IoT in aerospace. The Internet is a dangerous environment, and cyber safety is a big concern as IoT is adopted. Security is also a big challenge. New technology or automating workflows are relatively easy to implement. Nevertheless, errors in hardware and software technology can present a safety problem. Only think about what can go wrong if a fuel uplift calculation or fuel ordering procedure makes mistakes with an IoT solution.

The principle of the estimation of the current state of the automated system using the temperature sensor, the IR sensor and other sensors installed within the automated system and facilitated[2].The Internet-based Soft-i-Robot protection is modeled in complex and mal-structured situations with the soft computing paradigm for problematic resolution and decision-making[3]. The model has sensory subsystems such as accident recognition, image collection and sending to the server and IoT [4] [5] for Obstacle Avoidance. The power consumption of automation devices should be designed in order to use low modulation techniques and effective modulation techniques to reduce power during transmission [6].

2. IOT AND DATA ANALYTICS IN AEROSPACE: AN EXECUTIVE PERSPECTIVE

Below are the few advancement and research going on in terms of IoT over Aerospace domain.

- Autonomy
- Aircraft control from ground.
- Predictive Maintenance
- AR based manufacturing
- AI based decisions for pilots
- Touch less check in at Airports
- Connected cabin

The market for IoT in A&D was estimated at \$91.5 billion. By the year 2023, it is predicted to more than double, in large part due to the North American A&D market [7].

Let us quickly talk about the above 6 in details

Autonomy: As we all know Autonomy is becoming more popular in the Automobile Industry. As Auto industries advance in Autonomy, aircraft OEM's are also planning to offload pilots' work load by having more autonomy. How? By connecting more control devices through IoT which mean more data transmission from the electronic controls/panels present in the cockpit to a server and then decisions are made instantly using AI.

Aircraft control from ground: This is the most researched field where we can control the aircraft from ground when an emergency occurs or even some unexpected thing happens like the pilot is out of control/hijacks etc.

Predictive Maintenance: Predictive Analytics is becoming more popular nowadays where you can find the faulty devices or error which is going to happen in advance and repair it before it happens. This is well advanced in automobile Industry where it's just started in the aero domain. In Aero we can predict the failure in advance like landing gear failure, sensor failure, engine failure, controls failure, fuel leakage indications etc.

AR based Manufacturing: As we all know AR /VR is becoming more and more viable in manufacturing environments in most of the Industries. Aerospace doesn't trail in adopting that technology. AR based manufacturing for electronic equipment where you can visualize most of the lab-based environment and to see the equipment like how it fits depth of the screw etc.

AI based decisions for Pilots: In today's controls world we all know there are a lot of controls available in the cockpit compared to 10 years ago. The purpose of adding more controls is to offload pilot workload but at the same time it's becoming a risk when an emergency occurs where pilots will be getting a lot of messages and struggle to figure out what kind of decision they need to take. The future is trending towards where using AI we can help pilots to make some decisions and inform pilots reducing the options from 10 to 3.

Touch less check in at Airports: What a time to talk about this. As the whole world is trying to fight against the Pandemic called COVID -19, touch less is becoming more and more popular. Read from news that most of the railway stations, bus stations, and lift doors are becoming touch less. The advancement is required in Airports too. Where touch less baggage check in and passenger check in using biometric and facial recognition.

Connected cabin: In the era of IoT, connecting each and every electronics is becoming more popular to reduce workload and also to make decision/energy savings. As we all know when someone boards into the airplane what the pains we go through before we get into the seat. Some examples like, most of the time we struggle to fit our bags into the bin, not sure what kind of food is available, also in the same way cabin crew struggle with a lot of workload where they need to check each and every passenger about seat belts, food arrangement etc. I would like to discuss some use cases where I think the cabin can be connected in future using IoT and data analytics. Below figure just gives an overview of an entire connected cabin how everything inside the cabin is getting connected and transmitted through the server and Wi-Fi as shown in figure 2.

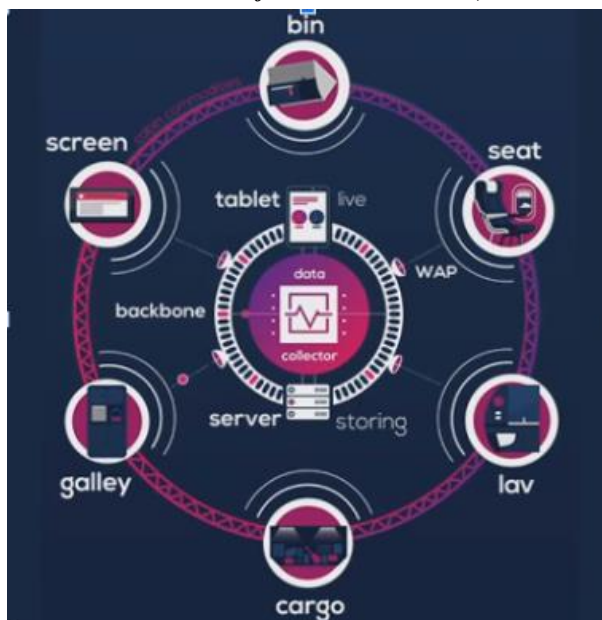


Fig. 2: Connected Cabin

Let us discuss a few use cases like Galley, Seat and Lavatory where we get connected and what kind of advantages we will be able to leverage out of those getting connected.

3. USE CASE-GALLEY VISION

I would briefly talk about the one-use case which is depicted in figure 3 from the Galley where inventory and location of the food. As we all know most of the time, cabin crew struggle to know the inventory of the food available and also location of the food. If we can connect the Galley and identify the food inventory data using IoT it will save enormous time where cabin crew spend time in searching for the food when someone asks for extra or additional items.

Let's talk about cabin safety. As we all know most of the time before takeoff and landing the crew needs to make sure all the passengers seat belts are buckled in. To do this cabin crew used to come to each seat and make sure everyone's seat belt is buckled and the seats are in upright position. If we can do the same using IoT where the data from the seat is transmission and the cabin crew can view the data from their iPad and make sure all the passengers buckled their seat belt.

Let us talk quickly about arranging food based on hand preference. As everyone experienced who ever travelled in an economy class about the space you have to eat the food. If you turn the tray around you might spill the food. In order to avoid that we can get the data of a passenger whether he is a right or a left-handed and based on that we can arrange the food accordingly before we serve. This will increase customer satisfaction and avoid food spillage which leads to food wastage.

Knowing the preference of the drinks. One of the data shows 80% of the tomato juice in the aircrafts is getting wasted. The reason is the cabin system or the food management company who load the food into the aircraft doesn't know what is the volume of tomato juice will be consumed in their flight until the cabin crew go and ask the passenger. If we know this is advanced by collecting the data, we can save a lot of food wastage and serve the community where they are struggling to get food.

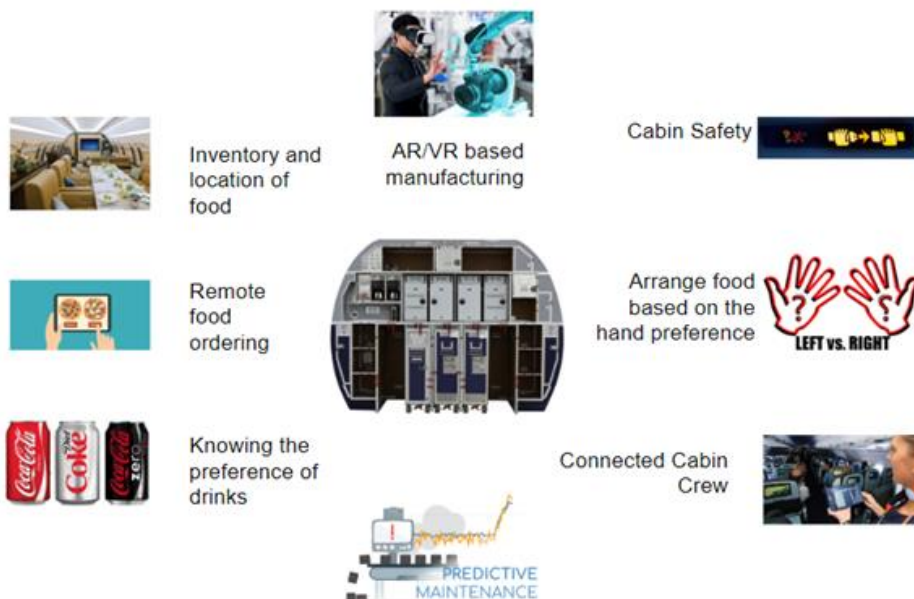


Fig. 3: Use case-Gallery View

4. CONCLUSION

This executive perspective article tells precisely how IoT is usually implemented inside plane together with shows in more detail in regards to several employ circumstances with regard to linked cabins. The discussion was done with a case study and some advancement such as Autonomy, Aircraft control from ground, Predictive Maintenance, AR based manufacturing, AI based decisions for pilots, Touch less check in at Airports, Connected cabin.

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