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Research Article

Role of Various Electro-tablets in Flight Deck and Fuselage

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Abstract

The flight operations inside the cockpit and fuselage are moving towards technological based systems, such as Tablets and Mobile computers. The new technology also offers a variety of possible options to pick the right tools and gadgets for regular operations performed by the Pilot, inside the Cockpit and in the fuselage. This paper surveys different gadgets, Electronic Flight Bag (EFB) used by the aviation pilots as well as Inflight Entertainment Devices (IFE) used in the aviation industry. Moreover, the present work also surveys the variety of gadgets used to achieve various goals with the existing issues and challenges.

More Information

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Introduction

The aviation industry is a fast-growing field, which helps in connecting people across the globe [1]. Technology plays a very crucial role in aviation operation. From flight booking to reaching the customer's destination the process evolves with technology. During the early ages paper charts were used by flight crew to determine the path and navigation route to reach the destination, after the technological advancements in the year 2011 FAA (Federal Aviation Administration) introduced the use of iPad for flight operations by the airlines. American Airlines was the first to approve iPad [2]. The new term that comes across by the pilots is EFB (Electronic Flight Bag) which is an Electro-Tablet used for various operations:

Storing the data

The flight charter which is in paper format is transformed into a digital paper and stored in the tablets for each interaction and minimizing the use of paper. According to United Airlines a conventional-Flight-Bag consists of 12,000 papers per pilot, and it requires 16 million paper sheets per year, by using the Electro-Tablets the airlines save huge amounts of trees, and it reduces 326000 gallons of fuel amount and weight on board in the airplane [1].

Navigation process

The Electro-Tablets are used for navigation by pilots to reach the destination, by using maps, virtual compass and the GPS (Global Positioning system). Sensors used for identifying the weather conditions such as storms [3].

Effective

Communication within the aircraft and outside the aircraft are done in an effective way by using the software which is compatible with the Electro-Tablets.

Weather prediction and analysis

The weather change affects the aircraft operation on the ground and in the air while flying, to make the precautionary measures by the pilots, there are weather prediction software's designed for aviation industry to predict the weather and tackle the situation caused by the change in weather and to analyze the route plan in the briefing session before entering the cockpit. By the flight crew.

Installation of flight software

There is software built especially for pilots which is significant for the flight operations, like the (foreflight app) which is used for flight planning, weather monitoring and charts. The different operating systems and devices support various applications.

The In-Flight-Entertainment provided by the airlines for long-haul [4] and short-haul in the fuselage, where the

customers are seated to reach their destination, also includes the use of Electro-tablets which helps the airlines in:

Storing the information

The in-Flight-Entertainment is a huge part of the airline industry which serves a hassle-free journey with the airline by facilitating the passengers with in-built music, movies and eBooks.

Connection

The connection between the devices can be established through satellite or ATG (air-to-ground) transmission.

Health monitoring

The passengers inside the flight can become ill because of fatigue [5], sound of the engine or environmental discomfort. By using the sensor with the device, the IFE can detect the passenger's health condition and send it to the flight crew.

Literature review

The growth of EFB (Electronic Flight Bag) has drastically increased, the various classes of EFB provide various features and certification that prove to fit in the aviation industry for use the pilots [1]. The EFB has changed the analogue input devices in the cockpit [2]. The EFB has a relationship with business operations, cost saving, operating EFB has increased productivity by providing effective results during the flight operations and limiting the use of paper charts.

Mobile computing becomes a major area for research and development of applications [6] and technologies that are bound to hardware. Development of mobile computing devices with the use of sensors helps in facilitating the gathering of the data and transforming the data according to the user's needs. The mobile computing-based technologies helps in communication with the other devices and allows to install the software for the use of customers and in the organization with cost effective approach and ease of access to the resources, which helps in collaboration, access information, update and upgrade the features installed and provides security.

The in-flight entertainment devices offer a wide range such as newspapers, magazines, songs and movies [4]. With the help of software properties which include videos, chat, games and games provided for the customers during their journey in the flight. The protocols and design approach followed for manufacturing the In-Flight Entertainment help in reducing the efforts of passenger health monitoring and boredom during the long-haul [7] in the wide body aircraft [8].

According to "ForeFlight A Boeing Company" 80% of the ForeFight employees who are pilots prefer iPad mini [9]. The use of iPad in the aviation industry was authorized in the year February-2011 by the FAA and in December-2011 American Airlines was the first airline to use the Jeppesen charts in iPad [10], a pilot from Canada suggested application that is running on iPad makes the navigation process easier than using the physical charts [10].

Categories of electro-tablets used in flight deck

A) Class-1 EFB [1]

The class-1 Electronic-Tablets is a portable plugin device which can be connected to the aircraft power supply. The class-1 devices are not connected to the mounting device or fixed devices in the aircraft power supply. The class-1 Electro-Tablet devices do not require airworthiness approval. But requires the approval of the certified power supply because they are connected to the aircraft power supply.

B) Class-2 EFB [1]

The class-2 Electro-Tablets require airworthiness approval, and they are connected to the aircraft power supply that requires the certified power supply certificate. The devices are mounted to aircraft, and they are controlled portable devices.

C) Class-3 EFB [1]

These systems are preinstalled, and it requires several certifications for working with the aircraft, the certificate includes (EFB Hardware installation integrity, such as the OS, servers, keyboard, screen, etc.) it also includes the aspect of human and machine interface, compatibility of the Hardware and software components qualities.

Electro-tablet manufacturers for aviation sector

A) Apple

iPad and iPhone are mostly used by pilots for their aircraft operations and support more of the aviation software than any other OS.

B) Samsung

An Android based system which is used for piloting operations and In-Flight Entertainment (IFE) for customer's entertainment in long-haul and short-haul flights by some renowned airlines.

C) Microsoft

Surface editions which works as desktop and Electronic-Tablets with Windows as the main operating system and Microsoft has recently entered the aviation industry.

D) Thales

Provides a flagship edition for the pilots with Windows operating system and easy attachments features for the pilots in the cockpit. Avant Up manufactured by Thales group offers the highest storage and used for IFE (In Flight Entertainment) for customers in renowned airlines like Qatar Airways.

Specifications of various electro-tablets used by pilots in the flight deck (Table 1).

Table 1: Specification difference between various Electro-Tablet Manufacturers.

iPad [11]	Galaxy Tab S 8.4 [12]
Manufacturer: Apple	Manufacture: Samsung
Operating System – iOS 17	Operating System – Android
Display – all-Screen OLED	Display – AMOLED
Weight – 188 grams	Weight - 294g(Wi-Fi) / 298g(LTE)
Storage – 8GB RAM (256GB-512GB) - 16GB RAM 512GB – 1TB (or) 2TB depending upon the version of ipad mini or ipad pro.	Storage – 16 GB
Sensors – Face ID Barometer Three-axis gyro Accelerometer Proximity sensor Ambient light	Sensor – Accelerometer Fingerprint Geomagnetic Gyro sensor Hall sensor RGB sensor
Location – GPS/GNSS Wi-Fi Digital Compass Cellular Bluetooth iBeacon micro location	Location – GPS Glonass Beidou Bluetooth
SURFACE PRO – 3 [13]	**THALES / AVANT UP [14]**
Manufacturer – Windows	Manufacturer – Thales Group
Operating system – Windows 8.1 or Windows 10	Operating system – Windows 10 Enterprise Edition Android for Avant Up
Display – 12" clear type full HD	Display – High-definition anti-glare system / Optiq display by Thales
Weight – 800 grs	Weight – 451 grs
Storage – 4GB RAM with 64GB or 128GB storage 8GB RAM with 256GB or 512GB.	Connected with the Docking Stations/ Server on platform supports 20TB storage
Sensors – Ambient light sensor Compass Accelerometer Gyroscope	Can be mounted with the existing Electro-Tablets and Docking system/ Back of the seat
Locations (wireless) – Wi-fi Bluetooth	Locations – Wi-Fi 3G 4G Bluetooth For Avant up – Two Bluetooth connections Built in Wi-Fi USB Headset port
Ports – Full size USB 3.0 Mini Display port Micro SD card reader Headset Jack Covert Port Charging Port Audio Jack	Ports – Ethernet
Battery life – Up to 9 hours	Battery Life – Connected with the Thales Tab holder which is directly connected with aircraft power supply.

Methodology

Comparing the properties of the various Electro-Tablets specifications used in the Cockpit by the pilots, flight crew members and in-flight-entertainment. Collecting the data from various resources, we can define the following differences and similarities of the Electro-Tablets and their performance by using the software analysis tool Excel for comparing the Electro-Tablets and their performance provided by the manufacturers.

By defining the comparisons among the various Electro-Tablets, we will be able to define the following:

1. Specifications of the Electro-Tablets.
2. Battery status.
3. Display configurations.
4. Camera quality.
5. Navigation process support.
6. Weight of the devices.
7. Number of ports available.
8. Flexibility and Feasibility.
9. Security of the Data.
10. Software compatibility.

By providing the exact numerical data of the Electro-Tablets the graphs have been obtained separately for each of the tablet manufacturers in the aviation industry with their products and specifications.

The data is not processed through any of the algorithms; it is purely dependent on the raw specifications and performance levels of the tablets. There are specific variants except iPad because, there are specific versions available for Samsung and Microsoft but, iPad there are variants like mini and pro with different OS are being used by pilots.

Results and discussion

The discussion includes the features and specifications of the various Electro-Tablets used in the Aviation industry.

In the following Bar charts, which include storage, selfies for video calls, battery for running the device, features, Bluetooth, Display-Resolution, Display-size, surfing, display and sim options which are separated in various charts and in the final Bar-chart combining all the specifications we can determine the features and specifications offered by the various Electro-tablet manufacturers for pilots.

The various colors portray the various Electro-Tablet manufacturers in the Aviation industry and for consumer use, for accomplishing regular tasks like navigation, calculation of distance and running specific software's which are recommended for use by the pilots in the aviation industry.

iPad is used by most of the pilots in major airlines, Android and Windows based tablets are slowly entering into the cockpit because of the usability, security and design constraints. The flexibility provided by iPad is more reliable than the Android and Windows based systems.

Thales Group Avant Up system is used in most of the airline for the in-flight-entertainment like the Air India airlines, Emirates and Qatar Airways.

The graphs below describe the performance of various Electro-Tablets which are used as Electronic Flight Bag in the cockpit and as In-Flight Entertainment in the fuselage. The exact numerical values have been provided as input and the output displayed shows that the portion or the percentage of each Electro-Tablets performance based on their manufacturer and the specifications which have been provided to the tablets (Figures 1-3).

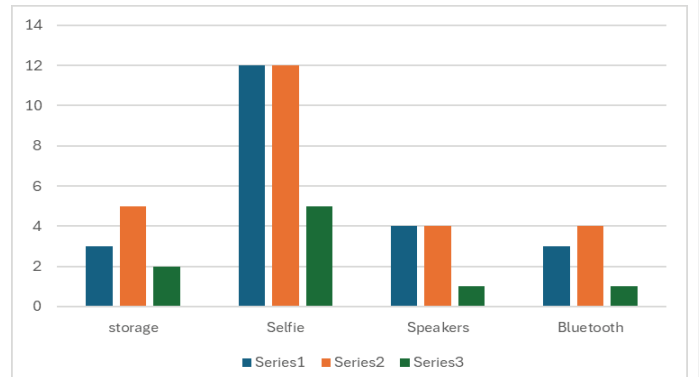

Figure 1: Comparison of various tablets and manufactures.

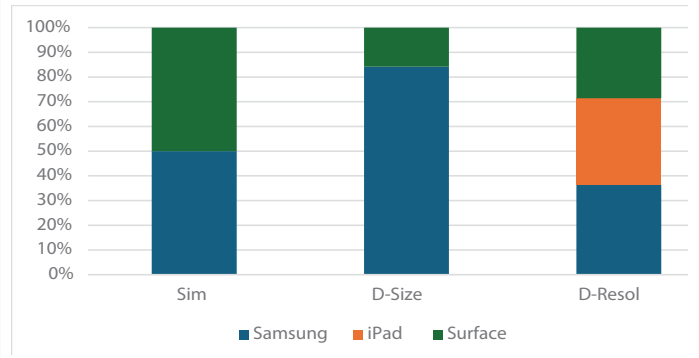

Figure 2: Comparison of various screen size.

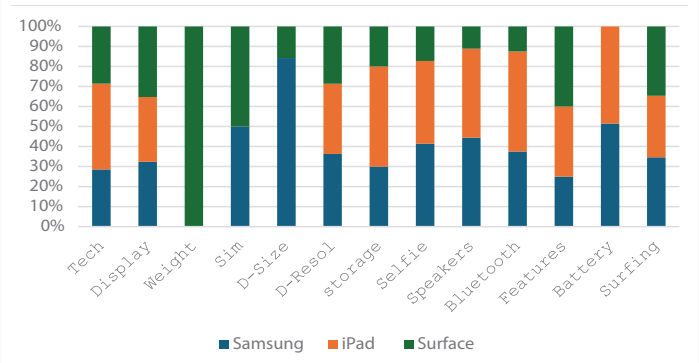

Figure 3: Overall performance of the tablets.

Conclusion

The Aviation Industry is growing increasingly and the need for Electro-Tablets with high specifications adapt to the changing conditions inside and outside the flight.

The EFB (Electronic Flight Bags) and In-Flight Environment devices plays a vital role in the Aviation sector by making communication easy, monitoring and maintenance with cost effective solutions, gathering information from various sources, providing real time navigation and storage, supporting the required aviation related software's for pilots and flight crew management and finally reduce the use of papers and save the trees.

In-Flight Entertainment Electro-Tablets are designed by the Aerospace groups in collaboration with top IT companies with high security standards, solutions for high storage options for the airlines to provide customers with e-resources so the customers can enjoy their journey by reducing stress, anxiety, monitoring the health of the customers and the recent emerge of video calls from 35,000 ft.

The result shows that the iPad is giving better performance when compared with Microsoft when comparing the SCORECARD design structure and flexibility to use [15-18] in the cockpit.

By combining both EFB and In-Flight-Entertainment devices as a solution for navigation, storage and entertainment the airline achieves a tremendous result in providing high safety security standards and minimizing costs and maximizing efficiency.

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