SUMMARY OF INVENTION

[0004a] According to a first aspect of the present invention, there is provided a portable autonomous vehicle connectivity platform, comprising:

a portable case;

one or more local area network (LAN) side adapters disposed within the portable case and configured to communicate with one or more local devices including an autonomous vehicle (AV), wherein the one or more LAN side adapters includes a wireless LAN adapter and a powered wired LAN adapter;

one or more wide area network (WAN) side adapters disposed within the portable case and configured to communicate with one or more remote servers, wherein the one or more WAN side adapters includes a plurality of cellular modems;

a gateway router disposed within the portable case for bridging communications between the one or more LAN side adapters and the one or more WAN side adapters; and

a controller including a processor and local storage coupled to the gateway router, wherein the local storage stores instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform operations including:

receiving a mission log report from the AV over the one or more LAN side adapters after the AV returns from a mission;

caching the mission log report in the local storage; and

transmitting the mission log report from the local storage to the one or more remote servers over the one or more WAN side adapters.

[0004b] According to a second aspect of the present invention, there is provided a portable autonomous vehicle connectivity platform, comprising:

a portable case;

a local area network (LAN) side adapter disposed within the portable case for communicating with unmanned aerial vehicles (UAVs);

a wide area network (WAN) side adapter disposed within the portable case for communicating with a remote server;

a gateway router disposed within the portable case and coupled to bridge communications between the LAN side adapter and the WAN side adapter; and

a controller, wherein the controller includes a processor and local storage, and wherein the local storage stores instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform operations including:

receiving data from the UAVs over the LAN side adapter;

caching the data in the local storage upon return of the UAVs after flying missions;

aggregating a bandwidth of a plurality of WAN side adapters including the WAN side adapter; and

transmitting the data to the remote server over the WAN side adapters.

[0004c] According to a third aspect of the present invention, there is provided a portable autonomous vehicle connectivity platform, comprising:

a portable case;

a local area network (LAN) side adapter disposed within the portable case for communicating with unmanned aerial vehicles (UAVs);

a wide area network (WAN) side adapter disposed within the portable case for communicating with a remote server;

a gateway router disposed within the portable case and coupled to bridge communications between the LAN side adapter and the WAN side adapter;

a controller coupled to the gateway router for caching data from the UAVs and transmitting the data to the remote server;

an internal chassis disposed within the portable case and to which internal components including the LAN side adapter, the WAN side adapter, the gateway router, and the controller are mounted; and

shock isolators mounted to inside surfaces of the portable case and coupled to the internal chassis to suspend the internal chassis within the portable case.

[0004d] According to a fourth aspect of the present invention, there is provided a portable autonomous vehicle connectivity platform, comprising:

a portable case;

one or more local area network (LAN) side adapters disposed within the portable case and configured to communicate with one or more local devices including an autonomous vehicle (AV);

one or more wide area network (WAN) side adapters disposed within the portable case and configured to communicate with one or more remote servers;

a gateway router disposed within the portable case for bridging communications between the one or more LAN side adapters and the one or more WAN side adapters; and

a controller including a processor and local storage coupled to the gateway router, wherein the local storage stores instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform operations including:

establishing a remote management connection between a remote terminal and the AV via the portable autonomous vehicle connectivity platform; and

conveying real-time configuration commands and response confirmations between the AV and the remote terminal over an encrypted communication session between the AV and the remote terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Non-limiting and non-exhaustive embodiments of the invention are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise specified. Not all instances of an element are necessarily labeled so as not to clutter the drawings where appropriate. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles being described.

[0006] FIG. 1 is an illustration of an autonomous vehicle (AV) ecosystem for using a portable AV connectivity platform (PAVCP) that links field deployed AVs to backend remote servers, in accordance with an embodiment of the disclosure.

[0007] FIG. 2 is a functional block diagram illustrating various functional components of the AV ecosystem including software utilities installed on the PAVCP, in accordance with an embodiment of the disclosure.

[0008] FIG. 3 is a flow chart illustrating a process of operation of the PAVCP, in accordance with an embodiment of the disclosure.

[0009] FIG. 4A is a perspective view illustration of the PAVCP with an open lid, in accordance with an embodiment of the disclosure.

[0010] FIG. 4B is a perspective view illustration of a rear of the PAVCP with a closed lid, in accordance with an embodiment of the disclosure.

[0011] FIG. 5A is a perspective view illustration of an internal chassis for mounting internal components within the portable case of the PAVCP, in accordance with an embodiment of the disclosure.

[0012] FIG. 5B is an exploded perspective view illustration of top side components mounted to the internal chassis, in accordance with an embodiment of the disclosure.

[0013] FIG. 5C is a perspective view illustration of an underside of the carriage lid and topside internal components, in accordance with an embodiment of the disclosure.

[0014] FIG. 5D is an exploded perspective view illustration of bottom side internal components mounted to the internal chassis, in accordance with an embodiment of the disclosure.

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A portable autonomous vehicle connectivity platform, comprising:

a portable case;

one or more local area network (LAN) side adapters disposed within the portable case and configured to communicate with one or more local devices including an autonomous vehicle (AV), wherein the one or more LAN side adapters includes a wireless LAN adapter and a powered wired LAN adapter;

one or more wide area network (WAN) side adapters disposed within the portable case and configured to communicate with one or more remote servers, wherein the one or more WAN side adapters includes a plurality of cellular modems;

a gateway router disposed within the portable case for bridging communications between the one or more LAN side adapters and the one or more WAN side adapters; and

a controller including a processor and local storage coupled to the gateway router, wherein the local storage stores instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform operations including:

receiving a mission log report from the AV over the one or more LAN side adapters after the AV returns from a mission;

caching the mission log report in the local storage; and

transmitting the mission log report from the local storage to the one or more remote servers over the one or more WAN side adapters.

2. The portable autonomous vehicle connectivity platform of claim 1, wherein the AV comprises one of a plurality of unmanned aerial vehicles (UAVs), and wherein the local storage stores further instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform further operations including:

receiving a plurality of mission log reports from the UAVs over the wireless LAN adapter;

caching the mission log reports in the local storage upon return of the UAVs after flying missions;

aggregating a bandwidth of the plurality of cellular modems; and

transmitting the mission log reports to the one or more remote servers over the cellular modems.

3. The portable autonomous vehicle connectivity platform of claim 2, wherein the local storage stores further instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform further operations including:

generating analytics data measuring one or more of an accumulation rate of the mission log reports, a storage occupancy of the mission log reports, or an offload rate of the mission log reports; and

reporting the analytics data over the WAN side adapters to one of the remote servers.

4. The portable autonomous vehicle connectivity platform of claim 1, wherein the one or more LAN side adapters further includes an additional wireless adapter having a lower power consumption and a lower bandwidth than the wireless LAN adapter for wirelessly coupling to a local weather station.

5. The portable autonomous vehicle connectivity platform of claim 1, wherein the local storage stores further instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform further operations including:

receiving mission planning data describing a new mission route for the AV over the one or more WAN side adapters from one of the remote servers; and

transferring the mission planning data to the AV upon establishing a communication session with the AV via the one or more LAN side adapters.

6. The portable autonomous vehicle connectivity platform of claim 1, wherein the local storage stores further instructions that, when executed by the processor,

causes the portable autonomous vehicle connectivity platform to perform further operations including:

establishing a remote management connection between a remote terminal and the AV via the portable autonomous vehicle connectivity platform; and

conveying real-time configuration commands and response confirmations between the AV and the remote terminal over an encrypted communication session between the AV and the remote terminal.

7. The portable autonomous vehicle connectivity platform of claim 1, wherein the portable case comprises a ruggedized, weather-resistant case with a lid.

8. The portable autonomous vehicle connectivity platform of claim 1, further comprising:

a power adapter disposed within the portable case and coupled to power the one or more LAN side adapters, the one or more WAN side adapters, the gateway router, and the controller, wherein the power adapter includes alternating current (AC) and direct current (DC) power regulators for powering internal components of the portable autonomous vehicle connectivity platform from external sources of either AC power or DC power.

9. The portable autonomous vehicle connectivity platform of claim 1, further comprising:

an internal chassis disposed within the portable case and to which internal components including the one or more LAN side adapters, the one or more WAN side adapters, the gateway router, and the controller are mounted; and

shock isolators mounted to inside surfaces of the portable case and mechanically coupled to the internal chassis to suspend the internal chassis within the portable case.

10. The portable autonomous vehicle connectivity platform of claim 9, wherein the shock isolators comprise four instances of the shock isolators each coupling a respective corner region of the internal chassis to one of the inside surfaces of the portable case.

11. The portable autonomous vehicle connectivity platform of claim 9, wherein the shock isolators are preloaded under compression between the inside surfaces and the internal chassis.

12. The portable autonomous vehicle connectivity platform of claim 9, wherein the portable autonomous vehicle connectivity platform includes no rigid connections between the internal components and the portable case and wherein all power or communication connections between external ports on the portable case and the internal components are connected via flexible cables.

13. The portable autonomous vehicle connectivity platform of claim 9, wherein the internal chassis includes a cooling cavity extending through a central portion of the internal chassis and aligned with vents disposed in the portable case, and wherein the internal components are mounted to top and bottom sides of the internal chassis sandwiching both sides of the cooling cavity with one or more heat sinks extending into the cooling cavity.

14. A portable autonomous vehicle connectivity platform, comprising:

a portable case;

a local area network (LAN) side adapter disposed within the portable case for communicating with unmanned aerial vehicles (UAVs);

a wide area network (WAN) side adapter disposed within the portable case for communicating with a remote server;

a gateway router disposed within the portable case and coupled to bridge communications between the LAN side adapter and the WAN side adapter; and

a controller coupled to the gateway router, wherein the controller includes a processor and local storage, and wherein the local storage stores instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform operations including:

receiving data from the UAVs over the LAN side adapter;

caching the data in the local storage upon return of the UAVs after flying missions;

aggregating a bandwidth of a plurality of WAN side adapters including the WAN side adapter; and

transmitting the data to the remote server over the WAN side adapters.

15. The portable autonomous vehicle connectivity platform of claim 14, wherein the data comprises one or more mission log reports.

16. The portable autonomous vehicle connectivity platform of claim 15, wherein the local storage stores further instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform further operations including:

generating analytics data measuring one or more of an accumulation rate of the mission log reports, a storage occupancy of the mission log reports, or an offload rate of the mission log reports; and

reporting the analytics data over one or more of the WAN side adapters.

17. The portable autonomous vehicle connectivity platform of claim 15, wherein the local storage stores further instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform further operations including:

receiving an over-the-air (OTA) software update for the UAVs over one or more of the WAN side adapters;

caching the OTA software update in the local storage; and

transmitting the OTA software update from the local storage to the UAVs over the LAN side adapter.

18. The portable autonomous vehicle connectivity platform of claim 14, wherein the local storage stores further instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform further operations including:

receiving mission planning data describing a new mission route for one of the UAVs over the WAN side adapter; and

transferring the mission planning data to the one of the UAVs via the LAN side adapter.

19. A portable autonomous vehicle connectivity platform, comprising:

a portable case;

a local area network (LAN) side adapter disposed within the portable case for communicating with unmanned aerial vehicles (UAVs);

a wide area network (WAN) side adapter disposed within the portable case for communicating with a remote server;

a gateway router disposed within the portable case and coupled to bridge communications between the LAN side adapter and the WAN side adapter;

a controller coupled to the gateway router for caching data from the UAVs and transmitting the data to the remote server;

an internal chassis disposed within the portable case and to which internal components including the LAN side adapter, the WAN side adapter, the gateway router, and the controller are mounted; and

shock isolators mounted to inside surfaces of the portable case and coupled to the internal chassis to suspend the internal chassis within the portable case.

20. The portable autonomous vehicle connectivity platform of claim 19, wherein the shock isolators are preloaded under compression between the inside surfaces and the internal chassis.

21. The portable autonomous vehicle connectivity platform of claim 19, wherein the portable autonomous vehicle connectivity platform includes no rigid connections between the internal components and the portable case and wherein all power or communication connections between external ports on the portable case and the internal components are connected via flexible cables.

22. The portable autonomous vehicle connectivity platform of claim 19, wherein the internal chassis includes a cooling cavity extending through a central portion

of the internal chassis and aligned with vents disposed in the portable case, and wherein the internal components are mounted to top and bottom sides of the internal chassis sandwiching both sides of the cooling cavity with one or more heat sinks extending into the cooling cavity.

23. A portable autonomous vehicle connectivity platform, comprising:

a portable case;

one or more local area network (LAN) side adapters disposed within the portable case and configured to communicate with one or more local devices including an autonomous vehicle (AV);

one or more wide area network (WAN) side adapters disposed within the portable case and configured to communicate with one or more remote servers;

a gateway router disposed within the portable case for bridging communications between the one or more LAN side adapters and the one or more WAN side adapters; and

a controller including a processor and local storage coupled to the gateway router, wherein the local storage stores instructions that, when executed by the processor, causes the portable autonomous vehicle connectivity platform to perform operations including:

establishing a remote management connection between a remote terminal and the AV via the portable autonomous vehicle connectivity platform; and

conveying real-time configuration commands and response confirmations between the AV and the remote terminal over an encrypted communication session between the AV and the remote terminal.