FIRE AUTONOMOUS LOCATION CONTAINMENT OPERATING NETWORK (FALCON) SYSTEM

BACKGROUND

[001] Embodiments of the invention described in this specification relate generally to fire detection and mitigation, and more particularly, to a fire autonomous location containment operating network (FALCON) system.

[002] Wildfires are one of the most disruptive and prevalent natural phenomena that keep getting disproportionately worse as a result of climate change. Wildfires disturb life, pose serious health risks, burn vegetation, destroy property, and increase the risk of flooding and mudslides. The 2020 season was by many metrics a record-breaking one with, according to the National Interagency Fire Center (NIFC), over 50,000 wildfires that burned close to nine million acres, significantly more than the 10-year average. Wildfire seasons have been getting longer and their reach and scale have been increasing, and this is only projected to get worse. Most of the efforts to combat wildfires focus either on the very early prevention or once wildfires have already escalated and are extremely hard to suppress, there are no effective solutions for the intermediate stage. It problematic in this lack of an autonomous, effective way to detect and mitigate a wildfire in its early stages with the help of natural and sustainable water sources to prevent escalation.

[003] Therefore, what is needed is a way to autonomously and effectively detect and mitigate wildfires at their early stages by way of existing water resources.

BRIEF DESCRIPTION

[004] Some embodiments of the invention include a novel fire autonomous location containment operating network (FALCON) system. In some embodiments, the __INVENTION__

BRIEF DESCRIPTION OF THE DRAWINGS

[005] Having thus described the invention in general terms, reference is now made to the accompanying drawings, which are not necessarily drawn to scale, and which show different views of different example embodiments.

DETAILED DESCRIPTION

[006] In the following detailed description of the invention, numerous details, examples, and embodiments of the invention are described. However, it will be clear and

apparent to one skilled in the art that the invention is not limited to the embodiments set forth and that the invention can be adapted for any of several applications.

[007] Some embodiments of the invention include a novel fire autonomous location containment operating network (FALCON) system. In some embodiments, the __INVENTION__

[008] As stated above, wildfires are one of the most disruptive and prevalent natural phenomena that keep getting disproportionately worse as a result of climate change. Wildfires disturb life, pose serious health risks, burn vegetation, destroy property, and increase the risk of flooding and mudslides. The 2020 season was by many metrics a record-breaking one with, according to the NIFC, over 50,000 wildfires that burned close to nine million acres, significantly more than the 10-year average. Wildfire seasons have been getting longer and their reach and scale have been increasing, and this is only projected to get worse. Most of the efforts to combat wildfires focus either on the very early prevention or once wildfires have already escalated and are extremely hard to suppress, there are no effective solutions for the intermediate stage. It problematic when there is not effective intermediate stage since there are ample natural and sustainable water sources to prevent escalation.

[009] The problem that the fire autonomous location containment operating network (FALCON) system addresses is the lack of an autonomous, effective way to detect and mitigate a wildfire in its early stages with the help of natural and sustainable water sources to prevent escalation. In general, the fire autonomous location containment operating network (FALCON) system does this by automating quick detection of wildfires through a system of high-tech cameras and a reliable system of pipes that facilitates direct mitigation of fires via natural water sources channeled through the reliable system of pipes. This simplifies detection and early mitigation, thereby reducing the amount of labor and capital needed to be deployed each time there is a wildfire in a high-risk area. The fire autonomous location containment operating network (FALCON) system can also help prevent fires from becoming mega-fires that cost billions of dollars. Furthermore, the fire autonomous location containment operating network (FALCON) system has a net positive environmental impact by utilizing natural resources as opposed to harmful chemicals traditionally used to suppress wildfires.

[0010] In particular, the fire autonomous location containment operating network (FALCON) system detects fires with the help of the high-tech cameras and advanced thermal imaging sensors. Each camera is positioned in predetermined zones spread throughout a high-

risk area. An example of this is shown in one of the accompanying figures, where Zones 1, 2, 3 are present in a high-risk area close to a fresh water lake and Zones 4 and 5 are present in another high-risk area closer to the ocean and a different fresh water lake. If there is an active threat, the fire autonomous location containment operating network (FALCON) system immediately sends alerts to nearby fire stations and residents that are near or in the zone. The fire autonomous location containment operating network (FALCON) system then proceeds to activate the pipe arrangement. All water that is used by the fire autonomous location containment operating network (FALCON) system comes from a reservoir and travels through underground pipes. Once it reaches the sprinkler, water is pressurized and shot out towards the area in which there is a threat. Cameras continue to monitor the fire while giving live reports to the authorities in the area. The system can be bypassed by human interaction at any stage of the process.

[0011] Embodiments of the fire autonomous location containment operating network (FALCON) system described in this specification differ from and improve upon currently existing options. In particular, the conventional fire mitigation technology presently in existence uses drones, mobile robots, or other types of deployable techniques and focus on one aspect of wildfire alleviation, either detection or mitigation. Furthermore, some fire departments have developed deployable solutions to use natural water sources such as ocean water in the San Francisco Bay Area but these solutions are not practical to deploy and often require a great deal of human labor. By contrast, the fire autonomous location containment operating network (FALCON) system of the present disclosure involves a fully autonomous pipe and valve system that pumps water from a reservoir, such as a fresh water lake or an ocean. Additionally, this solution advances existing solutions by streamlining both early detection and immediate mitigation. In particular, the fire autonomous location containment operating network (FALCON) system of the present disclosure is designed to be stationary in high-risk areas to maximize efficiency and decrease the risk of wildfire escalation. Further, the fire autonomous location containment operating network (FALCON) system uses natural water sources which minimizes its environmental footprint as opposed to the traditional use of chemicals and other substances used to suppress fires. Finally, the fire autonomous location containment operating network (FALCON) system is designed for both detection and immediate early mitigation while other solutions exclusively focus on one of the two creating friction between the two tasks. This system uses machine vision and imaging technology to detect fires and activates a powerful system of pipes to mitigate them in their early stages. As such, a new level of automation is

unlocked thanks to a design that addresses both detection and mitigation in the same system.

[0012] The fire autonomous location containment operating network (FALCON) system of the present disclosure is designed to be stationary in high-risk areas to maximize efficiency and decrease the risk of wildfire escalation. Further, the fire autonomous location containment operating network (FALCON) system uses natural water sources which minimizes its environmental footprint as opposed to the traditional use of chemicals and other substances used to suppress fires. Finally, the fire autonomous location containment operating network (FALCON) system is designed for both detection and immediate early mitigation while other solutions exclusively focus on one of the two creating friction between the two tasks.

[0013] The fire autonomous location containment operating network (FALCON) system of the present disclosure may be comprised of the following elements. This list of possible constituent elements is intended to be exemplary only and it is not intended that this list be used to limit the fire autonomous location containment operating network (FALCON) system of the present application to just these elements. Persons having ordinary skill in the art relevant to the present disclosure may understand there to be equivalent elements that may be substituted within the present disclosure without changing the essential function or operation of the fire autonomous location containment operating network (FALCON) system.

[0014] 1. Thermal sensors

[0015] 2. An antenna

[0016] 3. An infrared sensor connected nearby each thermal sensor

[0017] 4. A computing device (or “computer”)

[0018] 5. A router

[0019] 6. A camera

[0020] 7. Pressure building system (valves, pipes, sprinklers, pumps and motors, pressure transmitters)

[0021] The antenna is used to keep the camera up at a height from which the fire would be most visible. The camera utilizes infrared detection in order to locate the fire by identifying the light coming off of the fire. The computer takes the images from the infrared sensor to analyze and determine if there is a threat. If there is a real threat, the router will send a signal to a receiver tower (or “command tower”) indicating the presence of a fire. The receiver tower computer processes the input received from the router and then sends a corresponding command to the pressure building system. Based on the command it receives from the command

tower, the pressure building system builds pressure within the water so that it is able to spray over a large area effectively. Pressure is built by utilizing a combination of the valves, pipes, and sprinklers. Then the valves open to let water through the pipes (which are interconnected to form pipelines) based on the corresponding command(s) from the command tower. The water that the valves release runs through the pipes and pipelines. This channels the water to the sprinklers, which sprays the water out using the pumps and motors. The rate at which the pumps and motors push water through the pipelines is dictated by the pressure transmitters. These sprinklers will then push the water out at a high enough force to cover the area in which there is a fire.

[0022] The various elements of the fire autonomous location containment operating network (FALCON) system of the present disclosure may be related in the following exemplary fashion. It is not intended to limit the scope or nature of the relationships between the various elements and the following examples are presented as illustrative examples only. Referring to a first figure that accompanies the present specification, the fire autonomous location containment operating network (FALCON) system operates using thermal sensors, each of which has an antenna (shown in the first figure with reference number “1”), an infrared sensor (shown in the first figure with reference number “2”), a computer (shown in the first figure with reference number “3”), and a router (shown in the first figure with reference number “4”). The antenna (reference number “1”) is used to keep the camera up at a height from which the fire would be most visible. The camera utilizes the infrared sensor (reference number “2”) to perform infrared detection in order to locate the fire by identifying the light coming off of the fire. The computer (reference number “3”) takes the images from the infrared sensor (reference number “2”) to analyze and determine if there is a threat. If there is a real threat, the router (reference number “4”) will send a signal to the receiver tower (or “command tower”) indicating the presence of a fire.

[0023] Now reference is made to two additional figures that demonstrate different views and aspects of the fire autonomous location containment operating network (FALCON) system. Specifically, a second figure conceptually illustrates the pressure building system while a third figure conceptually illustrates a broad map of high-risk areas with the pressure building system spanning zoned sections of the high-risk areas. First referring to the third figure, a control tower is shown. This control tower is the receiver tower (or “command tower”) to which the router (reference number “4”) sends the signal. As shown in the third figure, temperature sensors on antennas in Zone 2 and Zone 5 of the different high-risk areas detect fires and the associated

routers send their respective signals to the control tower, which processes the input signals, and subsequently sends corresponding commands to pressure sensors of pressure building systems deployed for the different high-risk areas. Thus, the signal input received from the router is used by the computer in the command tower to determine how much (if any) pressure to apply to water that is retrieved from fresh water sources nearby the respective high-risk zone, in order to channel that water through the pipelines and spray out to cover the respective fire that is detected.

[0024] The pressure building system is shown in more detail by reference to the second figure. When assembled and functioning, the pressure building system builds pressure within the water so that it is able to spray over a large area effectively. It does so by utilizing a combination of control valves (shown in the second figure with reference number “6”), pipes (shown in the second figure with reference number “7”), and sprinklers (shown in the second figure with reference number “8”). The valves (reference number “6”) open and let water through the pipelines (reference number “7”) based on the corresponding commands from the receiver tower. The pipes (reference number “7”) take the water that the valves (reference number “6”) let the water flow through, carrying the water over to the sprinklers (reference number “8”) using a pump & motor (shown in the second figure with reference number “9”). The rate at which the pump & motor (reference number “9”) pushes water through the pipe (reference number “7”) is dictated by the pressure transmitter (shown in the second figure with reference number “10”). These sprinklers (reference number “8”) will then push water out at a high enough force to cover the area in which there is a fire.

[0025] The fire autonomous location containment operating network (FALCON) system of the present disclosure generally works by with these components operating together to detect fires, send warnings to people and firefighters in nearby areas, and mitigate the fires. The thermal cameras are positioned around a high-risk region arranged in a way to cover the most area possible for detection of wildfires. If the cameras detect any temperatures that are higher than normal, they will immediately send signals to nearby areas and fire stations. The fire autonomous location containment operating network (FALCON) system concurrently allows water to travel through the pipes so the water can reach the impacted areas. The water flows through the pipes and then the sprinklers will be put into action. Once it reaches the high temperatures areas, the water will spray through the high pressurized sprinklers and contain the fire. While the fire autonomous location containment operating network (FALCON) system is

autonomously operating, firefighters in the area will assess the zone where the higher temperature was detected to determine further actions (if any). Also, the firefighters can override the fire autonomous location containment operating network (FALCON) system to shut down the water manually at any point.

[0026] The cameras of the fire autonomous location containment operating network (FALCON) system use infrared sensors and are configured to visually detect heat and, by way of the embedded computer, compare it to the average heat of the surrounding areas to determine if there is a fire. The cameras and computers are able to detect fires as small as one square meter. Because these cameras are not thermal sensors, but instead visually detect large fluctuations of heat, there is a lower chance for there to be false alarms.

[0027] The pipes of the fire autonomous location containment operating network (FALCON) system are connected together into pipelines that lead out of a reservoir or natural water source at a higher elevation than the high-risk area, and thereby leads to every section within the high-risk area. If the water pressure within the pipes is too low, then the intake of water by the pipes will be increased by sending a signal to the pressure transmitters of the fire autonomous location containment operating network (FALCON) system. In the case of an emergency, the fire autonomous location containment operating network (FALCON) system will have the ability to close off specific pipes by using control valves in order to guide the water to the correct area.

[0028] The sprinklers of the fire autonomous location containment operating network (FALCON) system are placed around the area or zone to allow for maximum coverage. In some embodiments of the fire autonomous location containment operating network (FALCON) system, the sprinklers are large industrial sprinklers. The sprinklers are capable of spraying large amounts of water over a large area. In some embodiments, the sprinklers also pressurize the water and spray over the area in the case of an emergency.

[0029] To make the fire autonomous location containment operating network (FALCON) system of the present disclosure, one may plan to install and deploy three main parts: (i) the pipelines going out of the reservoir or other natural water source; (ii) the thermal detection cameras; and (iii) a digital interface to send out alerts to residents and administrators. In this way, the fire autonomous location containment operating network (FALCON) system is able to give residents live information about the fire and give access to admins to override the protocols/operations of the system. The pipelines should be positioned to maximize the area that

is covered. Smaller pipelines should be placed from the main pipeline and into other zones in order to cover maximum area. After all the pipelines are positioned properly, place thermal detection cameras on antennas. These antennas should be located throughout the zone, they will contain the thermal cameras and will keep the sensors stable. After placing the cameras on antennas, it is advised to make sure to test the cameras thoroughly to avoid any sort of false alarms that could lead to a false response. The fire autonomous location containment operating network (FALCON) system also operates in connection with a versatile interface that is easy to use. The interface has two main services: one for admins, and one for residents. The residents will get access to live information regarding the fire as well as guidance on how to evacuate. The admins would have access to everything the residents have as well as the ability to stop the system and manually turn on specific pipelines. In order to detect the wildfires, the sensors are placed upon antennas. In some embodiments, the antennas are made of alloy steel. The sensors should be placed in areas of high fire risk. These sensors will be made up of plastic and metal. The metal would be used to keep it durable and the plastic will be utilized to make the frame. The pipes will be made up of alloy steel, capable of supporting the water flowing through. These pipes will connect to pressurized sprinklers, which will be made of brass.

[0030] The fire autonomous location containment operating network (FALCON) system can be used in multiple ways. For instance, the fire autonomous location containment operating network (FALCON) system can be adapted and deployed for use to monitor the habitat of wildlife in the forest, and to monitor forest conditions for subsequent wildfires. The sensors give camera feed of wildlife in the zones and can be useful for park rangers and ecologists to monitor the area and monitor the ecosystem. This is also useful for predicting wildfires since the cameras can also monitor heat. The sensors are able to show humidity of the zones, which could make it possible to predict the chance of a wildfire occurring in the near future, giving residents a warning.

[0031] Using the fire autonomous location containment operating network (FALCON) system of the present disclosure is mostly autonomous. After installing and deploying all components, testing their operation, etc., the system starts and works automatically. Once a fire is detected the cameras will send a signal with details about the fire to a receiver tower which will trigger fire mitigation operations (described above) and also send a notification to a system operator (who receives in a system operator app or other interface). This allows for human overriding of the fire autonomous location containment operating network (FALCON)

system. Specifically, if the admin considers the information a minimal threat or no real threat, then the admin can shut off the system. If not, the fire autonomous location containment operating network (FALCON) system will autonomously carry out its fire mitigation operations. The admin may continue to assess the details (and updated details) sent from the cameras into the system operator app and may take actions when needed (e.g., shutting the system off once the fire is contained). In this way, the whole autonomous location containment operating network (FALCON) system is able to be controlled through the system operator app. However, in some embodiments, the system operator app requires authenticated login by the admin in order to shut off the system. Thus, the admin may need to input their user credentials and have adequate permissions to turn it off with app-based controls. Other features are supported by the autonomous location containment operating network (FALCON) system. For instance, the autonomous location containment operating network (FALCON) system of some embodiments may provide live feeds and details that are sent to the system operator app to allow park rangers and other safety professionals to simultaneously guide citizens out of the zone in danger. Safety officials can use the information to find ways to lead people to areas of safety.

[0032] Additionally, the autonomous location containment operating network (FALCON) system is not built to completely and exhaustively put out entire wildfires without any human involvement. Instead, the autonomous location containment operating network (FALCON) system is designed to mitigate a wildfire by controlling it before it rages out of control and until further action is made by firefighters, etc. Thus, the autonomous location containment operating network (FALCON) system may in some instances completely put out a wildfire, but when it is necessary, firefighters or park rangers will go to the affected area to certify complete suppression. And when such human actions are employed, they would typically use shovels and hoses to eliminate remaining embers and other threats.

[0033] The above-described embodiments of the invention are presented for purposes of illustration and not of limitation. While these embodiments of the invention have been described with reference to numerous specific details, one of ordinary skill in the art will recognize that the invention can be embodied in other specific forms without departing from the spirit of the invention. Thus, one of ordinary skill in the art would understand that the invention is not to be limited by the foregoing illustrative details, but rather is to be defined by the appended claims.

CLAIMS

I claim:

1. A fire autonomous location containment operating network (FALCON) system comprising:

a steel frame antenna that stands in an area of high fire risk (“high-risk area”);

an infrared camera with infrared sensor that captures infrared light associated with heat sources, said infrared camera attached to the antenna at a suitable height from which a view of a large surrounding area allows detection of fires;

a computing device that is communicably connected to the infrared camera, said computing device comprising a processing unit that is configured to receive thermal images captured by the infrared camera and analyze infrared light patterns in the thermal images to detect areas of sufficiently high heat that a potential fire is present;

a router that transmits signals to a command tower computer for processing, said router transmitting signals based on the analyzed infrared light patterns when sufficiently high heat is detected;

a camera housing that contains the infrared camera, the computing device, and the router, said camera housing holding the infrared camera in a position in which a lens of the infrared camera faces the large surrounding area, wherein the computing device is embedded within the camera housing behind the infrared camera; and

a pressure building system comprising pipes, control valves, sprinklers, pumps and motors, and pressure transmitters, wherein the pipes are configure to connect together to form pipelines that starts at a high elevation water source and provide a channel for water to flow through the pipes and distribute to sprinklers at a pressure set by the pressure transmitters in connection with command signals transmitted by the command tower based on the signals

received from the router, wherein the sprinklers release the pressurized water out at a high enough force to cover an area detected to have a fire.

ABSTRACT

A fire autonomous location containment operating network (FALCON) system is disclosed. A new level of automation is unlocked thanks to a design that addresses both detection and mitigation in the same system. This solution also uses natural water sources through a fully autonomous pipe and valve system. Some fire departments have developed deployable solutions to use natural water sources such as ocean water, but these solutions are not practical to deploy and often require a great deal of human labor.