FORM 2

THE PATENTS ACT, 1970

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The Patent Rules, 2003

COMPLETE SPECIFICATION

(See sections 10 & rule 13)

1. TITLE OF THE INVENTION

A SURVEILLANCE-BASED DEVICE CONTROL SYSTEM AND METHOD THEREOF

2. APPLICANT (S)

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed.

TECHNICAL FIELD

[0001] The present disclosure relates to the field of intelligent device automation systems. In particular, it relates to a surveillance-based device control system and method thereof.

BACKGROUND

[0002] Background description includes information that may be useful in understanding the present disclosure. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed disclosure, or that any publication specifically or implicitly referenced is prior art.

[0003] Saving electrical energy is necessary for a sustainable growth. But, most of the people have the habit of leaving the room without turning off the lights, fan, or air conditioner, resulting in wasteful energy consumption for the home or organization and a large cost from the budget. In the present scenario people are manually turning off and on devices, as well as utilizing some remotes to do so.

[0004] To avoid such energy wasting situations researchers are developing automatic device control systems. One of the existing prior arts authored by Y. Mittal *et. al.*, entitled "A voice-controlled multi-functional Smart Home Automation System", discloses a system with voice-commands to control the home-appliances and gadgets, for different functionalities and purposes. Another existing prior art authored by K. L. Raju *et. al.*, entitled "Home automation and security system with Node MCU using Internet of Things", discloses an IOT based sensing systems and monitoring systems for implementing an automated home. Another existing prior art authored by S. Suresh *et. al.*, entitled "Automatic lighting and control system for classroom", discloses an automatic lighting and control using Arduino for the efficient use of energy in Class room condition.

[0005] The existing prior arts uses complex infrastructure with sensors, voice commands and relay control systems to achieve the automatic device control and hence do not render a robust solution for a perfect automatic device control. Thus, the said systems need additional system control devices resulting in high cost. Hence, there is a need for an automatic device control system which can overcomes

critical limitations of existing systems using a simple and low- cost architecture, and can provide device control in real-time.

OBJECTS OF THE PRESENT DISCLOSURE

[0006] Some of the objects of the present disclosure, which at least one embodiment herein satisfies are as listed herein below.

[0007] It is an object of the present disclosure to provide a surveillance-based device control system and method thereof.

[0008] It is another object of the present disclosure to provide a system and method, which provides automated mechanism to control functional states of the devices based detecting the presence of user in real-time within the surroundings.

[0009] It is another object of the present disclosure to provide a system and method, which uses surveillance cameras to control the devices without the need for additional system control devices.

[0010] It is another object of the present disclosure to provide a system and method, which implements an intelligent device control action thereby contributing to energy consumption.

[0011] It is another object of the present disclosure to provide a system and method, which eliminates usage of control devices such as sensors and remotes in device automation.

SUMMARY

[0012] The present disclosure relates to the field of intelligent device automation systems. In particular, it relates to a surveillance-based device control system and method thereof.

[0013] An aspect of the present disclosure pertains to a surveillance-based device control system. The system comprising: one or more pre-processor, a memory coupled to the one or more processor. The memory comprises processor-executable instructions to cause the one or more pre-processors to: receive one or more videos from one or more of image capturing units mounted at one or more locations in at least one area installed with one or more devices. The one or more videos pertains

to recording of one or more regions of interest in the at least one area. Further, the system can be configured to process the one or more videos by at least one edge computing device to detect the presence of at least one user and to obtain a count of the at least one user present at the one or more regions of interest in the at least one area. Further, the system can be configured to transfer the count of the at least one user to at least one cloud database unit and activate at least one user interface unit by at least one user interface application to control the one or more devices installed in the at least one area based on the count of the at least one user. Furthermore, the system can be configured to perform at least one action on the one or more devices by the at least one user interface application based on the count of the at least one user, and facilitate control of the one or more devices installed in the at least one area.

[0014] In an aspect, the one or more image capturing units comprises of at least one of a digital imaging device, a CCTV imaging device, a web camera, a drone camera, and a handy Cam. The at least one region of interest comprises of at least one of a classroom, a laboratory, a meeting hall, a library, a study room, a waiting room, a hallway and a living room. The at least one area comprises of at least one of a school, a college, a house, a government office, and a private office.

[0015] In an aspect, the one or more devices comprises of at least one of a light, a fan, an air-conditioner, a room heater, a television, a radio, and a table lamp.

[0016] In an aspect, the one or more videos from one or more of image capturing units comprises of a live streaming video, and a recorded video. The one or more videos is accessible to the at least one user by at least one of a Local Area Network (LAN) and a Wireless-Fidelity (Wi-Fi) link. The one or more videos is processed by at least one deep learning technique to detect the presence of the at least one user. The one or more image capturing units comprises of at least one internet protocol (IP) camera accessible across the LAN.

[0017] In an aspect, the edge computing device is configured to processes the one or more video at the server and streams the processed information of count of the at least one user to the cloud database unit.

[0018] In an aspect, the cloud database unit comprises of a cloud database and a cloud server. The cloud database is configured for storing the processed data. The cloud server is configured for hosting the web servers for the at least one user interface applications.

[0019] In an aspect, the at least one user interface unit comprises of at least one device controlling panel to control the one or more devices based on the count of the at least one user.

[0020] In an aspect, the at least one user interface application comprises of at least one of a mobile based application and a web-based application.

[0021] In an aspect, the at least one action performed on the one or more devices comprises at least one of a switch off state and a switch on state based on the presence of the at least one user. The one or more devices operate in the switch off state, if the at least one user's presence is not detected in the one or more regions of interest, and wherein the one or more devices operate in the switch on state, if the at least one user's presence is detected in the one or more regions of interest.

[0022] In an aspect, a method for surveillance-based device control. The method includes steps of receiving, by the system, one or more videos from one or more of image capturing units mounted at one or more locations in at least one area installed with one or more devices. The one or more videos pertains to recording of one or more regions of interest in the at least one area. The one or more videos pertains to at least one recording of inner surroundings of the one or more regions of interest. The method includes steps of processing, by the system, one or more videos by at least one edge computing device to detect the presence of the at least one user, and obtain a count of the at least one user present at the one or more regions of interest in the at least one area. Further, the method comprises the step of transferring, by the system, the count of the at least one user to at least one cloud database unit, and activate at least one user interface unit by at least one user interface application to control the one or more devices installed in the at least one area based on the count of the at least one user. Furthermore, the method comprises the step of performing, by the system, at least one action on the one or more devices by the at least one user

interface application based on the count of the at least one user, and facilitate control of the one or more devices installed in the at least one area.

[0023] Various objects, features, aspects, and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like components.

BRIEF DESCRIPTION OF DRAWINGS

[0024] The accompanying drawings are included to provide a further understanding of the present disclosure, and are incorporated in, and constitute a part of this specification. The drawings illustrate exemplary embodiments of the present disclosure, and together with the description, serve to explain the principles of the present disclosure.

[0025] In the figures, similar components, and/or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label with a second label that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

[0026] FIG. 1 illustrates exemplary network architecture of the proposed surveillance-based device control system 102, in accordance with an embodiment of the present disclosure.

[0027] FIG. 2 illustrates architecture of the proposed surveillance-based device control system 102, in accordance with an embodiment of the present disclosure.

[0028] FIG. 3 illustrates an exemplary block diagram 300 of the hardware module of the surveillance-based device control system 102 in a hybrid computing configuration, in accordance with an embodiment of the present disclosure.

[0029] FIG. 4 illustrates an exemplary functional block diagram 400 of the cloud database unit with the device controlling panel in the surveillance-based device control system 102, in accordance with an embodiment of the present disclosure.

[0030] FIG. 5 illustrates an exemplary view of a flow diagram of the proposed method 500 for surveillance-based device control, in accordance with an embodiment of the present disclosure.

[0031] FIG. 6 illustrates an exemplary computer system 102 in which or with which embodiments of the present disclosure can be utilized, in accordance with embodiments of the present disclosure.

DETAILED DESCRIPTION

[0032] The following is a detailed description of embodiments of the disclosure depicted in the accompanying drawings. The embodiments are in such detail as to clearly communicate the disclosure. However, the amount of detail offered is not intended to limit the anticipated variations of embodiments; on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present disclosure as defined by the appended claims.

[0033] The present disclosure relates to the field of intelligent device automation systems. In particular, it relates to a surveillance-based device control system and method thereof.

[0034] Various aspects of the present disclosure are described with respect to FIG 1-6.

[0035] FIG. 1 illustrates exemplary network architecture of the proposed surveillance-based device control system 102, in accordance with an embodiment of the present disclosure.

[0036] In an embodiment, referring to FIG. 1, the system 102 will be connected to a network 104, which is further connected to one or more image capturing unit 108-1, 108-2, … 108-N (collectively referred as image capturing unit 108, herein) associated with one or more users 106-1, 106-2, … 106-N (collectively referred as user 106, herein). The image capturing unit 108 may be at least one of a digital imaging device, a CCTV imaging device, a web camera, a drone camera, a handy Cam or any custom-built computing device integrated within a modern imaging machine that can connect to a network as an IoT (Internet of Things) device.

Furthermore, the network 104 can be configured with a centralized server 110 that stores compiled data from all the secure transactions.

[0037] In an embodiment, the system 102 may receive at least one input data from the one or more image capturing units 108. A person of ordinary skill in the art will understand that the one or more image capturing units108 may be individually referred to image capturing unit 108 and collectively referred to as image capturing units 108.

[0038] In an embodiment, the image capturing unit 108 may transmit the at least one received data packet over a point-to-point or point-to-multipoint communication channel or network 104 to the system 102.

[0039] In an embodiment, the image capturing unit 108 may involve collection, analysis, and sharing of data received from the system 102 via the communication network 104.

[0040] In an embodiment, the system 102 may execute one or more instruction for a surveillance-based device control system and method thereof.

[0041] In an exemplary embodiment, the system 102 may include, but not be limited to, a computer enabled device, a mobile phone, a tablet, a display device, a display projector, a AR/VR/MR, a imaging device, a sensors, a NFC, a network (Wired or Wireless), an apparatus to dispatch gift, prints, ecommerce, instructions, a Remote Detection Service (Detection Device) enabled devices such as iBeacon technologies, NFC, IR/RF services, bluetooth to detect the devices nearby, a connect signs objects, an apparatus, a vending machine, a gift claw machine, a combination of the vending machine, and the gift claw machine, a drone, a robot, an advertisement displays, or some combination thereof.

[0042] In an exemplary embodiment, the communication network 104 may include, but not be limited to, at least a portion of one or more networks having one or more nodes that transmit, receive, forward, generate, buffer, store, route, switch, process, or a combination thereof, etc. one or more messages, packets, signals, waves, voltage or current levels, some combination thereof, or so forth. In an exemplary embodiment, the communication network 104 may include, but not be limited to, a wireless network, a wired network, an internet, an intranet, a public network, a

private network, a packet-switched network, a circuit-switched network, an ad hoc network, an infrastructure network, a Public-Switched Telephone Network (PSTN), a cable network, a cellular network, a satellite network, a fiber optic network, or some combination thereof.

[0043] In an embodiment, the one or more image capturing units 108 may communicate with the system 102 via a set of executable instructions residing on any operating system. In an embodiment, the one or more image capturing units 108 may include, but not be limited to, a digital imaging device, a CCTV imaging device, a web camera, a drone camera, a handy Cam, any electrical, electronic, electro-mechanical, or an equipment, or a combination of one or more of the above devices such as mobile phone, smartphone, Virtual Reality (VR) devices, Augmented Reality (AR) devices, laptop, a general-purpose computer, desktop, personal digital assistant, tablet computer, mainframe computer, or any other computing device, wherein the one or more image capturing units 108 may include one or more in-built or externally coupled accessories including, but not limited to, a visual aid device such as camera, audio aid, a microphone, a keyboard, input devices such as touch pad, touch enabled screen, electronic pen, receiving devices for receiving any audio or visual signal in any range of frequencies, and transmitting devices that can transmit any audio or visual signal in any range of frequencies. It may be appreciated that the one or more image capturing units 108 may not be restricted to the mentioned devices and various other devices may be used.

[0044] In an embodiment, the network 104 is further configured with a centralized server 110 including a database, where the user identity data is used for providing authentication to the users. It can be retrieved based on the requirement.

[0045] In an embodiment, the system 102 can be configured to receive one or more videos from one or more of image capturing units 108 mounted at one or more locations in at least one area installed with one or more devices. The one or more videos pertains to recording of one or more regions of interest in the at least one area. The one or more image capturing units can include, but not limited to: a digital imaging device, a CCTV imaging device, a web camera, a drone camera, a handy Cam, and the likes. The one or more image capturing units may comprise of at least

one internet protocol (IP) camera accessible across a Local Area Network (LAN). The at least one region of interest can include, but not limited to: a classroom, a laboratory, a meeting hall, a library, a study room, a waiting room, a hallway, a living room, and the likes. The at least one area can include, but not limited to: a school, a college, a house, a government office, a private office, and the likes. The one or more videos from one or more of image capturing units can include, but not limited to: a live streaming video, a recorded video, and the likes.

[0046] In an embodiment, the system 102 can be configured to process the one or more videos by at least one edge computing device 308 to detect the presence of at least one user, and to obtain a count of the at least one user present at the one or more regions of interest in the at least one area. The edge computing device 308 is configured to processes the one or more video at the server and streams the processed information of count of the at least one user to the cloud database unit. The one or more videos is processed by at least one deep learning technique to detect the presence of the at least one user.

[0047] In an embodiment, the system 102 can be configured to transfer the count of the at least one user to at least one cloud database unit 408. Further, activate at least one user interface unit 406 by at least one user interface application to control the one or more devices installed in the at least one area based on the count of the at least one user. the cloud database unit 408 may comprise of a cloud database and a cloud server. The cloud database can be configured for storing the processed data. The cloud server can be configured for hosting the web servers for the at least one user interface applications. The at least one user interface unit 406 may comprise of at least one device controlling panel to control the one or more devices based on the count of the at least one user 106. The at least one user interface application can include, but not limited to: a mobile based application, a web-based application, and the likes.

[0048] In an embodiment, the system 102 can be configured to perform at least one action on the one or more devices by the at least one user interface application based on the count of the at least one user. Further, facilitates control of the one or more devices installed in the at least one area. The at least one action performed on the

one or more devices can include but not limited to: a switch off state and a switch on state based on the presence of the at least one user. The one or more devices operate in the switch off state, if the at least one user's presence is not detected in the one or more regions of interest. The one or more devices operate in the switch on state, if the at least one user's presence is detected in the one or more regions of interest.

[0049] Although FIG. 1 shows exemplary components of the network architecture 100, in other embodiments, the network architecture 100 may include fewer components, different components, differently arranged components, or additional functional components than depicted in FIG. 1. Additionally, or alternatively, one or more components of the network architecture 100 may perform functions described as being performed by one or more other components of the network architecture 100.

[0050] FIG. 2 illustrates architecture of the proposed surveillance-based device control system 102, in accordance with an embodiment of the present disclosure.

[0051] In an aspect, referring to FIG. 2, the system 102 may comprise one or more processor(s) 202. The one or more processor(s) 202 may be implemented as one or more microprocessors, microcomputers, microcontrollers, edge or fog microcontrollers, digital signal processors, central processing units, logic circuitries, and/or any devices that process data based on operational instructions. Among other capabilities, the one or more processor(s) 202 may be configured to fetch and execute computer-readable instructions stored in a memory 204 of the system 102. The memory 204 may be configured to store one or more computer-readable instructions or routines in a non-transitory computer readable storage medium, which may be fetched and executed to create or share data packets over a network service. The memory 204 may comprise any non-transitory storage device including, for example, volatile memory such as Random Access Memory (RAM), or non-volatile memory such as Erasable Programmable Read-Only Memory (EPROM), flash memory, and the like.

[0052] Referring to FIG. 2, the system 102 may include an interface(s) 206. The interface(s) 206 may comprise a variety of interfaces, for example, interfaces for

data input and output devices, referred to as I/O devices, storage devices, and the like. The interface(s) 206 may facilitate communication to/from the system 102. The interface(s) 206 may also provide a communication pathway for one or more components of the system 102. Examples of such components include, but are not limited to, processing unit/engine(s) 208 and a local database 210.

[0053] In an embodiment, the processing unit/engine(s) 208 may be implemented as a combination of hardware and programming (for example, programmable instructions) to implement one or more functionalities of the processing engine(s) 208. In examples described herein, such combinations of hardware and programming may be implemented in several different ways. For example, the programming for the processing engine(s) 208 may be processor-executable instructions stored on a non-transitory machine-readable storage medium and the hardware for the processing engine(s) 208 may comprise a processing resource (for example, one or more processors), to execute such instructions. In the present examples, the machine-readable storage medium may store instructions that, when executed by the processing resource, implement the processing engine(s) 208. In such examples, the system 102 may comprise the machine-readable storage medium storing the instructions and the processing resource to execute the instructions, or the machine-readable storage medium may be separate but accessible to the system 102 and the processing resource. In other examples, the processing engine(s) 208 may be implemented by electronic circuitry.

[0054] In an embodiment, the local database 210 may comprise data that may be either stored or generated as a result of functionalities implemented by any of the components of the processor 202 or the processing engines 208. In an embodiment, the local database 210 may be separate from the system 102.

[0055] In an exemplary embodiment, the processing engine 208 may include one or more engines selected from any of a video acquisition module 212, a video processing and user detection module 214, a user interface activation module 216, a device action module 218, and other modules 220 having functions that may include but are not limited to testing, storage, and peripheral functions, such as wireless communication unit for remote operation, audio unit for alerts and the like.

[0056] In an embodiment, the video acquisition module 212 may include means of receiving one or more videos from one or more of image capturing units 108 mounted at one or more locations in at least one area installed with one or more devices. The one or more videos pertains to recording of one or more regions of interest in the at least one area.

[0057] In an embodiment, the video processing and user detection module 214 may be configured to process the one or more videos by at least one edge computing device 308 to detect the presence of at least one user 106. Further, the video processing and user detection module 214 may be configured to obtain a count of the at least one user present at the one or more regions of interest in the at least one area.

[0058] In an embodiment, the user interface activation module 216 may be configured to transfer the count of the at least one user to at least one cloud database unit 408. Further, the user interface activation module 216 may be configured to activate at least one user interface unit 406 by at least one user interface application. Further, the at least one user interface application controls the one or more devices installed in the at least one area based on the count of the at least one user.

[0059] In an embodiment, the device activation module 218 may be configured to perform at least one action on the one or more devices by the at least one user interface application based on the count of the at least one user. Further, the device activation module 218 may be configured to facilitate control of the one or more devices installed in the at least one area.

[0060] FIG. 3 illustrates an exemplary block diagram 300 of the hardware module of the surveillance-based device control system 102 in a hybrid computing configuration, in accordance with an embodiment of the present disclosure.

[0061] In an embodiment, referring to FIG. 3, the exemplary block diagram 300 of the hardware module of the surveillance-based device control system 102 in a hybrid computing configuration. The hardware module may comprise of one or more regions of interest 302-1 and 302-2, at least one edge computing device 308, at least one local host server room 310 and at least one receiver 312. The one or more regions of interest 302-1 and 302-2 may comprise of the one or more image

capturing units 108-1 and 108-2. Further, the one or more regions of interest 302-1 and 302-2 may comprise of one or more devices 304-1, 304-2, 304-3 and 304-4. Further, the one or more regions of interest 302-1 and 302-2 may comprise of at least one device controlling panel 306-1 and 306-2. The at least one local host server room 310 may comprise of a storage database 310-1, a local host server 310-2, and an operator console 310-3. The at least one device control panel 306-1 may comprise of an IoT processing system 402-1 at least one control switch 404-1 connected to the one or more devices 304-1. Further, the one or more image capturing units 108-1 and 108-2 may comprise of internet protocol (IP) cameras accessible across the LAN.

[0062] FIG. 4 illustrates an exemplary functional block diagram 400 of the cloud database unit with the device controlling panel in the surveillance-based device control system 102, in accordance with an embodiment of the present disclosure.

[0063] In an embodiment, referring to FIG. 4, exemplary functional block diagram 400 of the cloud database unit with the device controlling panel in the surveillance-based device control system 102. The functional block diagram 400 may comprise of the at least one cloud database unit 408, the at least one user interface unit 406, and the at least one device controlling panel 306-1, 306-2 and 306-3 at one or more regions of interest. The at least one device control panel 306-1 may comprise of an IoT processing system 402-1 at least one control switch 404-1 connected to the one or more devices 304-1. The at least one device control panel 306-2 may comprise of an IoT processing system 402-2 at least one control switch 404-2 connected to the one or more devices 304-3. The one or more videos from the one or more image capturing units is received from the edge computing device 308 using the LAN and Wi-Fi. The video stream can be retrieved, viewed, and analyzed in the at least one cloud database unit 408 comprising of a storage database 408-1, and a cloud server 408-2. The cloud database unit 408 receives the processed information regarding the count of the at least one user 106 in one or more regions of interest through receiver from the local host server 310-2 and from the at least one edge computing device 308. The cloud database 408 may store real-time information, and the cloud server 408-2 may coordinate the operations with at least one user interface unit 406

with the remote servers of mobile application 406-1 and/or web applications 406-2.

[0064] In an embodiment, referring to figure 4, wireless connectivity establishes communication between the at least one cloud database unit 408 and the at least one user interface unit 406. The user 106 can manage the devices and monitor the events using user interface 406. The user interface unit 406 comprises a mobile application in mobile 406-1 and a web application running on a computer 406-2.

[0065] In an exemplary embodiment, in the device control system 102, the user can have two types of video surveillance applications: a live video streaming (LVS) and a recorded video review (RVR) to detect the presence of the at least one user 106. Information regarding the device control for the respective regions of interest may streamed to the corresponding device-controlling panels 306-1, 306-2 and 306-3. In an instance, the processed data on the count of the at least one user 106 may receive by the device controlling panel 306-1 through a wireless Wi-Fi connection. The controlling panel 306-1 may comprise of the IoT processing system (micro-controller unit (MCU)) 402-1 receives the processed data from the cloud database unit 408 using wireless communication and the corresponding devices 304-1 is controlled by the control switch 404-1.

[0066] FIG. 5 illustrates an exemplary view of a flow diagram of the proposed method 500 for surveillance-based device control, in accordance with an embodiment of the present disclosure.

[0067] In an embodiment, referring to FIG. 5, an exemplary view of a flow diagram of the proposed method 500 for surveillance-based device control. The method 502-1 the exemplary view of a flow diagram for surveillance-based device control emphasising the cloud database unit-based data updating and data reading. The data on the count of the user is updated to the cloud database unit and the device control panel reads the data from the cloud database unit 408. At step 504, the system 102, starts the process for surveillance-based device control. At step 506, the system 102, captures surveillance video from the one or more regions of interest 302-1 and 302-2 streamed through the one or more image capturing units 108 using Wi-Fi network and LAN. At step 508, the system 102, segments the one or more regions of interest

based on the one or more devices 304-1, 304-2,304-3 and 304-4 to be controlled. At step 510, the system processes the video streams from step 506 for detecting the presence of the at least one user 106. At step 512, the system checks the presence of the user 106. If presence of the user detected at 512-1 the system may obtain the count of the user and increment the count density at step 514. At step 516, the system 102, may update the count of the user 106 from the one or more regions of interest to the cloud database unit 408.

[0068] Further, at step 518, the system 102, the count of the user updated in the cloud database unit 408 is read by the device controlling panels. At step 520, the system 102, may check if the count of the user is greater than or equal to 1. If the count of the user 106 is found to be greater than or equal to 1 at step 520-1, the system 102, may proceed to the step 522 and the corresponding devices are controlled by the device controlling panel. The device controlling panel may keep the functional devices present in the one or more regions of interest in the switch on state. During the presence of the user, if the user gives the instructions to controls the device manually at step 524, the corresponding action for controlling the device is performed at step 526. If the count of the user 106 is not found to be greater than or equal to 1 at step 520-2, the system 102, may proceed to the step 510 and further, process the video streams to detect the presence of the user 106 in another instant of time. If presence of the user not detected at 512-2 the system may proceed to the step 528 and switch off all the devices in the region of interest. Further, the system 102, continues to the step 510 to check for the presence of user 106.

[0069] In an embodiment, referring to FIG. 5, method 502-2 the exemplary view of a flow diagram for surveillance-based device control emphasising the edge computing device-based data updating and data reading. The data on the count of the user is updated to the edge computing device and the device control panel reads the data from the edge computing device 308 acting as the IoT cloud. At step 504, the system 102, starts the process for surveillance-based device control. At step 506, the system 102, captures surveillance video from the one or more regions of interest 302-1 and 302-2 streamed through the one or more image capturing units 108 using Wi-Fi network and LAN. At step 508, the system 102, segments the one or more

regions of interest based on the one or more devices 304-1, 304-2,304-3 and 304-4 to be controlled. At step 510, the system processes the video streams from step 506 for detecting the presence of the at least one user 106. At step 512, the system checks the presence of the user 106. If presence of the user detected at 512-1 the system may obtain the count of the user and increment the count density at step 514. The system 102, may update the count of the user 106 from the one or more regions of interest to the to the edge computing device 308 at step 516, and to the IoT cloud at step 518.

[0070] Further, the count of the user updated in the edge computing device 308 from step 516 is read by the device controlling panels. At step 520, the system 102, may check if the count of the user is greater than or equal to 1. If the count of the user 106 is found to be greater than or equal to 1 at step 520-1, the system 102, may proceed to the step 522 and the corresponding devices are controlled by the device controlling panel. The device controlling panel may keep the functional devices present in the one or more regions of interest in the switch on state. During the presence of the user, if the user gives the instructions to controls the device manually at step 524, the corresponding action for controlling the device is performed at step 526. If the count of the user 106 is not found to be greater than or equal to 1 at step 520-2, the system 102, may proceed to the step 510 and further, process the video streams to detect the presence of the user 106 in another instant of time. If presence of the user not detected at 512-2 the system may proceed to the step 528 and switch off all the devices in the region of interest. Further, the system 102, continues to the step 510 to check for the presence of user 106.

[0071] FIG.6 illustrates an exemplary computer system in which or with which embodiments of the present disclosure can be utilized, in accordance with embodiments of the present disclosure.

[0072] Referring to FIG. 6, computer system includes an external storage device 610, a bus 620, a main memory 630, a read only memory 640, a mass storage device 650, communication port 660, and a processor 670. A person skilled in the art will appreciate that computer system may include more than one processor and communication ports. Examples of processor 670 include, but are not limited to, an

Intel® Itanium® or Itanium 2 processor(s), or AMD® Opteron® or Athlon MP® processor(s), Motorola® lines of processors, FortiSOC™ system on a chip processors or other future processors. Processor 670 may include various modules associated with embodiments of the present disclosure. Communication port 660 can be any of an RS-232 port for use with a modem based dialup connection, a 10/100 Ethernet port, a Gigabit or 10 Gigabit port using copper or fiber, a serial port, a parallel port, or other existing or future ports. Communication port 660 may be chosen depending on a network, such a Local Area Network (LAN), Wide Area Network (WAN), or any network to which computer system connects.

[0073] In an embodiment, the memory 630 can be Random Access Memory (RAM), or any other dynamic storage device commonly known in the art. Read only memory 640 can be any static storage device(s) e.g., but not limited to, a Programmable Read Only Memory (PROM) chips for storing static information e.g., start-up or BIOS instructions for processor 670. Mass storage 660 may be any current or future mass storage solution, which can be used to store information and/or instructions. Exemplary mass storage solutions include, but are not limited to, Parallel Advanced Technology Attachment (PATA) or Serial Advanced Technology Attachment (SATA) hard disk drives or solid-state drives (internal or external, e.g., having Universal Serial Bus (USB) and/or Firewire interfaces), e.g. those available from Seagate (e.g., the Seagate Barracuda 7102 family) or Hitachi (e.g., the Hitachi Deskstar 7K1000), one or more optical discs, Redundant Array of Independent Disks (RAID) storage, e.g. an array of disks (e.g., SATA arrays), available from various vendors including Dot Hill Systems Corp., LaCie, Nexsan Technologies, Inc. and Enhance Technology, Inc.

[0074] In an embodiment, the bus 620 communicatively couples processor(s) 670 with the other memory, storage and communication blocks. Bus 620 can be, e.g. a Peripheral Component Interconnect (PCI) / PCI Extended (PCI-X) bus, Small Computer System Interface (SCSI), USB or the like, for connecting expansion cards, drives and other subsystems as well as other buses, such a front side bus (FSB), which connects processor 670 to software system.

[0075] In another embodiment, operator and administrative interfaces, e.g. a display, keyboard, and a cursor control device, may also be coupled to bus 620 to support direct operator interaction with computer system. Other operator and administrative interfaces can be provided through network connections connected through communication port 660. External storage device 610 can be any kind of external hard-drives, floppy drives, IOMEGA® Zip Drives, Compact Disc - Read Only Memory (CD-ROM), Compact Disc - Re-Writable (CD-RW), Digital Video Disk - Read Only Memory (DVD-ROM). Components described above are meant only to exemplify various possibilities.

[0076] If the specification states a component or feature "may", "can", "could", or "might" be included or have a characteristic, that particular component or feature is not required to be included or have the characteristic.

[0077] As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

[0078] It is to be appreciated by a person skilled in the art that while various embodiments of the present disclosure have been elaborated for a surveillance-based device control system and method thereof. However, the teachings of the present disclosure are also applicable for other types of applications as well, and all such embodiments are well within the scope of the present disclosure. However, the surveillance-based device control system and method thereof is also equally implementable in other industries as well, and all such embodiments are well within the scope of the present disclosure without any limitation.

[0079] Accordingly, the present disclosure provides a surveillance-based device control system and method thereof.

[0080] Moreover, in interpreting the specification, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other

elements, components, or steps that are not expressly referenced. Where the specification claims refer to at least one of something selected from the group consisting of A, B, C….and N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

[0081] While the foregoing describes various embodiments of the disclosure, other and further embodiments of the disclosure may be devised without departing from the basic scope thereof. The scope of the disclosure is determined by the claims that follow. The disclosure is not limited to the described embodiments, versions or examples, which are included to enable a person having ordinary skill in the art to make and use the disclosure when combined with information and knowledge available to the person having ordinary skill in the art.

ADVANTAGES OF THE PRESENT DISCLOSURE

[0082] The present disclosure provides a surveillance-based device control system and method thereof.

[0083] The present disclosure provides a system and method which provides automated mechanism to control functional states of the devices based detecting the presence of user in real-time within the surroundings.

[0084] The present disclosure provides a system and method which uses surveillance cameras to control the devices without the need for additional system control devices.

[0085] The present disclosure provides a system and method which implements an intelligent device control action thereby contributing to energy consumption.

[0086] The present disclosure provides a system and method which eliminates usage of control devices such as sensors and remotes in device automation.

We Claim:

1. A surveillance-based device control system (102), the system (102) comprising:

one or more processors (202); and

a memory coupled to the one or more processors (202), wherein said memory (204) stores instructions which when executed by the one or more processors (202) cause the system (102) to:

receive one or more videos from one or more of image capturing units (108) mounted at one or more locations in at least one area installed with one or more devices, wherein the one or more videos pertains to recording of one or more regions of interest in the at least one area;

process the one or more videos by at least one edge computing device (308) to detect the presence of at least one user (106), and obtain a count of the at least one user present at the one or more regions of interest in the at least one area;

transfer the count of the at least one user to at least one cloud database unit (408), and activate at least one user interface unit (406) by at least one user interface application to control the one or more devices installed in the at least one area based on the count of the at least one user; and

perform at least one action on the one or more devices by the at least one user interface application based on the count of the at least one user, and facilitate control of the one or more devices installed in the at least one area.

2. The system (102) as claimed in claim 1, wherein the one or more image capturing units (108) comprises at least one of a digital imaging device, a CCTV imaging device, a web camera, a drone camera, and a handy Cam,

wherein the at least one region of interest comprises of at least one of a classroom, a laboratory, a meeting hall, a library, a study room, a waiting room, a hallway and a living room,

wherein the at least one area comprises of at least one of a school, a college, a house, a government office, and a private office.

3. The system (102) as claimed in claim 1, wherein the one or more devices comprises of at least one of a light, a fan, an air-conditioner, a room heater, a television, a radio, and a table lamp.

4. The system (102) as claimed in claim 1, wherein the one or more videos from one or more of image capturing units comprises of a live streaming and a recorded video,

wherein the one or more videos is accessible to the at least one user by at least one of a Local Area Network (LAN) and a Wireless-Fidelity (Wi-Fi) link,

wherein the one or more videos is processed by at least one deep learning technique to detect the presence of the at least one user,

wherein the one or more image capturing units comprises of at least one internet protocol (IP) camera accessible across the LAN.

5. The system (102) as claimed in claim 1, wherein the edge computing device (308) is configured to processes the one or more video at the server and streams the processed information of count of the at least one user to the cloud database unit.

6. The system (102) as claimed in claim 1, wherein the cloud database unit (408) comprises of a cloud database and a cloud server,

wherein the cloud database is configured for storing the processed data,

wherein the cloud server is configured for hosting the web servers for the at least one user interface applications.

7. The system (102) as claimed in claim 1, wherein the at least one user interface unit (406) comprises of at least one device controlling panel to control the one or more devices based on the count of the at least one user (106).

8. The system (102) as claimed in claim 1, wherein the at least one user interface application comprises of at least one of a mobile based application and a web-based application.

9. The system (102) as claimed in claim 1, wherein the at least one action performed on the one or more devices comprises at least one of a switch off state and a switch on state based on the presence of the at least one user,

wherein the one or more devices operate in the switch off state, if the at least one user's presence is not detected in the one or more regions of interest, and wherein the one or more devices operate in the switch on state, if the at least one user's presence is detected in the one or more regions of interest.

10. A method (500) for surveillance-based device control, the method (500) comprising:

receiving, by the system (102), one or more videos from one or more of image capturing units (108) mounted at one or more locations in at least one area installed with one or more devices, wherein the one or more videos pertains to recording of one or more regions of interest in the at least one area;

processing, by the system (102), the one or more videos by at least one edge computing device (308) to detect the presence of the at least one user (106), and obtain a count of the at least one user present at the one or more regions of interest in the at least one area;

transferring, by the system (102), the count of the at least one user to at least one cloud database unit (408), and activate at least one user interface unit (406) by at least one user interface application to control the one or more devices installed in the at least one area based on the count of the at least one user; and

performing, by the system (102), at least one action on the one or more devices by the at least one user interface application based on the count of the at least one user, and facilitate control of the one or more devices installed in the at least one area.

For VIT-AP University

Tarun Khurana

Regd. Patent Agent [IN/PA-1325]

Dated: 19th December, 2023

ABSTRACT

A SURVEILLANCE-BASED DEVICE CONTROL SYSTEM AND METHOD THEREOF

Present disclosure discloses a surveillance-based device control system (102) and method thereof. System (102) receives one or more videos from one or more of image capturing units mounted at one or more locations in at least one area installed with one or more devices. The one or more videos pertains to recording of one or more regions of interest in the at least one area. System (102) processes the videos to detect the presence of the user and obtain a count of the user present at the region of interest. System (102) transfers the count of the user to cloud database unit and activate user interface unit to control the devices installed in the at least one area based on the count of the at least one user. System (102) performs at least one action on the devices by a user interface application, and facilitate control of the devices.

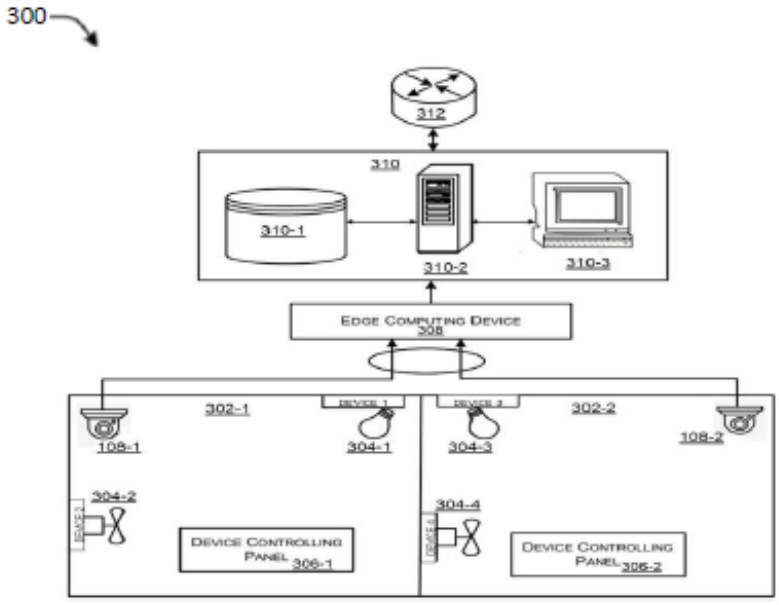

FIG. 3

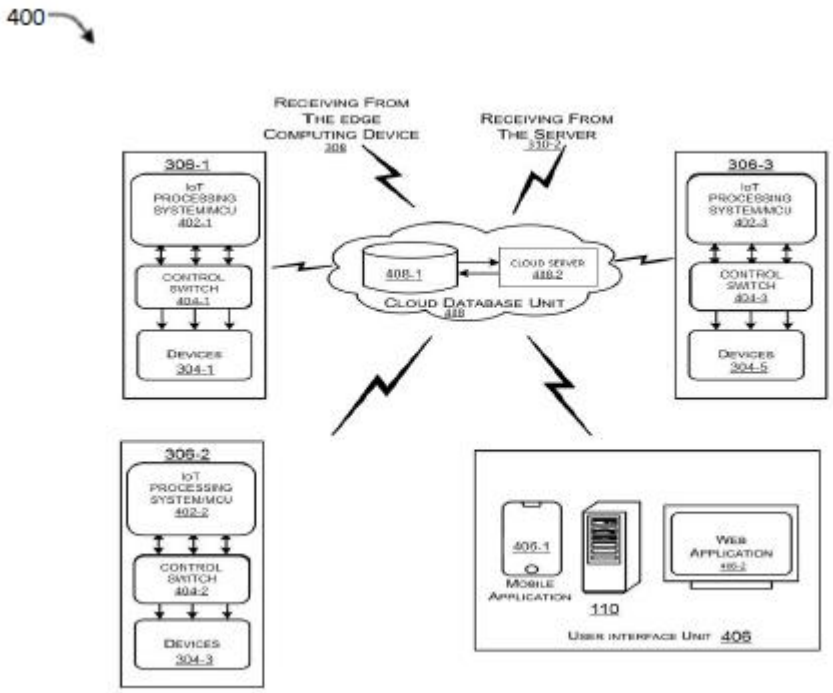
400
RECEIVING FROM THE EDGE COMPUTING DEVICE
308
RECEIVING FROM THE SERVER
310-2
306-1
IoT PROCESSING SYSTEM/MCU
402-1
CONTROL SWITCH
404-1
DEVICES
304-1
408-1
CLOUD SERVER
410-2
CLOUD DATABASE UNIT
410
306-3
IoT PROCESSING SYSTEM/MCU
402-3
CONTROL SWITCH
404-3
DEVICES
304-5
306-2
IoT PROCESSING SYSTEM/MCU
402-2
CONTROL SWITCH
404-2
DEVICES
304-3
406-1
MOBILE APPLICATION
110
WEB APPLICATION
406-2
USER INTERFACE UNIT 406

FIG. 4