(12)Indian Patent Application

(21) Application Number: 202241052048

(22) Filing Date: 12/09/2022 (43) Publication Date: 15/03/2024

(71) Applicant(s): L&T TECHNOLOGY SERVICES LIMITED

(72) Inventor(s): Paul, Sachin Raj

(51) International Classifications: G07C 5/08 H04L 12/26 G07C 5/00 B66F 17/00 G08B 25/00

(54) Title: METHOD AND SYSTEM FOR MONITORING SAFETY PARAMETERS

(57) Abstract: The present invention describes a method and system for monitoring safety parameters of an airplane in compliance with the airplane safety parameters. The system includes an airplane safety device which may obtain a status information corresponding to a current state of the plurality of airplane components (118) via a plurality of sensors (114) associated with each of a plurality of airplane components (118). The system receives the status information from the plurality of sensors (114) associated with the plurality of airplane components (118). Analyze the status information, based on one or more safety-parameters to determine an anomaly in the current state of one or more airplane components. The system triggers a corresponding action to reset the current state of one or more non-compliant airplane components. The action includes displaying an alert message via the user interface (330a) and controlling the corresponding actuators associated with each of the non-compliant airplane components.

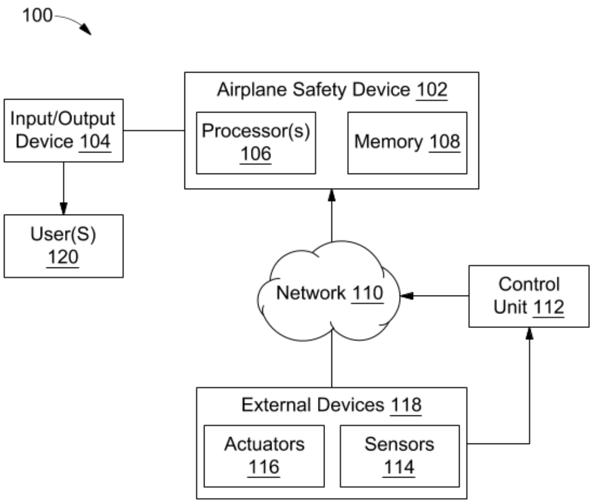

FIG. 1

FORM 2

THE PATENTS ACT 1970
(39 OF 1970)
&
The Patent Rules, 2003

Complete Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

SYSTEM AND METHOD FOR MONITORING SAFETY PARAMETERS

2. APPLICANT(S)

(a) NAME : **L&T TECHNOLOGY SERVICES LIMITED**

(b) NATIONALITY : **INDIAN**

(c) ADDRESS : DLF IT SEZ Park, 2nd Floor – Block 3
1/124, Mount Poonamallee Road,
Ramapuram, Chennai – 600 089,
INDIA.

3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification describes the invention and the manner in which it is to be performed

DESCRIPTION

Technical Field

[001] This disclosure relates generally to airplane safety system, and more particularly to a system and method for monitoring various airplane safety parameters using a digital monitoring device.

BACKGROUND

[002] The public transport system including the airplanes, the railways, and the buses are equipped with various components to provide comfort to passengers while travelling such as food trays, the seat recliners, LED screen, reading lights, etc. These components when inside an airplane needs to be monitored for security reasons specially during an airplanes landing, takeoffs, and emergencies to comply with airplane safety norms. There are many airplane safety norms defined which are to be adhered to in order to ensure safety of the plane and the people boarded on the plane. Adherence to the defined airplane safety norms is to be ensured by the various cabin crew manually.

[003] During an airplane's landings and takeoffs, the cabin crew instructs the passengers to comply to the safety norms of keeping the backrest upright, closing the food trays, opening the window shutters and switching their phones or devices to airplane mode. However, the crew ensures compliance by making voice announcements and manually going over to the passengers' seats and repositioning the passenger's seats, folding the food trays, opening the window shades, etc. Controlling the components manually by the cabin crew may result in extra time consumption and may cause delay in the airplane take-off and landing schedules. Further, in case of a larger airplane operating at full capacity, manual supervision may lead to overlooking of a few passengers who might have not adhered to the safety norms, which may pose a risk to every passenger's safety.

[004] There is therefore a need in the art to provide an automated system to monitor as well as regulate the various airplane components from a single location inside the airplanes.

SUMMARY OF THE INVENTION

[005] In an embodiment, a system for monitoring airplane safety parameters is disclosed. The system may include a plurality of sensors associated with each of a plurality of airplane components, each of the plurality of airplane components that may be located at a respective seating region of a plurality of seating regions defined within a plane. Further, the plurality of sensors may be configured to obtain a status information corresponding to a current state of the plurality of airplane components. The system may further include an airplane safety actuator associated with each of the plurality of airplane components. The system may further comprise an airplane safety device which may be communicatively coupled with the plurality of sensors and the plurality of actuators. The airplane safety device may comprise a user interface, a one or more processors and a memory which may be communicatively coupled to the one or more processors. Further, the memory may store processor-executable instructions which upon execution by the one or more processors may cause the one or more processors to perform various functions such as, but not limited to, to receive the status information from the plurality of sensors associated with the plurality of airplane components. The status information may be analyzed based on one or more airplane safety-parameters to determine an anomaly in the current state of one or more airplane components, and wherein the anomaly may be indicative of non-compliance of the one or more airplane components with the one or more safety parameters. Further, an action may be triggered corresponding to the anomaly to reset the current state of one or more non-compliant airplane components, to comply with one or more safety-parameters. In an embodiment, the action triggered may comprise displaying an alert message via the user interface in response to the anomaly in the current state of one or more airplane components and in response to resetting the current state of the one or more non-compliant airplane components. Further, the action triggered may comprise controlling an actuator associated with each of the one or more non-compliant airplane components in response to the anomaly.

[006] In another embodiment, a method for monitoring airplane safety parameters is disclosed. The method may include receiving, a status information from a plurality of sensors associated with a plurality of airplane components. It may be noted that each of the plurality of airplane components are located at a respective seating region of a plurality of seating regions defined within an airplane, and the plurality of sensors is configured to obtain the status information corresponding to a current state of the plurality of airplane components. Further, the method may comprise analyzing the status information based on one or more safety-parameters, in order to determine an anomaly in the current state of one or more airplane components. It may be noted that the anomaly may be indicative of non-compliance of the one or more airplane components with the one or more airplane safety parameters. The method may further include triggering an action corresponding to the anomaly, to reset the current state of one or more non-compliant airplane components to comply with the one or more safety-parameters. It should be noted that the action triggered by the airplane safety device may comprise of displaying an alert message via a user interface in response to the anomaly in the current state of one or more airplane components and in response to resetting the current state of the one or more non-complaint airplane components and controlling an actuator associated with each of the one or more non-compliant airplane components in response to the anomaly. In an embodiment, the plurality of actuators may be associated with each of the plurality of airplane components. The method may further include to control an actuator associated with each of the one or more non-compliant airplane components in response to the anomaly detected. In an embodiment, the plurality of actuators may be associated with each of the plurality of airplane components.

BRIEF DESCRIPTION OF THE DRAWINGS

[007] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles.

[008] FIG. 1 illustrates a block diagram of a network implementation of a system for monitoring safety parameters, particularly in an airplane, in accordance with an embodiment of the present disclosure.

[009] FIG. 2 illustrates a functional block diagram of the airplane safety device, in accordance with an embodiment of the present disclosure.

[010] FIG. 3a and FIG. 3b illustrate a schematic diagram of a system of a digitally simulated digitally simulated airplane model and an interactive user interface in form of a dashboard, in accordance with an embodiment of the present disclosure.

[011] FIG. 3c illustrates a detail view of a passenger seat or a cabin suite from the corresponding digitally simulated interactive airplane model, in accordance with an embodiment of the present disclosure.

[012] FIG. 4a illustrates a schematic diagram of a window of an airplane depicting placement of sensors and actuators, in accordance with an embodiment of the present disclosure.

[013] FIG. 4b illustrates a burst view of a window of an airplane, in accordance with an embodiment of the present disclosure.

[014] FIG. 5 illustrates an actuation mechanism and sensor arrangement for a seat of an airplane, in accordance with an embodiment of the present disclosure.

[015] FIG. 6a illustrates a food tray, in accordance with an embodiment of the present disclosure.

[016] Referring now to FIG. 6b, a food tray is depicted with food kept on it, in accordance with an embodiment of the present disclosure.

[017] FIG. 6c illustrates an actuation mechanism for a food tray, in accordance with an embodiment of the present disclosure.

[018] FIG. 7a illustrates the position of onboard camera, in accordance with an embodiment of the present disclosure.

[019] FIGs. 7b, 7c and 7d illustrate smart devices depicting airplane mode, in accordance with an embodiment of the present disclosure.

[020] FIG. 8 illustrates a moving aisle, in accordance with an embodiment of the present disclosure.

[021] FIG. 9 illustrates a flow chart of a method for monitoring safety parameters, in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE DRAWINGS

[022] Exemplary embodiments are described with reference to the accompanying drawings. Wherever convenient, the same reference numbers are used throughout the drawings to refer to the same or like parts. While examples and features of disclosed principles are described herein, modifications, adaptations, and other implementations are possible without departing from the spirit and scope of the disclosed embodiments. It is intended that the following detailed description be considered as exemplary only, with the true scope being indicated by the following claims. Additional illustrative embodiments are listed below.

[023] The disclosure pertains to monitoring safety parameters and providing a remedial output which may be received by an airplane safety device connected to a plurality of airplane components. The airplane safety device may receive input from the plurality of sensors like light transmitters, light receivers, image sensors, proximity sensors, etc. coupled to the plurality of airplane components. The plurality of airplane components may include, but not limited to a passenger’s seat, a food tray associated with the passenger’s seat, one or more window shades, seat belts, and the like. The plurality of sensors may be configured to transmit status information which may indicate a real-time status of the plurality of airplane components to the airplane safety device. Based on the status information received from the plurality of sensors, the airplane safety device may visually indicate the status of the various airplane components to a user via an interactive display. Further based upon the real-time status of the various airplane components, the user may give a corresponding input from the airplane safety device to actuate the airplane components and reset the status of the airplane components in accordance with the airplane safety norms.

[024] Referring now to FIG. 1, a block diagram of a network implementation of a system 100 for monitoring safety parameters, particularly in an airplane, is illustrated, in accordance with an embodiment of the present disclosure. The system 100 may implement as an automated safety monitoring system with an interactive dashboard to monitor and regulate the plurality of airplane components as per the safety norms to ensure safety of the passengers within the airplane. The system 100 may include an airplane safety device 102. The airplane safety device 102 may further include one or more processor 106 and a memory 108. By way of example, the airplane safety device 102 may be implemented in any computing device which may be configured or operatively connected with a server (not shown). In an embodiment, the airplane safety device 102 may be implemented using an open-source IoT platform such as, but not limited to, Thingsboard, Wolkabout or Kaa can be used to integrate multiple sensors, transforms real-time readings into meaningful data, and may combines different sensors and services, data collection, analytics and visualization, and remote control. In an embodiment, the IOT platform may be used with a combination of Amazon managed services such AWS IoT, Amazon Kinesis, Amazon QuickSight and Amazon S3.

[025] In an embodiment, examples of processor 106 used may include, but not limited to an Intel® Itanium® or Itanium 2 processor(s), or AMD® Opteron® or Athlon MP® processor(s), Motorola® lines of processors, FortiSOC™ system on a chip processors or other future processors. Processor 106 may include various modules associated with embodiments of the present invention. Further, processors 106 may include a microcontroller such as, but not limited to, NodeMCU microcontroller with ESP8266 WiFi Module which a self-contained SOC (system-on-chip) with integrated TCP/IP protocol stack that can give any microcontroller access to a WiFi network, ATMega328P microcontroller with Arduino UNO (OR) Raspberry Pi Pico.

[026] Further, one or more users 120 may communicate with the system 100 through one or more user input/output devices 104 provided in the airplane safety device 102. Further, the airplane safety device 102 may be communicably coupled to external devices 118 through a control unit 112 via a wireless or wired communication network 110. In an embodiment the user 120 may be a supervisor or pilot or airplane crew entrusted with the task of monitoring the safety parameters of an airplane. In an embodiment, the user 120 may communicate with the airplane safety device 102 using a user device (not shown) which may include, but not limited to, a laptop computer, a desktop computer, a notebook, a workstation, a portable computer, a personal digital assistant, a handheld or a mobile device. In an embodiment, the user device (not shown) may be same as the input/output device 104.

[027] In an embodiment, the user 120 may be authenticated by the airplane safety device 102 based on an input of various authentication information including but not limited to, user name and password, biometric information such as finger print scan, retina scan, etc. In an embodiment, the user 120 may be provided access to the airplane safety device 102 based on a hierarchical user profile information such as pilot access, crew access, administrator access, etc. In an embodiment, the access authentication of the user 120 may be based on the hierarchical user profile information for example, an administrator access may provide full access to the airplane safety device 102, which pilot access may be allowed to override the time information of the airplane and may not be able to manipulate the security parameters, crew access may provide an access to monitor and reset the status information of the airplane components.

[028] In an embodiment, the airplane safety device 102 may be communicatively coupled to an external device 118 for sending and receiving various data. In an embodiment, the external devices 118 may be physically or electrically or communicatively coupled to various airplane components such as, but not limited to, seats, food trays, window shutters, reading lights, cameras, conveyors, etc. provided in the airplane. The external devices 118 may include, but not limited to, actuators 116, sensors 114, a remote server (not shown), digital devices (not shown), etc. In another embodiment, the external device 118 may also include a computing device including but not limited to a smartphone, a smart mobile device, a laptop, a smartwatch, a personal digital assistant (PDA), an e-reader, a tablet, IoT devices, and the like. In another embodiment, the airplane safety device 102 may be connected to the external device 118 over the communication network 110. In another embodiment, the airplane safety device 102 may connect to external device 118 via a wired connection, for example via Universal Serial Bus (USB), etc.

[029] Additionally, the input/output device 104 of the airplane safety device 102 may include an IoT based interactive dashboard (described later) which may be used to monitor and control the plurality of airplane components via the external devices 118 comprising the plurality of sensors 114 and the plurality of actuators 116. The airplane safety device 102 may include hardware and software systems for collecting, storing, visualizing, and analyzing data from the external devices 118. The dashboard provided by the input/output device 104 may be in communication with and responsive to the plurality of sensors 114 and the plurality of actuators 116 through a wired or a wireless connection to depict the real time status of the plurality of airplane components. The dashboard may be provided as a graphical user interface (GUI) and may also include touch-sensitive input buttons to configure or reset the status of the airplane components. Further, each of the sensor from the plurality of sensors 114 may be in communication with the input/output device 104 using protocols such as, but not limited to, MQTT (Message Queue Telemetry Transport) which is a lightweight binary protocol or an open messaging protocol and used for sending simple data flows from sensors to applications and middleware. In an embodiment, other communication protocols known in the art may also be utilized.

[030] The memory 108 may be communicatively coupled to the one or more processors 106. The memory 108 may be a non-volatile memory or a volatile memory. Examples of non-volatile memory may include, but are not limited to a flash memory, a Read Only Memory (ROM), a Programmable ROM (PROM), Erasable PROM (EPROM), and Electrically EPROM (EEPROM) memory. Examples of volatile memory may include but are not limited to Dynamic Random Access Memory (DRAM), Static Random-Access memory (SRAM)), flash memory, magnetic or optical cards, or other type of media/machine-readable medium suitable for storing electronic instructions (e.g., computer programming code, such as software or firmware).

[031] The memory 108 may store various parameters such as, but not limited to, seating region information, section parameters, time information, emergency parameters, speed parameters, status parameters, etc. that may be captured, processed, and/or required by the system 100. Further, the memory 108 stores a processor-executable instructions, which may be processed by the processor 106 to perform regulation and monitoring of the external devices 118 comprising the plurality of airplane components.

[032] In an embodiment, the graphic user interface of the input/output device 104 may be configured to visually display the status of the external devices 118 and the plurality of airplane components, as an output, as well as receiving an input from the user 120, in accordance with the output. The input and output via the airplane safety device 102 may regulate the external devices 118 comprising the plurality of airplane components through the network 110. It may be noted that a wired or a wireless connection may be used as a network 110 to monitor the safety parameters of the airplane. Additionally, the dashboard may be simulated using any programming language known in the art, alternatively, any open-source IoT platform, known in the art, can be used. Also, analog data received from the sensors 114 and the actuators 116 may be converted to digital data to be displayed on the dashboard in real-time. The network 110 may be a wired or a wireless network, or a combination thereof. and the examples may include, but are not limited to the Internet, Wireless Local Area Network (WLAN), Wi-Fi, Long Term Evolution (LTE), Worldwide Interoperability for Microwave Access (WiMAX), and General Packet Radio Service (GPRS). Various devices in the system 100 may be configured to connect to the communication network 110, in accordance with various wired and wireless communication protocols. Examples of such wired and wireless communication protocols may include, but are not limited to, a Transmission Control Protocol and Internet Protocol (TCP/IP), User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File

Transfer Protocol (FTP), Zig Bee, EDGE, IEEE 802.11, light fidelity (Li-Fi), 802.16, IEEE 802.11s, IEEE 802.11g, multi-hop communication, wireless access point (AP), MQTT protocol, device to device communication, cellular communication protocols, and Bluetooth (BT) communication protocols.

[033] In an embodiment, the external devices 118 and the airplane safety device 102 may be communicably connected to each other using Message Queuing Telemetry Transport (MQTT) protocol. In an embodiment, data flows from sensors 114 and actuators 116 to applications and middleware of the airplane safety device 102 and the control unit 114 through MQTT protocol. In an embodiment, other communication protocols such as, but not limited to, AMQP, HTTP or CoAP may be used. The use of MQTT protocol may be preferred due to its easier implementation in devices, lower power consumption requirements and lower bandwidth requirement and low latency. In an embodiment, the network 110 may comprise one or more MQTT clients such as, but not limited to, passenger infotainment devices connected to each of the seating regions, pilot devices. In an embodiment, MQTT subscriber may be devices which have subscribed to topics to receive notifications corresponding to the subscribed topics. In an embodiment, topics may be pre-defined and an MQTT broker may filter messages and transmit to appropriate subscribers based on the topics they have subscribed to. In an embodiment, the passenger infotainment devices may be configured or subscribed to receive instructions generated from the airplane safety device 102 and/or the pilot device (not shown). In an embodiment, each of the user devices (not shown), the sensors 114, the actuators 116 and the control unit 112 may publish by way of broadcasting messages and may subscribe to topics to receive messages sent by the airplane safety device 102 and the external devices 118.

[034] In an exemplary embodiment, the publishers may be the sensors 114 and the subscriber may be controllers of the control unit 112 and the IOT enabled airplane safety device 102 which may receive the data sent by the sensors 114. The broker may distribute the collected data from the publishers to the subscribers. For example, the sensor can send information to the broker to distribute to the subscribers based on a topic they have subscribed to. In an embodiment, MQTT broker may be, but not limited to, Mosquitto, HiveMQ and the like.

[035] The topic may be to know the status of the various airplane components such as windows, trays, backrests, smart devices, etc. The subscriber will listen for incoming messages from the subscribed topic and react to the messages published to that topic, such as “open” or “close”. The subscriber will respond to the publisher message by resetting the status of the airplane components through actuators 116 in communication with the control unit 112 and the airplane safety device 102. For example, the actuators 116 may also be the subscribers connected to the broker responding to the topic published.

[036] Other types of communication such as sensor to sensor communication, sensors to gateway, or gateway to IOT control panel may also be included in the scope of the invention.

[037] It may be noted that the plurality of sensors 114 coupled to the plurality of airplane components may include image sensors, inductive sensors, photoelectric sensors tilt sensors, proximity sensors, etc. which may be associated to the plurality of airplane components in order to monitor and control the safety parameters. The plurality of sensors 114 provide a current status of the plurality of the airplane components such as, for example, if a food tray of a seating region is open or close, if a window shutter is open or closes, if the smart devices in the seating region are working in airplane mode or not, if the back rest of the seat of the seating region is erect or inclined, etc. The status received from the sensors 114 may be processed by the airplane safety device 102 to determine if all the external devices 118 are complaint of the pre-defined safety norms. In an embodiment, the safety norms may be pre-defined by an administrator or pilot of the airplane. In an embodiment, the safety norms are to be complied during take-off and landing of the plane as well as during any emergency indicated by the pilot of the airplane. In an embodiment, the safety norms to be complied by the airplane safety device 102 may include, but not limited to, closure of the food trays, opening of the window shutters, making the backrest of the seats upright, smart devices to be operated in airplane mode, etc.

[038] In an embodiment, sensors 114 may be coupled to the plurality of airplane components, such as for example, photoelectric sensors would be attached to the window shades to detect the closure or opening of the window shutters. In an embodiment, proximity or induction sensors may be provided to detect the closure of the food trays. In an embodiment, a receiver may be attached to a top portion of the food tray and a transmitter may be attached to the back side of the seat to which the food tray is attached. When the food tray is close the receiver may come in contact with the transmitter indicating that the food tray is closed. In an embodiment, tilt sensors may be coupled to the passenger’s seat to determine if the passenger’s seat is upright or inclined. In another embodiment, image sensors may be positioned in each of the seating regions or in proximity to various airplane components may determine the current status of the smart devices as well as positions of the various airplane components including the passenger’s seat, food tray, the seat back-rest position, window shutter, etc.

[039] In an embodiment, the actuators 116 may be coupled to the plurality of airplane components of the external devices 118, such as, for example, actuators to automatically open the window shutter or one or more windows in seating regions. In an embodiment, the actuators may make the backrest upright of one or more seat of the seating regions. In an embodiment, the actuators may close the food trays of the one or more seating regions and so on.

[040] In an embodiment, the signals received from the sensors 114 by the airplane device 102 may be processed by the one or more processors 106. In an embodiment, the external devices 118 may be connected to the airplane safety device 102 through a control unit 112 which may be connected to various actuators (not shown) which may be deployed throughout the plurality of airplane components to monitor and control respective components of the airplane. In an embodiment, the controllers may execute one or more control algorithms to facilitate monitoring and control of the components such as, but not limited to, machines, hydraulics, conveyor systems, etc. According to the current disclosure, the controllers may be controlled by the airplane safety device 102 in order to reset their positions in order to comply with the safety parameters. Controllers may include software executable controllers which may be implemented on hardware platform or a hybrid device that combines controller functionality and other functions such as visualization. The control software or algorithms executed by the controllers may include coding or algorithm to process input signal read from the actuators 116 or sensors 114 used to monitor and control the airplane components. External devices may include both input devices that input data for controlling the external devices including the airplane components. Examples of such input devices may include, but are not limited to, sensors 114 (such as proximity sensors, photoelectric sensors, induction sensors, imaging sensors or cameras, etc.), manual operated actuators (e.g., push buttons, locks, etc.), and other such devices. In an embodiment, actuators 116 may also include output devices such as, but not limited to, motor drives, pneumatic actuators, devices robot control inputs, valves, hydraulics, etc.

[041] The one or more processors 106 may be configured to determine the status information of the plurality of airplane components based on the signals received from the control unit 112 and the sensors 114 of the external devices 118. The status information may be utilized to determine if the status of the plurality of airplane components is in compliance with pre-defined compliant position as per the pre-defined safety parameters. The one or more processors 106 may be implemented based on temporal and spatial processor technologies, which may be known to one ordinarily skilled in the art. Examples of implementations of the processor 106 may include a Graphics Processing Unit (GPU), a Reduced Instruction Set Computing (RISC) processor, an Application-Specific Integrated Circuit (ASIC) processor, a Complex Instruction Set Computing (CISC) processor, a microcontroller, Artificial Intelligence (AI) accelerator chips, a co-processor, a central processing unit (CPU), and/or a combination thereof. The memory 108 may include suitable logic, circuitry, and/or interfaces that may be configured to store instructions executable by the processor 106. The memory 108 may also store various data that may be captured, processed, and/or required by the system 100. Further, the status of the airplane components may be changed using control signals sent to actuators 116 from the control unit 112 in accordance with the pre-defined airplane safety parameters which are to be followed during the landings, takeoffs, and emergency. In an embodiment, the airplane safety device 102 may then visually indicate the changed status and position of the various airplane components via the graphical user interface of the input/output device 104 using a plurality of colored visuals. The graphical user interface of the input/output device 104 may indicate empty seats as grey or black/white squares, seats with passengers and having all their corresponding airplane components in compliance with the safety parameters as green color squares and seats with passengers and having one or more of their corresponding airplane components in non-compliance with the safety parameters as red color squares. Further, the graphical user interface of the input/output device 104 may provide an indication of the non-compliant component next to the red squares. Accordingly, based upon the color coding, the user 120 may identify the changes with the status and position of the airplane components and may give the desired input via the input/output device 104.

[042] Further, based upon the user input via the input/output device 104, the airplane safety device 102 may interact with the actuators 116 of the various airplane components through the control unit 112 to make them compliant to the pre-defined safety parameters, as is explained in conjunction with FIG. 2.

[043] Referring now to FIG. 2, a functional block diagram 200 of the airplane safety device 102 is illustrated, in accordance with an embodiment of the present disclosure. In some embodiments, the airplane safety device 102 may include a status information receiving module 202, an analyzing module 204, an action triggering module 206 and a display module 208. The action triggering module 206 may further include an alert message displaying module 206a and actuator controlling module 206b. In an embodiment, the status information receiving module 202 may receive the status information from the plurality of sensors 114 associated with the plurality of airplane components. It may be noted that each of the plurality of airplane components may be located at a respective seating region of a plurality of seating regions defined within the airplane. As explained earlier, the plurality of sensors 114 associated with each of the airplane components, may be configured to obtain the status information corresponding to a real time status as current status of the plurality of airplane components.

[044] The analyzing module 204 may analyze the status information based on one or more pre-defined airplane safety parameters to determine an anomaly in the current state of one or more airplane components. The anomaly may be indicative of non-compliance of the one or more airplane components with the one or more airplane safety parameters. The analyzing module 204 may analyze and provide the airplane safety device 102 with the information status of the current positions of the various airplane components including but not limited to the inclination of the seat, the positions of the window shade, status of the passenger's mobile phone, status of the food tray, etc.

[045] The display module 208 may display information related to all the airplane components and their current statuses for the user to determine if all the components are in compliance with the safety parameters. A simulated model of the airplane components of all the seating regions in the airplane enable a remote access for controlling and monitoring the airplane safety operations through the input/output device 104 in a user-friendly manner.

[046] The status information analyzed by the analyzing module 204 may be depicted using corresponding visual information, where the visual information may help to determine an anomaly in the current state of the airplane window shade 402 in accordance with the airplane safety parameters. It may be noted that the visual information may be generated using a set of color-coded information. Further, any change in the status of the window shade may be visually updated using a color-coded information. The color-coded information may be depicted via the input/output device 104, with the color red indicating non-compliance with the airplane safety parameters while a green color may indicate a complete compliance with airplane safety parameters. Further, based upon the color-coded information, a corresponding remedial action may be triggered. Display of the status information of the plurality of airplane components is further explained in conjunction with the FIG. 3a-b, FIG. 4a-b, FIG. 5, FIG. 6a-b, FIG. 7a-c and FIG. 8.

[047] The airplane safety device 102, based on the output from the sensors 114 of the corresponding airplane components may automatically generate a message that the "Airplane is ready to take-off/land" or "Safety procedure is complete" in case the status of the airplane components is compliant to the safety parameters. Additionally, the monitoring and control of the safety parameters may be performed by a single airplane safety dashboard which may be operated even by the pilots without requiring any presence of the airplane crew. Further, the airplane with business class, the corresponding alerts may also be provided on the LED/LCD screen provided to the passengers for infotainment. Additionally, safety feedback of individual passenger may be preserved in the form of a data, where the feedback may rate the passengers based on compliance to the airplane safety parameters. Based on the rating, a reward processing scheme may be introduced by the airlines to provide reward points to the passengers who have adhered promptly to all the safety parameters. The reward points may be used during the next booking with the airlines. Such a scheme may be implemented to increase the adherence to the safety parameters by the passengers. In an embodiment, the reward points based on the safety feedback of individual passenger may be stored on a remote server such, but not limited to, a cloud server. The passenger may access the reward points by using unique login credentials to login to a website while making airplane booking reservations.

[048] The action triggering module 206 may trigger a remedial action corresponding to the anomaly detected by the plurality of sensors. Further, the action may provide instructions to the control unit 112 which may generate control signals to reset the current state of one or more non-compliant airplane components to comply with the one or more safety-parameters. The action triggering module 206 may initiate the corresponding action further with an alert message displaying module 206a and an actuator controlling module 206b. The alert message displaying module 206a may correspondingly display an alert message via the user interface which may be the input/output device 104, in response to the anomaly in the current state of one or more airplane components. Additionally, the alert message displaying module 206a may display an alert message in response to detection of an anomaly and to alert the passenger that a remedial action will be following after a pre-defined time to reset the current state of the one or more non-compliant airplane components. In an embodiment, the pre-defined time may be 15-30 seconds after which the remedial in form of an automated actuation may be taken. In an embodiment, based on the alert, the passenger may manually reset the status of the one or more non-compliant airplane components. The actuator controlling module 206b may control the plurality of actuators associated with each of the one or more non-compliant airplane components in response to the anomaly detected. The action triggering module may again be explained in conjunction with FIG. 3a-b, FIG. 4a-b, FIG. 5, FIG. 6a-b, FIG. 7a-c and FIG. 8.

[049] The modules of the functional block diagram 200 may be implemented as a combination of hardware and software or firmware for example, programmable instructions to implement one or more functionalities of the modules. In examples described herein, such combinations of hardware and programming may be implemented in several different ways. For example, the programming for the modules may be processor executable instructions stored on a non-transitory machine-readable storage medium and the hardware for the modules may comprise a processing resource (for example, one or more processors), to execute such instructions. In the present examples, the machine-readable storage medium may store instructions that, when executed by the processing resource, implement the modules of the functional block diagram 200.

[050] Now referring to FIG. 3a and FIG. 3b, a schematic diagram of a digitally simulated airplane model and an interactive user interface in form of a dashboard 300a is illustrated, in accordance with an embodiment of the present disclosure. As illustrated, the dashboard 300a may include the digitally simulated model 302 of interior of an airplane. In an embodiment, the dashboard 300a may be an IoT based interactive interface comprising one or more touch-sensitive buttons for enabling various function as described in FIG. 3b. In an embodiment, a plurality of physical buttons 304 may be provided to actuate the actuators attached to various airplane components in order to make them comply to the airplane safety norms.

[051] As shown in FIG. 3b, the dashboard 300a may provide one or more touch-sensitive buttons to power on the on-board camera system 304, a switch to power the aisle lights 314, a switch to make warning announcement 316 with respect to non-compliance of the safety parameters or take-off or landing instructions.

[052] In an embodiment, the dashboard may provide a safety key 312 which may further include a green key 312a, a yellow key 312b and a red key 312c. The safety key 312 may be depicted using appropriate color (depicted using appropriate shading) which may visually help the user to identify the status of the compliance of the safety parameters of all the seats. In an embodiment, the green key 312a may represent the seats which are in compliance of the safety parameters, the red key 312c may represent the seats which are non-compliant to the one or more safety parameters and the yellow key 312b may represent the seats which are in transition to switch from a non-compliant condition to a compliant condition or vice versa or seats to which a warning has been given. In another embodiment, the dashboard 300a may further represent the seats by their numbers and their physical positions in the airplane. The dashboard may depict each seat in different color combinations and shapes. For example, each seat may be depicted by the dashboard in a color selected from a green, yellow or red color, and using an icon of a shape selected from an oval shape, square shape, or rectangular shape, etc. to depict its status as per the safety key. Thus, the seats which are in compliance condition are demonstrated on the dashboard 300a using the green icons and will be listed in the green key 312a. In this embodiment, the seats in compliance condition may imply that there is no need for remedial action. In another embodiment, the seats which may be non-compliant are demonstrated by the dashboard 300a using the red icons and will be listed in the red key 312c. Accordingly, the non-compliant condition of the seats may correspond to those seats which may require a remedial action to make them comply to the safety parameters. In another embodiment, the seats which may be in transition from a compliant condition to a non-compliant condition or vice versa may be indicated by the yellow regions and may be listed in the yellow key 312b. In an embodiment, the seats which may be in transition may include seats which have been issued an alert warning asking them to comply to the safety parameters after which a remedial action may be taken. It may further be noted that the digitally simulated interactive airplane model 302 may include to display a plurality of regions, in the form of a digitized icons, in accordance with the color-coded safety key 312 to help determine their corresponding statuses by a user. Further, to perform the remedial action, the user may select the corresponding seat based on the color-coded view and provide a corresponding remedial input in order to make them compliant to the safety parameters, as is explained in conjunction with FIG. 3c.

[053] Now, referring to FIG. 3c, a detail view 300c of a passenger seat or a cabin suite from the corresponding digitally simulated interactive airplane model 302 is illustrated, as an embodiment of the present disclosure. The detail view 300c may be displayed on selection of a seat icon in the simulated interactive airplane model 302. The detail view 300c may depict the corresponding plurality of airplane components associated to the seat selected in form of digital icons representing the backrest 306, food tray 308 and window 310, smart device status 318, etc. Based on the visual indications obtained from the dashboard 302, the user 120 may select a particular passenger seat icon from a plurality of icons to provide a detail view 300c which may appear as a pop-up display indicating the status of the backrest 306, the food tray 308, the window 310, the smart device(s) 318, etc. Further, in the detail view 300c, the status of the backrest 306, food tray 308, window 310, the smart device(s) 318, etc. may be color coded to depict the compliance or non-compliance status of each component through a green or red color respectively. Also, on selection of the respective icon of status 320 of the same may be indicated below. For example, the FIG. 3C depicts the status 320 of backrest 306 as reclined. A remedial input may be provided through the selection of the respective icon which may be enabled as to provide control signals to reset the status of the corresponding component to make it compliant to the safety parameters. Further, the seat information 322 may be displayed indicating seat number 324, seat category 326 and seat description 328.

[054] It may be noted that the detail view 300c may be implemented as an interactive display. Further, the detail view 300c may visually indicate the real-time status information of one or more plurality of components from the plurality of airplane components using the color-coded information in accordance with the airplane safety parameters. Further, an anomaly in the real-time status information may be indicated through a red color. Accordingly, based upon the status information received, the user may provide the corresponding remedial input by selecting the airplane component over the interactive dashboard. Further, upon selecting the airplane component(s), the interactive dashboard may correspondingly receive the remedial input which may be processed by the processor 106. Based on the processed remedial input, the processor 106 may transmit the control signals to the control unit 112 which may actuate the corresponding actuator from the plurality of actuators 116 associated with each of the one or more non-compliant airplane components. Additionally, the response of the remedial input may be transmitted either over a wired connection or may be wirelessly to the control unit 112 and the processor 106 using the plurality of sensors 114. It may also be noted that based upon the successful completion of the remedial action by the corresponding actuators, the dashboard may update the status information of the corresponding airplane component(s) visually using the color-coded information. In an embodiment, the updating of the status information when compliant to the safety parameters may include changing the color of the seat 306 icon to green.

[055] Referring now to FIG. 4a, a schematic diagram of a window 400a of an airplane, is shown, in accordance with an embodiment of the present disclosure. A window 400a is depicted in which 402 shows a window with shade open and 404 depicts a window with shade closed. According to the safety parameters, the window shade associated with the window 400a may be in an open state 402 during an airplane's takeoff or the landing, or emergency. In an embodiment, the opening of the window shade in accordance with the safety parameters may be performed manually by a user or automatically by the airplane safety device 102. In an embodiment, a transmitter of the proximity sensor may be positioned on one side and a receiver may be placed on the opposite side of the window in such a way that when the shade is open the light transmitted by the transmitter may be received by the receiver as shown by the broken line 401. In case the shade is closed as shown in 404, the light transmitted by the transmitter will be cut-off by the shade and the receiver on the opposite side would not detect the light indicating that the shade is closed.

[056] Referring now to FIG. 4b, a burst view 400b of a window of an airplane, in accordance with an embodiment of the present disclosure. In an embodiment, a proximity sensor or a photoelectric sensor may be used to detect the status of the window shade. In other words, a transmitter of the proximity sensor may be positioned on one side 418 and a receiver may be placed on the opposite side 420 of the window in such a way that when the shade is open the light transmitted by the transmitter 418 may be received by the receiver 420 as shown by the broken line 422. The shade when open will not interrupt the light transmitted by the transmitter and the receiver 420 may detect the light to depict that the shade is open. In case the shade is closed, the receiver may not receive any light as the light would be interrupted by the shade in between. The view 400b shows a photoelectric sensor placed at a position 418 and a receiver at position 420 which may align with the transmitter 418 when the shade 410 is in open position and send corresponding signal to the processor 106 to depict that the window shade is open. In an embodiment, a window frame 402may house a glass 406 which may be sealed in place by a seal 416. When the shade is closed, the receiver 420 may not receive any light transmitted from the transmitter 418 and it may send the corresponding signal to the processor 106 to depict that the shade 410 is closed. In an embodiment, the position of the transmitter 418 may be interchangeable with the position of the receiver. In an embodiment, a proximity sensor may be used instead of the photoelectric sensor.

[057] In an embodiment, an actuator (not shown) may be provided attached to the frame 420 associated to the window frame 402 to actuate the shade to open in order to comply with the safety parameters. In an embodiment, the actuator may be a stepper motor which may have a belt or a chain mechanism attached to the shade 410 in order to pull open the shade 410 when actuated by the control unit 112. In an embodiment, one or more LED lights may be provided on the shade of the windows to provide a visual indication to the user 120 who may have closed the window shade during take-off, landing or any emergency situation. The LED lights may turn red to depict that the window shade is to be opened by the user 120.

[058] Referring now to FIG. 5, an actuation mechanism and sensor arrangement 500 for a seat of an airplane is depicted, in accordance with an embodiment of the present invention. In order to comply with the safety parameters, the backrest 502 of the seats should be in upright position. Therefore, a seat’s backrest 502 which is not compliant to the safety parameters must be readjusted using an actuator to be in upright position. As illustrated, a seat may include an armrest 504 with an actuator 506 in form of a push button. A tilt sensor may be placed in proximity to a hinge between the seat and the backrest 502. It may be noted that the push button 506 may further be coupled with a movable metal plunger 506a, which may further be coupled with a spring 506b and an electromagnet 506c. The electromagnet 506c may be controlled to actuate the seat’s backrest 502 to become upright in accordance with the airplane safety parameters wirelessly by the control unit 112. The electromagnet 506c of the push button 506 may be energized to actuate the push button to reset the seat’s backrest 502 to an upright position in accordance with the airplane safety parameters. It may be noted that based upon the completion of the action in order to comply with the airplane safety parameters, the dashboard 300a of the airplane safety device 102 may correspondingly update the status of the airplane component visually from red to green.

[059] In an embodiment, a sensor may be coupled to the electromagnet 506c of the push button 506 which may detect actuation of the electromagnet and confirm the readjustment of the backrest 502 with the status of the tilt sensor (not shown) in order to detect any malfunctioning of the actuator. The safety device 102 may determine the corresponding updated status of the seat's backrest to be compliant with the safety parameters based on the comparison of inclination detected by the tilt sensor with a preset inclination. In an embodiment, the preset inclination may be defined in conformity with the safety parameters.

[060] Referring now to FIG. 6a, a food tray 602 is depicted, in accordance with an embodiment of the present disclosure. The food tray 602 is associated with a back portion of a seat 610 which is in front of the seat with which the food tray 602 is associated to. As illustrated, the airplane component may include the food tray 602 associated with a passenger seat. In another embodiment, a sensor such as, but not limited to, proximity sensors, tilt sensor or photoelectric sensors may be used to detect the position of the food tray 602 if it is open or closed. In case of a tilt sensor, it would be placed on the side edge 604 of the food tray to detect the tilt of the food tray 602 with respect to the back portion of the seat 610 in front in order to determine if the food tray is open or close. In case of a photoelectric sensor, a transmitter and receiver may be placed on a top portion of the food tray 602 and the corresponding position of the back side of the seat in front 610 so that the transmitter and receiver of the photoelectric sensor are aligned with each other in a close position. In the same embodiment, the signal may determine the status of the food tray 602 to be compliant with the safety parameters based on the status information detected by the sensor. Accordingly, on detecting that a food tray 602 is in an open position, an anomaly may be detected and the control unit 112 may be configured to actuate the trigger (as shown in FIG. 6b), for readjustment of the food tray 602 to be closed in order to be compliant with the safety parameters.

[061] Referring now to FIG. 6b, a food tray 602 is depicted with food kept on it, in accordance with an embodiment of the present disclosure. In one embodiment, the control unit 112 may detect presence of object such as food 603 kept on the tray 602 by using one or more weight sensor (e.g. a load cell) provided on the tray 602 or through images captured by an over head camera 601 capturing the tray 602. In an embodiment, based on the detection of a presence of an object on the tray 602 an announcement may be generated informing the passenger to empty the table 602 to prevent any harm to the objects placed on the table 602. In an embodiment, the based on the detection of a presence of an object on the tray 602, the control signal sent to actuate the tray 602 to close may be ignored or queued. Once the objects on the tray 602 has been cleared the control signals from the control unit 112 may actuate the actuators of the tray 602 to close the tray 602.

[062] Referring now to FIG. 6c, an actuation mechanism for a food tray 602 is illustrated, in accordance with an embodiment of the present disclosure. In the same embodiment, the sensor arrangement for the food tray 602 may include a photoelectric sensor, an inclination sensor, and the like. In an embodiment, when an anomaly is detected, i.e., when the status information of food tray 602 is non-compliant with the safety parameters of the airplane, the airplane safety device 102 may initially generate an alert and send remedial input to the control unit 112 to reset the position of the food tray 602 to close the tray 602. In an embodiment, the alert may include a visual alert, by way of an example such as a continuous pulse of light, a sound alert such as a beep, or a combination thereof. The alert may be detected by the user through the dashboard. Further, based upon the alert, the user may interact with the dashboard of the airplane safety device 102 and provide a remedial input which may trigger a series of actions corresponding to the anomaly detected. In an embodiment, the passenger may also be alerted by way of an announcement to close the tray manually before an automated remedial action is taken.

[063] In an embodiment, the actuator in form of a motor 606 may be connected to a gear train 612 connected to a rope and pulley assembly to pull up the food tray 602 using two draw strings 608 attached to each side of the food tray 602. It may be noted that based upon the completion of the actuation the food tray 602 is closed to be in compliance with the airplane safety parameters, the airplane safety device 102 may update the status of the food tray 602 from red to green. Additionally, other sensors may also be employed which may include a reed switch which may detect the status of the food tray 602 based upon the determination of a magnetic field around the lock mechanism of the food tray 602 confirming compliance with the airplane safety parameters. In an embodiment, hydraulic/pneumatic piston cylinder may be used as actuators for closing the food tray 602. In an embodiment, alternative drive assemblies such as belt pulley drive assembly may be used instead of a gear train 612.

[064] Referring now to FIG. 7a illustrates the position of onboard camera, in accordance with an embodiment of the present disclosure. An onboard camera 702 may be attached comprising an image sensor, capturing the various airplane components in view of the camera 702. The onboard camera 702 may be activated by a user such as the airplane crew, via the airplane safety device 102 (as illustrated with FIG. 3) to further determine the status of the smart devices of passengers.

[065] FIGs. 7b, 7c and 7d illustrate smart devices depicting airplane mode, in accordance with an embodiment of the present disclosure. It may be noted that the onboard camera 702 may capture various images of the smart device in its field of view and the airplane safety device 102 may further be trained and programmed via machine learning models to learn and identify different airplane symbols used in various digital devices 704 (for example models of smartphone and smart watches) to determine and capture whether the airplane symbol is ON or OFF. Also, the Further, upon activation, a passenger may need to position their digital device 704 at a particular position in the field of view of the camera 702. Additionally, a passenger may identify an active onboard camera 702 via a LED indicator. In an embodiment, the airplane safety device 102 may further be trained and programmed via machine learning models to learn and identify an interface of the smart devices depicting the status of the airplane mode of the smart device along with other different functionalities. In an embodiment, the airplane safety device 102 may further identify the no-service icon 710 depicting that the network service of the device has been disabled. In an embodiment, the airplane safety device 102 may further identify the network bars depicting reception of the network in the smart devices to determine if a device is receiving the network or not.

[066] In an embodiment, to determine the status of the smart digital device 704, the onboard camera 702 may be activated by opening a shutter (not shown). Correspondingly, a first an alert audio message may be generated by a user based on which the passengers may position their corresponding digital devices 704 in the field of view of the onboard camera 702. Further, by positioning the digital device 704 in the respective field of view, the onboard camera 702 may capture the images of a digital device 704 displaying an airplane mode 708 to determine the status of the mobile signal in compliance with airplane safety parameters. It may be noted that the image with active airplane mode may be in compliance with the airplane safety parameters while a non-active airplane mode in the captured image as non-compliant. Further, the captured image may be processed by the airplane safety device 102 using an image processing software, where the image processing software may be pre-trained using various training images and test images to be able to recognize the symbol of the airplane to confirm if the smart device such as phones, tablets, etc. are in airplane mode or not. It may be noted that the image processing may be performed by the "AiKno" Cognitive Meta Data extraction proprietary software of LTTS which may identify and extract the airplane symbol from the captured image. Additionally, the status of the digital devices 704 may be determined by identifying the strength of the current mobile signal with a predefined threshold signal strength. Further, in case the current signal strength may be identified to be greater than the predefined threshold signal strength, then it may be non-compliant to the airplane safety parameters and the status of which may be indicated via the airplane dashboard 302.

[067] Additionally, the onboard camera 702 may be further be used to determine the current status of the plurality of airplane components which may include to determine the inclination of the passenger's seat 502, to determine the position of the food tray 602 with respect to the passenger's seat as well as may determine the status of the window shade 402 and may update the user 120 via the dashboard 300a using corresponding color coded information.

[068] In an embodiment, in order to ensure that the various smart devices of the passengers are operating in airplane mode, a list of passengers along with their travel schedule may be sent to the operators. The operators may cut-off all mobile signals to such devices for the duration of the scheduled travel. In another embodiment, an MQTT application may be installed on the smart devices in order for them to operate as MQTT client, which may in turn transmit the network status of the device by publishing the status information to be received by the airplane safety device 102 which may be a MQTT subscriber. In an embodiment, the airplane safety device 102 being a subscriber may request the status information from the clients to check if the devices are operating in the airplane mode or not. In an embodiment, each smart devise may be recognized through its IP address or IMEI number, etc. and may be identified by passenger's seat number or name or mobile number as provided by the passenger when installing the MQTT client application while boarding.

[069] In an exemplary embodiment, a topic like Device status/Airplane mode may be created on which the client may publish the message "ON" or "OFF". Once the message is received by the client application of the dashboard from all the smart devices in the airplane. The client application which may have subscribed to the same topic, should not find any mobile numbers connected to the MQTT broker once the airplane has taken off as the internet connectivity would be lost, which may confirm that all the smart phone clients have switched off or activated airplane mode on their smart devices. In case, a smart device is not turned off or operated in airplane mode, the MQTT client of the device may connected to the MQTT broker and indicating the status as "ON" which will be received by the subscriber and displayed on the dashboard.

[070] Referring now to FIG. 8, a moving aisle is illustrated in accordance with an embodiment of the present disclosure. As illustrated, an aisle in form of a conveyor belt 802 may be provided in the airplane. Additionally, the conveyor belt 802 arrangement may further include a drive belt 802a, a drive motor 802b, a drive pulley 802c and a driven pulley 802d arrangement. Further, the conveyor belt 802 may be made of a high friction material like rubber, polyvinyl chloride or polyesters, etc. It may be noted that the drive motor 802b may be controlled and regulated by the airplane safety device 102 through control signals given by the control unit 112 over a wired or a wireless connection.

[071] In an embodiment, the conveyor belt 802 over the aisle may be controlled by the airplane safety device 102 to deliver and receive the food items and other commodities, to further reduce dependence on the airplane crew during the journey. It may be noted that a request for a food item or any other article by a passenger may be depicted by pressing a button provided in the seating region or area and the dashboard 300a of the airplane safety device 102 may then display the requirement raised by the passenger. The request may be responded correspondingly by the user by sending the item over the conveyor belt 802 to the corresponding passenger seating area. The various trolleys (for example the food trolley, the garbage bin, etc.) may first be fixed within slots 804 provided over the conveyor belt 802. The slots 804 may act as a stopper and may make the trolleys to remain stationary at one place and the conveyor belt 802 may start and stopped remotely by the airplane safety device 102. In an embodiment, the conveyor belt 802 may also be used by the commuters who may find difficult to walk down the aisle in large aircrafts. It may be noted that the conveyor belt 802 may be activated as when required by the user.

[072] In an embodiment, the conveyor belt 802 over the aisle may be controlled by the airplane safety device 102 to deliver and receive the food trays and other commodities, to further reduce dependence over the airplane crew during the journey. It may be noted that the need for the food tray or any other article by a passenger may be depicted by the airplane safety device 102 which may then be responded correspondingly by the user over the conveyor belt 802. The various Airplane trolleys (for example the food tray, the garbage bin tray, etc.) may first be fixed within the slots provided over the conveyor belt 802, which may then be start and stopped remotely by the airplane safety device 102. In an embodiment, the conveyor belt 802 may also be used by the commuters who may find difficult to walk down the aisle in large aircrafts. It may be noted that the conveyor belt 802 may be activated as when required by the user

[073] Referring now to FIG. 9, a method for monitoring safety parameters is depicted via a flowchart 900, in accordance with an embodiment. FIG. 9 is explained in conjunction with FIGS. 1-9. Each step of the flowchart 900 may be executed by various modules (same as the modules of the system 900).

[074] At step 902, a status information from a plurality of sensors associated with a plurality of airplane components may be received by an airplane safety device 102, where each of the plurality of airplane components are located at a respective seating region of a plurality of seating regions defined within an airplane. At step 902a, the status information corresponding to a current state of the plurality of airplane components may be obtained by the plurality of sensors 114. In an embodiment, the plurality of airplane components located at a seating region may include, but not limited to, seat's backrest, food tray, window shades, smart devices, etc. The status information may include that status of compliance of each airplane component. For example, backrest of all seats should be upright, all food trays should be closed, all smart devices must be operated in airplane mode, all the window shades should be open. in order to be compliant to safety norms of an airplane. This status information of the airplane components may be detected by using one or more sensors attached to the airplane components or by capturing images of the seating regions using an overhead camera.

[075] Further, at step 904, the status information based on one or more safety-parameters to determine an anomaly in the current state of one or more airplane components may be analyzed by the airplane safety device 102. It may be noted that the anomaly may be indicative of non-compliance of the one or more airplane components with the one or more airplane safety parameters. In an exemplary embodiment, in case a seat's backrest is detected in a reclined state, a sensor such as a tilt sensor which may be attached to the seat's backrest may detect the inclination of the backrest and indicate the same to the airplane safety device 102. The airplane safety device 102 may depict the status of the seat's backrest through the interactive dashboard 300a.

[076] Thereafter, at step 906, an action corresponding to the anomaly to reset the current state of one or more non-compliant airplane components to comply with the one or more safety-parameters may be triggered by the airplane safety device 102. In relation to the above exemplary embodiment, a remedial action may be initiated by actuating an actuator attached to a button controlling the backrest's inclination. The button may be actuated by the airplane safety device 102 in order to bring the backrest to an upright position. The action triggered by the airplane safety device 102 may be performed in various steps of 906a – 906b. At step 906a, an alert message may be displayed, via the user interface 302 in response to the anomaly in the current state of one or more airplane components and in response to resetting the current state of the one or more non-complaint airplane components by the airplane safety device 102. Thereafter, at step 906b, an actuator associated with each of the one or more non-compliant airplane components may be controlled in response to the anomaly detected.

[077] Embodiments of the present disclosure may be implemented entirely hardware, entirely software (including firmware, resident software, micro-code, etc.) or combining software and hardware implementation that may all generally be referred to herein as a "circuit," "module," "component," or "system." Furthermore, aspects of the present disclosure may take the form of a computer program product comprising one or more computer readable media having computer readable program code embodied thereon.

[078] Thus, it will be appreciated by those of ordinary skill in the art that the diagrams, schematics, illustrations, and the like represent conceptual views or processes illustrating systems and methods embodying this invention. The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing associated software. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the entity implementing this invention. Those of ordinary skill in the art further understand that the exemplary hardware, software, processes, methods, and/or operating systems described herein are for illustrative purposes and, thus, are not intended to be limited to any particular named.

[079] As used herein, and unless the context dictates otherwise, the term "coupled to" is intended to include both direct coupling (in which two elements that are coupled to each other contact each other) and indirect coupling (in which at least one additional element is located between the two elements). Therefore, the terms "coupled to" and "coupled with" are used synonymously. Within the context of this document terms "coupled to" and "coupled with" are also used euphemistically to mean "communicatively coupled with" over a network, where two or more devices are able to exchange data with each other over the network, possibly via one or more intermediary device.

[080] It should be apparent to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced. Where the specification claims refers to at least one of something selected from the group consisting of A, B, C …. and N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

[081] While the foregoing describes various embodiments of the invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof. The scope of the invention is determined by the claims that follow. The invention is not limited to the described embodiments, versions or examples, which are included to enable a person having ordinary skill in the art to make and use the invention when combined with information and knowledge available to the person having ordinary skill in the art.

[082] It is intended that the disclosure and examples be considered as exemplary only, with a true scope of disclosed embodiments being indicated by the following claims.

WE CLAIM:

1. A system (100) for monitoring safety parameters, the system (100) comprising:

a plurality of sensors (114) associated with each of a plurality of airplane components (118), each of the plurality of airplane components (118) located at a respective seating region (330c) of a plurality of seating regions (302) defined within an airplane, wherein the plurality of sensors (114) is configured to obtain a status information corresponding to a current state of the plurality of airplane components (118);

a plurality of actuators (116) associated with each of the plurality of airplane components (118); and

an airplane safety device (102) communicatively coupled with the plurality of sensors (114) and the plurality of actuators (116), the airplane safety device (102) comprising:

a user interface (300a);

one or more processors (106); and

a memory (108) communicatively coupled to the one or more processors (106), wherein the memory (108) stores processor-executable instructions which, upon execution by the one or more processors (106), cause the one or more processors (106) to:

receive the status information from the plurality of sensors (114) associated with the plurality of airplane components (118);

analyze the status information, based on one or more safety-parameters, to determine an anomaly in the current state of the one or more airplane components (118), wherein the anomaly is indicative of non-compliance of the one or more airplane components (118) with the one or more safety parameters; and

trigger an action corresponding to the anomaly, to reset the current state of one or more non-compliant airplane components (118), to comply with the one or more safety-parameters, wherein the action comprises:

displaying an alert message via the user interface (330a) in response to the anomaly in the current state of one or more airplane components (118) and in response to resetting the current state of the one or more non-complaint airplane components; and

controlling an actuator associated with each of the one or more non-compliant airplane components in response to the anomaly.

2. The system as claimed in claim 1, wherein the action further comprises:

generating an audio output corresponding to the anomaly in the current state of the one or more non-compliant airplane components.

3. The system as claimed in claim 1, wherein the processor-executable instructions further cause the one or more processors (106) to:

display, via the user interface (330a), the status information corresponding to the current state of the plurality of airplane components (118),

wherein the user interface (330a) comprises:

a plurality of zones corresponding to the plurality of seating regions, each of the plurality of zones comprising a plurality of sub-zones corresponding to each of the plurality of airplane components (118) associated with each of the plurality of seating regions,

wherein the status information corresponding to the current state of each of the plurality of airplane components (118) is displayed in association with a respective sub-zone, via one or more visual indicators.

4. The system as claimed in claim 1, wherein the plurality of sensors (114) comprises:

a plurality of image sensors, each positioned in proximity to each of the plurality of airplane components (118) and configured to obtain an image of the respective airplane component of the plurality of airplane components (118) and of an associated field of view within the respective seating region; and

a plurality of photosensors, each positioned in proximity to each of the plurality of airplane components (118) and configured to detect presence of the respective airplane component in a predetermined position.

5. The system as claimed in claim 4, wherein the processor-executable instructions further cause the one or more processors (106) to:

detect a flight-mode configured on a smart device, wherein detection of the flight-mode is performed by at least one of:

capturing, by an image sensor of the plurality of image sensors, an image of the smart device within the field of view of the image sensor, and processing the image, using a machine learning (ML) model, to detect the flight-mode configured on the smart device;

detecting, by a radio sensor, radio signals transmitted or received by the smart device, and analysing the radio signals; or

detecting, via an open messaging protocol, a connectivity status of the smart device.

6. The system as claimed in claim 5, wherein the action further comprises at least one of:

displaying an alert message, via the user interface (330a), in response to an absence of the flight-mode configured on the smart device; or

upon detecting the absence of the flight-mode configured on the smart device, transmitting an identity of the respective smart device to a telecom service provider along with a request to block data transmission for the respective smart device for a predefined time; or

transmitting a message, via the open messaging protocol, to switch on the flight-mode.

7. The system as claimed in claim 1, wherein the plurality of airplane components (118) comprises:

a plurality of window shades,

wherein at least one sensor, of the plurality of sensors (114), associated with each of the plurality of window shades is configured to detect the current state of the respective window shade, wherein the current state of the respective window shade corresponds to one of an open state or a closed state of the window shade.

8. The system as claimed in claim 7, wherein the plurality of actuators associated with each of the plurality of window shades comprises:

an electromechanical actuator configured to open or close the respective window shade of the plurality of window shades, based on the respective status information, and

wherein the electromechanical actuator is one of a servo motor and a solenoid.

9. The system as claimed in claim 1, wherein the plurality of airplane components (118) comprises:

a plurality of food trays,

wherein at least one sensor, of the plurality of sensors (114), associated with each of the plurality of food trays is configured to detect the current state of the respective food tray, wherein the current state of the respective food tray corresponds to one of an expanded state or a collapsed state of the food tray.

10. The system as claimed in claim 9, wherein the plurality of actuators associated with the plurality of food trays comprises:

an electromechanical actuator configured to actuate the respective food tray to one of the expanded state or the collapsed state, based on the current state,

wherein the electromechanical actuator is one of a drive motor and pulley assembly, and a piston and cylinder assembly.

11. The system as claimed in claim 1, wherein the plurality of airplane components (118) comprises:

a plurality of seats, each positioned at a respective seating region of the plurality of seating regions defined within the airplane,

wherein at least one sensor, of the plurality of sensors (114), associated with each of the plurality of seats is configured to detect the current state of the respective seat, wherein the current state of the respective seat corresponds to one of a normal orientation state or an inclined orientation state.

12. The system as claimed in claim 11, wherein the plurality of actuators associated with each of the plurality of seats comprises:

an electromechanical actuator to configure a push-button associated with a respective seat in one of a first state and a second state,

wherein in the first state of the push-button, the seat is fixed in one of the normal orientation state and the inclined orientation state,

wherein in the second state of the push-button, the respective seat is configured to be transitioned between the normal orientation state and the inclined orientation state, based on the current state of the seat, and

wherein the electromechanical actuator comprises an electromagnet, a spring and a plunger rod connected to the push button.

13. The system as claimed in claim 1, wherein the plurality of airplane components (118) comprises:

one or more smart device comprising a client application and communicably connected to the airplane safety device through an open messaging protocol, wherein

each of the one or more smart devices communicably connect to the airplane safety device via the open messaging protocol through the client application.

14. The system as claimed in claim 1, wherein the plurality of airplane components (118) comprises a conveyor provided on a floor surface between the seating regions, and

the plurality of actuators associated with the conveyor comprises a motor configured move the conveyor.

15. A method for monitoring safety parameters, the method comprising:

receiving a status information from a plurality of sensors (114) associated with a plurality of airplane components (118),

wherein each of the plurality of airplane components (118) are located at a respective seating region of a plurality of seating regions defined within an airplane, and wherein the plurality of sensors (114) is configured to obtain the status information corresponding to a current state of the plurality of airplane components (118);

analysing the status information based on one or more safety-parameters, to determine an anomaly in the current state of the one or more airplane components,

wherein the anomaly is indicative of non-compliance of the one or more airplane components with the one or more safety parameters;

triggering an action corresponding to the anomaly, to reset the current state of the one or more non-compliant airplane components and to comply with the one or more safety-parameters,

wherein the action comprises:

displaying an alert message via a user interface (330a) in response to the anomaly in the current state of one or more airplane components and in response to resetting the current state of the one or more non-complaint airplane components; and

controlling an actuator associated with each of the one or more non-compliant airplane components in response to the anomaly,

wherein the plurality of actuators (116) are associated with each of the plurality of airplane components (118).

Dated this 12th day of September 2022

-- ***Digitally Signed***--
Bhanu Prasad
(INPA No: **3253**)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

ABSTRACT

METHOD AND SYSTEM FOR MONITORING SAFETY PARAMETERS

The present invention describes a method and system for monitoring safety parameters of an airplane in compliance with the airplane safety parameters. The system includes an airplane safety device which may obtain a status information corresponding to a current state of the plurality of airplane components (118) via a plurality of sensors (114) associated with each of a plurality of airplane components (118). The system receives the status information from the plurality of sensors (114) associated with the plurality of airplane components (118). Analyze the status information, based on one or more safety-parameters to determine an anomaly in the current state of one or more airplane components. The system triggers a corresponding action to reset the current state of one or more non-compliant airplane components. The action includes displaying an alert message via the user interface (330a) and controlling the corresponding actuators associated with each of the non-compliant airplane components.

(*To be published with FIG. 1)*

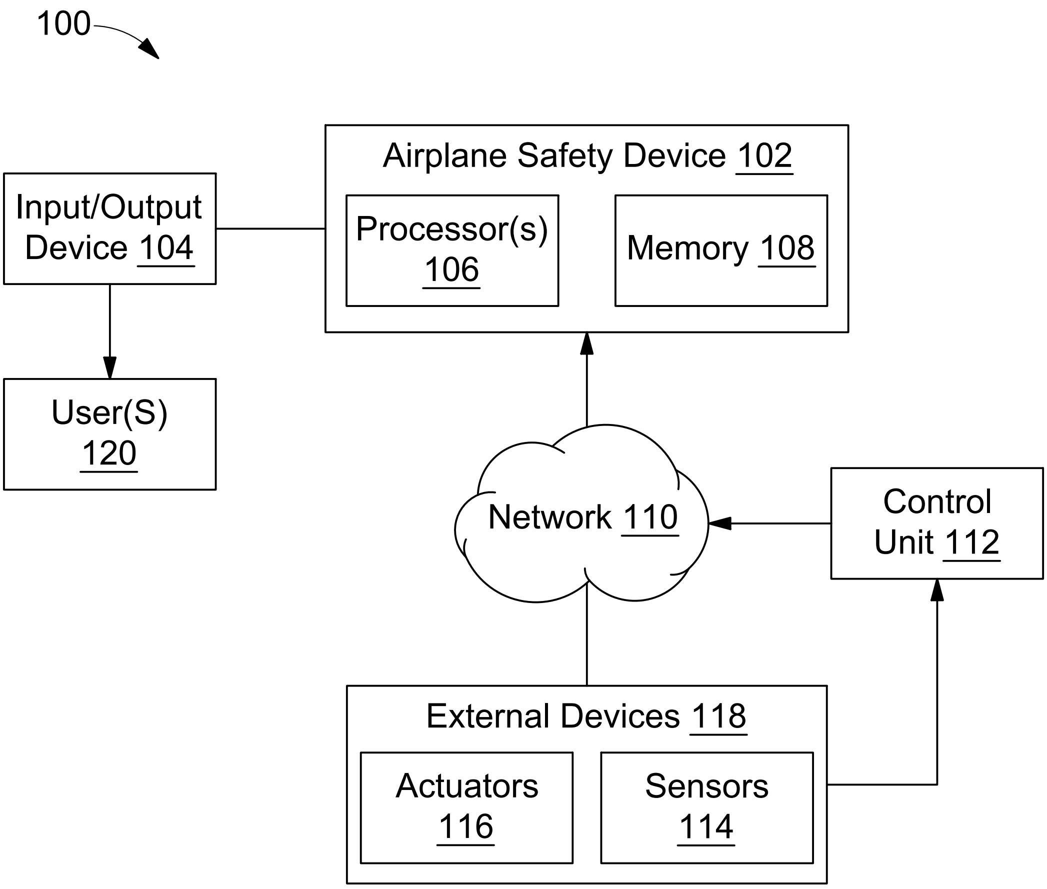

FIG. 1

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

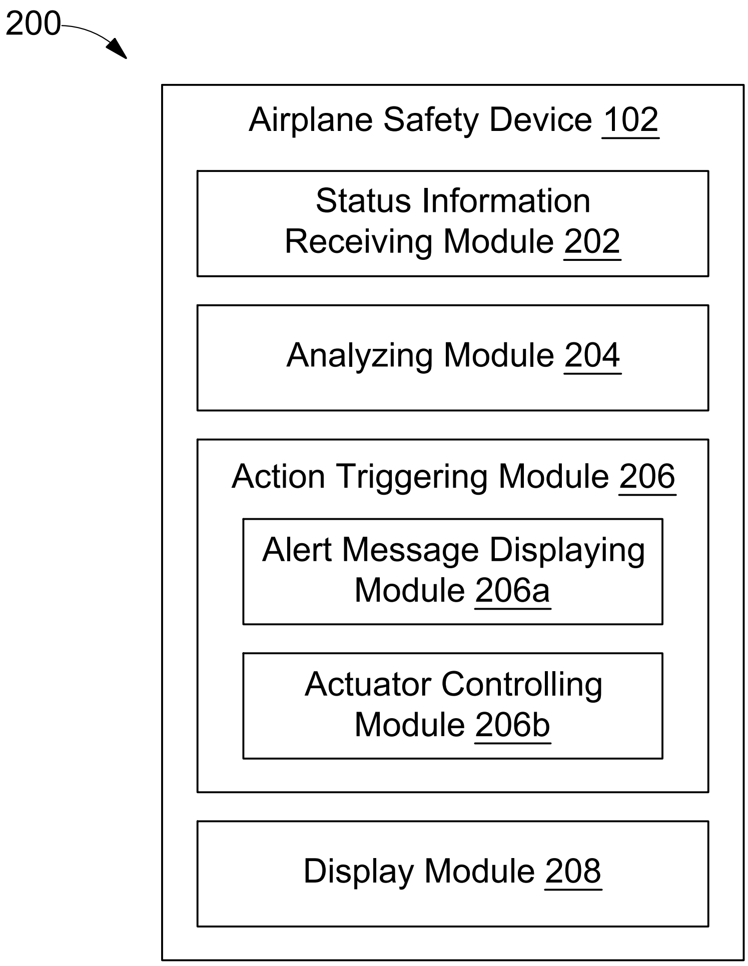

FIG. 2

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

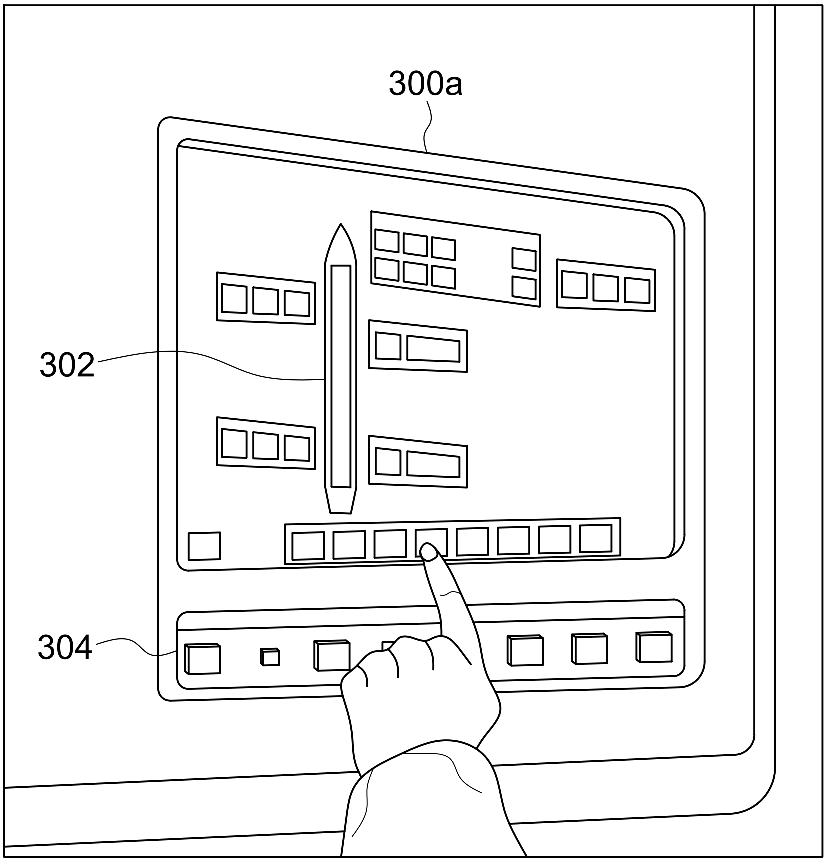

FIG. 3a

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

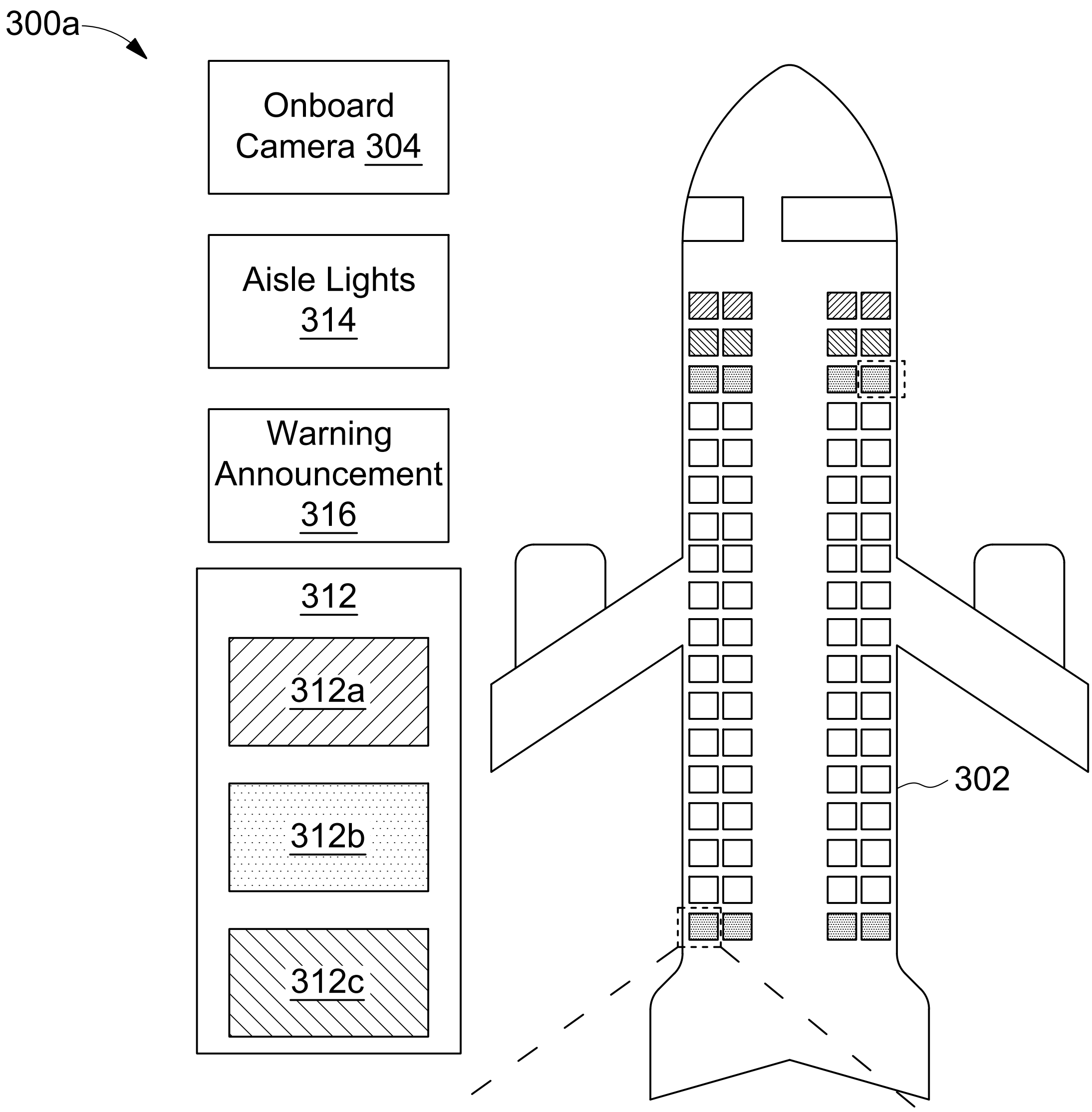

FIG. 3b

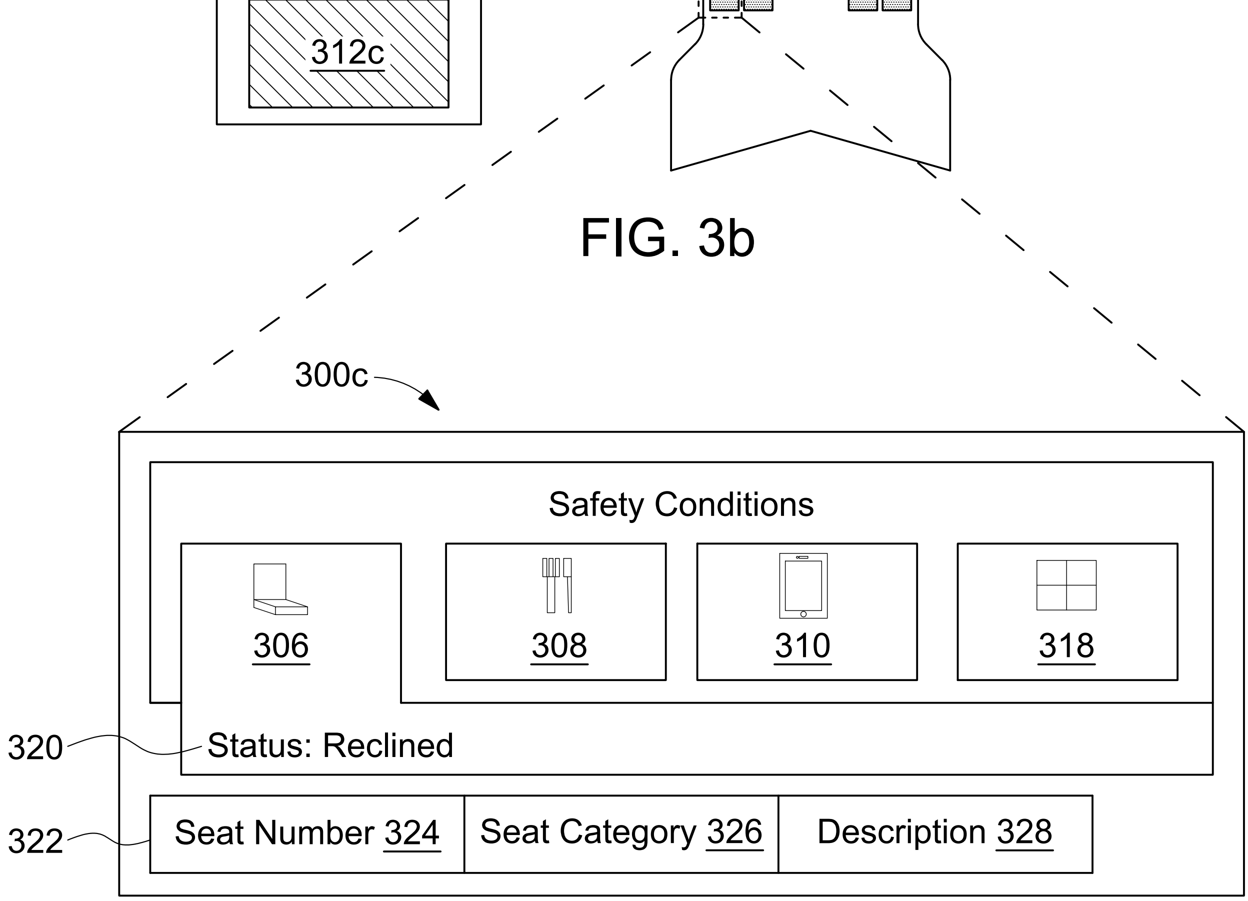

FIG. 3c

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

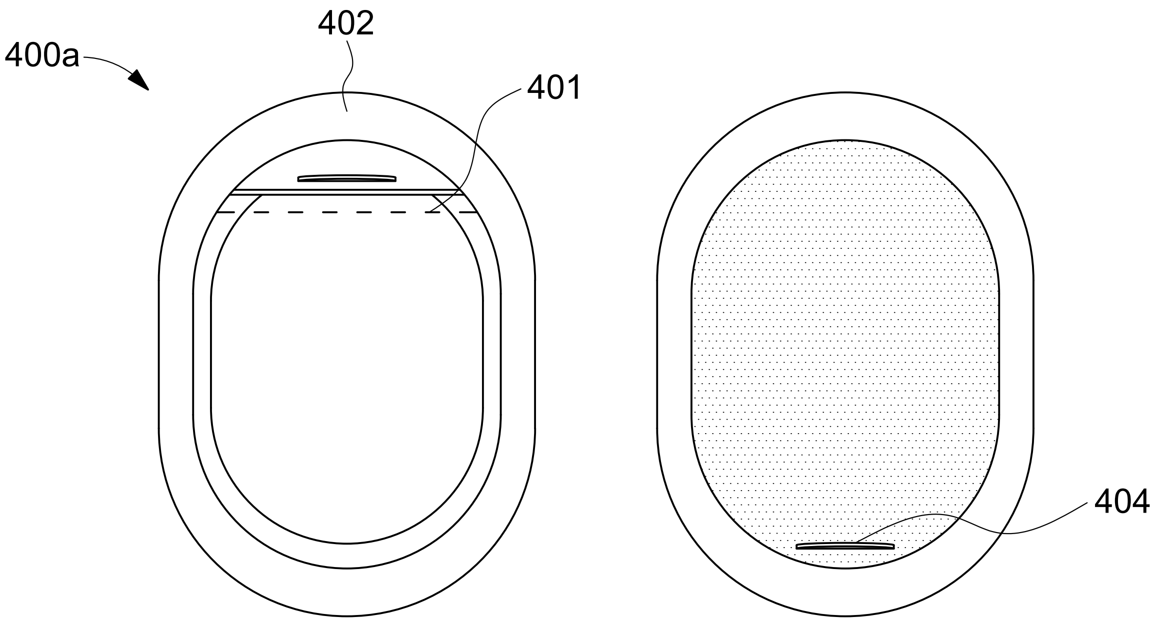

FIG. 4a

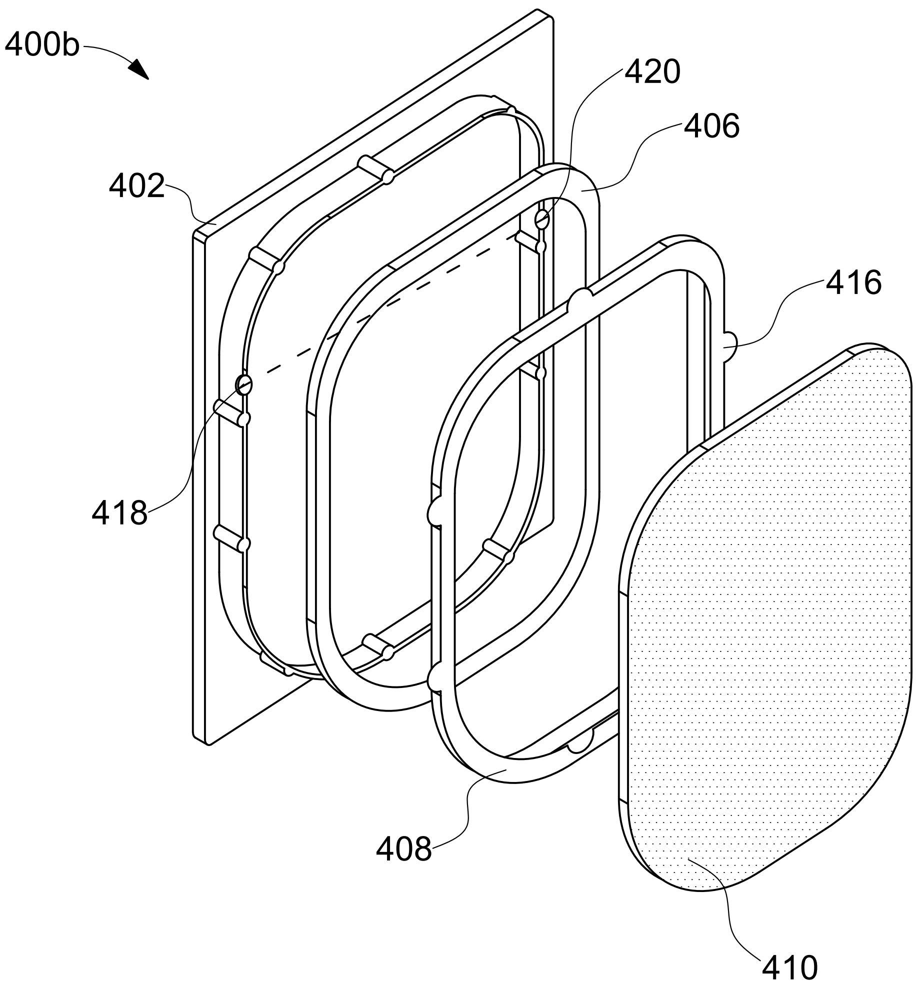

FIG. 4b

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

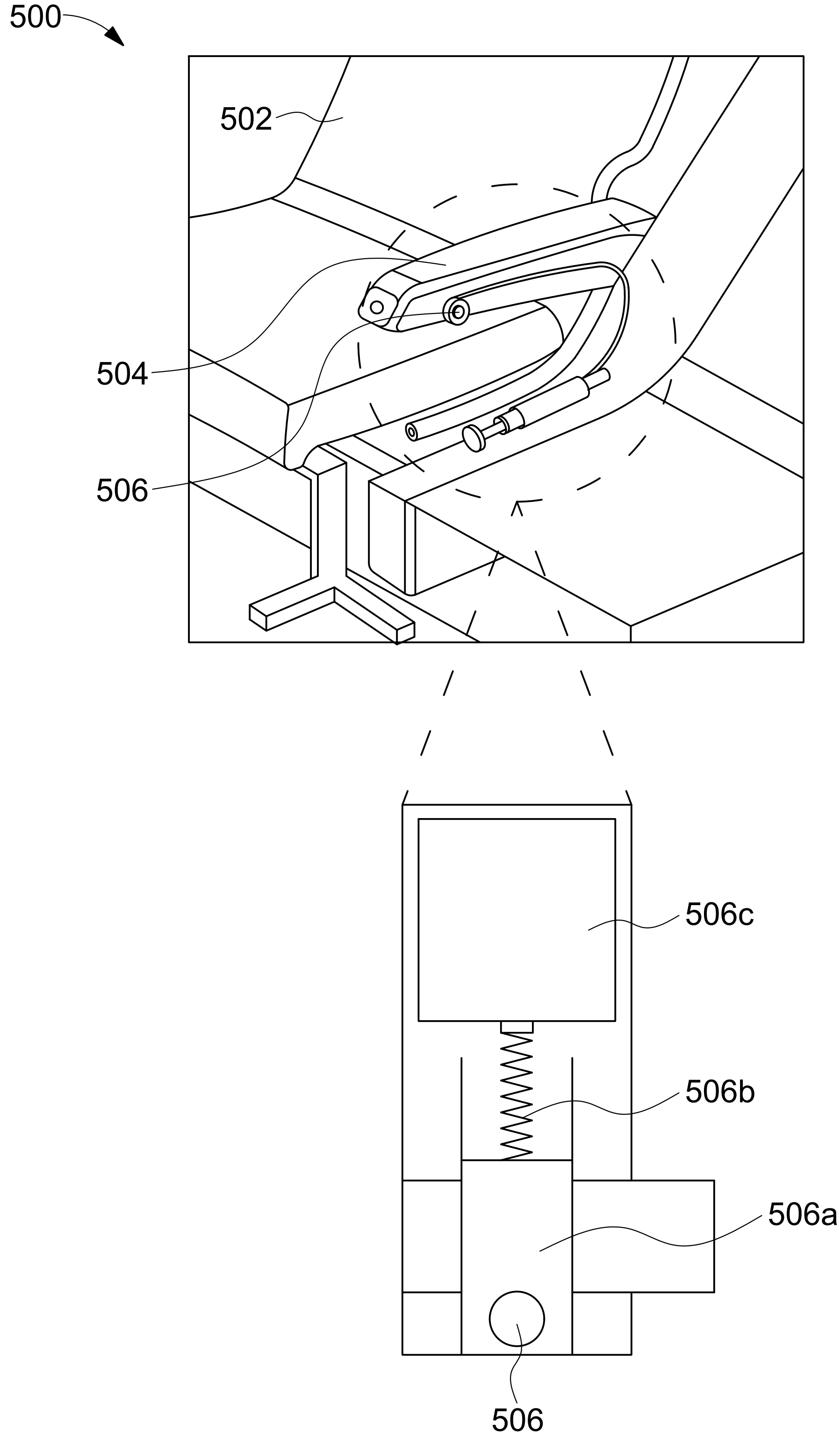

FIG. 5

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

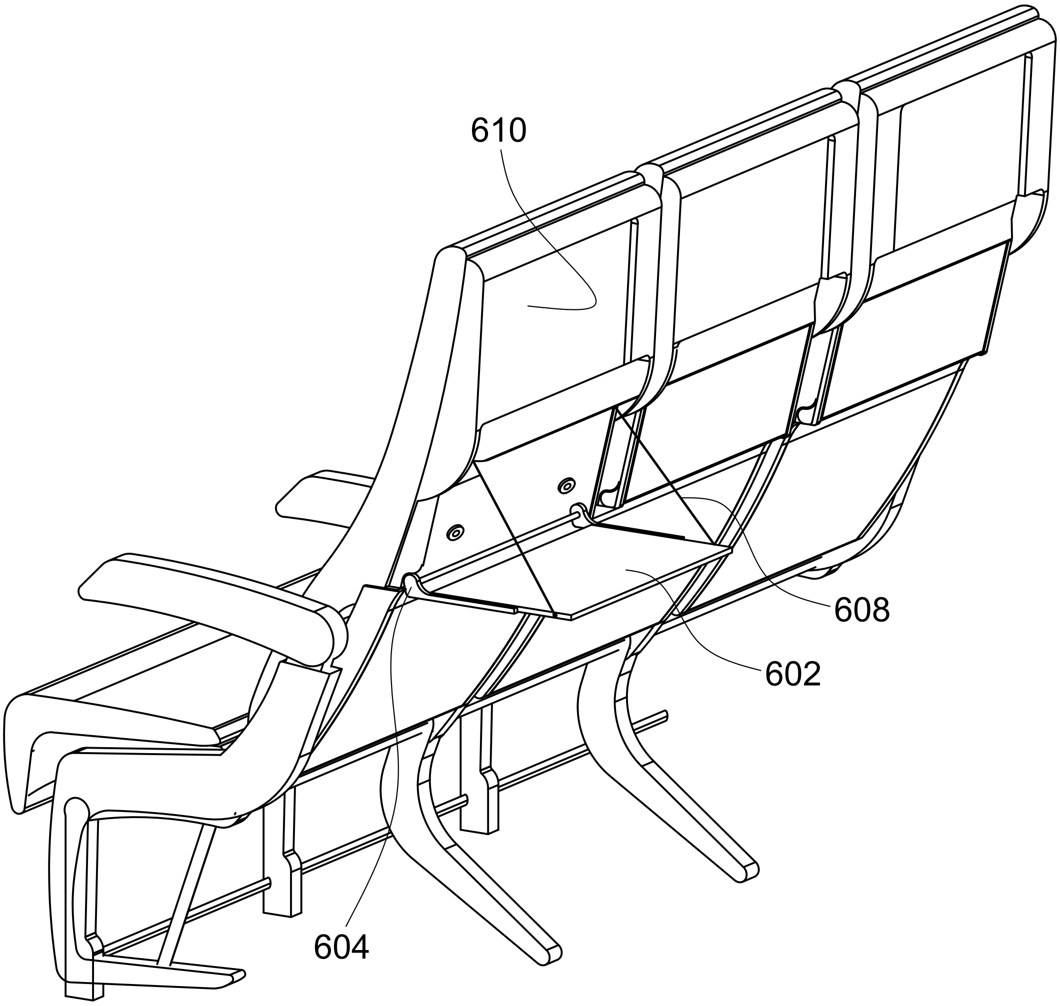

FIG. 6a

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

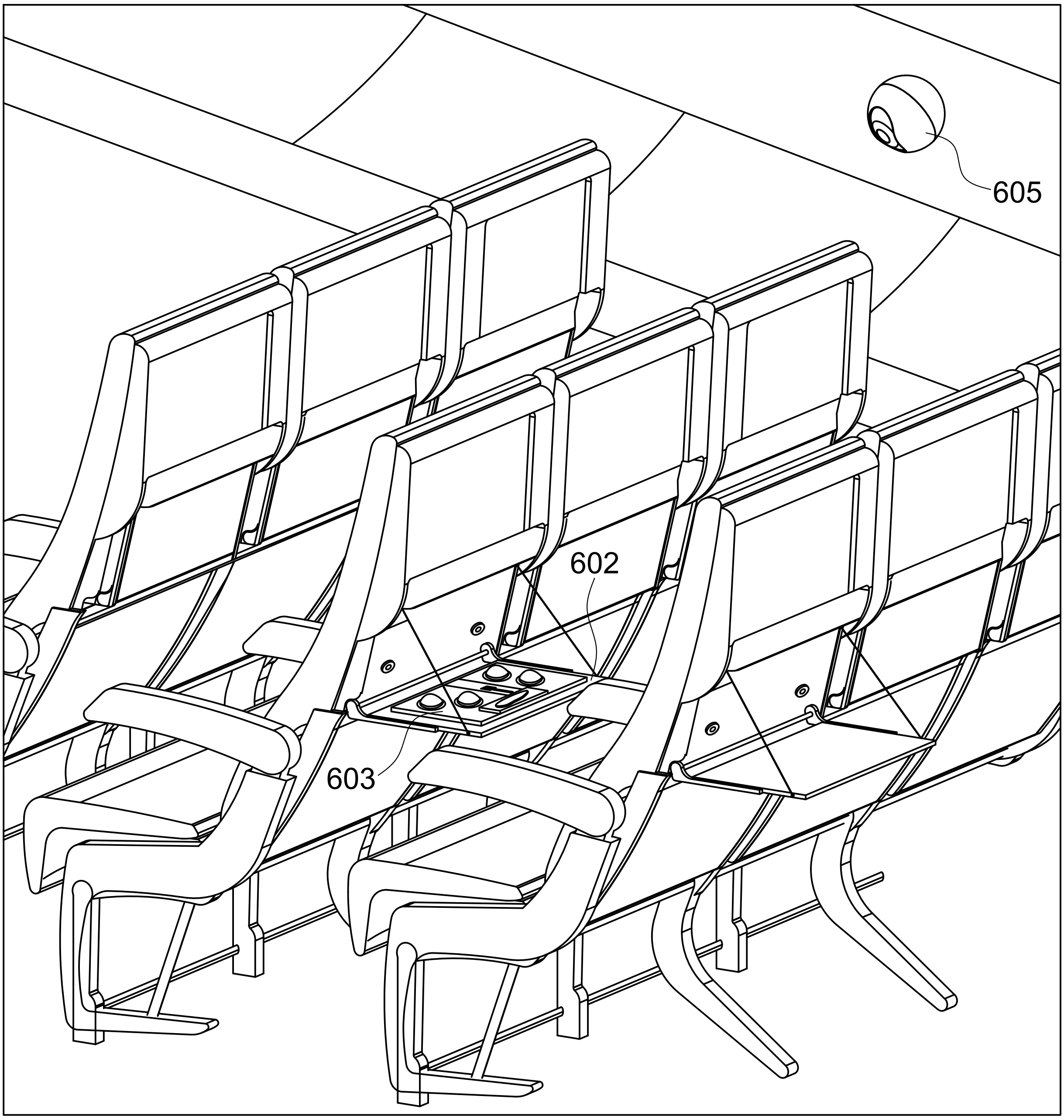

FIG. 6b

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

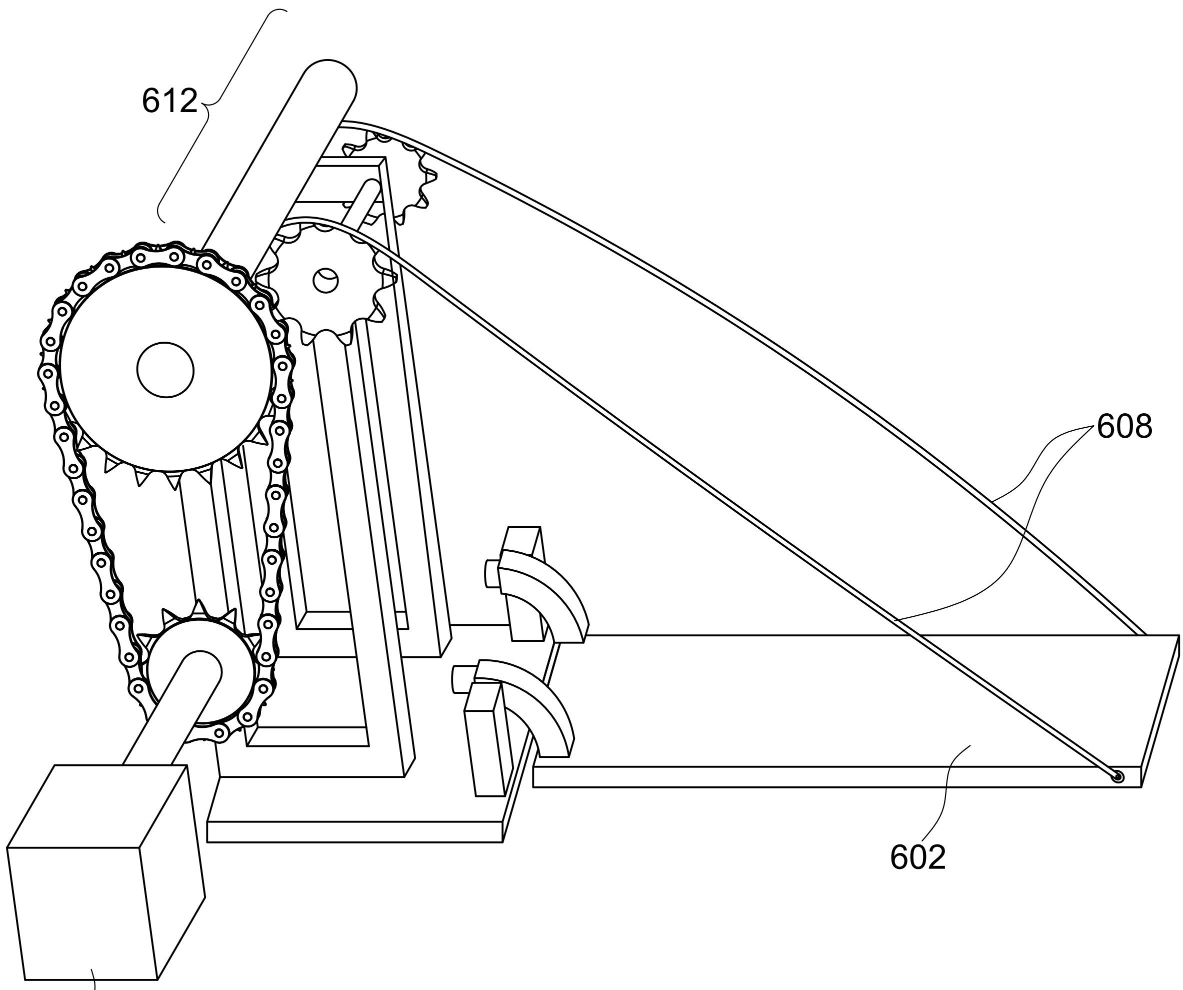

FIG. 6c

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

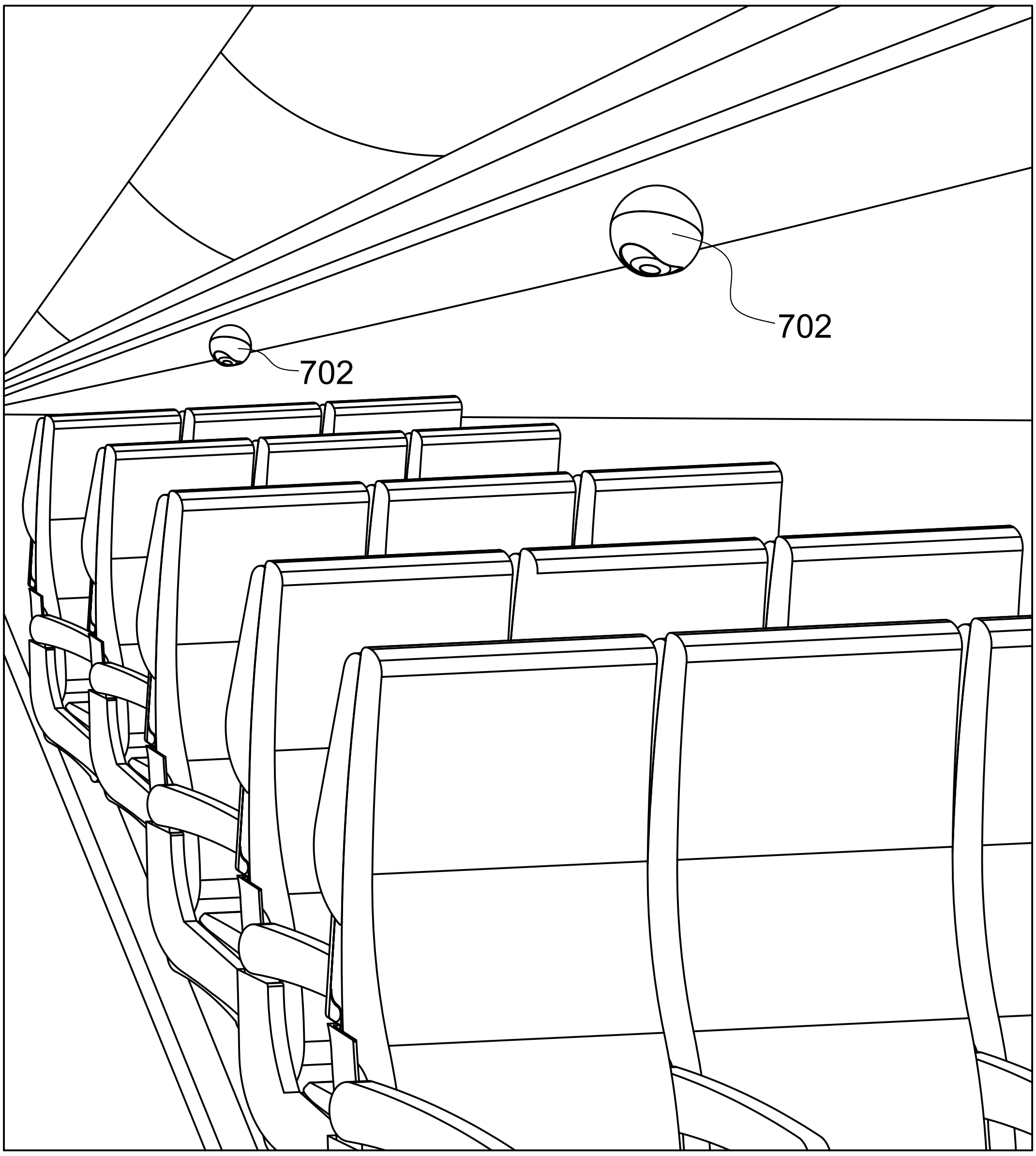

FIG. 7a

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

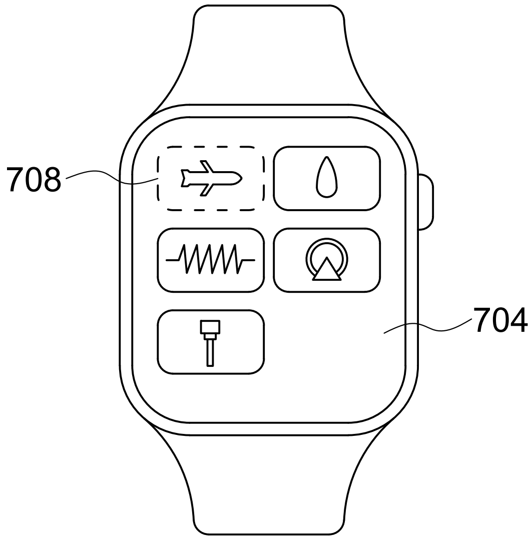

FIG. 7b

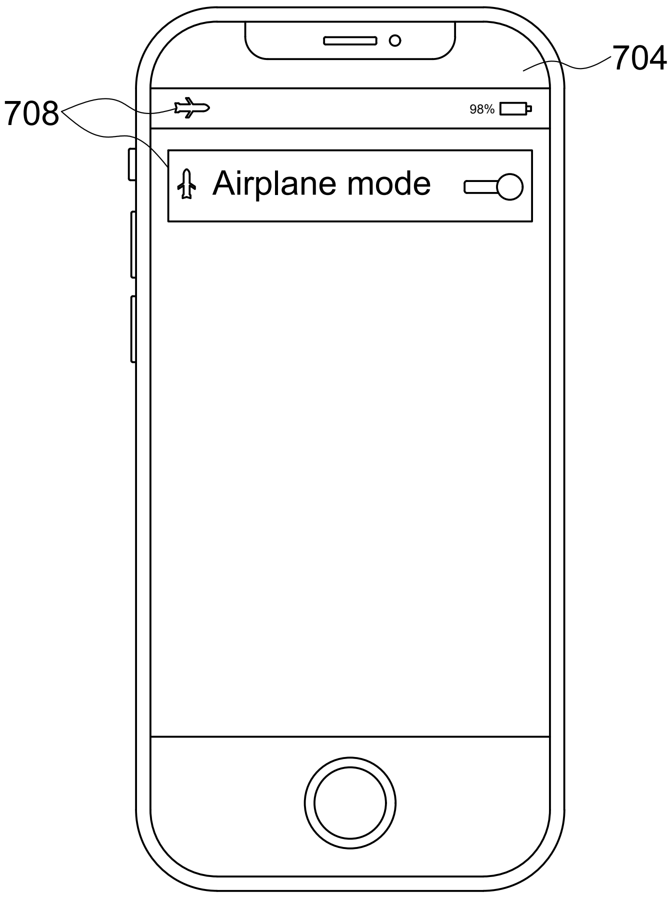

FIG. 7c

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

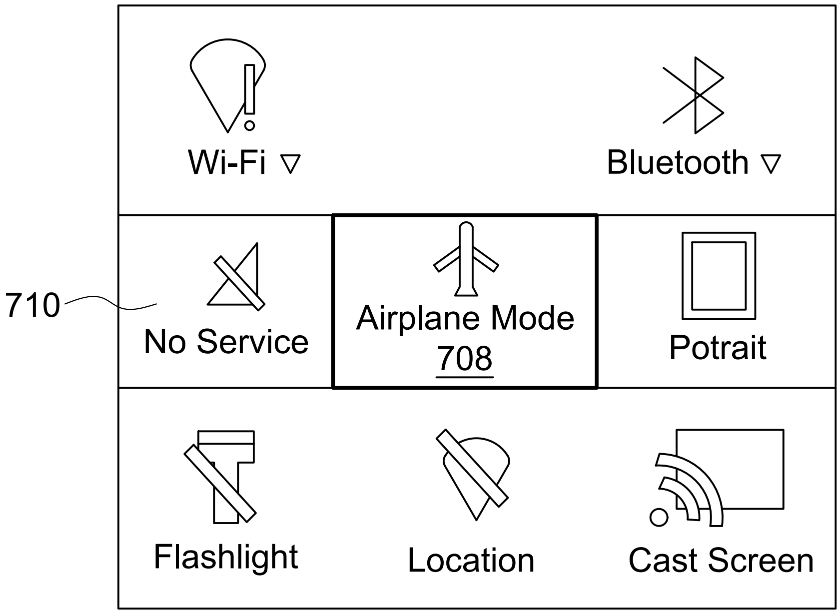

FIG. 7d

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

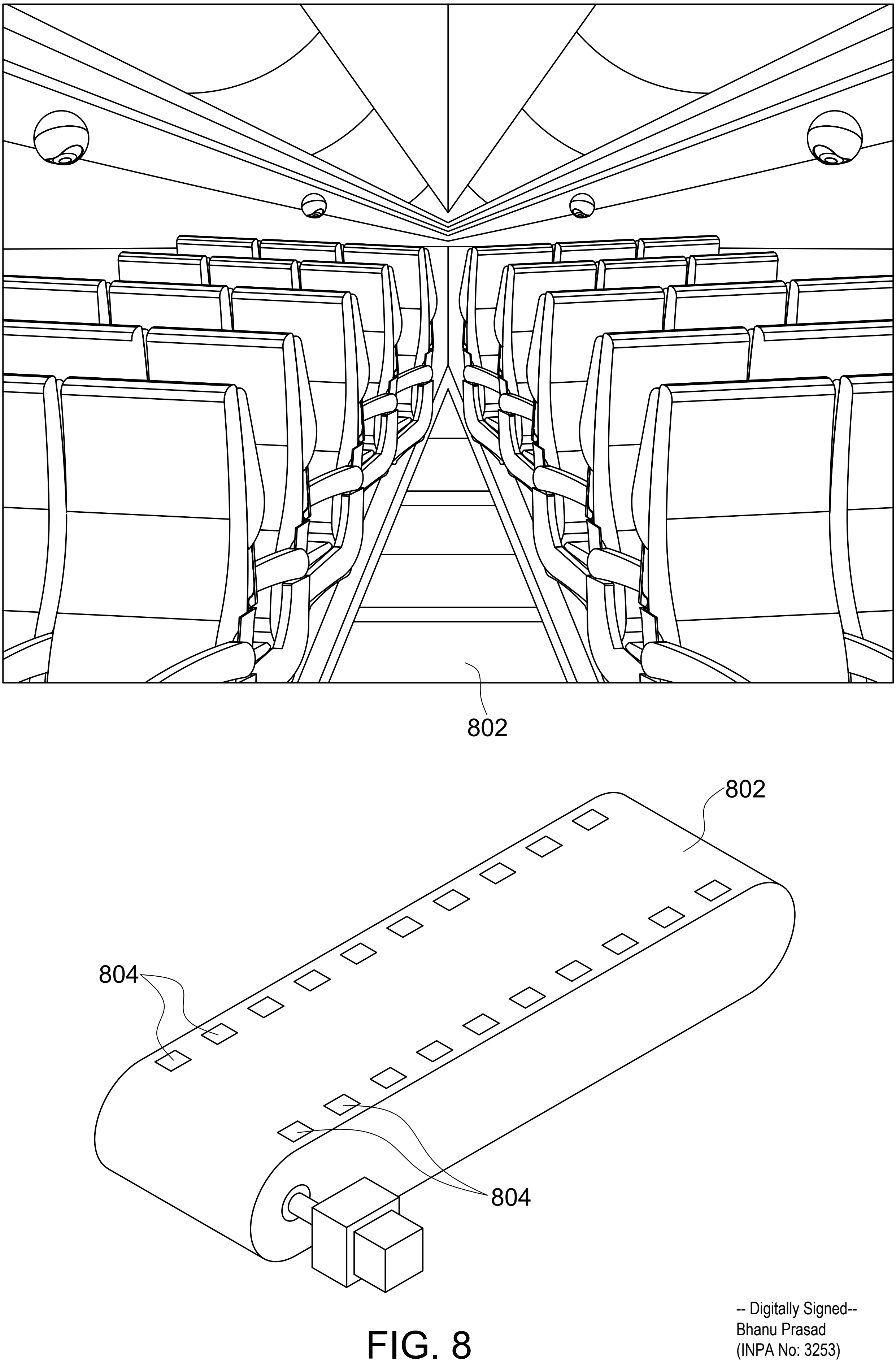

FIG. 8

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

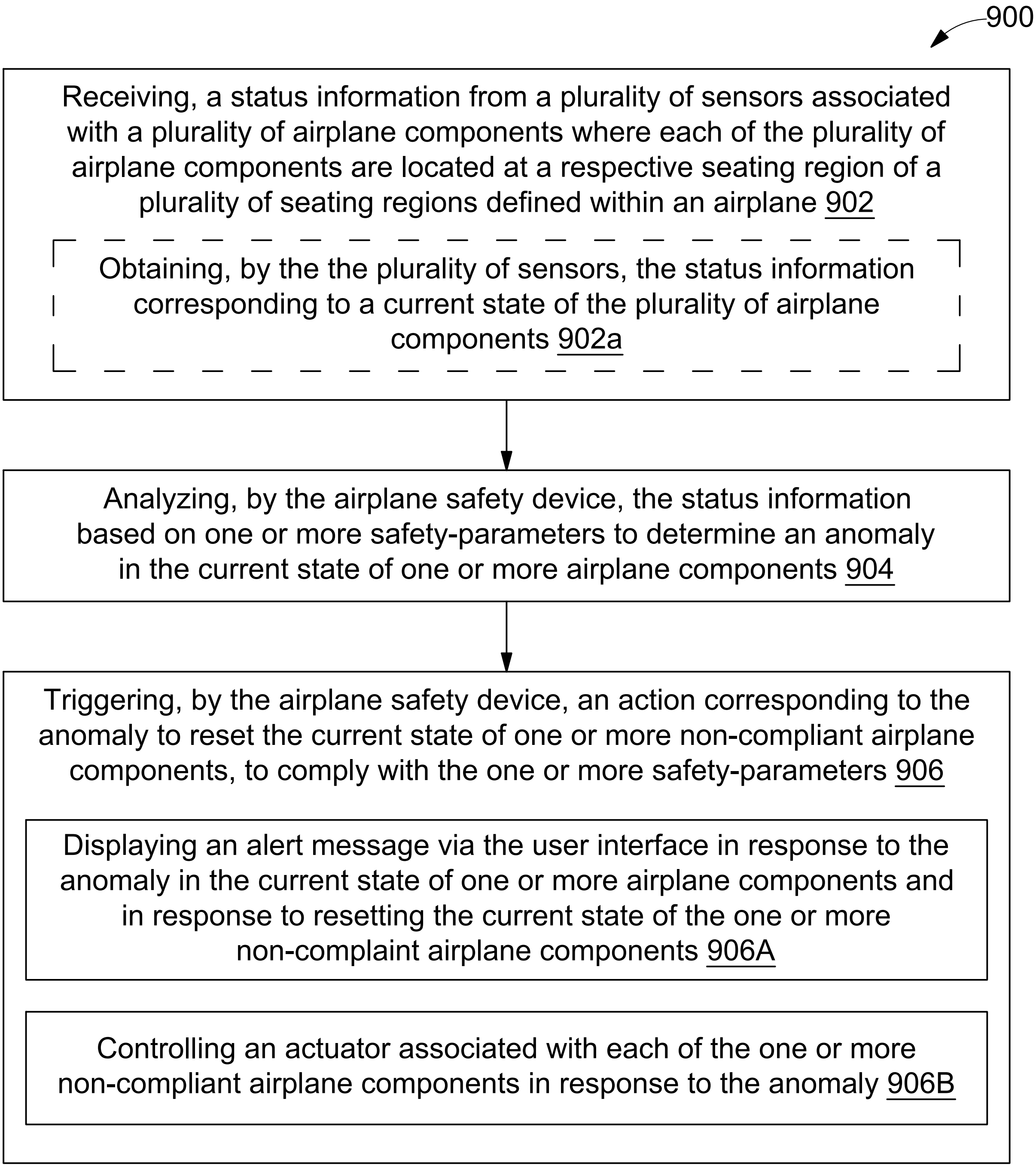

FIG. 9

-- Digitally Signed--
Bhanu Prasad
(INPA No: 3253)
Manager, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.