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62/301,858	03/01/2016		130	0087299-000001		

CONFIRMATION NO. 4060

FILING RECEIPT

21839
BUCHANAN, INGERSOLL & ROONEY PC
POST OFFICE BOX 1404
ALEXANDRIA, VA 22313-1404



Date Mailed: 03/14/2016

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Power of Attorney:

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 62/301,858**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

System for Identifying and Controlling Unmanned Aerial Vehicles

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 C.F.R. § 1.53(c).

Attorney Docket Number	0087299-000001
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Inventor(s)					
Given Name	Middle Name	Family Name	CITY	STATE	COUNTRY
John	M.	FALK	Tysons Corner	VA	USA
Title of Invention					
SYSTEM FOR IDENTIFYING AND CONTROLLING UNMANNED AERIAL VEHICLES					
Correspondence Address					
The address corresponding to Customer Number 2 1 8 3 9					
This invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
☒ No. ☐ Yes, the name of the U.S. Government agency and the Government contract number are:					
Enclosed Application Parts					
☒	Specification/Claims/Abstract	# of Pages	15	☐	CD(s) Number
☒	Drawings	# Sheets	5	☐	Other (specify):
Total Pages in Spec/Drawings			20		
☒ Application Data Sheet. See 37 CFR 1.76					
Method of Payment of Filing Fees				FILING FEE AMOUNT	
☒	Applicant claims small entity status. See 37 CFR 1.27			Filing Fee (1005)	\$ 130.00
☒	The Director is hereby authorized to charge any deficiency in filing fees or credit any overpayment to Deposit Account 02-4800.			Total Page Fee (101+ pages) (1085) \$200	\$ _____
☒	Payment by credit card. Payment will be made electronically at time of filing.			Total App. Filing Fee	\$ 130.00
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SIGNATURE /Kyle K. Tsui/DATE March 1, 2016
 TYPED or PRINTED NAME Kyle Tsui
703.836.6620
Regis. No. 62602

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	System for Identifying and Controlling Unmanned Aerial Vehicles			
First Named Inventor/Applicant Name:	John M. Falk			
Filer:	Kyle Kahung Tsui/nina leta			
Attorney Docket Number:	0087299-000001			
Filed as Small Entity				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
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Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
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Total in USD (\$)				130

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First Named Inventor/Applicant Name:	John M. Falk
Customer Number:	21839
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Authorized User	TSUI, KYLE

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Specification	Specification.pdf	458299	no	16
			82d0f3a04fb863a28ab3ee2c58ef0a7d364ade20		
Warnings:					
Information:					
2	Drawings-only black and white line drawings	Drawings.pdf	37001	no	5
			c8ddf1c95fbf5be62862c3f43c764c6b2e9b7a04		
Warnings:					
Information:					
3	Application Data Sheet	WebADS.pdf	113084	no	7
			9576084eda8c0eb4a11a36f3cee884976196a250		
Warnings:					
Information:					
4	Transmittal of New Application	Provisional_TL.pdf	21689	no	1
			a20513941d2ee3e0f474dd7612eb174faec00aa2		
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	29650	no	2
			2225e0988fbc3d6a06c6c54de61f1b33b882e91d		
Warnings:					
Information:					
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**APPLICATION FOR
UNITED STATES LETTERS PATENT**

FOR

System for Identifying and Controlling Unmanned Aerial Vehicles

by

Falk, John M.

**Attorney Docket No. 0087299-000001
BUCHANAN INGERSOLL & ROONEY PC
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-1-

System for Identifying and Controlling Unmanned Aerial Vehicles

FIELD OF THE INVENTION

[0001] This application is directed to a system and method for remotely controlling a vehicle, and in particular, a system and method for remotely controlling an unmanned aerial vehicle.

BACKGROUND

[0002] Unmanned vehicles are being increasingly deployed for a variety of tasks including recreational activities such as recreational aerial filming or photography, monitoring of crops or wildlife, remote inspection of industrial equipment, law enforcement, search and rescue operations, delivery of supplies to remote or inaccessible locations, and military applications. Unmanned vehicles that are airborne are typically described as unmanned aerial vehicles (UAVs) or drones. UAVs and unmanned vehicles generally may carry cameras, sensors, communications equipment, or other payloads and are capable of controlled and sustained flight.

[0003] One common aspect shared by unmanned vehicles including UAVs is that the vehicles do not include human operators in the vehicle itself, so some form of remote control or self-piloting by the UAV itself is necessary. Accordingly, UAVs may either be piloted or optionally piloted unmanned systems. When optionally piloted, known UAVs may fly autonomously based on pre-programmed flight plans, based on a set of predetermined rules, or a combination of both, for example. Even when piloted, known UAVs may react autonomously in varying degrees. Other known UAVs may only be remote-piloted and therefore lack any autonomy. UAVs may employ limited autonomous modes that include the ability to self-level, to loiter over a particular location, to execute take-offs or landings, to automatically return to a particular location, and to automatically land if communications to the operator are lost for a period of time. UAVs may also employ more autonomous modes that include the ability to execute complete flight plans by following waypoints, to react to obstacles while executing a flight plan or while being remotely piloted, and to perform certain portions of a flight plan such as maintaining a certain altitude or location with no oversight.

[0004] Due, however, to growing concerns related to the increasing use of UAVs, governments are interested in regulating the use of UAVs. In particular, the integration of UAVs into a nation's airspace that was previously regulated and used by manned vehicles such as conventional airplanes presents difficulties. Unlike manned vehicles, UAV operators need not obtain certifications or licenses prior to the

-2-

operation of their devices. At best, some jurisdictions such as the United States require UAV users to obtain a Certificate of Authorization from the Federal Aviation Administration (FAA) and to mark their UAVs. But no uniform technique for identifying the owner of a particular UAV exists.

[0005] One regulatory reaction to the increasing concerns surrounding UAVs is the enactment of a registration requirement for UAVs weighing more than half a pound but less than fifty-five pounds. Although the FAA provides a registration number with a Certificate of Authorization as a result of this registration and ties the specific owner with the specific UAV, the FAA does not dictate how the registration number is to be placed onto the UAV. Instead, the FAA suggests options for affixing the registration number to the UAV includes permanent marker, label, and engraving. The FAA also states that the registration number may be placed in an accessible battery compartment. This variety of possible techniques and locations for marking a UAV make it difficult to quickly determine the party responsible for a UAV. This is particularly important in areas where UAV usage is restricted and the owner of the trespassing UAV must be ascertained in a timely manner.

[0006] By virtue of their unmanned nature, UAVs typically depend on a remote human operator to provide at least some commands through wireless communications technologies. In addition, any imagery or other sensory data obtained by the UAV is typically desired by the human operators on a real-time or near real-time basis. Thus, two-way communication between the UAV and the human operator is desirable. UAVs typically available to consumers include the ability to use a Wi-Fi network to interface with the operator's smartphone, tablet, or other computing device. Wi-Fi networks are, however, limited in range and are susceptible to interference. More advanced UAVs employed by the military or law enforcement officials may instead use satellite links or other more robust and long-ranged wireless technologies to remain in contact with the human operators. These long-ranged wireless technologies are ordinarily well beyond the means of individuals and smaller corporations which limits the utility of UAVs in certain applications.

[0007] Another concern with UAVs is the multitude of control technologies being employed for different UAVs. Although certain consumer UAVs may be operated through smartphones, tablets, or other portable computing devices, more advanced UAVs may employ dedicated control systems specific to that particular model of UAV, or in some instances, particular versions of a certain model of UAV. The requirement of employing such dedicated control systems for UAVs therefore slows the adoption and deployment of advanced UAVs in certain arenas.

-3-

[0008] A need therefore exists to address these and other problems with known UAVs.

SUMMARY OF THE INVENTION

[0009] The beacon described here is attached to an unmanned aerial vehicle, the unmanned aerial vehicle including a control system, a sensory system, and a communications module. The beacon includes an attachment mechanism configured to securely and removably attach the apparatus to the unmanned aerial vehicle.

[0010] The beacon includes first indicia identifying an owner or responsible party, and second indicia identifying a particular unmanned aerial vehicle. At least a portion of the first and second indicia together form a unique identifier associating the owner or responsible party with the unmanned aerial vehicle. The unique identifier is readable by a detector spaced away from the unmanned aerial vehicle. In addition, information provided by the sensory system of the unmanned aerial vehicle may be encoded with the unique identifier formed from portions of the first and second indicia. The unique identifier of the beacon may be readable while the unmanned aerial vehicle is in motion relative to the detector, and the attachment mechanism of the beacon may only be removable by an authorized individual.

[0011] The beacon described here may also include an unmanned aerial vehicle communications module configured to provide commands and transmit and receive information to and from the unmanned aerial vehicle through the unmanned aerial vehicle communications system, a remote communications module configured to participate on at least one wireless communications system as well as transmit and receive information across the at least one wireless communications system to and from a remote operator, and a beacon control system configured to receive information and commands from the remote communications module and to transform the information and commands for compatibility with the unmanned aerial vehicle. The beacon control system may also transmit the transformed information and commands to the unmanned aerial vehicle through the unmanned aerial vehicle communications module, receive information from the unmanned aerial vehicle through the unmanned aerial vehicle communications module and to transform the information for transmission over the at least one wireless communications system, and transmit the transformed information to the remote operator. The remote communications module of the beacon may switch between wireless communications systems during a flight plan based on a set of predetermined criteria. The beacon control system may transform commands received by the remote communications module by mapping at least one of the received commands to at least one command compatible with the unmanned aerial vehicle. The beacon control system may also determine

-4-

an appropriate mapping and utilize the determined appropriate mapping so that compatible commands are transmitted to the unmanned aerial vehicle control system.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0012] FIG. 1 depicts certain aspects of known UAVs and the remote operator control system.

[0013] FIG. 2 depicts a known UAV with one embodiment of the beacon attached to the external housing or body of the UAV.

[0014] FIG. 3 depicts one embodiment of the components of the beacon.

[0015] FIG. 4 depicts another embodiment of the components of the beacon.

[0016] FIG. 5 depicts yet another embodiment of the components of the beacon.

DETAILED DESCRIPTION OF THE INVENTION

[0017] FIG. 1 depicts a block diagram showing certain aspects of known UAVs 10 and of known remote operator control systems 20. Known UAVs 10 comprise a sensory system 11 and a control system 12 that may communicate with each other and/or directly with a communications system 15. The communications system 15 of the UAV 10 transmits information from the sensory system 11, control system 12, and other components of the UAV to the remote operator control system 20. The information from the UAV 10 is transmitted over a dedicated wireless communications link to the communications module 25 of the remote operator control system 20. At least one human operator uses the remote operator control system 20 to process the information being provided by the UAV 10. When the human operator manipulates the remote operator control system 20, a control signal is transmitted by the communications module 25 to the UAV 10. The communications system 15 of the UAV 10 receives the control signal from the remote operator control system 20 and the UAV 10 responds to the human operator's commands. The dedicated wireless communications link between the UAV 10 and the remote operator control system 20 is used to relay information and control signals to and from the UAV 10 and the remote operator control system 20.

[0018] As described above, however, known UAVs do not include information that facilitates a quick determination as to who may be the registered owner of a particular UAV. Accordingly, one embodiment of the beacon 100 is affixed to the external housing or body of a UAV 10 as shown in FIG. 2. The beacon 100 is secured to the external housing or body of the UAV 10 so that the owner of the UAV 10 may be

-5-

quickly identified upon retrieval of the UAV 10. The beacon 100 is sized and placed so that normal operation of the UAV 10 is not hampered in any manner. In one embodiment of the beacon 100, an external housing 110 encloses components necessary for the functioning of the beacon 100. The beacon 100 also includes an attachment mechanism 130 that provides at least a physical interface for attaching the beacon 100 to the external housing or body of the UAV 10. Although certain components are depicted in the drawings, it is to be understood that an embodiment of the beacon need not include all of the illustrated components.

FIRST EMBODIMENT OF THE BEACON

[0019] In one embodiment, indicia 120 with information is included with the beacon 100. Examples of the information includes that needed for compliance with regulatory requirements such as the owner's unique identification number issued in compliance with a Certificate of Aircraft Registration/Proof of Ownership issued by the Federal Aviation Administration (FAA) through registration of the vehicle into the Small Unmanned Aircraft System registry. The indicia 120 may include markings embody the information required by regulatory requirements or may include markings that encode the information required by regulatory requirements. When encoded, the information is preferably stored in the indicia 120 in a commonly machine-readable manner such as a quick response (QR) code, a magnetic or optical marker, or another easily accessible format. The indicia 120 may exhibit certain characteristics such as radio-opacity to facilitate reading of the encoded information, or the indicia 120 may react to external stimuli such as an interrogation signal being emitted by an active reader. Embodiments utilizing machine-readable indicia may tailor the indicia 120 to be readable at a distance. For example, one embodiment of the beacon 100 may include indicia 120 that provides a reaction to an interrogation signal that may be detected by an active reader while the active reader is spaced away from the external housing 110 of the beacon 100. This ability to react to an active reader some distance from the beacon 100 is particularly useful in situations where precisely locating the beacon 100 for reading by a reader is not desirable. For example, an active reader may be placed in a fixed location where multiple UAVs 10 with beacons 100 pass so that information associated with each UAV 10 may be recorded without interrupting the flight of each UAV 10.

[0020] In certain embodiments of the beacon 100, multiple forms of readable indicia may be included to facilitate rapid usage of the information. For example, the beacon 100 may include first indicia 121 that

-6-

encodes in an optical form the information required by regulation, and second indicia 122 that encodes in a computer-readable form the information required by regulatory requirements. In other embodiments, the beacon 100 may include first and second indicia 121, 122 that have different information. For example, the first indicia 121 may only include the information required by regulation, and the second indicia 122 may only include additional information such as the intended flight plan for the UAV or the intended purposes of the UAV. In some embodiments, the first and second indicia 121, 122 may need to be considered together to obtain the contained information. It should be noted that although embodiments of the beacon 100 including two indicia 121, 122 are described, any number of components may be included as part of the indicia 120 for the beacon 100 are contemplated.

[0021] In at least one embodiment of the beacon 100 including the indicia 120, the beacon 100 is produced on a large scale to facilitate wide adoption and to help reduce costs. In such an embodiment, the indicia 120 may be printed or otherwise placed on an external housing 110 of the beacon 100 by the owner after registration is completed. The indicia 120 may be of any form, including optical or magnetic, where the beacons 100 may be produced on a large scale in a cost efficient manner.

[0022] In certain embodiments, once information is encoded in the indicia 120, including first or second indicia 121, 122, the information cannot be easily changed without detectible modifications to the beacon 100. This type of indicia 120 is particularly useful when it is desirable to associate certain information with the particular owner or the UAV itself. For example, if the UAV 10 is deployed by law enforcement, it may be desirable to prepare chronological documentation regarding the seizure, custody, control, transfer, analysis, and disposition of evidence gathered by the sensing devices available to the UAV 10. Such chronological documentation establishes a chain of custody to provide assurances regarding the authenticity of data collected by sensing devices.

[0023] FIG. 4 depicts an embodiment of the beacon 200 that helps provide such assurances regarding the authenticity of data collected by a UAV 10. This embodiment of the beacon 200 includes a beacon control system 210 and a UAV communications module 220. The beacon control system 210 includes circuitry such as a processor configured to include the logical steps needed to execute certain functions of the beacon 200, and memory configured to store any programs or data needed by the processor to perform the functions of the beacon 200. In addition, the processor is configured to communicate with components of the beacon 200 as necessary. In certain embodiments of the beacon 200, the beacon

-7-

control system 210 utilizes the information contained in the indicia 120. When the indicia 120 includes first and second indicia 121, 122, for example, the beacon control system 210 reads the information encoded by the first and second indicia 121, 122 so that the needed information is available to the processor of the beacon control system 210. In other embodiments when various forms of indicia 120 are available, the processor of the beacon control system 210 will retrieve the needed information from the appropriate subset of indicia 120 or the entirety of the indicia 120 so that the desired functions may be performed. The beacon control 210 can also communicate with the UAV 10 communications module 220 which interfaces with the sensory and/or control systems of a UAV 10 as necessary.

[0024] For example, a UAV 10 may be deployed with a particular sensory package for surveillance for law enforcement purposes. As the sensory package is employed, the UAV 10 may provide information such as its current location or the current time so that the sensory package may integrate this data into the information being stored or transmitted for later retrieval and analysis. In such a situation, the UAV 10 may also retrieve information encoded in the indicia 120 through the UAV communication module 220 and the beacon control system 210 that may help uniquely identify the owner and/or the UAV 10 employed to collect the information to be analyzed. This information retrieved from the indicia 120 may be encoded into the information being stored or transmitted for later retrieval and analysis using known techniques such as watermarking so that the information retrieved from the indicia 120 helps provide assurances regarding the authenticity of the data collected by the UAV 10. Thus, in addition to the contemporaneous location and time information that is integrated into the data collected by the sensory package, the information retrieved from the indicia 120 provides another form of assurance that the information recorded by the sensory package of the UAV 10 is authentic. This data collected by the sensory package may be stored on the UAV 10 itself for later retrieval, may be transmitted to the remote operator, or may be both stored on the UAV 10 and transmitted to the remote operator. When information from the indicia 120 is employed in this manner, it is preferable that the information encoded in the indicia 120 be resistant to modification so that, at a later time, the particular UAV 10 that was utilized to collect the information may be identified with certainty.

[0025] The UAV communications module 220 allows for at least one-way communication from the beacon 200 to UAV 10. In such embodiments, the beacon control system 210 retrieves the information encoded in the indicia 120 and based on a request received by the UAV communications module 220, the

-8-

beacon control system 210 transmits the encoded information to the UAV 10. In some embodiments, two-way communication between the beacon 200 and the UAV 10 is desirable. In these embodiments, the UAV communications module 220 transmits and receives information to and from the beacon control system 210. The beacon control system 210 performs the tasks necessary to satisfy any requests for information from the UAV 10, and also performs the tasks necessary to process any information received from the UAV 10. In some embodiments, the attachment mechanism 130, in addition to providing a physical interface for attaching the beacon 200 to the UAV 10, also provides an interface for the beacon 200 to communicate with the UAV 10 directly. For example, the attachment interface 130 may include a USB interface so that the beacon 200 may directly communicate with aspects of the UAV 10 and/or the sensory package being carried by the UAV 10. Other types of electrical interfaces may be utilized to facilitate communication between the beacon 200 and the UAV 10 and are not specifically enumerated here.

[0026] In certain embodiments, the attachment mechanism 130 includes the ability to lock and prevent unauthorized individuals from detaching the beacon 100. Combination locking mechanisms or keyed locking mechanisms may be employed for this purpose so that only individuals with the correct combination and/or key may detach the beacon 100 from the external housing or body of the UAV 10. Other techniques for securing the beacon 100 to the UAV 10 in a manner that prevents unauthorized removal are not specifically described here.

SECOND EMBODIMENT OF THE BEACON

[0027] The beacon may also operate as a component that allows a UAV 10 to communicate with a remote operator using available wireless communications networks. These wireless communications networks may operate on any compatible frequency including frequencies from 500-980 MHz. FIG. 5 depicts an embodiment of the beacon 300 that includes aspects described above for the first embodiment of the beacon such as the beacon control system 210, indicia 120 including the first and second indicia 121, 122, a UAV communications module 220, and the attachment mechanism 130. The depicted beacon 300 also includes storage 320 and a remote communications system 310. The storage 320 is available for the beacon control system 210 to utilize as needed to store programs, data, or other information necessary for the beacon control system 210 to perform its tasks. The storage 320 may be such as a hard disk, an optical disc, solid state memory, or any other computer-readable media.

-9-

[0028] The beacon 300 also includes a remote communications module 310. The remote communications module 310 facilitates communication between the beacon 300 and an underlying wireless communications system such as a Wi-Fi network, a cellular phone network, a satellite network, FirstNet, or another suitable wireless communications system. In some embodiments, the remote communications module 310 may switch seamlessly between different wireless communications systems as needed to ensure a reliable connection with the remote operator. The remote communications module 310 may employ a software-defined radio so that fewer separate hardware components for each wireless communication system must be included in each beacon 300. In other embodiments, a combination of hardware and software may comprise the components needed to interact with a particular wireless communications system.

[0029] Through the use of the remote communications module 310, the beacon 300 and the UAV 10 participate on the wireless communications network without requiring additional configuration within the wireless communication network. Instead, the beacon 300 performs all the necessary negotiation of protocols, frequencies, or other parameters so that the beacon 300 can transmit and receive information over the wireless communications network. When, for example, the beacon 300 participates on a cellular network, all the functions a typical cellular phone on the cellular network would ordinarily perform are executed by the beacon 300. In some embodiments, the beacon 300 may include hardware so that a subscriber identity module (SIM) card may be inserted to assign a particular international mobile subscriber identity and its related key to the beacon 300. In other embodiments, the beacon 300 may include specific hardware that contains the information needed to participate on a wireless communication network.

[0030] One way the UAV 10 equipped with the beacon 300 participates on the wireless communications network is by transmitting and receiving commands to and from a remote operator control system 20 so that the UAV 10 may be remotely piloted. Another way the UAV 10 equipped with the beacon 300 may participate on the wireless communications network is by uploading sensory data to the wireless communications network so that other systems may receive and process the sensory data. As is clear from this description, the remote operator control system 20 need not be the same as the monitoring system that receives and processes sensory data.

-10-

[0031] The beacon 300 also includes the beacon control system 210. The beacon control system 210 may translate information and commands received by the remote communications module 310 for compatibility with the UAV 10. For example, the commands and information being transmitted over the wireless communications system may be compressed or otherwise optimized for transmission. In such a circumstance, the beacon control system 210 will transform the commands and information so that the UAV 10 only receives the compatible transformed commands and information. The beacon control system 210 may also transform any information from the UAV 10 for transmission to the remote operator over the wireless communications system by compressing or otherwise optimizing the information prior to transmission by the remote communications module 310. In some embodiments, certain portions of the transformation may be performed by the remote communications module 310 and/or the UAV communications module 220 and/or the beacon control system 210. The transformation of the commands may be performed by mapping at least one command received by the remote communications module 310 from the remote operator to at least one command compatible with the UAV 10. In some embodiments, the transformation involves multiple commands being mapped onto a single compatible command, or a single command being mapped onto multiple compatible commands.

[0032] To illustrate these aspects of the beacon 300, the Vigilant Immersive Simulation Studio will be described in conjunction with the above described beacon 300. The Vigilant Immersive Simulation Studio employs curved screen displays that provide an immersive panoramic display of the current surroundings for the UAV 10, and control systems for the remote operator to direct the UAV 10. If, for example, a particular UAV 10 is not equipped to provide an immersive panoramic display of the current surroundings of the UAV 10, the beacon 300 may translate the available sensory information so that the Vigilant Immersive Simulation Studio can provide the needed immersive experience to the operator without requiring reconfiguration of the Vigilant Immersive Simulation Studio itself. Alternatively, the beacon 300 may also translate the commands provided by the Vigilant Immersive Simulation Studio so that the UAV 10 receives commands compatible with the remote operator control system 12. It is of course possible that only certain commands from the remote operator control system 20 may be translated by the beacon 300 prior to retransmission to the UAV 10, and that only certain sensory information from the UAV 10 may be translated by the beacon 300 prior to retransmission to the remote operator control system 20.

-11-

[0033] The beacon 300 may also employ a set of criteria for determining which wireless communications system to employ during a portion of a given flight plan. For example, the beacon 300 may first rely on a Wi-Fi network until the reliability or the bandwidth available over the Wi-Fi network becomes unacceptable. The beacon 300 may then rely on a cellular network until the reliability or the bandwidth available over the cellular network becomes unacceptable, at which point the beacon 300 may rely on a satellite network or FirstNet. The beacon 300 may also consider other factors such as cost, latency, or resistance to interception when determining which wireless communications system to utilize. In some embodiments, the remote operator may specify the particular wireless communications system to be utilized during portions of a given flight plan.

[0034] To provide a concrete example of this aspect of the beacon 300, consider a UAV 10 with a flight plan where the remote operator may communicate with the UAV 10 through the beacon 300 using Wi-Fi due to the relatively proximity of the remote operator and the UAV 10. For a second portion of the flight plan, the UAV 10 will have traveled sufficiently far from the remote operator that another wireless communications system is needed. At this stage, the beacon 300 may utilize a cellular phone network to communicate with the remote operator. At a third portion of the flight plan, the UAV 10 is approaching an area with limited cellular coverage so the beacon 300 may utilize a satellite network to communicate with the remote operator. As the UAV 10 returns to the remote operator, the beacon 300 may switch back to different types of wireless communications systems based on predetermined criteria.

[0035] By including such a beacon 300, each UAV 10 need not include all the components and logic for determining the appropriate wireless communications system to utilize during the flight plan. Rather, the beacon 300 may be utilized so that changes in the availability of certain wireless communications systems need not affect the components or the logic contained in a particular UAV 10.

[0036] The beacon 300 may also operate as a translator between multiple different types of control systems for operating a single UAV 10. Remote operators may already have a particular control system 20 available that is suitable for use with a UAV 10, where the particular control system is not designed to operate with the UAV 10. In other circumstances, a particular control system 20 is more desirable than another controls system due to the available controls, displays, level of operator comfort, and other factors. Similar to the mapping described above, the beacon 300 may be configured so that the beacon control system 210 includes multiple mappings for particular remote operator control systems 20

-12-

available to a particular remote operator and the commands available for a particular UAV 10. The remote operator then chooses the control system 20 to be used and associates the control system 20 with the beacon 300. The beacon control system 210 then handles the translation of commands and information to and from the UAV 10 and the remote operator control system 20. In at least some embodiments, the beacon 300 performs the translation in a manner where neither the UAV 10 nor the control system 20 utilized by the remote operator requires modification to perform their desired tasks. In certain embodiments, the beacon 300 may automatically determine the appropriate mapping for a particular control system 20 utilized by the remote operator based on the transmissions and/or commands received by the remote communications module 310. In these embodiments, the remote operator could, for example, utilize a first control system 20 during a first portion of a flight plan, and then utilize a second control system 20 during a second portion of a flight plan. In such a scenario, the beacon 300 would recognize transmissions from the second control system 20 and automatically utilize the mapping appropriate for the second control system 20 so that the UAV 10 remains under control of the remote operator. Such a beacon 300 would also be suitable for when a first control system 20 becomes inoperable and the remote operator must then use a second control system 20 to control the UAV 10.

[0037] Although the invention is illustrated and described herein with reference to specific embodiments, the beacon is not intended to be limited to the details shown. Rather, various modifications may be made in the details within the scope and range equivalents of the claims and without departing from the invention.

-13-

WHAT IS CLAIMED IS:

1. An apparatus attached to an unmanned aerial vehicle, the unmanned aerial vehicle including a control system, a sensory system, and a communications module, the apparatus comprising:
an attachment mechanism configured to securely and removably attach the apparatus to the unmanned aerial vehicle;
a first indicia identifying an owner or responsible party;
a second indicia identifying a particular unmanned aerial vehicle;
wherein at least a portion of the first and second indicia together form a unique identifier associating the owner or responsible party with the unmanned aerial vehicle; and
wherein the unique identifier is readable by a detector spaced away from the unmanned aerial vehicle.
2. The apparatus of claim 1, wherein information obtained by the sensory system is encoded, prior to transmission or storage for later retrieval, with the unique identifier formed from the portions of the first and second indicia.
3. The apparatus of claim 1, wherein the unique identifier is readable by the detector while the vehicle is in motion relative to the detector.
4. The apparatus of claim 1, wherein the attachment mechanism is only removable by an authorized individual.
5. A beacon attached to an unmanned aerial vehicle, the unmanned aerial vehicle including a control system, a sensory system, and a communications system, the beacon comprising:
an attachment mechanism configured to securely and removably attach the apparatus to the unmanned aerial vehicle;
an unmanned aerial vehicle communications module configured to provide commands and transmit and receive information to and from the unmanned aerial vehicle through the unmanned aerial vehicle communications system;

-14-

a remote communications module configured to participate on at least one wireless communications system, the remote communications module being configured to transmit and receive information across the at least one wireless communications system to and from a remote operator;

a beacon control system configured to receive information and commands from the remote communications module and to transform the information and commands for compatibility with the unmanned aerial vehicle, the beacon control system further being configured to transmit the transformed information and commands to the unmanned aerial vehicle through the unmanned aerial vehicle communications module;

wherein the beacon control system is further configured to receive information from the unmanned aerial vehicle through the unmanned aerial vehicle communications module and to transform the information for transmission over the at least one wireless communications system; and

wherein the remote communications module transmits the transformed information to the remote operator.

6. The beacon of claim 5, wherein the remote communications module switches between wireless communications systems during a flight plan based on a set of predetermined criteria.

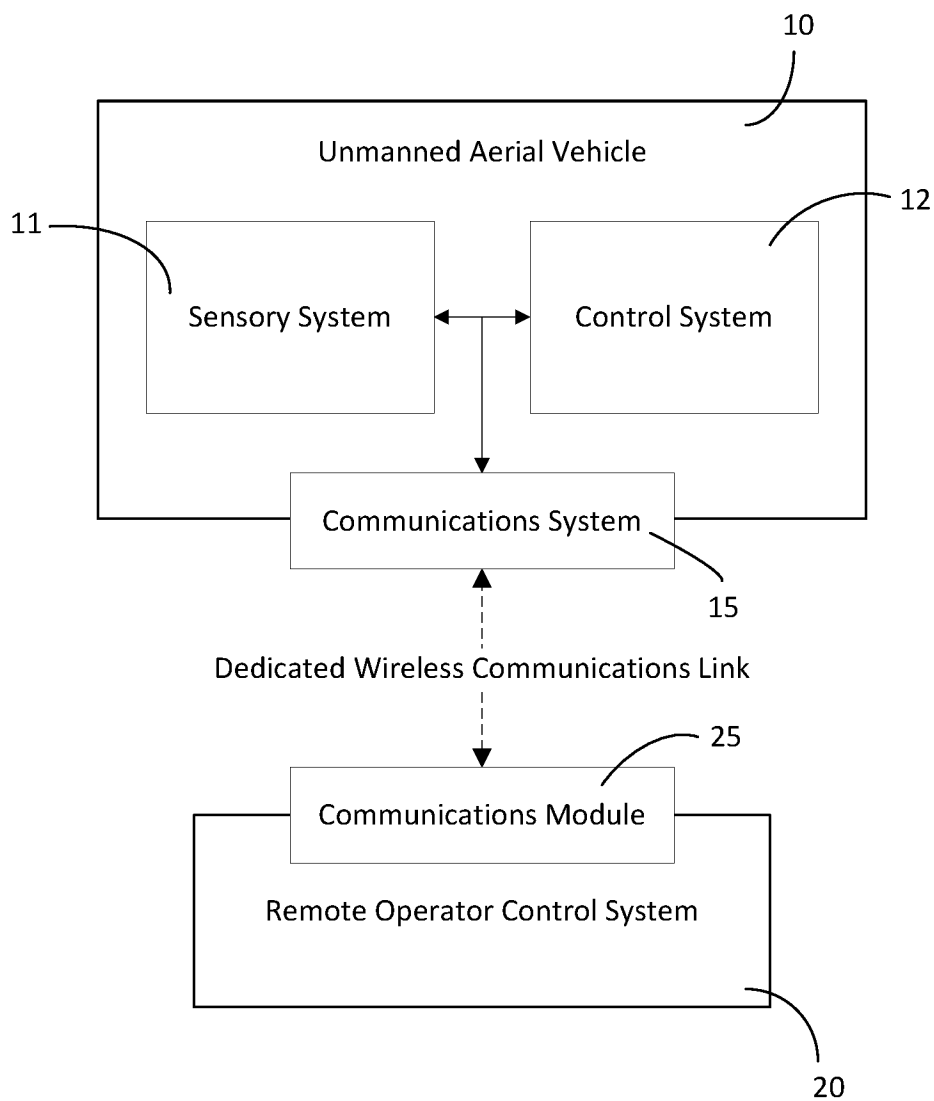
7. The beacon of claim 5, wherein the beacon control system transforms the commands received by the remote communications module by mapping at least one of the received commands to at least one command compatible with the unmanned aerial vehicle.

8. The beacon of claim 7, wherein the beacon control system determine an appropriate mapping and utilize the determined appropriate mapping so that compatible commands are transmitted to the unmanned aerial vehicle control system.

-15-

ABSTRACT OF THE DISCLOSURE

A beacon for attachment to an unmanned aerial vehicle that provides information needed to identify the owner of a particular unmanned vehicle. The beacon may also include a remote communications module configured to participate on wireless communications networks and a beacon control system configured to issue commands compatible with the unmanned aerial vehicle. The beacon may further a beacon control system configured to translate multiple types of commands from different controls systems into commands compatible with the unmanned aerial vehicle.



PRIOR ART

FIG. 1

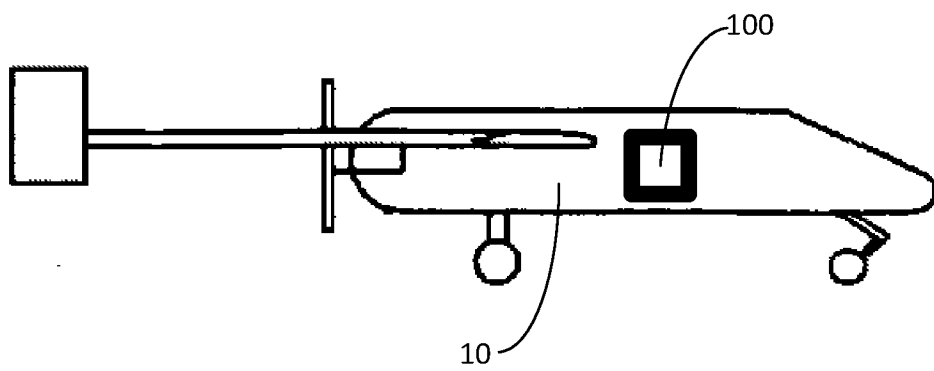


FIG. 2

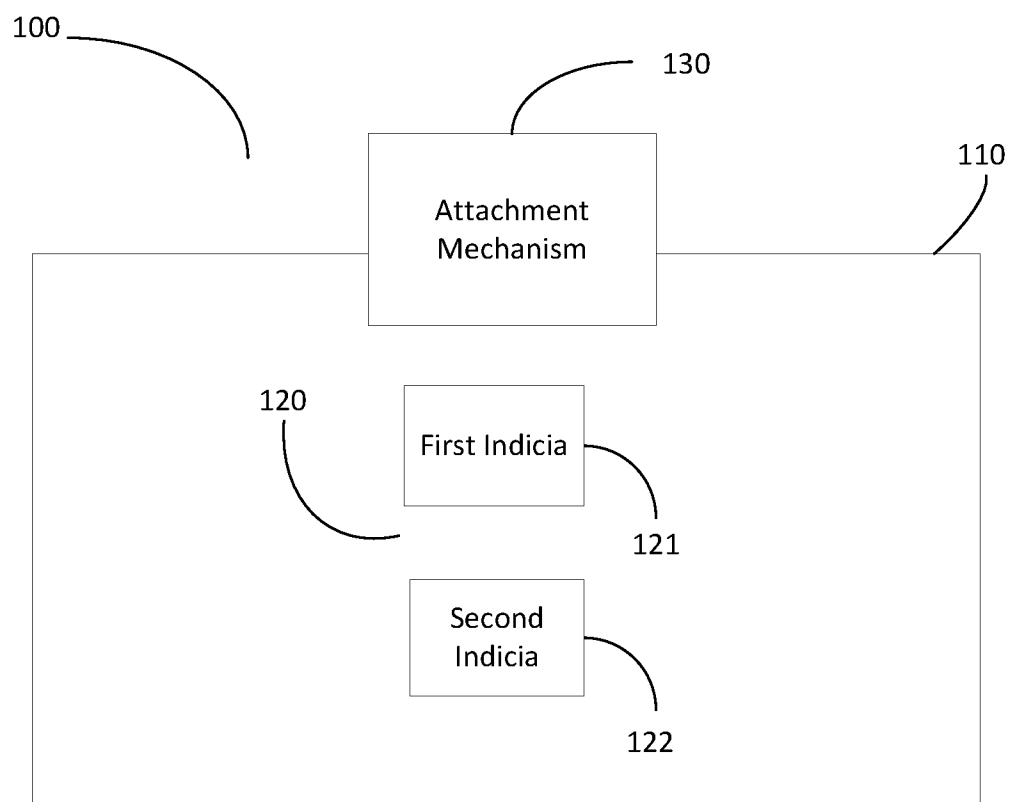


FIG. 3

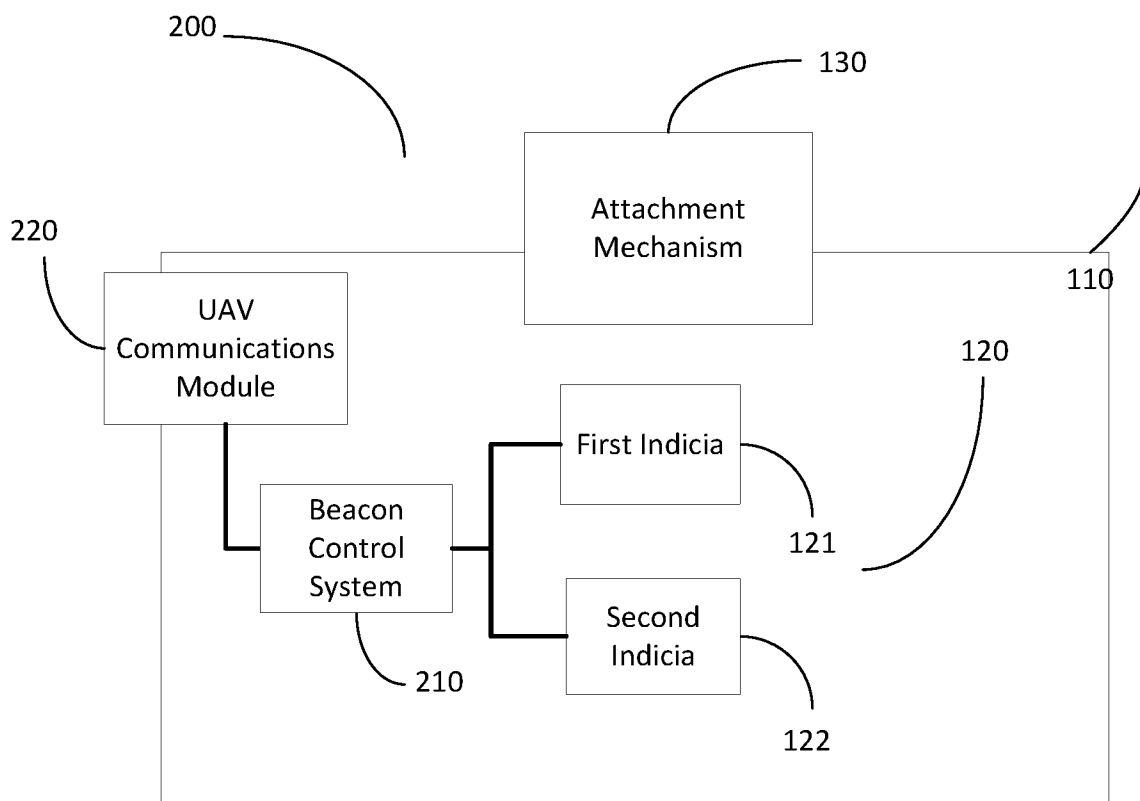


FIG. 4

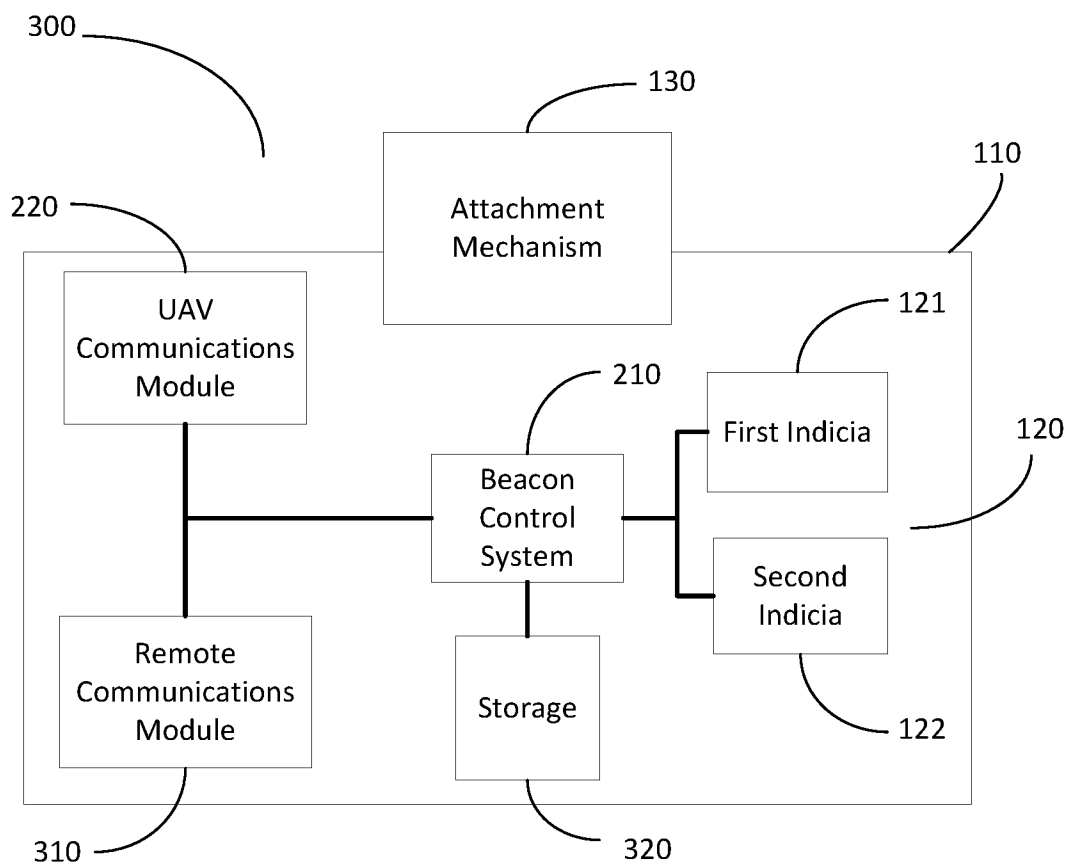


FIG. 5

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0087299-000001
		Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--

Inventor Information:

Inventor 1				
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All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add				

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Application Information:

Title of the Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		
Attorney Docket Number	0087299-000001	Small Entity Status Claimed	☒
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	Suggested Figure for Publication (if any)	

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0087299-000001
		Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0087299-000001
		Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		

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This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

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Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

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Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ^l (if applicable)

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Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0087299-000001
		Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

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B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

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- ☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	0087299-000001
	Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.								
Applicant 1								
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.								
			Clear					
☒ Assignee	☐ Legal Representative under 35 U.S.C. 117	☐ Joint Inventor						
☐ Person to whom the inventor is obligated to assign.	☐ Person who shows sufficient proprietary interest							
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:								
Name of the Deceased or Legally Incapacitated Inventor:								
If the Applicant is an Organization check here. ☒								
Organization Name	Vigilent Inc.							
Mailing Address Information For Applicant:								
Address 1	8618 Westwood Center Drive							
Address 2								
City	Tysons Corner	State/Province	VA					
Country ⁱ	US	Postal Code	22182					
Phone Number		Fax Number						
Email Address								
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0087299-000001
		Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		

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If the Assignee or Non-Applicant Assignee is an Organization check here. ☒			
Organization Name	Vigilent Inc.		
Mailing Address Information For Assignee including Non-Applicant Assignee:			
Address 1	8618 Westwood Center Drive		
Address 2			
City	Tysons Corner	State/Province	VA
Country i	US	Postal Code	22182
Phone Number		Fax Number	
Email Address			
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	0087299-000001
		Application Number	
Title of Invention	System for Identifying and Controlling Unmanned Aerial Vehicles		

Signature:

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See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Kyle K. Tsui/			Date (YYYY-MM-DD)	
First Name	Kyle	Last Name	Tsui	Registration Number	62602
Additional Signature may be generated within this form by selecting the Add button.					