United States Patent	12388675
Kind Code	B2
Date of Patent	August 12, 2025
Inventor(s)	Lyle; Christopher H. et al.

Systems and methods for power management on a transportation vehicle

Abstract

Methods and systems are provided for a transportation vehicle. One method includes configuring a listening threshold value for a Type A, universal serial bus (USB) port on the transportation vehicle; providing an initial power to the USB port without any attached USB device; in response to attaching a USB device to the USB port, detecting an increase in current greater than the listening threshold value; temporarily turning off the initial power to the USB port; setting an operating threshold value, and providing operating power to the USB port; detecting a drop in current when the USB device is disconnected; and resetting the listening threshold value and providing the initial power to the USB port.

Inventors: **Lyle; Christopher H. (Trabuco Canyon, CA), Patel; Nirav (Fullerton, CA), Gee; Glen (Irvine, CA), Lazarev; Konstantin (Anaheim, CA)**

Applicant: **Panasonic Avionics Corporation** (Irvine, CA)

Family ID: **1000008751560**

Assignee: **PANASONIC AVIONICS CORPORATION (Irvine, CA)**

Appl. No.: **18/196945**

Filed: **May 12, 2023**

Prior Publication Data

Document Identifier	Publication Date
US 20240380635 A1	Nov. 14, 2024

Publication Classification

Int. Cl.: **H04L12/40** (20060101)

U.S. Cl.:

CPC **H04L12/40039** (20130101); H04L2012/4028 (20130101)

Field of Classification Search

CPC: H04L (12/40039); H04L (2012/40267); H04L (2012/40273); H04L (2012/4028); G06F (1/26); G06F (1/266); G06F (1/28); G06F (1/32); G06F (1/3215); G06F (2213/0042)

USPC: 710/8; 710/10; 713/320; 713/321; 713/340

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
10256646	12/2018	Suen et al.	N/A	N/A
2022/0200294	12/2021	Huang	N/A	G06F 1/26
2022/0200452	12/2021	Koki	N/A	G06F 1/28

Primary Examiner: Mamo; Elias

Attorney, Agent or Firm: LOZA & LOZA, LLP

Background/Summary

TECHNICAL FIELD

(1) The present disclosure relates to transportation vehicles in general, and more particularly, to innovative technology for power management on transportation vehicles.

BACKGROUND

(2) Transportation vehicles, for example, aircraft, trains, buses, recreation vehicles, boats and other similar vehicles, use various computing/electronic devices (interchangeably referred to as computing devices) for providing various functions, including entertainment, system control, content storage, and other functions. These computing devices include hardware (for example, servers, switches, network interface cards, storage adapters, storage devices, seat devices, smart monitors, and others) and software (for example, server applications, operating systems, firmware, management applications, application programming interface (APIs) and others).

(3) Transportation vehicles today have individualized functional equipment dedicated to a particular passenger seat, which can be utilized by a passenger, such as adjustable seats, adjustable environmental controls, adjustable lighting, telephony systems, video and/or audio entertainment systems, crew communication systems, and the like. For example, many commercial airplanes have individualized video and audio entertainment systems, often referred to as “in-flight entertainment”/“in-flight entertainment and communication” or “IFE”/“IFEC” systems (interchangeably referred to as “IFE”).

(4) Type A USB (Universal Serial Bus) ports including outlets are used on transportation vehicles to charge mobile devices and/or to connect to seat devices. There is no efficient way to detect if a Type A USB port is being used by a device. In conventional systems, each Type A USB port is typically provided the same operational power, whether the port is in-use or not. This becomes challenging e.g., on an aircraft power availability can be limited, due to weight, space, and other

design constraints. Continuous efforts are being made to develop technology for efficiently detecting use of Type A USB ports and optimizing power consumption and distribution.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The various features of the present disclosure will now be described with reference to the drawings of the various aspects disclosed herein. In the drawings, the same components may have the same reference numerals. The illustrated aspects are intended to illustrate, but not to limit the present disclosure. The drawings include the following Figures:

(2) FIG. **1**A shows an example of a power management system for a transportation vehicle used according to various aspects of the present disclosure;

(3) FIG. **1**B shows a process flow for power management on a transportation vehicle, according to one aspect of the present disclosure;

(4) FIG. **1**C shows a sequence diagram for power management on an aircraft, according to one aspect of the present disclosure;

(5) FIG. **2**A shows an example of an operating environment for implementing the various aspects of the present disclosure on an aircraft;

(6) FIG. **2**B shows an example of the operating environment on a non-aircraft transportation vehicle type, according to one aspect of the present disclosure;

(7) FIG. **3** shows an example of a content distribution system on an aircraft, used according to one aspect of the present disclosure; and

(8) FIG. **4** shows a block diagram of a computing system, used according to one aspect of the present disclosure.

DETAILED DESCRIPTION

(9) As a preliminary node, the terms “component”, “module”, “system”, and the like as used herein are intended to refer to a computer-related entity, for example, a software-executing processor, hardware, firmware or a combination thereof. For example, a component may be, but is not limited to being, a process running on a hardware processor, a hardware processor, an object, an executable, a thread of execution, a program, and/or a computer.

(10) By way of illustration, an application running on a server and the server can be a component. One or more components may reside within a process and/or thread of execution, and a component may be localized on one computer and/or distributed between two or more computers. Also, these components can execute using one or more non-transitory, computer readable media having data structures stored thereon. The components may communicate via local and/or remote processes such as in accordance with a signal having one or more data packets (e.g., data from one component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems via the signal).

(11) Computer executable components can be stored, for example, on non-transitory, computer/machine readable media including, but not limited to, an ASIC (application specific integrated circuit), CD (compact disc), DVD (digital video disk), ROM (read only memory), hard disk, EEPROM (electrically erasable programmable read only memory), solid state memory device or any other storage device, in accordance with the claimed subject matter.

(12) Vehicle **11**: In one aspect, the following disclosure describes a seat box **10** as schematically illustrated in FIG. **1** for use on a vehicle **11**, such as an airplane, ship, train, ferry, bus, or any other type of vehicle. While the seat box **10** is not of any type, it is contemplated that the seat box **10** will provide greater advantages on vehicles where weight is of more importance, such as on busses and trains, and more particularly on aircraft. On an aircraft, the seat box **10** is preferably a line replaceable unit (LRU) that may be replaced with another seat box **10** in the event of a malfunction,

defect, or damager thereto.
(13) In one aspect, the seat box **10** receives power from a power source **12** in the vehicle **11**, such as an outlet connected to the vehicle electrical system (not shown). The seat box **10** may be of any kind, such as a high-power supply (HPS) type, direct current seat electric box (DC-SEB) type, high definition or 4K premium seat electric box (HD-PSEB or 4K-PSEB) types, or any other type.
(14) When vehicle **11** is an aircraft, it receives AC (alternating current) power at around 115 V and converts the power to 28V, direct current (DC) for distribution to the vehicle electrical system and items connecting thereto. The seat box **10** distributes power among passenger seats on the vehicle, typically a group or row of seats, to power items at each seat, for example, a reading light, flight attendant call light, a monitor, or other items. For example, the seat box **10** receives vehicle power at an input **28** and provides it to a distribution circuitry **26** for distributing the power through an output **30** to various output ports **18** and **40** of the seat box **10**. The distribution circuity **26** may also convert the power to a lower voltage, usually from 5 V to 3.3 V.
(15) In another aspect, the conversion can also be performed by outlets **38**. That is, electrical power received from the vehicle power source **12** is provided at the same voltage as received at input **28** to each port **18** and to outlets **38** and **68** connected thereto and converted by each outlet to an inclusive range between 5 V to 3.3 V. Power conversion outside of the seat box **10** by the outlets **38** and **68** advantageously reduces heat in the seat box, which may be in area where heat dissipation is difficult such as under a seat or other confined space such as a compartment overhead or in the floor. In alternative configurations, the seat box **10** may receive AC power from the vehicle power source **12** and converts the received power to DC within the seat box **10** via the distribution circuitry **26**.
(16) In one aspect, output ports **18** and **40** of the seat box **10** are connected to the distribution circuitry **26**. The ports **18** and **40** may be of different types. For example, a first type of port **18** is configured for connection to an outlet (or jack) **38** including a controlled power outlet **38** or a static power outlet **68**. Examples of power-controlled outlets **38** are outlet types capable of communicating negotiated power usage and implement USB Power Delivery 3.0 protocol or later. Generally, these outlets have flexibility for a broad range of operability and pass at least current power usage data and power requests from a personal electronic device (PED) **44**, **14** or **16** (may also be referred to as USB device **14** or **16**) back to the seat box **10**. The PEDs **14** or **16** described herein refer generally to electronics devices that use a USB protocol for connectivity and/or charging. The USB protocol for charging include at least USB 2.0/BC1.2, and a protocol or protocols based on USB power delivery.
(17) The power outlets **38** draw power from a source, if permitted to by command/control from the seat box **10**. The first type of ports **18** of the seat box **10** may also connect to non-controlled power outlets for example, Type A USB outlets/jacks. The USB Type A outlets can be used for charging a PED **44**, **14** or **16**, which may be a mobile phone, tablet computer, phablet (larger sized mobile phone nearing tablet-size), laptop computer, or other kind of PED connectable to a USB outlet. In another aspect, USB Type A outlets are used to connect a USB device to a computing device.
(18) FIG. **1**A also shows ports **40** that are for vehicles providing monitors (may also be referred to as smart monitors or seat devices) **42** at passenger seats. For instance, the vehicle **11** may include an entertainment system **36** (called an inflight entertainment system or IFE system on aircraft), including monitors **42** mounted at seatbacks, bulkheads, or armrests of seats, for use by passengers The IFE system **36** includes the Series 2000, 3000, eFX, eX2, eXW, eX3, NEXT, and/or any other in-flight entertainment system developed and provided by Panasonic Avionics Corporation (without derogation of any trademark rights of Panasonic Avionics Corporation) of Irvine, California, the assignee of this application.
(19) For vehicle **11** having monitors **42** for passenger use, ports **40** supply the monitors with power. Vehicles used over shorter distances, such as aircraft for short haul flights, may not have monitors **42**, in which case the ports **40** are not necessary and may be removed to reduce cost and weight of

the seat box **10**. If ports **40** are included, the ports preferably report power supplied therefrom to a power load manager **34**, described below in detail In another aspect, monitors **40** may also have ports **18**, including USB Type A ports that are used to connect and/or charge a USB device (e.g., PED **44**, **14** or **16**).
(20) In one aspect, each seat box **10** includes a processor **32** and memory **20** connected to the processor via a standard interconnect/bus system (not shown). The bus system may include, for example, a system bus, a Peripheral Component Interconnect (PCI) bus, a HyperTransport or industry standard architecture (ISA) bus, a small computer system interface (SCSI) bus, a universal serial bus (USB), or an Institute of Electrical and Electronics Engineers (IEEE) standard 1394 bus (sometimes referred to as "Firewire") or any other interconnect type. Processor **32** may be, or may include, one or more programmable general-purpose or special-purpose microprocessors, digital signal processors (DSPs), programmable controllers, application specific integrated circuits (ASICs), programmable logic devices (PLDs), or the like, or a combination of such devices. Processor **32** may also be a low power type, such as an ARM processor, but may be other types as well, such as an Intel or AMD type processor (without derogation of any third party trademark rights), preferably a type intended for low power or mobile use.
(21) Memory **20** represents any form of random-access memory (RAM), read-only memory (ROM), flash memory, or the like, or a combination of such devices SDRAM, NVRAM. The seat box **10** also includes storage media **22** accessible by the processor **32** for non-volatile storage of data when the vehicle is powered down or power is otherwise not available from the vehicle power source **12**. The storage media **22** may be flash memory, a solid-state drive, hard disk drive, or other type of media for non-volatile storage of data. A ROM or EEPROM may be included for non-volatile data storage as well, either alone or in combination with other non-volatile storage media
(22) In one aspect, the storage media stores a configuration data structure **23** (which includes a file, an object or any other data format, structured or unstructured). The configuration data structure **23** stores a first threshold value (may also be referred to as a listening threshold value). For example, the first threshold value may be a current value, I**1** (e.g., 0.2 A) that is pre-set for a USB Type A outlet for a port that is not in use. I**1** defines the minimal initial power that is provided to outlet **38**, e.g., 1 W (0.2*5V, where 5V is the voltage provided to each outlet/port). The configuration data structure **23** also includes the initial power limit (P**1**), which in this example is 1 W.
(23) The configuration data structure **23** also stores an operating (or a second) threshold value and an operating power value. For example, the second threshold value, I**2** may be 2.1 A and the operating power (P**2**) for this example may be 10.5 W (2.1 A*5V). Of course, these current/power levels are only shown as examples and are not intended to limit the scope of the various aspects of the present disclosure.
(24) The processor **32** is connected in communication with each port **18** and **40** of the seat box **10**. The processor **32** executes program logic, including a software application referred to hereafter as a power load manager **34**. The power load manager **34** uses the configuration data structure **23** to configure the various threshold values described above and allocates the initial power and the in-use, operating power to each outlet.
(25) In one aspect, the power load manager **34** allocates a minimum current level for each port (or outlet, used interchangeably herein), I**1**, e.g., 0.2 A at a minimum initial power level, P**1**, e.g., 1 W. Once a USB Type A device is plugged into the port/outlet, the device draws more current than the first threshold value, I**1** (e.g., **02**A). This triggers a fault and temporarily, the initial power, P**1**, is turned off. The power load manager **34** receives a notification of the triggered fault and sets the second threshold value, I**2**, e.g., 2.1 A. The power load manager **34** then provides the operating power, P**2** to the port/outlet, e.g., 10.5 W. Once the device is disconnected, the process moves back to where the minimum initial power is provided to the port and the first threshold value, I**1** is reset.
(26) Process Flow: FIG. **1**B shows a process **50** for detecting a Type A, USB device, according to one aspect of the present disclosure. Process **50** is executed on a vehicle, e.g., an aircraft and

executed by a processor, e.g., **32** using the configuration data structure **23** and executable instructions. Process **50** begins in block B**51**, when the various ports **18**/**40** and the associated outlets (e.g., **38**/**68**) are installed can be made available for use. As mentioned above some of the ports (**18**/**40**)/outlets (**38**) comply with the USB Type A technical specifications. In block B**52**, a first threshold value (or a listening threshold value) (I**1**, e.g., (0.2 A) and a second threshold value) or an operational threshold value (I**2**, e.g., 2.1 A) is stored in the configuration data structure **23**. A corresponding initial power, P**1** (e.g., 1 W) and an operational power, P**2** (e.g., 10.5 W) is also stored in the configuration data structure **23**.

(27) When a Type A USB device is not attached to a Type A USB outlet (**38**)/port (**18** or **40**), then in block B**53**, the power load manager **34** provides an initial power, P**1** to the port/outlet, upon receiving a “not in-use” notification from the port/outlet in block B**54**.

(28) In block B**55**, a USB device with a Type A connector is plugged into one of the Type A USB port/outlets. The USB Type A device draws a current that is greater than the first threshold value, I**1**. This triggers a fault in block B**56**, and the initial power, P**1** is turned off. The power load manager **34** receives a device “in-use” notification that means the port/outlet is in use. The power load manager **34** reads the second threshold value I**2** and sets the second threshold value for the port in block B**57**. Furthermore, the fault is cleared and the power load manager **34** provides the operational power P**2** to the in-use port/outlet.

(29) In block B**58**, the power load manager **34** monitors the port/outlet usage. As an example, the current drawn from the port in-use is measured and reported to the power load manager **34**. In block B**59**, the USB device is unplugged. This results in a drop in current usage. The drop in current indicates that the port/outlet is not being used. In block B**60**, the power load manager **34** turns off the operational power, P**2** and resets the first threshold value. Thereafter, the initial power, P**1** is provided to the port/outlet. Process **51** then repeats, when a USB device is attached again.

(30) FIG. **1**C shows sequence diagram for in-use detection of a Type A USB device **44**. The sequence diagram shows a Type A USB port **18** which also includes outlet **38**. The sequence diagram shows a “notification” block within the power load manager **34**, described above with respect to FIGS. **1**A-**1**B. In one aspect, the notification block may be a sub-component within the power load manager **34**.

(31) The sequence diagram begins with the “initial power on” block **81**. The power supply **12** is initialized (**81**A), the first threshold value, I**1** (e.g., 0.2 A) is set (**81**B) and the initial power, P**1** (e.g., 1 W) is provided to the port (**81**C). The power load manager **34** is notified or determines that no device is in use (**81**D).

(32) The “in-use detection block **82**” is executed when a Type A, USB device **44** is attached by a user **80**, shown as **82**A/**82**B. The attached USB device draws more current than the first threshold value (**82**C). A fault is triggered (**82**D) and the initial power, P**1** to the port/outlet is temporarily turned off (**82**E). The second threshold value, I**2** (e.g., 2.1 A) is set (**82**F). The fault is cleared by clearing a latch (not shown) (**82**G) and the operating power, P**2** (e.g., 10.5 W) is provided to the port (**82**H). The power load manager **34** is notified (or determines) of the in-use detection (**821**). While the device is being used, the current drawn by the device is measured (**82**J) by the port and reported (**82**K) to the power load manager **34**. The measurement and reporting continue while the USB device is in use.

(33) The “not in-use” detection sequence begins in block **83**. Before the device is detached, the process continues to measure (**82**J) and report the current drawn at the port (**82**K) to the power load manager **34**. When the device is detached (**83**A/**83**B), there is a drop (e.g., 0 A) in the drawn current (**83**C). The dropped current is measured (**83**D) and reported (**83**E). If the dropped current value meets a threshold value (**83**F), then the first threshold value, I**1** (e.g., 0.2 A) is set (**83**G). The power load manager **34** receives a notification of “not in-use” detection (**83**H). The process blocks **82** starts again, when the USB device is attached again to the Type A, USB port.

(34) In one aspect, the sequence process blocks of FIG. **1**C are executed by a state machine (not

shown). The state machine may be a part of the power load manager **34**. In another aspect, the power load manager **34** and the state machine are executed by a seat device, e.g., monitors **42** that provide a Type A USB port/outlet. The adaptive aspects of the present disclosure are not limited to any specific location where the power load manager **34** and the state machine are executed.

(35) In one aspect, methods and systems are provided for a transportation vehicle. One method includes storing (e.g., B**52**, FIG. **1**B) a listening threshold value (e.g., I**1**) for a Type A, universal serial bus (USB) port (e.g., **18** and/or outlet **38**, FIG. **1**A) on the transportation vehicle (e.g., **11**, FIG. **1**A); providing (e.g., B**53**, FIG. **1**B) an initial power (e.g., P**1**) to the USB port without any attached USB device; in response to attaching a USB device to the USB port, detecting (e.g., B**55**, FIG. **1**B) an increase in current greater than the listening threshold value; temporarily turning off (e.g., B**56**, FIG. **1**B) the initial power to the USB port; setting an operating threshold value (e.g., B**57**, FIG. **1**B), and providing operating power (e.g., B**57**, FIG. **1**B) to the USB port; detecting (e.g., B**59**, FIG. **1**B) a drop in current when the USB device is disconnected; and resetting (e.g., B**60**, FIG. **1**B) the listening threshold value and providing the initial power to the USB port.

(36) The various aspects of the present disclosure solve the inherent challenge of efficiently detecting the use of a Type A USB device. In conventional systems, each port is typically provided the same operational power, whether the port is in-use or not. This becomes challenging for a transportation vehicle, e.g., on an aircraft power availability can be limited, due to weight, space, and other design constraints. The present disclosure solves this challenge by providing a low initial power P**1** when a port is not in use, detecting use of a Type A USB device and then providing the operational power P**2**, which is greater than P**1**. When a device is detached, the operational power, P**2** is reset to the lower initial power, P**1**. This optimizes overall power consumption and distribution on the transportation vehicle.

(37) Vehicle Information System: FIG. **2**A shows an example of a vehicle information system **100**A (also referred to as system **100**A) that can be configured for installation aboard an aircraft **132** (similar to vehicle **11** of FIG. **1**A), according to one aspect of the present disclosure. When installed on an aircraft, system **100**A can comprise an aircraft passenger IFE system. System **100**A comprises at least one content source **113** and one or more user (or passenger) media client user interface systems (may also be referred to as a seat device/seatback device) **114** that communicate with a real-time content distribution system **104**. The content sources **113** may include one or more internal content sources, such as a media server system **112**, that are installed aboard the aircraft **132**, one or more remote (or terrestrial) content sources **116** that can be external from the aircraft **132**, or a distributed content system. The media server system **112** can be provided as an information system controller for providing overall system control functions for system **100**A and/or for storing viewing content **124**, including pre-programmed viewing content and/or content **120** downloaded to the aircraft, as desired. The viewing content **124** can include television programming content, music content, podcast content, photograph album content, audiobook content, and/or movie content without limitation. The viewing content as shown and described herein are not exhaustive and are provided herein for purposes of illustration only and not for purposes of limitation.

(38) The media server system **112** can include, and/or communicate with, one or more conventional peripheral media storage systems (not shown), including optical media devices, such as a digital video disk (DVD) system or a compact disk (CD) system, and/or magnetic media systems, such as a video cassette recorder (VCR) system, a solid state drive (SSD) system, or a hard disk drive (HDD) system, of any suitable kind, for storing the preprogrammed content and/or the downloaded content **120**. The media server system **112** may stream and/or otherwise transmit data stored on the storage system to content distribution system **104** to be played by a passenger using user interface system **114** (also referred to as a set device or a smart monitor).

(39) For example, one type of content that may be transmitted to user interface system **114** comprises viewing content **124**. The viewing content **124** can comprise any conventional type of

audio and/or video viewing content, such as stored (or time-delayed) viewing content and/or live (or real-time) viewing content. As desired, the viewing content **124** can include geographical information. Alternatively, and/or additionally, to entertainment content, such as live satellite television programming and/or live satellite radio programming and/or live wireless video/audio streaming, the viewing content likewise can include two-way communications, such as real-time access to the Internet **118** and/or telecommunications and/or a cellular base station **123** that communicates through an antenna **111** to a transceiver system **109** and a computer system **107**. The functionality of computer system **107** is similar to computing system **106** for distributing content using the content distribution system **104** described herein. It is noteworthy that although two antenna systems **110**/**111** have been shown in FIG. **2**A, the adaptive aspects disclosed herein may be implemented by fewer or more antenna systems.

(40) Being configured to distribute and/or present the viewing content **124** provided by one or more selected content sources **113**, system **100**A can communicate with the content sources **113** in real time and in any conventional manner, including via wired and/or wireless communications. System **100**A and the terrestrial content source **116**, for example, can communicate directly and/or indirectly via an intermediate communication system, such as a satellite communication system **122** or the cellular base station **123**.

(41) System **100**A can receive content **120** from a selected terrestrial content source **116** and/or transmit (upload) content **128**, including navigation and other control instructions, to the terrestrial content source **116**. As desired, the terrestrial content source **116** can be configured to communicate with other terrestrial content sources (not shown). The terrestrial content source **116** is shown as a network device that provides access to the Internet **118**. Although shown and described as comprising the satellite communication system **122** and the cellular base station **123** for purposes of illustration, the communication system can comprise any conventional type of wireless communication system, such as any wireless communication system and/or an Aircraft Ground Information System (AGIS) communication system.

(42) To facilitate communications with the terrestrial content sources **116**, system **100**A may also include an antenna system **110** and a transceiver system **108** for receiving the viewing content from the remote (or terrestrial) content sources **116**. Transceiver system **108** is preferably configured to both send and receive data to any suitable content source device. The antenna system **110** preferably is disposed outside, such as an exterior surface of a fuselage **136** of the aircraft **132**. The antenna system **110** can receive viewing content **124** from the terrestrial content source **116** and provide the received viewing content **124**, as processed by the transceiver system **108**, to a computer system **106** of system **100**A. The computer system **106** can provide the received viewing content **124** to the media (or content) server system **112** and/or directly to one or more of the user interface systems **114** including an IFE or a PED, as desired. Although shown and described as being separate systems for purposes of illustration, the computer system **106** and the media server system **112** can be at least partially integrated, and in some aspects comprises a single computer system.

(43) The user interface system **114** may comprise computing terminals/smart monitors in communication with a wireless access point **130**, for example, a port that user interface system **114** plugs into. The user interface system **114** provides a display device to view content, for example, a screen having a keyboard or a touchscreen. The user interface system **114** includes a hardware interface to connect to an access point **130** to provide a wired and/or a wireless connection for the user interface system **114** to interface with.

(44) In at least one aspect, the user interface system **114** comprises a software application that a user downloads and installs on a PED to receive and view content via an access point **130**, described below in detail. While bandwidth limitation issues may occur in a wired or wireless system on a vehicle, such as an aircraft **132**, in general a system bus of the vehicle information **100**A system is configured to have sufficient bandwidth to support data transfers for all user

interface systems **114** aboard the vehicle, i.e., devices used by passengers.

(45) The user interface system **114** can include an input system (not shown) for permitting the user (or passenger) to communicate with system **100**A, such as via an exchange of control signals **138**. Illustrative user instructions **140** can include instructions for initiating communication with the content source **113**, instructions for selecting viewing content **124** for presentation, and/or instructions for controlling the presentation of the selected viewing content **124**. If a fee is required for accessing the viewing content **124** or for any other reason, payment information likewise can be entered via the input system. The input system can be provided in any conventional manner and typically includes a touch screen, API, a microphone for voice input, one or more switches (or pushbuttons), such as a keyboard or a keypad, and/or a pointing device, such as a mouse, trackball, or stylus.

(46) In one aspect, the user interface system **114** is provided at individual passenger seats of aircraft **132**. The user interface system **114** can be adapted to different aircraft and seating arrangements and the adaptive aspects described herein are not limited to any specific seat arrangements or user interface types.

(47) FIG. **2**B shows an example of implementing the vehicle information system **100**B (may be referred to as system **100**B) on an automobile **134** that may include a bus, a recreational vehicle, a boat, and/or a train, or any other type of passenger vehicle without limitation. The various components of system **100**B may be similar to the components of system **100**A described above with respect to FIG. **2**A and for brevity are not described again.

(48) Content Distribution System: FIG. **3** illustrates an example of the content distribution system **104** for the vehicle information system **200** (similar to **100**A/**100**B), according to one aspect of the present disclosure. The content distribution system **104** couples, and supports communication between the server system **112**, and the plurality of media client systems **114**.

(49) The content distribution system **104**, for example, can be provided as a conventional wired and/or wireless communication network, including a telephone network, a local area network (LAN), a wide area network (WAN), a campus area network (CAN), personal area network (PAN) and/or a wireless local area network (WLAN) of any kind. Exemplary wireless local area networks include wireless fidelity (Wi-Fi) networks in accordance with Institute of Electrical and Electronics Engineers (IEEE) Standard 802.11 and/or wireless metropolitan-area networks (MANs), which also are known as WiMax Wireless Broadband, in accordance with IEEE Standard 802.16.

(50) Preferably configured to support high data transfer rates, the content distribution system **104** may comprise a high-speed Ethernet network, such as any type of Fast Ethernet (such as 100 Base-X and/or 100 Base-T) communication network and/or Gigabit (such as 1000 Base-X and/or 1000 Base-T) Ethernet communication network, with a typical data transfer rate of at least approximately one hundred megabits per second (100 Mbps) or any other transfer rate. In some aspects, the content distribution system **104** may comprise a fiber optic network. To achieve high data transfer rates in a wireless communications environment, free-space optics (or laser) technology, millimeter wave (or microwave) technology, and/or Ultra-Wideband (UWB) technology can be utilized to support communications among the various system resources, as desired, for example, a 5G network.

(51) As illustrated in FIG. **3**, the distribution system **104** can be provided as a plurality of area distribution boxes (ADBs) **206**, a plurality of floor disconnect boxes (FDBs) **208**, and a plurality of seat electronics boxes (SEBs) (and/or VSEBs and/or PSEBs) **210** being configured to communicate in real time via a plurality of wired and/or wireless communication connections **212**.

(52) The distribution system **104** likewise can include a switching system **202** for providing an interface between the distribution system **104** and the server system **112**. The switching system **202** can comprise a conventional switching system, such as an Ethernet switching system, and is configured to couple the server system **112** with the ADBs **206**. Each of the ADBs **206** is coupled with, and communicates with, the switching system **202**. In addition, the distribution system **104**

includes one or more WAPs (**130**A to **130**N) connected in communication with the switch system **202** for wireless distribution of content to user interface systems **114**.
(53) Each of the area distribution boxes **202**, in turn, is coupled with, and communicates with, at least one FDB **208**. Although the ADBs **206** and the associated FDBs **208** can be coupled in any conventional configuration, the associated FDBs **208** preferably are disposed in a star network topology about a central ADB **206** as illustrated in FIG. **3**. Each FDB **208** is coupled with, and services, a plurality of daisy-chains of SEBs **210**. The SEBs **210**, in turn, are configured to communicate with the user interface system **114**. Each SEB **210** can support one or more of the user interface systems **114**.
(54) The switching systems **202**, the ADBs **206**, the FDBs **208**, the SEBs (and/or VSEBs, and/or PSEBs) **210**, the antenna system **110** (and/or **111**, FIG. **2**A), the transceiver system **108** (and/or **109**, FIG. **2**A), the content source **113**, the server system **112**, and other system resources of the vehicle information system preferably are provided as line replaceable units (LRUs). The use of LRUs facilitate maintenance of the vehicle information system **200** because a defective LRU can simply be removed from the vehicle information system **200** and replaced with a new (or different) LRU. The defective LRU thereafter can be repaired for subsequent installation. Advantageously, the use of LRUs can promote flexibility in configuring the content distribution system **104** by permitting ready modification of the number, arrangement, and/or configuration of the system resources of the content distribution system **104**. The content distribution system **104** likewise can be readily upgraded by replacing any obsolete LRUs with new LRUs.
(55) The content distribution system **104** can include at least one FDB internal port bypass connection **214** and/or at least one SEB loopback connection **216**. Each FDB internal port bypass connection **214** is a communication connection **212** that permits FDBs **208** associated with different ADBs **206** to directly communicate. Each SEB loopback connection **216** is a communication connection **212** that directly couples the last SEB **210** in each daisy-chain of SEBs **210** for a selected FDB **208** as shown in FIG. **3**. Each SEB loopback connection **216** therefore forms a loopback path among the daisy-chained SEBs **210** coupled with the relevant FDB **208**.
(56) It is noteworthy that the various aspects of the present disclosure may be implemented without using FDB **208**. When FDB **208** is not used, ADB **206** communicates directly with SEB **210** and/or server system **112** may communicate directly with SEB **210** or the seats. The various aspects of the present disclosure are not limited to any specific network configuration.
(57) Processing System: FIG. **4** is a high-level block diagram showing an example of the architecture of a processing system **500** that may be used according to one aspect. The processing system **500** can represent any computer system disclosed herein, for example, terrestrial content source **116**, satellite communication system **122**, computer system **106**, media server system **112**, user interface system **114**, WAP **130**, or any user device that attempts to interface with a vehicle computing device. Note that certain standards and well-known components which are not germane to the present aspects are not shown in FIG. **4**.
(58) The processing system **500** includes one or more processor(s) **502** and memory **504**, coupled to a bus system **505**. The bus system **505** shown in FIG. **4** is an abstraction that represents any one or more separate physical buses and/or point-to-point connections, connected by appropriate bridges, adapters and/or controllers. The bus system **505**, therefore, may include, for example, a system bus, a Peripheral Component Interconnect (PCI) bus, a HyperTransport or industry standard architecture (ISA) bus, a small computer system interface (SCSI) bus, a universal serial bus (USB), or an Institute of Electrical and Electronics Engineers (IEEE) standard 1394 bus (sometimes referred to as “Firewire”) or any other interconnect type.
(59) The processor(s) **502** are the central processing units (CPUs) of the processing system **500** and, thus, control its overall operation. In certain aspects, the processors **502** accomplish this by executing software stored in memory **504**. A processor **502** may be, or may include, one or more programmable general-purpose or special-purpose microprocessors, digital signal processors

(DSPs), programmable controllers, application specific integrated circuits (ASICs), programmable logic devices (PLDs), or the like, or a combination of such devices.
(60) Memory **504** represents any form of random access memory (RAM), read-only memory (ROM), flash memory, or the like, or a combination of such devices. Memory **504** includes the main memory of the processing system **500**. Instructions **506** may be used to implement the power load module **34**, and/or the process blocks of FIGS. **1**B-**1**C described above.
(61) Also connected to the processors **502** through the bus system **505** are one or more internal mass storage devices **510**, and a network adapter **512**. Internal mass storage devices **510** may be or may include any conventional medium for storing large volumes of data in a non-volatile manner, such as one or more magnetic or optical based disks, flash memory, or solid-state drive.
(62) The network adapter **512** provides the processing system **500** with the ability to communicate with remote devices (e.g., over a network) and may be, for example, an Ethernet adapter or the like.
(63) The processing system **500** also includes one or more input/output (I/O) devices **508** coupled to the bus system **505**. The I/O devices **508** may include, for example, a display device, a keyboard, a mouse, etc. The I/O device may be in the form of a handset having one or more of the foregoing components, such as a display with a real or virtual keyboard, buttons, and/or other touch-sensitive surfaces.
(64) Thus, methods and systems for power management on a transportation vehicle have been described. Note that references throughout this specification to “one aspect” (or “embodiment”) or “an aspect” mean that a particular feature, structure or characteristic described in connection with the aspect is included in at least one aspect of the present disclosure. Therefore, it is emphasized and should be appreciated that two or more references to “an aspect” or “one aspect” or “an alternative aspect” in various portions of this specification are not necessarily all referring to the same aspect. Furthermore, the particular features, structures or characteristics being referred to may be combined as suitable in one or more aspects of the disclosure, as will be recognized by those of ordinary skill in the art.
(65) While the present disclosure is described above with respect to what is currently considered its preferred aspects, it is to be understood that the disclosure is not limited to that described above. To the contrary, the disclosure is intended to cover various modifications and equivalent arrangements within the spirit and scope of the appended claims.

Claims

1. A method, comprising: configuring a listening threshold value for a Type A, universal serial bus (USB) port on a transportation vehicle; providing an initial power to the USB port without any attached USB device; in response to attaching a USB device to the USB port, detecting an increase in current at the USB port greater than the listening threshold value; temporarily turning off the initial power to the USB port in response to detecting the increase in current greater than the listening threshold value; setting an operating threshold value, and providing operating power to the USB port; detecting a drop in current at the USB port below a disconnect threshold value when the USB device attached to the USB port becomes is disconnected from the USB port; and resetting the listening threshold value and providing the initial power to the USB port in response to detecting the drop.
2. The method of claim 1, wherein the listening threshold value is a first current value.
3. The method of claim 2, wherein the operating threshold value is a second current value that is greater than the listening threshold value.
4. The method of claim 1, wherein the operating power is greater than the initial power.
5. The method of claim 1, further comprising: monitoring a current drawn by the USB device, while the USB device is in use; and detecting a drop in the current drawn value below a threshold to determine that the USB device is detached.

6. The method of claim 1, wherein the transportation vehicle is an aircraft.
7. The method of claim 1, wherein the transportation vehicle is not an aircraft.
8. A non-transitory machine-readable storage medium having stored thereon instructions for performing a method, comprising machine executable code which, when executed by a machine, causes the machine to: configure a listening threshold value for a Type A, universal serial bus (USB) port on a transportation vehicle; provide an initial power to the USB port without any attached USB device; in response to attaching a USB device to the USB port, detect an increase in current at the USB port greater than the listening threshold value; temporarily turn off the initial power to the USB port in response to detecting the increase in current greater than the listening threshold value; set an operating threshold value, and providing operating power to the USB port; detecting a drop in current at the USB port below a disconnect threshold value when the USB device attached to the USB port becomes disconnected from the USB port; and reset the listening threshold value and providing the initial power to the USB port in response to detecting the drop.
9. The non-transitory machine-readable storage medium of claim 8, wherein the listening threshold value is a first current value.
10. The non-transitory machine-readable storage medium of claim 8, wherein the operating threshold value is a second current value that is greater than the listening threshold value.
11. The non-transitory machine-readable storage medium of claim 8, wherein the operating power is greater than the initial power.
12. The non-transitory machine-readable storage medium of claim 8, wherein the machine executable code which when executed by the at least one machine, further causes the at least one machine to: monitor a current drawn by the USB device, while the USB device is in use; and detect a drop in the current drawn value below a threshold to determine that the USB device is detached.
13. The non-transitory machine-readable storage medium of claim 8, wherein the transportation vehicle is an aircraft.
14. The non-transitory machine-readable storage medium of claim 8, wherein the transportation vehicle is not an aircraft.
15. A system, comprising: a memory containing non-transitory machine readable storage medium comprising machine executable code having stored thereon instructions; and a processor of a first node coupled to the memory, the processor configured to execute the machine executable code to: configure a listening threshold value for a Type A, universal serial bus (USB) port on a transportation vehicle; provide an initial power to the USB port without any attached USB device; in response to attaching a USB device to the USB port, detect an increase in current at the USB port greater than the listening threshold value; temporarily turn off the initial power to the USB port in response to detecting the increase in current greater than the listening threshold value; set an operating threshold value, and providing operating power to the USB port; detecting a drop in current at the USB port below a disconnect threshold value when the USB device attached to the USB port becomes is disconnected from the USB port; and reset the listening threshold value and providing the initial power to the USB port in response to detecting the drop.
16. The system of claim 15, wherein the listening threshold value is a first current value.
17. The system of claim 15, wherein the operating threshold value is a second current value that is greater than the listening threshold value.
18. The system of claim 15, wherein the operating power is greater than the initial power.
19. The system of claim 15, wherein the machine executable code further causes to: monitor a current drawn by the USB device, while the USB device is in use; and detect a drop in the current drawn value below a threshold to determine that the USB device is detached.
20. The system of claim 15, wherein the transportation vehicle is an aircraft.