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(54) **ONBOARD EXECUTION OF FLIGHT RECORDER APPLICATION**

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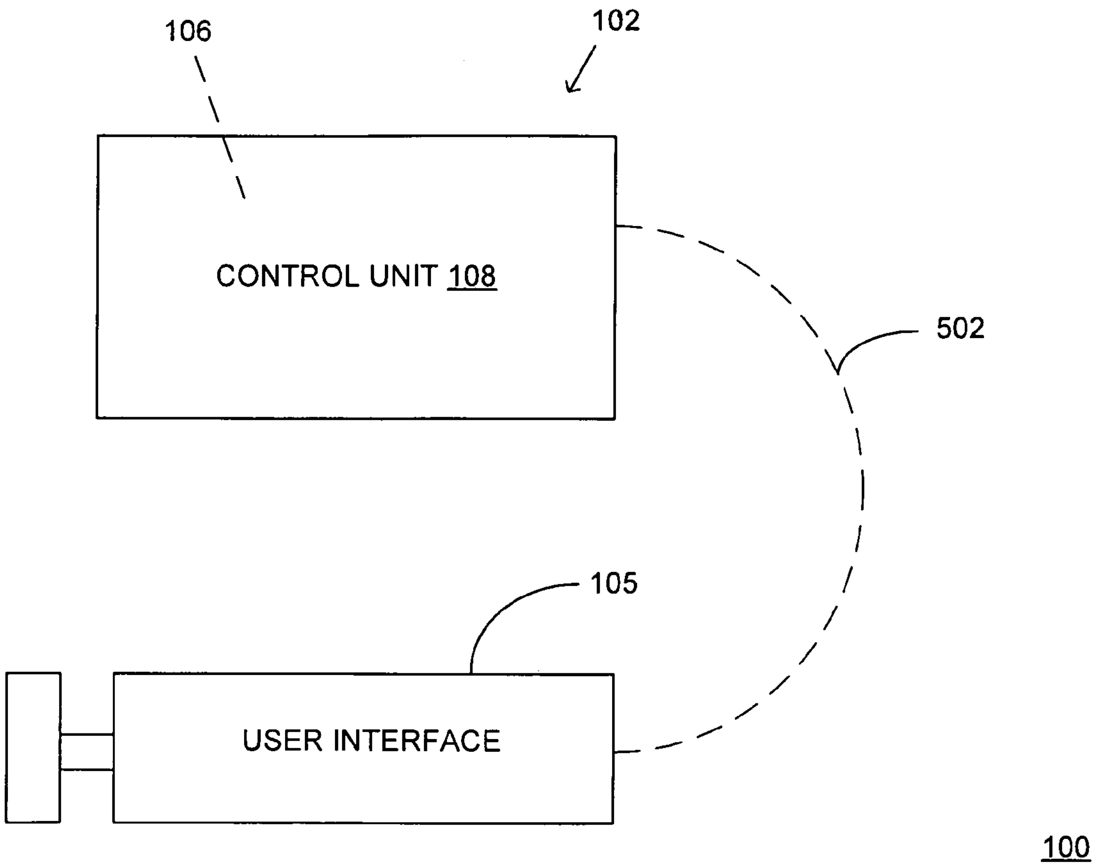
(57) **ABSTRACT**

An apparatus in an example comprises an onboard controller and a flight recorder application. The onboard controller is onboard a vehicle and comprises an onboard operating system (OS). The flight recorder application is executable onboard the vehicle by the onboard operating system.



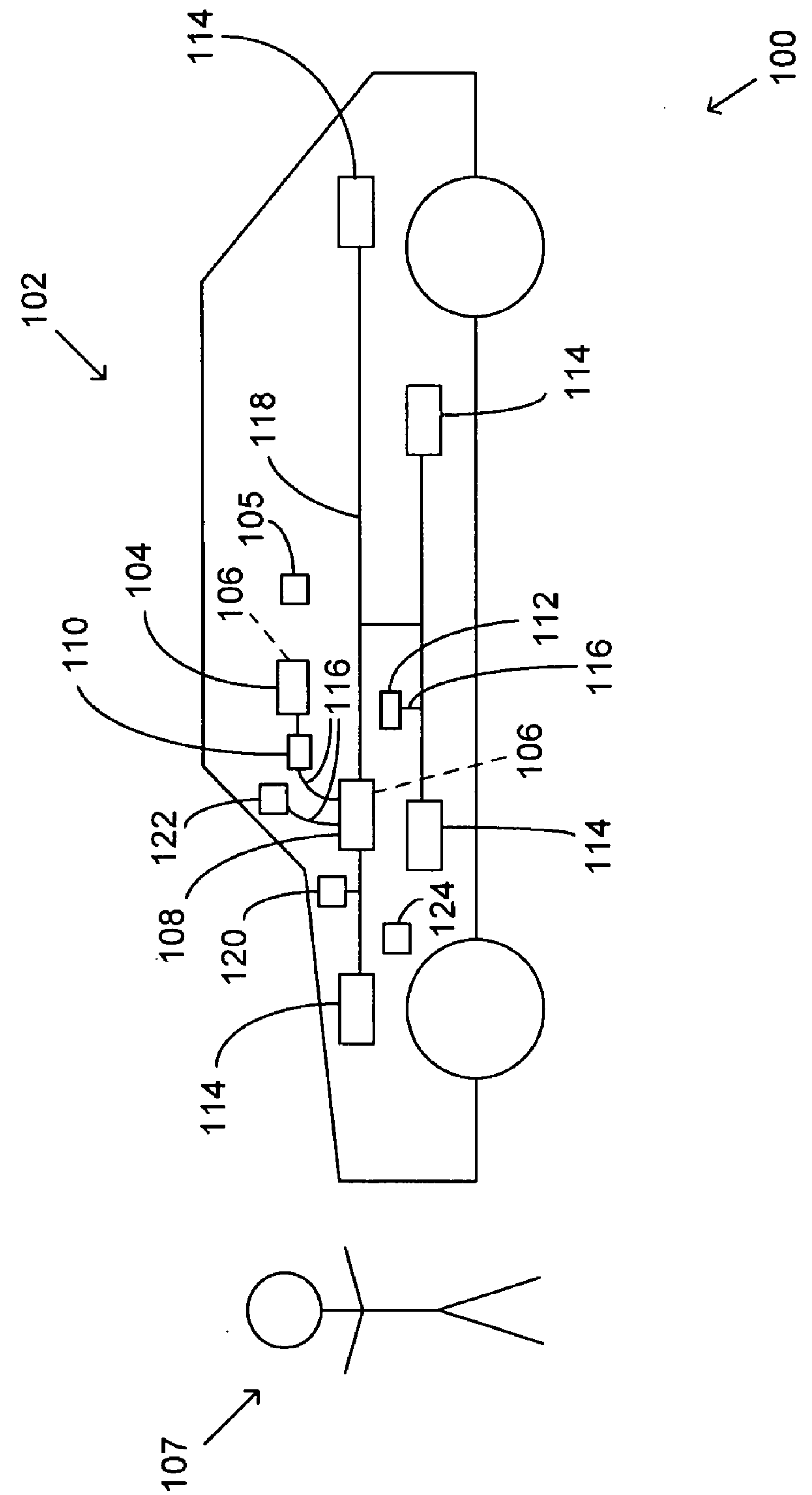

100
102
104
105
106
106
107
108
110
112
114
114
114
114
114
116
116
118
120
122
124

FIG. 1

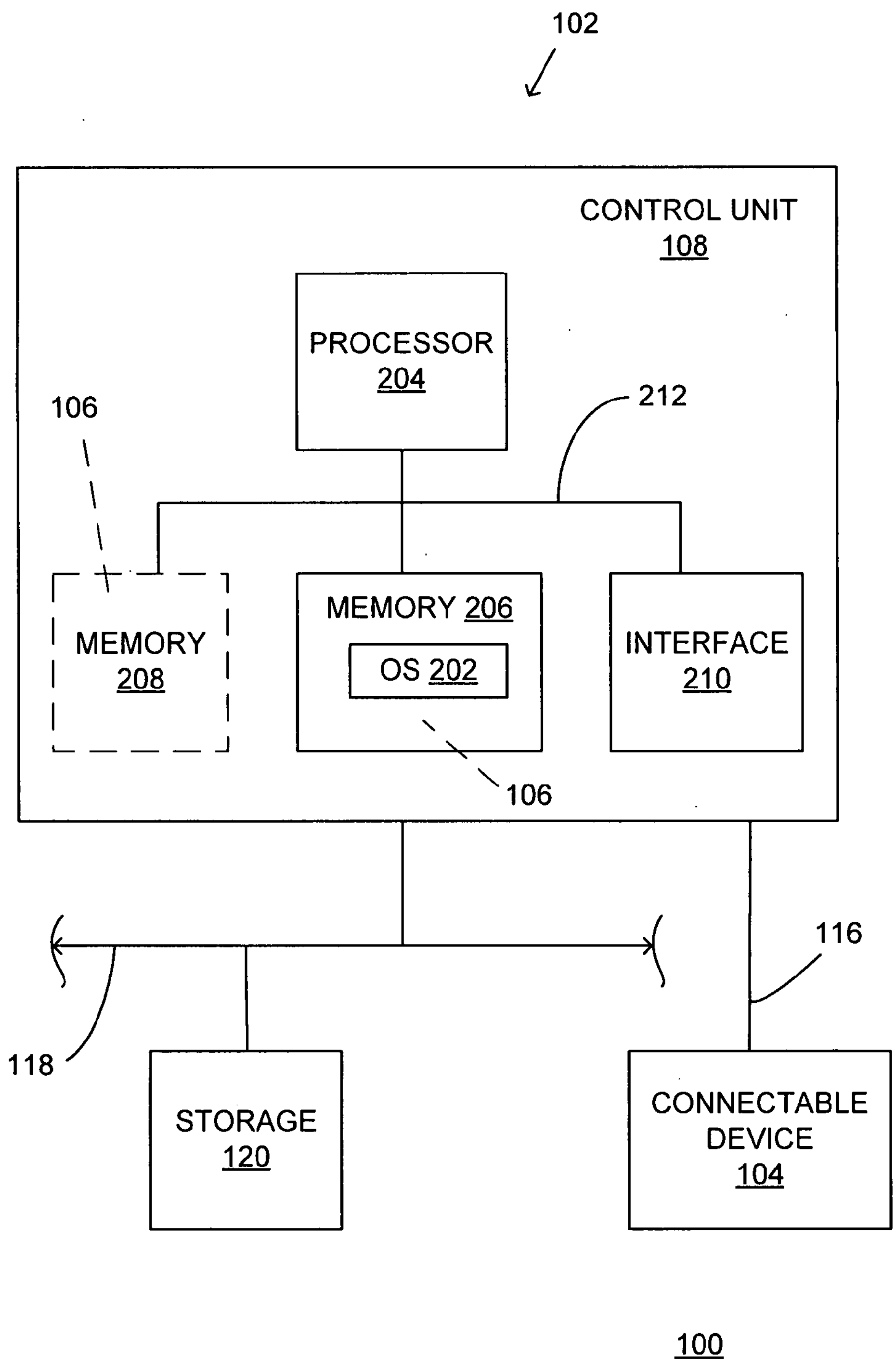

102
CONTROL UNIT
108
PROCESSOR
204
106
212
MEMORY
208
MEMORY 206
OS 202
INTERFACE
210
106
116
118
STORAGE
120
CONNECTABLE
DEVICE
104
100

FIG. 2

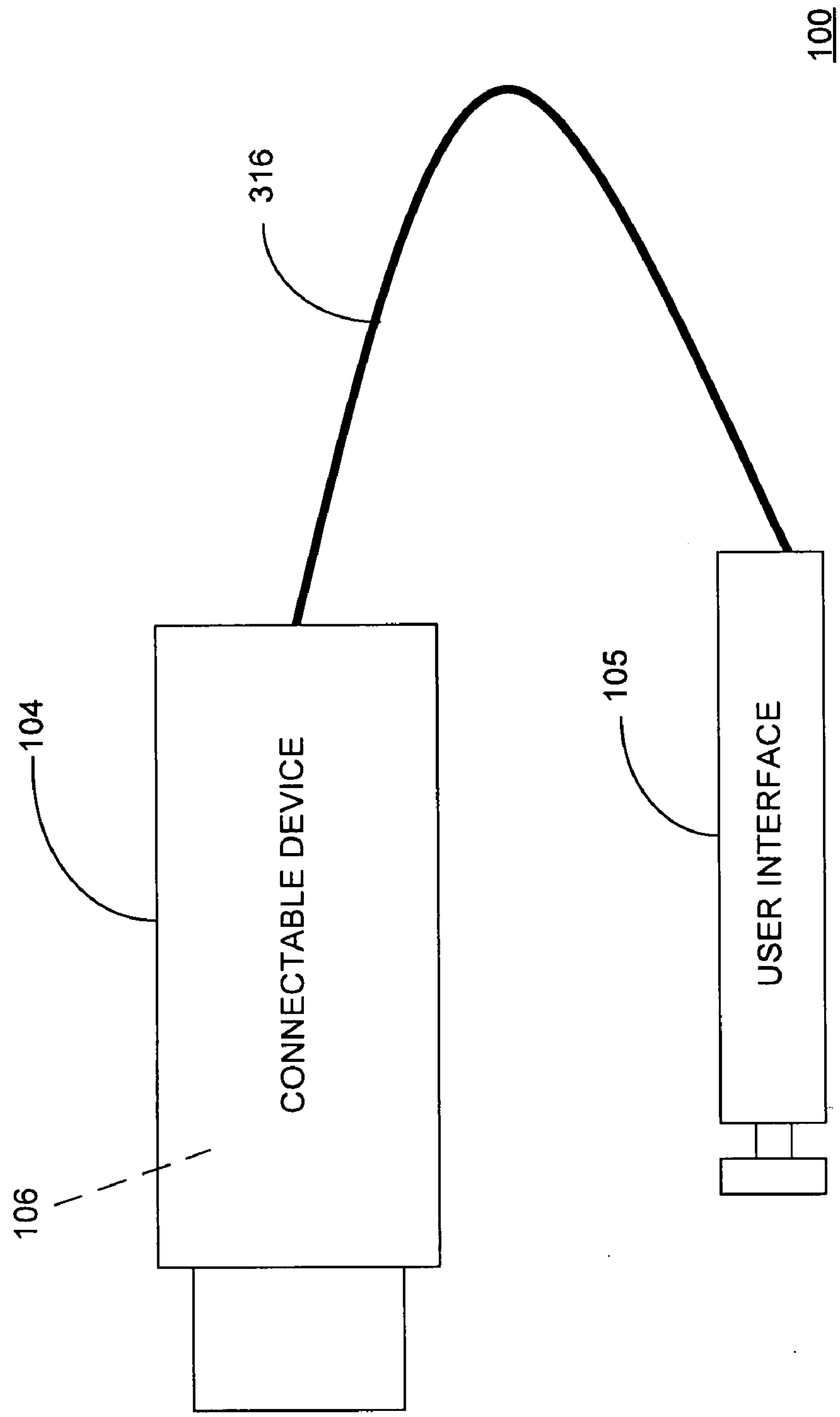


FIG. 3

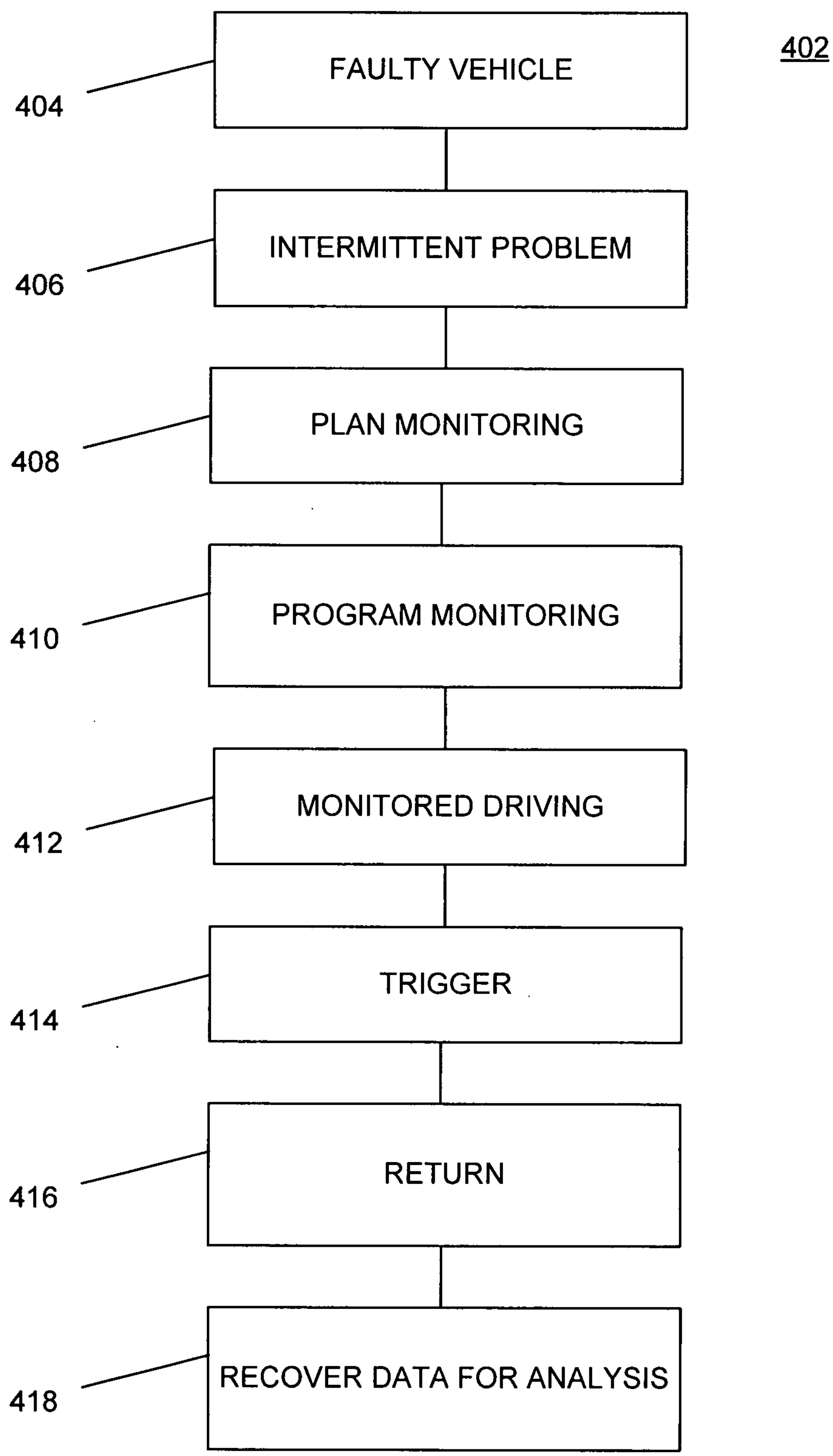

402
404
FAULTY VEHICLE
406
INTERMITTENT PROBLEM
408
PLAN MONITORING
410
PROGRAM MONITORING
412
MONITORED DRIVING
414
TRIGGER
416
RETURN
418
RECOVER DATA FOR ANALYSIS

FIG. 4

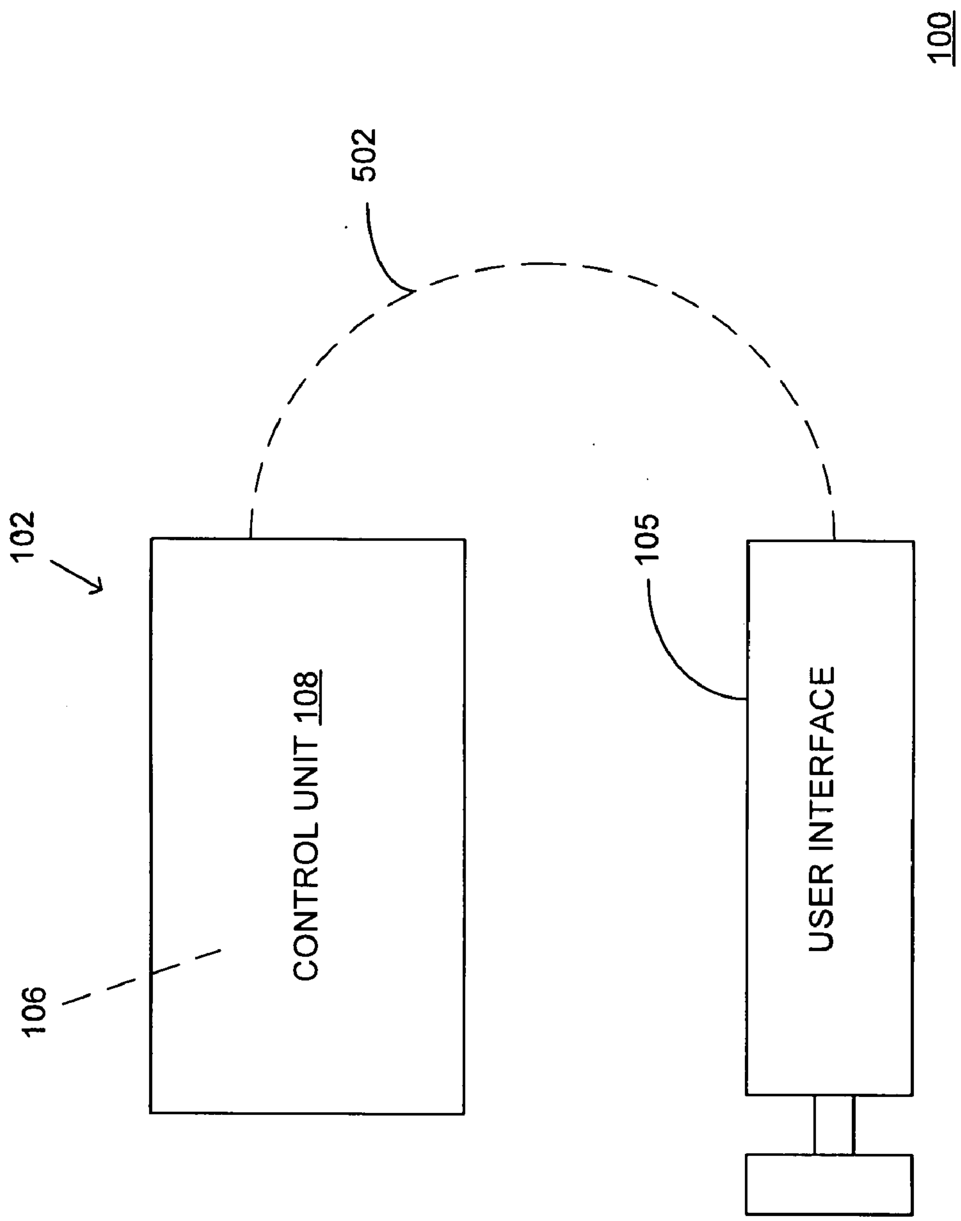


FIG. 5

ONBOARD EXECUTION OF FLIGHT RECORDER APPLICATION

BACKGROUND

[0001] Offboard flight recorders for vehicles such as automobiles have taken the form of offboard dedicated equipment connected by a diagnostic connector to a bus internal to the vehicle. The offboard dedicated equipment has a processor that runs a flight recorder application. On-Board Diagnostics (OBD) refers to the self-diagnostic and reporting capability of a vehicle. OBD systems give information about the condition and/or health of a vehicle to the owner and/or a repair technician. The OBD-II specification has mandated a diagnostic connector in every vehicle sold in the US after 1996. The standardized hardware interface is the J1962 connector, a female 16-pin (2×8) connector. The J1962 and/or OBD-II connector is usually located on the driver side of the passenger compartment near the center console. The J1962 and/or OBD-II connector provides a standardized fast digital communications port for real-time data and a standardized series of diagnostic trouble codes (DTCs) that allow one to identify and remedy malfunctions within the vehicle.

DESCRIPTION OF THE DRAWINGS

[0002] Features of exemplary implementations of the invention will become apparent from the description, the claims, and the accompanying drawings in which:

[0003] FIG. **1** is a representation of an implementation of an apparatus that comprises a vehicle, one or more connectable devices, and one or more user interfaces, and illustrates a flight recorder application that may be locatable in the vehicle and/or one or more of the one or more connectable devices, and further illustrates one or more users.

[0004] FIG. **2** is an enlarged, partial representation of the vehicle and the connectable device of an implementation of the apparatus of FIG. **1**, and illustrates the vehicle with a control unit and a storage device.

[0005] FIG. **3** is an enlarged, partial representation of the connectable device coupled with a first exemplary implementation of the user interface of an implementation of the apparatus of FIG. **1**.

[0006] FIG. **4** is a representation of an exemplary logic flow for review of a problem with the vehicle of an implementation of the apparatus of FIG. **1**.

[0007] FIG. **5** is an enlarged, partial representation of a second exemplary implementation of the user interface coupled with a control unit of the vehicle of an implementation of the apparatus of FIG. **1**.

DETAILED DESCRIPTION

[0008] Referring to the BACKGROUND section above, the offboard flight recorders are expensive in terms of complexity and/or consumption of resources. The offboard flight recorders may need: custom circuitry for monitoring the bus internal to the vehicle; custom power supply; a custom implementation of the flight recorder application; operating system (OS) software and/or drivers to handle the vehicle interface; custom physical enclosure, handling of cooling, cable strains, user interface, and the like; and/or custom cables for attachment to the J1962 and/or OBD-II connector of the vehicle.

[0009] An exemplary implementation executes a flight recorder application onboard the vehicle. Standard computer-type docking connections on the vehicle such as universal serial bus (USB) and/or wireless capabilities such as under the Bluetooth® standard are increasingly available. The vehicle comprises an onboard processor with operating system (OS), for example, in an electronic control unit (ECU) that is onboard the vehicle. The flight recorder application in an example may be locatable onboard or offboard the vehicle, with execution of the flight recorder application onboard the vehicle. An exemplary implementation comprises low-cost hardware to support user triggers. The triggers would activate a recording by the flight recorder application. The user would take the vehicle to a technician who could view the data logs to understand occurrences, conditions, and/or behavior of the vehicle around the point of activation of the trigger.

[0010] Automotive vehicles may have an onboard device running an operating system such as offered by Microsoft Corporation under the trade identifier MICROSOFT® AUTO (World Wide Web microsoft.com). A mass storage device aboard the vehicle may hold the operating system as well as applications, previously directed to infotainment facilities in the vehicle such as audio, phone, navigation, etc. An exemplary implementation serves to help in diagnosing intermittent faults in the vehicle, for example, by allowing an application to monitor the status of a set of defined signals and record them at trigger points.

[0011] An exemplary approach performs automotive flight recorder functionality onboard without the use of custom external hardware. An exemplary implementation reduces and/or avoids a requirement and/or constraint for custom leads to connect a recorder to a vehicle. An exemplary implementation reduces and/or avoids a requirement and/or constraint for custom operating system software. An exemplary implementation employs an operating system already planned, designed, implemented, and/or provided with and/or on the vehicle. An exemplary implementation reduces and/or avoids a requirement and/or constraint for custom monitoring hardware and/or functionality for the bus and/or low level drivers to monitor the bus. An exemplary implementation employs bus monitoring capabilities already planned, designed, implemented, and/or provided with and/or on the vehicle, for example, through an ECU that provides an operating system. An exemplary implementation provides and/or allows flight recording with reduction, avoidance, and/or constraint of power use and/or heat generation attributable to presence of the flight recorder application.

[0012] An exemplary implementation employs a vehicle that comprises an onboard device with an operating system, for example, capable of running third party applications. An exemplary onboard device is connected to an internal bus of the vehicle and capable of communicating with other onboard devices. An exemplary implementation stores data recorded by the other onboard devices in a storage device such as a mass storage device. An exemplary mass storage device is located in an ECU that comprises the operating system, an onboard hard drive, an onboard memory device, and/or an external and/or offboard memory device such as a universal serial bus (USB) memory device and/or stick connected to the vehicle and/or an offboard memory device wirelessly connected to the ECU. An exemplary approach loads a flight recorder application directly onto an onboard ECU. An exemplary approach runs a flight recorder application from an external device such as a USB memory device and/or stick.

[0013] Turning to FIG. **1**, an implementation of an apparatus **100** in an example comprises a vehicle **102**, one or more connectable devices **104**, and one or more user interfaces **105**.

A flight recorder application **106** in an example may be locatable in the vehicle **102** and/or one or more of the one or more connectable devices **104**. An exemplary flight recorder application **106** comprises an exemplary implementation of an algorithm, procedure, program, process, mechanism, engine, model, coordinator, module, user-level application, software, code, and/or logic. One or more users **107** in an example may operate, interact, and/or appear with the vehicle. Exemplary users **107** comprise an operator and/or driver of the vehicle **102**, a technician that services the vehicle **102**, a passenger in the vehicle **102**, and/or a person.

[0014] The vehicle **102** in an example comprises an automobile. The vehicle **102** in an example comprises an onboard controller and/or control unit such as an electronic control unit (ECU) **108**, one or more connectors such as a universal serial bus (USB) connector **110** and/or diagnostic connector **112**, one or more onboard vehicle controllers **114**, one or more cables and/or leads **116**, one or more busses **118**, one or more storage devices **120**, and/or one or more user interfaces **122**. The electronic control unit **108** in an example comprises an operating system (OS) **202** (FIG. **2**), for example, that is capable of running third party applications. An exemplary onboard vehicle controller **114** comprises an ECU. An ECU as the onboard vehicle controller **114** in an example omits and/or lacks an operating system that is capable of running third party applications, as an exemplary difference between an ECU as the onboard controller **114** and the electronic control unit **108**.

[0015] An ECU as the electronic control unit **108** and/or one or more of the onboard vehicle controllers **114** in an example comprises an embedded system that controls one or more electrical subsystems in the vehicle **102**. ECUs as the electronic control unit **108** and/or one or more of the onboard vehicle controllers **114** comprises, for example, an Engine Control Unit and/or Powertrain Control Module (PCM), Transmission Control Unit (TCU), Telephone Control Unit (TCU), Man Machine Interface (MMI), Door Control unit, Seat Control Unit, antilock brake system (ABS) controller, a stability controller, and/or Climate Control Unit.

[0016] An exemplary ECU as the electronic control unit **108** and/or one or more of the onboard vehicle controllers **114** in an example obtains and/or receives information from a sensor **124**, for example, associable with one or more designated, selected, desired, measurable, defined, and/or predetermined parts, tendencies, and/or behaviors of the vehicle **102**. For example, the ABS controller as the electronic control unit **108** and/or the onboard vehicle controller **114** may provide Parameter Identification (PID) values such as for the wheel speed from an exemplary sensor **124** that comprises a wheel speed sensor. An exemplary automobile as the vehicle **102** comprises ten (10) to one hundred fifty (150) ECUs as the electronic control unit **108** and/or one or more of the onboard vehicle controllers **114**.

[0017] The diagnostic connector **112** in an example comprises a J1962 and/or OBD-II connector, for example, an On-Board Diagnostics (OBD) standardized hardware interface. An exemplary J1962 and/or OBD-II connector as the diagnostic connector **112** comprises a digital communications port, for example, a standardized fast port such as for real-time data. An exemplary J1962 and/or OBD-II connector as the diagnostic connector **112** communicates diagnostic trouble codes (DTCs), for example, a standardized series of codes that allow one to identify and/or remedy malfunctions within the vehicle **102**.

[0018] The bus **118** in an example conforms to one or more standards and/or protocols, for example, Controller Area Network (CAN) specification, Standard Corporate Protocol (SCP), UART Based Protocol (UBP, where UART refers to Universal Asynchronous Receiver/Transmitter), ISO9141 (where the ISO trademark is associated with the International Organization for Standardization), and/or KWP2000 (Key-Word Protocol 2000). CAN comprises a broadcast, differential serial bus standard for connecting ECUs. CAN is designed to be robust in electromagnetically noisy environments. CAN may employ a differential balanced line such as RS-485. An exemplary CAN bus comprises a balanced and/or differential two-wire interface running over a shielded twisted pair (STP), unshielded twisted pair (UTP), or ribbon cable. An exemplary node employs a male nine-pin D connector. Exemplary bit encoding comprises non-return to zero (NRZ) encoding with bit-stuffing for data communication on a differential two-wire bus. NRZ encoding in an example allows compact messages with a reduced and/or minimum number of transitions and/or relatively high resilience to external disturbance.

[0019] The user interface **122** in an example comprises a touch screen, navigation screen, and/or dashboard panel device. The user interface **122** in an example is mounted, attached, and/or supported on a dashboard of the vehicle **102**.

[0020] The connectable device **104** in an example comprises a storage and/or memory device, a universal serial bus (USB) and/or USB connectable device, a USB memory device and/or stick, a USB adapter, a computer-type docking connector, a hardware device, and/or a relatively low-complexity and/or low-cost device. The connectable device **104** in an example is located offboard the vehicle **102**. An exemplary storage device as the connectable device **104** is capable of being loaded with the flight recorder application **106**. Referring to FIGS. **1** and **3**, an exemplary USB adapter as the connectable device **104** in an example serves to couple an exemplary user interface **105** with the USB connector **110**. The USB connector **110** in an example comprises a standard USB interface provided on an automobile as the vehicle **107**. The user **107** in an example inserts or removes the USB adapter as the connectable device **104** into a port and/or slot as the USB connector **110**, for example, at selection, discretion, and/or desire of the user **107**.

[0021] Turning to FIG. **2**, the electronic control unit **108** in an example comprises a processor **204**, one or more memories **206** and/or **208**, interface **210**, and/or one or more busses **212**. The operating system (OS) **202** in an example is located in the memory **206**. The operating system **202** in an example supports execution of the flight recorder application **106** onboard the vehicle **102** by the processor **204**. The operating system **202** in an example comprises an operating system offered by Microsoft Corporation under the trade identifier MICROSOFT AUTO (World Wide Web microsoft.com). The operating system **202** in an example serves to promote diagnosis of intermittent faults in the vehicle **102**, for example, by allowing an exemplary flight recorder application **106** to monitor a status of a set of defined signals connected with operation and/or state of the vehicle **102** and/or record the set of signals at trigger points. The trigger points in an example comprise one or more detected and/or measured conditions, for example, a signal reaching a threshold such as for Parameter Identification (PID), a specific Diagnostic Trouble Code (DTC) being raised, and/or the user **107** performing a selected and/or predefined action, for example, an operator as the user

107 presses a trigger button and/or touches a point on a navigation screen as an exemplary user interface **105**.

[0022] The memory **206** in an example comprises a mass storage device capable of being loaded with the operating system **202**. The memory **206** in an example is capable of being loaded with the flight recorder application **106**. The operating system **202** in an example locally executes the flight recorder application **106** from the memory **206**. A mass storage device as the memory **206** in an example holds the operating system **202**, the flight recorder application **106**, and one or more additional applications, for example, audio, phone, navigation, and/or the like.

[0023] The interface **210** in an example allows an operator as the user **107** to initiate and/or trigger a recording, such as through employment of the onboard vehicle controllers **114**. The interface **210** in an example comprises a hardwired and/or wireless interface. A hardwired interface as the interface **210** in an example comprises a USB port. A wireless interface as the interface **210** in an example comprises a transmitter/receiver. The interface **210** in an example allows a technician as the user **107** to extract and/or access data from the memory **206** stored through employment of the flight recorder application **106**. In another example, a technician as the user **107** extracts and/or accesses data from the storage device **120**.

[0024] A transmitter/receiver of a wireless interface as the interface **210** in an example conforms to a standard such as a Bluetooth® standard. An exemplary standard allows intelligent devices to communicate with each other, for example, over relatively short range wireless links and/or with relatively low power consumption. The Bluetooth® standard in an example employs short-range radio frequency (RF) technology that operates at 2.4 GHz and is capable of transmitting voice and data. An exemplary effective range of devices under the Bluetooth® standard comprises thirty-two (32) feet (10 meters). An exemplary data transfer rate under the Bluetooth® standard comprises one (1) Mbps (megabits per second). Relatively low power consumption under the standard in an example allows relatively extended operation for battery powered devices, for example, wireless and/or cell phones, personal digital assistants (PDAs), and/or Internet tablets.

[0025] The memory **208** in an example comprises a mass storage device capable of being loaded with the flight recorder application **106**. The operating system **202** in an example executes the flight recorder application **106** from the memory **208**. The interface **210** in an example allows a technician to extract and/or access data from the **206** stored through employment of the flight recorder application **106**. The memories **206** and **208** may be located on different storage devices or a same storage device, for example, in different partitions and/or non-contiguous memory locations. The memory **208** in an example is considered non-local to memory locations that store the operating system **202**. For example, an exemplary flight recorder application **106** located in the memory **208** may be considered non-local to memory locations of the memory **206** that store the operating system **202**, as an exemplary difference between the memory **208** and the memory **206**.

[0026] The operating system **202** in an example executes the flight recorder application **106** from memory of the connectable device **104**. The connectable device **104** is connected with the vehicle **102** through the lead **116** to allow the processor **204** and the operating system **202** to execute the flight recorder application **106** from the memory of the connectable device **104**. The universal serial bus (USB) connector **110** in an example serves to couple the connectable device **104** with bus **116** of the vehicle **102**.

[0027] Referring to FIGS. **1** and **3**, an exemplary USB adapter as the connectable device **104** in an example serves to couple an exemplary user interface **105** with the USB connector **110**. The user interface **105** in an example comprises a trigger coupled with the USB connector **110**, for example, through employment of a cable and/or lead **316** such as a flying lead. An exemplary trigger as the user interface **105** comprises a button and/or switch that the user **107** depresses and/or engages such as with a finger of the user **107**. The trigger as the user interface **105** in an example allows the user **107** to operate the trigger and activate a recording by the flight recorder application **106**. A flying lead as the lead **316** attached to a USB stick as the connectable device **104** in an example serves to couple a trigger component and/or device as the user interface **105**. The operator as a user **107** in an example operates the trigger as the user interface **105** such as when the operator as the user **107** senses, perceives, identifies, and/or detects an intermittent issue, problem, fault, condition, and/or behavior of the vehicle **102**. Pressing of the trigger as the user interface **105** in an example serves to cause the flight recorder application **106** to effect, cause, direct, and/or provide a recording such as through employment of ECUs as the onboard vehicle controllers **114**.

[0028] Turning to FIG. **5**, user interface **105** in an example comprises a wireless trigger that communicates with the electronic control unit **108** over a wireless interface **502**. The wireless interface **502** in an example serves to carry electromagnetic waves. A wireless trigger as the user interface **105** in an example comprises a wireless phone and/or communication device. A wireless trigger as the user interface **105** and the electronic control unit **108** in an example conform to a standard such as the Bluetooth® standard.

[0029] A driver as a first user **107** in an example takes the vehicle **102** to a technician as a second user **107**. The technician as the user **107** in an example views information and/or data logs stored by the recorder application **106**, for example, to identify and/or understand one or more occurrences, conditions, and/or behaviors of the vehicle **102** around the point of activation of the trigger. The technician as the user **107** in an example accesses a USB memory stick as the connectable device **104** that is attachable to the vehicle **102**, for example, through employment of a standard USB interface as the USB connector **110**.

[0030] An illustrative description of an exemplary operation of an implementation of the apparatus **100** is presented, for explanatory purposes. Turning to FIG. **4**, in an exemplary logic flow **402** at STEP **404**, an operator as a user **107** takes a vehicle **102** for review and/or diagnosis such as by a technician as a user **107**, for example, at a service center and/or station, garage, and/or shop (not shown) such as because the vehicle is exhibiting and/or experiencing faulty operation. At STEP **406** in an example the technician as the user **107** makes a determination that the vehicle **102** comprises an intermittent issue, problem, fault, condition, and/or behavior. For example, the technician as the user **107** in a selected, limited, initial, and/or preliminary amount of time, testing, and/or operation fails to and/or cannot reproduce an issue with the vehicle **102**, for example, to meet and/or resemble an issue described and/or relayed by the operator as a user **107** of the vehicle. At STEP **408** in an example the technician as the user **107** plans, identifies, and/or determines one or more signals that should be monitored, one or more trigger levels and/or conditions, and/or one or more times for pre-recording and/or post-recording, for example, by and/or through employment of the flight recorder application **106**. A technician as a user **107** in an example may employ one or more signal value thresholds for Parameter Identification (PID) and/or an occurrence and/or appearance of one or more Diagnostic Trouble Codes (DTCs) as a trigger for monitoring and/or recording.

[0031] At STEP **410** in an example the technician as the user **107** programs the signals to be monitored and/or trigger conditions into the flight recorder application **106**. The technician as the user **107** in an example programs the signals to be monitored and/or trigger conditions into the flight recorder application **106** on the vehicle **102** or off the vehicle **102**, for example, for execution of the flight recorder application **106** with execution onboard the vehicle **102** of the signals to be monitored and/or trigger conditions. The technician as the user **107** in an example programs the signals to be monitored and/or trigger conditions into the flight recorder application **106** on the electronic control unit **108** or on the connectable device **104**, for example, with execution onboard the vehicle **102** of the flight recorder application **106** to handle and/or oversee the signals to be monitored and/or trigger conditions.

[0032] Through input to the flight recorder application **106** by the technician as the user **107** at STEP **410** in an example signals are selected and/or predetermined to be monitored over a monitoring time for capture of data as recordings of the vehicle **102**. The technician as the user **107** at STEP **410** in an example determines and/or sets up pre-trigger and post-trigger recording times for the flight recorder application **106**.

[0033] A number and/or all of the control unit **108** and the onboard vehicle controllers **114** in an example comprise a respective ECU that is capable of responding to PID requests, for example, a pre-selected, selected, predetermined, and/or determined set of PID requests. For example, the ABS controller as the electronic control unit **108** and/or the onboard vehicle controller **114** may provide Parameter Identification (PID) values such as for the wheel speed from a sensor **124**, for example, a wheel speed sensor. The flight recorder application **106** in an example may request as the electronic control unit **108** and/or the onboard vehicle controller **114** an ABS controller to display the speed of the vehicle **102**, a Transmission Control Unit (TCU) to select correct and/or desired gearing for the vehicle **102**, a stability controller to determine whether a corner is being taken or one of the wheels of the vehicle **102** is slipping, and/or the like. The flight recorder application **106** in an example makes analogous and/or substantially same inquiries to recover, obtain, and/or record information in response to PIDs, for example, requested by the technician as the user **107** such as through pre-selected input and/or pre-selected programming of the flight recorder application **106**, for example, during a visit and/or stop of the vehicle **102** at a service center and/or station, garage, and/or shop (not shown).

[0034] At STEP **412** in an example the technician as a user **107** releases the vehicle **102** to the operator as a user **107**, for example, for normal, regular, usual, and/or typical driving with the monitoring having been loaded into the flight recorder application **106**. At STEP **414** in an example the operator as the user **107** may trigger a recording by the flight recorder application **106**. The operator as the user **107** in an example employs a trigger device as the user interface **105** and/or a dashboard panel device and/or touch screen as the user interface **122**. The operator as the user **107** in an example triggers the recording upon sensing, perceiving, identifying, and/or detecting the intermittent issue, problem, fault, condition, and/or behavior of the vehicle **102**.

[0035] Further at STEP **414** in an example a technician as a user **107** may employ one or more value thresholds for Parameter Identification (PID) and/or an occurrence and/or appearance of one or more Diagnostic Trouble Codes (DTCs) as a trigger for monitoring and/or recording. The flight recorder application **106** at STEP **414** in an example timestamps each reading and/or recording, for example, to promote accuracy such as in rendering of the data at STEP **418** for review by a technician as the user **107**. The flight recorder application **106** in an example records a type of trigger that causes a recording and/or a time of the trigger within and/or during the recording.

[0036] At STEP **416** in an example the operator as the first user **107** returns the vehicle **102** to the technician as the second user **107** at a selected, scheduled, arbitrary, and/or convenient after a period and/or amount of driving and/or operation of the vehicle **102** and/or recording through employment of the flight recorder application **106**. At STEP **418** in an example the technician as the user **107** recovers data recorded by the flight recorder application **106**, for example, through employment of ECUs as the onboard vehicle controllers **114**. The technician as the user **107** in an example performs, directs, and/or oversees analysis of the data effected, caused, directed, and/or provided from and/or through employment of the flight recorder application **106**. The technician as the user **107** in an example obtains, receives, retrieves, and/or downloads the data from the electronic control unit **108**, the connectable device **104**, and/or the storage device **120**.

[0037] The technician as the user **107** at STEP **418** in an example reviews the recordings, for example, recordings of the conditions of the vehicle **102** before and after a trigger point. The recordings in an example comprise captured data of the signals that were selected and/or predetermined to be monitored over a monitoring time, for example, through input to the flight recorder application **106** by the technician as the user **107** such as at STEP **410**. The technician as the user **107** at STEP **410** in an example predetermined, selected, and/or set up pre-trigger and post-trigger recording times for the flight recorder application **106**. An amount of data recorded at STEP **414**, returned at STEP **416**, and/or recovered at STEP **418** in an example may depend on a capture rate and a number of signals identified for monitoring.

[0038] An exemplary implementation comprises an onboard controller and a flight recorder application. The onboard controller is onboard a vehicle and comprises an onboard operating system (OS). The flight recorder application is executable onboard the vehicle by the onboard operating system.

[0039] The onboard controller comprises an electronic control unit (ECU). The flight recorder application accesses one or more onboard vehicle controllers through onboard execution of the flight recorder application by the onboard operating system. The onboard controller through execution of the flight recorder application onboard the vehicle by the onboard operating system stores data recorded by one or more onboard vehicle controllers in a mass storage device. The onboard controller comprises an onboard memory device. The mass storage device comprises one or more of the onboard memory device of the onboard controller, an onboard hard drive that is onboard the vehicle, an onboard memory device that is onboard the vehicle, and/or a connectable memory device that is connectable with the vehicle through an interface of the vehicle. The onboard controller is coupled with an internal bus of the vehicle. The flight recorder application accesses one or more onboard vehicle controllers over the internal bus of the vehicle through onboard execution of the flight recorder application by the onboard operating system.

[0040] The flight recorder application comprises an onboard flight recorder application that is stored onboard the vehicle. The onboard operating system supports onboard execution of the onboard flight recorder application. The onboard controller comprises an electronic control unit (ECU). An onboard storage device is local to the onboard operating system. The onboard flight recorder application is stored in the onboard storage device that is local to the onboard operating system. The onboard flight recorder application that is stored in the onboard storage device that is local to the onboard operating system accesses one or more onboard vehicle controllers through onboard execution of the onboard flight recorder application by the onboard operating system.

[0041] The onboard controller comprises an electronic control unit (ECU). An onboard storage device is separate from the onboard operating system. The onboard flight recorder application is stored in the onboard storage device that is separate from the onboard operating system. The onboard flight recorder application that is stored in the onboard storage device that is separate from the onboard operating system accesses one or more onboard vehicle controllers through onboard execution of the onboard flight recorder application by the onboard operating system.

[0042] The flight recorder application is stored in a connectable device that is connectable with the onboard processor and supportable by the onboard operating system for execution onboard the vehicle of the flight recorder application by the onboard operating system. The onboard controller comprises an electronic control unit (ECU). Upon a connection of the connectable device with the onboard operating system the flight recorder application that is stored in the connectable device accesses one or more onboard vehicle controllers through onboard execution of the flight recorder application stored in the connectable device, by virtue of support by the onboard operating system of the onboard execution of the flight recorder application by the onboard operating system. The connectable device is connected with the onboard processor through a universal serial bus (USB) connection. The flight recorder application that is stored in the connectable device accesses one or more onboard vehicle controllers through onboard execution of the flight recorder application stored in the connectable device connected through the USB connection, by virtue of support by the onboard operating system of the onboard execution of the flight recorder application by the onboard operating system.

[0043] An exemplary implementation comprises a flight recorder application that is executed by an onboard operating system (OS) that is onboard a vehicle. The flight recorder application assists diagnosis of one or more intermittent faults in the vehicle. The flight recorder application monitors a status of a set of technician-selected, pre-defined signals that relate to real-time sensor and/or actuator values stored in one or more electronic control units (ECUs). The flight recorder application records a set of signal triggers selected by a technician subsequent to an identification by an operator of the vehicle of the one or more intermittent faults in the vehicle. The set of signal triggers comprise a user trigger that is invocable by one or more of: the operator of the vehicle upon experience of a condition of concern; a sensor read of parameter identification (PID) value that reaches or exceeds a technician-defined level; and/or an onboard controller that raises a diagnostic trouble code (DTC). Upon a recurrence of one or more of the one or more intermittent faults in the vehicle and/or an occurrence of one or more other intermittent faults in the vehicle, one or more of the same set of signal triggers and/or one or more other signal triggers are selectable by the technician.

[0044] The flight recorder application is located any of onboard the vehicle or offboard the vehicle with a connection to the operating system. The flight recorder application is executed onboard the vehicle by the operating system that is located onboard the vehicle whether the flight recorder application is located onboard the vehicle or offboard the vehicle with the connection to the operating system. Indicated in the flight recorder application located any of onboard the vehicle or offboard the vehicle with the connection to the operating system are one or more signals to be monitored onboard the vehicle and/or one or more trigger conditions to be executed onboard the vehicle. The flight recorder application is executed onboard the vehicle by the operating system to monitor the one or more signals onboard the vehicle and/or execute the one or more trigger conditions onboard the vehicle.

[0045] Indicated in the flight recorder application located any of onboard the vehicle or offboard the vehicle with the connection to the operating system is a request for a performance of a recording through employment of one or more onboard vehicle controllers based on a perception of an occurrence of an intermittent event. The flight recorder application is executed onboard the vehicle by the operating system to execute onboard the vehicle the performance of the recording through employment of the one or more onboard vehicle controllers. The flight recorder application is executed onboard the vehicle by the operating system to execute onboard the vehicle a storage, any of onboard the vehicle or offboard the vehicle, of data obtained through employment of the one or more onboard vehicle controllers in the performance of the recording.

[0046] An implementation of the apparatus **100** in an example comprises a plurality of components such as one or more of electronic components, chemical components, organic components, mechanical components, hardware components, optical components, and/or computer software components. A number of such components can be combined or divided in an implementation of the apparatus **100**. In one or more exemplary implementations, one or more features described herein in connection with one or more components and/or one or more parts thereof are applicable and/or extendible analogously to one or more other instances of the particular component and/or other components in the apparatus **100**. In one or more exemplary implementations, one or more features described herein in connection with one or more components and/or one or more parts thereof may be omitted from or modified in one or more other instances of the particular component and/or other components in the apparatus **100**. An exemplary technical effect is one or more exemplary and/or desirable functions, approaches, and/or procedures. An exemplary component of an implementation of the apparatus **100** employs and/or comprises a set and/or series of computer instructions written in or implemented with any of a number of programming languages, as will be appreciated by those skilled in the art. An implementation of the apparatus **100** in an example comprises any (e.g., horizontal, oblique, angled, or vertical) orientation, with the description and figures herein illustrating an exemplary orientation of an exemplary implementation of the apparatus **100**, for explanatory purposes.

[0047] An implementation of the apparatus **100** in an example encompasses an article. The article comprises one or more computer-readable signal-bearing media. The article comprises means in the one or more media for one or more exemplary and/or desirable functions, approaches, and/or procedures.

[0048] An implementation of the apparatus **100** in an example employs one or more computer readable signal bearing media. A computer-readable signal-bearing medium in an example stores software, firmware and/or assembly language for performing one or more portions of one or more implementations. An example of a computer-readable signal bearing medium for an implementation of the apparatus **100** comprises a memory and/or recordable data storage medium of the vehicle **102**, connectable device **104**, onboard controller and/or electronic control unit (ECU) **108**, and/or storage device **120**. A computer-readable signal-bearing medium for an implementation of the apparatus **100** in an example comprises one or more of a magnetic, electrical, optical, biological, chemical, and/or atomic data storage medium. For example, an implementation of the computer-readable signal-bearing medium comprises one or more floppy disks, magnetic tapes, CDs, DVDs, hard disk drives, and/or electronic memory. In another example, an implementation of the computer-readable signal-bearing medium comprises a modulated carrier signal transmitted over a network comprising or coupled with an implementation of the apparatus **100**, for instance, one or more of a telephone network, a local area network ("LAN"), a wide area network ("WAN"), the Internet, and/or a wireless network. A computer-readable signal-bearing medium in an example comprises a physical computer medium and/or computer-readable signal-bearing tangible medium.

[0049] The steps or operations described herein are examples. There may be variations to these steps or operations without departing from the spirit of the invention. For example, the steps may be performed in a differing order, or steps may be added, deleted, or modified.

[0050] Although exemplary implementation of the invention has been depicted and described in detail herein, it will be apparent to those skilled in the relevant art that various modifications, additions, substitutions, and the like can be made without departing from the spirit of the invention and these are therefore considered to be within the scope of the invention as defined in the following claims.

What is claimed is:

1. An apparatus, comprising:

an onboard controller that is onboard a vehicle and comprises an onboard operating system (OS); and

a flight recorder application that is executable onboard the vehicle by the onboard operating system.

2. The apparatus of claim **1**, wherein the onboard controller comprises an electronic control unit (ECU), wherein the flight recorder application accesses one or more onboard vehicle controllers through onboard execution of the flight recorder application by the onboard operating system.

3. The apparatus of claim **1**, wherein the onboard controller through execution of the flight recorder application onboard the vehicle by the onboard operating system stores data recorded by one or more onboard vehicle controllers in a mass storage device.

4. The apparatus of claim **3**, wherein the onboard controller comprises an onboard memory device, wherein the mass storage device comprises one or more of the onboard memory device of the onboard controller, an onboard hard drive that is onboard the vehicle, an onboard memory device that is onboard the vehicle, and/or a connectable memory device that is connectable with the vehicle through an interface of the vehicle.

5. The apparatus of claim **1**, wherein the onboard controller is coupled with an internal bus of the vehicle, wherein the flight recorder application accesses one or more onboard vehicle controllers over the internal bus of the vehicle through onboard execution of the flight recorder application by the onboard operating system.

6. The apparatus of claim **1**, wherein the flight recorder application comprises an onboard flight recorder application that is stored onboard the vehicle.

7. The apparatus of claim **6**, wherein the onboard operating system supports onboard execution of the onboard flight recorder application.

8. The apparatus of claim **6**, wherein the onboard controller comprises an electronic control unit (ECU), the apparatus further comprising:

an onboard storage device that is local to the onboard operating system;

wherein the onboard flight recorder application is stored in the onboard storage device that is local to the onboard operating system, wherein the onboard flight recorder application that is stored in the onboard storage device that is local to the onboard operating system accesses one or more onboard vehicle controllers through onboard execution of the onboard flight recorder application by the onboard operating system.

9. The apparatus of claim **6**, wherein the onboard controller comprises an electronic control unit (ECU), the apparatus further comprising:

an onboard storage device that is separate from the onboard operating system;

wherein the onboard flight recorder application is stored in the onboard storage device that is separate from the onboard operating system, wherein the onboard flight recorder application that is stored in the onboard storage device that is separate from the onboard operating system accesses one or more onboard vehicle controllers through onboard execution of the onboard flight recorder application by the onboard operating system.

10. The apparatus of claim **1**, wherein the flight recorder application is stored in a connectable device that is connectable with the onboard processor and supportable by the onboard operating system for execution onboard the vehicle of the flight recorder application by the onboard operating system.

11. The apparatus of claim **10**, wherein the onboard controller comprises an electronic control unit (ECU), wherein upon a connection of the connectable device with the onboard operating system the flight recorder application that is stored in the connectable device accesses one or more onboard vehicle controllers through onboard execution of the flight recorder application stored in the connectable device, by virtue of support by the onboard operating system of the onboard execution of the flight recorder application by the onboard operating system.

12. The apparatus of claim **10**, wherein the onboard controller comprises an electronic control unit (ECU), wherein the connectable device is connected with the onboard processor through a universal serial bus (USB) connection, wherein the flight recorder application that is stored in the connectable device accesses one or more onboard vehicle controllers through onboard execution of the flight recorder application stored in the connectable device connected through the USB connection, by virtue of support by the onboard operating system of the onboard execution of the flight recorder application by the onboard operating system.

13. An apparatus, comprising:

a flight recorder application that is executed by an onboard operating system (OS) that is onboard a vehicle;

wherein the flight recorder application assists diagnosis of one or more intermittent faults in the vehicle.

14. The apparatus of claim **13**, wherein the flight recorder application monitors a status of a set of technician-selected, pre-defined signals that relate to real-time sensor and/or actuator values stored in one or more electronic control units (ECUs).

15. The apparatus of claim **13**, wherein the flight recorder application records a set of signal triggers selected by a technician subsequent to an identification by an operator of the vehicle of the one or more intermittent faults in the vehicle, wherein the set of signal triggers comprise a user trigger that is invocable by one or more of:

the operator of the vehicle upon experience of a condition of concern;

a sensor read of parameter identification (PID) value that reaches or exceeds a technician-defined level; and/or

an onboard controller that raises a diagnostic trouble code (DTC);

wherein upon a recurrence of one or more of the one or more intermittent faults in the vehicle and/or an occurrence of one or more other intermittent faults in the vehicle, one or more of the same set of signal triggers and/or one or more other signal triggers are selectable by the technician.

16. A method, comprising the step of:

executing onboard a vehicle a flight recorder application by an operating system that is located onboard the vehicle.

17. The method of claim **16**, wherein the step of executing onboard the vehicle the flight recorder application comprises the steps of:

locating the flight recorder application any of onboard the vehicle or offboard the vehicle with a connection to the operating system; and

executing onboard the vehicle the flight recorder application by the operating system that is located onboard the vehicle whether the flight recorder application is located onboard the vehicle or offboard the vehicle with the connection to the operating system.

18. The method of claim **16**, wherein the step of executing onboard the vehicle the flight recorder application comprises the steps of:

locating the flight recorder application any of onboard the vehicle or offboard the vehicle with a connection to the operating system;

indicating in the flight recorder application located any of onboard the vehicle or offboard the vehicle with the connection to the operating system one or more signals to be monitored onboard the vehicle and/or one or more trigger conditions to be executed onboard the vehicle; and

executing onboard the vehicle the flight recorder application by the operating system to monitor the one or more signals onboard the vehicle and/or execute the one or more trigger conditions onboard the vehicle.

19. The method of claim **16**, wherein the step of executing onboard the vehicle the flight recorder application comprises the steps of:

locating the flight recorder application any of onboard the vehicle or offboard the vehicle with a connection to the operating system;

indicating in the flight recorder application located any of onboard the vehicle or offboard the vehicle with the connection to the operating system a request for a performance of a recording through employment of one or more onboard vehicle controllers based on a perception of an occurrence of an intermittent event; and

executing onboard the vehicle the flight recorder application by the operating system to execute onboard the vehicle the performance of the recording through employment of the one or more onboard vehicle controllers.

20. The method of claim **19**, wherein the step of executing onboard the vehicle the flight recorder application by the operating system to execute onboard the vehicle the performance of the recording through employment of the one or more onboard vehicle controllers comprises the step of:

executing onboard the vehicle the flight recorder application by the operating system to execute onboard the vehicle a storage, any of onboard the vehicle or offboard the vehicle, of data obtained through employment of the one or more onboard vehicle controllers in the performance of the recording.

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