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(54) **SYSTEM AND METHOD FOR MANAGING AND MONITORING LIFTING SYSTEMS AND BUILDING FACILITIES**

(57) It is provided an intelligent automatic remote system for optimizing tension profile and power consumption of a lifting system. The intelligent automatic remote system comprises load sensors for collecting lift operation data such as cable tension profile, power consumption and loading of the lifting system. The system further comprises a load control unit for controlling the movement of a plurality of lifts and lift equipment in the lifting system; adjustable counterweights for balancing the loading conditions of lift cars; a regenerative energy storage assembly is used to store electrical energy re-

generated during movement of lift cars and/or counterweights and feed the stored electrical energy into electric motors actuating the movement of lift cars. The system further comprises a smoke ventilation system working with the fire sensors. The smoke ventilation system includes permanent ports being located above the lift shafts and installed with solar thermal-energy exchange windows; wherein the solar thermal-energy exchange windows are closed to perform energy generation at normal situations and automatically opened to act as ventilation ports when there is a fire.

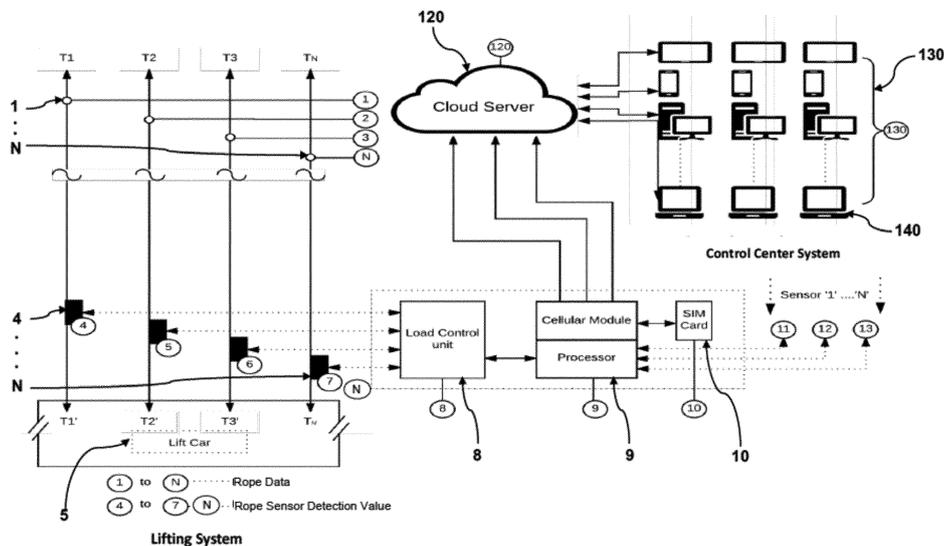


Fig. 2

Description**TECHNICAL FIELD**

5 **[0001]** The present invention relates to a management, monitoring, and reporting system for monitoring the conditions of a lifting system, optimizing tension profile and power consumption of the lifting system and other building facilities. Further, the present invention related to estimating life cycles of the lifting system for Lift Maintenance and Measure Audit report (LMAR).

BACKGROUND

10 **[0002]** Across the city of the world, energy efficiency of buildings has become a "major Task", with Architects, Engineers, Planners, Developer, and Builders proposing more and more "passive" and low energy buildings' with a much lower consumption of energy for all functions such as heating, air-conditioning, lighting or other services of all kinds. It goes as far as proposing "energy- positive" buildings producing more energy than they consume. The trend is clear in all types of constructions, from the individual house to the residential complex from the industrial hall to the administrative building. The soaring cost of energy is the prime reason for this rapid evolution. Moreover, the increased consciousness brought by the debate on Climate Change and the perception that fossil fuels are limited in time' has made it that it has become a main priority for the construction sector. The concentration of Carbon Dioxide CO₂, the culprit of global warming has increased by over 40 per Cent since pre-industrial times. The increase is primarily due to burning of fossil fuels and secondarily due to deforestation. Its present- day concentration is the highest in the last 800,000 years. One of the toughest challenges we have for a sustainable future is to reduce consumption of raw material.

15 **[0003]** Lift cars are usually attached to a number of rope and/or cable that is rove over a sheave and attached at the other end to a counterweight. An Auditor having the Lift car in view may communicate desired Data to who is typically located in the machine room at top the Lift shaft. Going back to Rope and/or cable systems. Since the time man has occupied more than one floor of a building, he has given consideration to some form of vertical movement. The daily fight to overcome gravity, led man to explore and develop various technology sectors in order to improve the quality of life. The simplest way to lift a mass is to hold it and use one's strength to lift it. We have done a lot in terms of lifting speed and practicality, but the physical commitment is still needed. Therefore , the basic elements needed to make a rope system, are the load support , evenly driven, a suspension means(the ropes) and a lifting machine located at a high position. There are various layouts for rope system, such overhead, bottom drive, single wrap, Double wrap, with compensation ropes or without etc., energy, cost so implemented.

20 **[0004]** Rope and/or cable tensioning uneven setting and rove over a sheave intend several cost and safety problems, the fact that a wear-minimizing setting of the rope tensions by conventional means is hardly possible. Regarding methods for tensioning, even if the workers are able to measure the tension of each rope, the setting be perform by trial and error, the human senses approach the optimal rope adjustment the rope set by tightening or relaxing each rope several times in small increments. This procedure costs a lot of time with rope sets. A Lift installation with various load distributions in the rope set during the ride, cannot be considered to feature ideal rope tensions. Setting the rope tensions the best possible way as such a system can be adjusted optimally. Then the rope load can be measured on the drive and then displayed and evaluated in the sensor suite. As a result, the user receives the optimal rope tension values, which, when executed, get the smallest possible wear of the ropes caused by the individual rope tensions. The rope setting should be checked periodically, since the load distribution in the rope set may well change over time. One of the problems to be carefully evaluated by the designer of a traction lifts is the uncontrolled movement of the car due to the loss or excess of traction of the ropes in the pulley grooves of the traction sheave. In fact, the clause 1.4.4 of the Lifts Directive 95/ 16/ EC establish that requirement.

SUMMARY OF INVENTION

25 **[0005]** According to some aspects of the invention, it is provided an intelligent automatic remote system and method to assist responsible persons for lifts e.g. building owners and management agencies, lift supplier, lift maintenance contractors to engage lift maintenance audit. The intelligent automatic remote system can be considered an important tool in the hands of the building operations personnel to provide more effective and efficient control lift systems and they are capable of maintaining acceptable environmental conditions in Lift system and can perform some relatively complex control sequences. However, since they are hardware-intensive, the initial installation costs and maintenance requirements can be substantial. There are also problems of limited accuracy, mechanical wear and inflexibility. The intelligent automatic remote system can minimize the number of hours the elevator is out of order. It can also minimize the following:

(a) Maintenance time.

(b) Time required for repairing elevator

5 [0006] According to some aspects of the invention, it is provided an intelligent automatic remote system comprising a plurality of load sensors, being installed on a plurality of suspension means being dragged by a plurality of tracking pulleys in a lifting system, for collecting lift operation data such as cable tension profile, power consumption and loading of the lifting system; a load control unit for controlling the movement of a plurality of lift cars in the lifting system; a processor, being connected to the load control unit, for executing a various of operations to optimize the load distribution in the suspension means and power consumption of the lifting system; a server for receiving and storing the lift operation data; a communication module being integrated with the processor and connected to the server; and a control center system, including a plurality of network user interfaces, for accessing the internet server so as to form an intelligent system. The intelligent automatic remote system may further comprise a plurality of noise sensors, for detecting whether the tension of the suspension means is evenly distributed.

10 [0007] According to some aspects of the invention, each of the load sensors are integrated with wire or wireless transmitters for transmitting the lift operation data to the load control unit; each of the noise sensors are integrated with wire or wireless transmitter for transmitting the noise data to the load control unit; and the load control unit is integrated with wire or wireless transceivers for receiving lift operation data from the load sensors and transmitting control signals to a motor control panel.

15 [0008] According to some aspects of the invention, the intelligent automatic remote system further comprises a plurality of adjustable counterweights for balancing the loading conditions of lift cars; a plurality of electric motors for actuating the movement of lift cars; a plurality of regenerative energy storage assemblies for storing the electrical energy regenerated during movement of lift cars and/or counterweights and feeding the stored electrical energy into the lifting system, electricity distribution network; and/or a main isolator.

20 [0009] According to some aspects of the invention, the intelligent automatic remote system may further include a plurality of metering devices for interfacing with load sensors; a plurality of electrical power supplies, being interlinked with a plurality of motor control panels and the regenerative energy storage assemblies. Each of the electrical power supplies comprises a plurality of isolating switches for switching the power supply to motor control panel between the regenerative energy storage assemblies and the electrical supply circuit of the building; and a section of the conduction for hooking on of current transformer (CT) clamps for interfacing with the metering devices.

25 [0010] According to some aspects of the invention, the intelligent automatic remote system further comprises a plurality of optical intelligent systems, which may be installed at lift shafts, lift machine rooms and lift equipment or any other locations in or out of the building. The optical intelligent systems may comprise inertial or non-inertial cameras, for animating and tracing the elevating trips of the lift cars; and 3D cameras for recording flow of passengers in the lifting system.

30 [0011] According to some aspects of the invention, the intelligent automatic remote system further comprises a plurality of door sensors, being installed in the lift cars, for detecting whether doors of the lift cars are opened or closed; and a plurality of hoist brakes, guide stoppers, machine holders, and/or rope grippers or similar means, wherein each of the hoist brake is urged to hold a lift car when the door sensor in said lift car detects that the door of said lift car door is opened.

35 [0012] According to some aspects of the invention, the intelligent automatic remote system further comprises a plurality of fire sensors, being installed in a plurality of lift shafts, for detecting the presence of a flame or fire and transmitting the detected signals to the load control unit; a smoke ventilation system; wherein the load control unit automatically initiates the operation of a smoke ventilation system and moves the lift cars to a safety floor when there is a fire.

40 [0013] According to some aspects of the invention, the smoke ventilation system includes a plurality of ventilation ports being located above the lift shafts, wherein the ventilation ports are powered with solar energy and/or battery and automatically opened when there is a fire.

45 [0014] According to some aspects of the invention, the smoke ventilation system includes a plurality of permanent ports being located above the lift shafts and installed with solar thermal-energy exchange windows, louver, vent, and/or similar means; wherein the solar thermal-energy exchange windows and/or similar means are closed to perform energy generation at normal situations and automatically opened to act as ventilation ports when there is a fire.

50 [0015] According to some aspects of the invention, the smoke ventilation system further includes a plurality of buttons, being located at stairs and/or corridors of the building; wherein the load control unit are triggered to initiate the operation of the smoke ventilation system and move lifts to a safety floor when one of the buttons is pressed.

55 [0016] According to some aspects of the invention, a method is provided for optimizing tension profile and power consumption of the lifting system comprising steps: collecting, with the load sensors, lift operation data such as cable tension profile, power consumption and loading of the lifting system; detecting, with a plurality of noise sensors, whether the tension of the suspension means is evenly distributed; balancing, with a plurality of adjustable counterweights, the loading conditions of lift cars; adjusting the parallelism of the tracking pulleys; storing, with a regenerative energy storage assembly, electrical energy regenerated during movement of lift cars and/or counterweights; and feeding, with the regenerative energy storage assembly, the stored electrical energy into electric motors actuating the movement of lifts.

5 [0017] According to some aspects of the invention, a method is provided for estimating life cycle of a lifting system in a premise for lift maintenance and auditing comprising steps: recording, with a plurality of 3D cameras, flow of passengers in the lifting system; determining size, distribution and movement pattern of population in the premise; determined the required capacity of vertical transportation; dividing floors of the premises into clusters of stops to be served by different lift cars to improve efficiency of the lifting system; and estimating the life cycles of the lifting system for lift maintenance and auditing.

10 [0018] In connected above , as lift (elevator) might have been installed inside the Lift shaft or any location all over the world such as vessel, building etc. whereby be connected by IT interface via cellular wireless communication module, such as GPRS (general packet radio service) system or similar means to form a lift remote , reporting, Maintenance, audit and measure system.

15 [0019] Lift operation auditing with internet of things (IOT) technology, we consider the internet of things as an area of innovation and growth, as the IOT continuous to develop, related technology such as sensors, cloud computing, internet & big data could be combined for lift service enhancement. The present invented method help to collecting lift operating data such as suspension, running mode and energy consumption etc. in order to perform lift system auditing and monitoring.

[0020] The present invention relates the measure patterns of IOT module upload sensor data and/or detecting data (especially apply to the lift equipment(s) located inside lift machine room, lift shaft, lift car, lift pit, lift machine, brake, etc.) to Cloud and present to user(s) by web user interface (UI) produces internet of systems.

20 [0021] The present invention pertains to lift operation data remote audit and more particularly, to apparatus for the remote network system can be integrated to cellular connected but not limited to Wi-Fi, GPRS, 3G/ 4G/ 5G, NB-IoT, LoRa, Sigfox etc. thereof.

[0022] The present invention includes cloud server (120) comprising but not limited to :

- 25 i. database,
- ii. web hosting,
- iii. data analysis engine and represent the data by HTML format etc.,
- iv. (130) Device can access (120) by web user interface (UI) with SSL connection include but not limited to:
- v. Personnel Computer (PC)
- vi. Notebook
- 30 vii. Mobile etc.,

35 [0023] The present invention enhances maintenance and remote audit measures to prevent rope breakages. The invented method and apparatus may include a processor. The processor may be configured to provide an index that is based on the infrastructure change identifier, the device identifier and the application identifier. The index may correspond to a predicted failure rate for the infrastructure change.

40 [0024] The present invention disclose preventive method to ensure all lift ropes under operation are in safe working order and effect reporting No of rope replacement in progress or begin planned. The invented method and apparatus may include machine readable memory that is configured to store a data object. The data object may include an infrastructure change identifier, corresponding to an infrastructure change, a device identifier that identifies a device that is associated with the change, and an application identifier that identifies a program that is associated with the change.

45 [0025] The present invention to provide intelligence and calculate the rope life time for uneven tensioned rope in order to improve safety. The apparatus may include machine readable memory that is configured to store a data object. The data object may include an infrastructure change identifier, corresponding to an infrastructure change, the detector and/or sensor identifier that identifies a system that is associated with the change, and an application identifier that identifies a program that is associated with the change.

50 [0026] The present invention solve out the problem to record the individual rope performance and automatic to furnish report via internet. Apparatus and methods for reducing infrastructure failure rates are provided. Infrastructure may include hardware, software, sensor, network, component, equipment, system, processes, information, applications, programs, circuits, schedules, instruments, cost and audit unit, structures, roadways, transportation systems or any other types of infrastructure.

55 [0027] The present invention solve out the problem auditors directly examine auditee systems, review documents without auditee assistance, conduct onsite visits without auditee participation, complete checklists without auditee assistance, analyze information without auditee assistance, collect samples without auditee participation, observe work without auditee assistance. ISO 19011 expects either audit program managers or audit team leaders to be responsible for planning which audit methods and such as ISO 14064 and Building Information Model (BIM) should be used and how they should be used as efficiently and effectively as possible.

[0028] In accordance to one aspect of the present invention, provided is a system for monitoring operations of a lifting system comprising one or more lifts and one or more counterweights, comprising: one or more load sensors, each

installed on a suspension means or lift equipment, for collecting lift operation data comprising tension profile, power consumption, and loading of the lift, wherein the suspension means comprises one or more ropes, cables and one or more tracking pulleys; a load control unit for controlling the movement of the lifts; a processor, electrically connected to the load control unit, configured to execute an optimization process to optimize load distribution in the suspension means and the power consumption of the lift; one or more remote processors configured to receive and store the lift operation data; a communication module, electrically connected to the processor, for communicating with the remote processors and a control center; and the control center comprising one or more networked user interfaces, for accessing and retrieving data from the remote processors.

[0029] In accordance to one embodiment, the aforesaid system further comprises a plurality of noise sensors for collecting noise data for determination of the load distribution evenness of the cables in the suspension means; wherein at least one of the load sensors is integrated with a wired or wireless transmitter for transmitting the lift operation data to the load control unit; wherein at least one of the noise sensors is integrated with a wired or wireless transmitter for transmitting the noise data to the load control unit; and wherein the load control unit is integrated with a wired or wireless transceivers for receiving lift operation data from the load sensors and transmitting data signals to the remote processors for audit control.

[0030] In accordance to another embodiment, the aforesaid system further comprises: one or more electric drives for actuating movements of the lift; one or more isolating switches, each installed between a motor control panel and an electrical power supply, for allocating currents to the electric drives according to the power consumption of the lifting system measured by the load sensors; and one or more regenerative energy storage assemblies, each respectively connected to one of the isolating switches, for storing electrical energy regenerated during movements of the lift cars and/or counterweights, and feeding the stored electrical energy into the lifting system or an electricity distribution network.

[0031] In accordance to another embodiment, the aforesaid system further comprises: one or more cameras, for capturing the lift movements and passenger flow for simulating the lift cars' flights; one or more door sensors, each installed in one of the lift, for detecting whether the lift car's doors are opened or closed; and one or more hoist brakes and braking means, wherein each of the hoist brake or braking means is urged to hold the lift car when the door sensor in the lift detects that the doors of the lift are opened.

[0032] In accordance to another embodiment, the aforesaid system further comprises one or more fire or smoke detectors, each installed in one of one or more lift shafts and building facilities for detecting presence of fire and transmitting a fire detection signal to the load control unit when the presence of fire is detected; a fire alarm system; wherein the load control unit automatically initiates the fire alarm operation; and wherein the fire alarm system operation comprises moving the lift cars to a safety floor when the fire detection signal is received.

[0033] In accordance to another embodiment, the aforesaid fire alarm system comprises one or more ventilation ports located above at least one of the lift shafts; wherein at least one of the ventilation ports is installed with a solar thermal-energy exchange window; wherein the solar thermal-energy exchange window; and wherein the solar thermal-energy exchange window is closed for energy generation under normal condition and caused to open for ventilation when the presence of fire is detected.

[0034] In accordance to another aspect of the present invention, provided is a system for monitoring and reporting one or more building facilities' life cycle, maintenance, and metrics audit, comprising: one or more sensing modules for collecting operation data of the one or more building facilities; one or more processors configured to: receive and store the collected operation data; simulating a building information model (BIM) of the building using the collected operation data; generate the one or more building facilities' life cycle, maintenance, and metrics audit reports using the collected operation data; compute a present carbon dioxide emission of the building; and predict a future carbon dioxide emission of the building.

[0035] In accordance to one embodiment, the aforesaid sensing modules comprise one or more load sensors, each installed on a suspension means in at least one of the lift for collecting lift operation data comprising cable tension profile, power consumption, and loading of the lift; one or more electrical transformers, each installed in an electrical power circuit of one of the building facilities for measuring electrical and/or voltage of the building facility's electricity consumption; one or more fire or smoke detectors, each installed in one of one or more lift shafts, for detecting presence of fire and transmitting a fire detection signal to the load control unit when the presence of fire is detected;

[0036] In accordance to another embodiment, the aforesaid system further comprises a fire alarm system comprising one or more ventilation ports located above the lift shafts, wherein the ventilation ports are caused to be opened when there is the presence of fire is detected; wherein the fire alarm system operation comprises moving the lifts to a safety floor when the fire detection signal is received.

[0037] In accordance to another embodiment, the aforesaid system further comprises one or more photovoltaic solar electricity generation units; wherein the photovoltaic solar electricity generation units comprise one or more building windows and building glass wall coated with transparent photovoltaic material and electrically connected to an electricity storage station; wherein aforesaid system further comprises a ventilation system comprising one or more ventilation ports located above at least one of the lift shafts; wherein at least one of the ventilation ports is installed with one or

more of the coated building windows; and

[0038] wherein the coated building windows installed at the ventilation ports are caused to open for heat dissipation; and wherein excess electricity generated by the coated building windows is redistributed into an electricity distribution network and tracked for carbon trading.

[0039] In accordance to another embodiment, the aforesaid system further comprises one or more solar thermal-energy exchange units comprising one or more building windows coated with transparent thermal absorbing material and connected to a thermal-electricity conversion layer; wherein the thermal-electricity conversion layer is a piezoelectric coating on the coated building window electrically connected to an electricity storage station; wherein the aforesaid system further comprises a ventilation system comprising one or more ventilation ports located above at least one of the lift shafts; wherein at least one of the ventilation ports is installed with one or more of the coated building windows; wherein the coated building windows installed at the ventilation ports are closed for energy generation from the lift shafts heat under normal condition and are caused to open for heat dissipation; and wherein excess electricity generated by the coated building windows is redistributed into an electricity distribution network and tracked for carbon trading.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] The problem to be solved of the invention will be apparent upon consideration of the following description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention. In the drawings, wherein like reference delineate similar elements throughout the several views:

FIG. 1 is a block diagram in accordance with the data operation and configuration of one embodiment of the intelligent automatic remote system;

FIG. 2 is an illustrative block diagram of one embodiment of the intelligent automatic remote system;

FIG. 3 is an illustrative diagram showing different running modes of a lifting system in one embodiment of the intelligent automatic remote system;

FIG. 4 is an illustrative diagram showing the connection of isolating switches in one embodiment of the intelligent automatic remote system;

FIG. 5 is an illustrative diagram showing power regeneration and data integration in one embodiment of the intelligent automatic remote system at different running modes of the lifting system.

DETAILED DESCRIPTION OF EMBODIMENTS

[0041] FIG. 1 is a block diagram in accordance with the data operation and configuration of one embodiment of the intelligent automatic remote system, illustrating data acquisition, analytics, processing, communication, overview running mode and interface of the systems.

[0042] Fig. 2 illustrates one of embodiment of the intelligent automatic remote system. In this embodiment, the intelligent automatic remote system comprises a plurality of load sensors 4, being installed on a plurality of suspension means 1 being dragged by a plurality of tracking pulleys in a lifting system, for collecting lift operation data such as cable tension profile, power consumption and loading of the lifting system; a load control unit 8 for controlling the movement of a plurality of lift cars 5 in the lifting system; a processor 9, being connected to the load control unit 8, for executing a various of operations to optimize the load distribution in the suspension means and power consumption of the lifting system; a cloud server 120 for receiving and storing the lift operation data; a cellular module being integrated with the processor 9 and connected to the cloud server 120; and a control center system 130, including a plurality of network user terminals 140, for accessing the internet server so as to form an intelligent system. The intelligent automatic remote system may further comprise a plurality of noise sensors, for detecting whether the tension of the suspension means is evenly distributed.

[0043] In some embodiments of the invention, each of the load sensors 4 are integrated with wire or wireless transmitters for transmitting the lift operation data to the load control unit 8; each of the noise sensors are integrated with wire or wireless transmitter for transmitting the noise data to the load control unit 8; and the load control unit 8 is integrated with wire or wireless transceivers for receiving lift operation data from the load sensors and transmitting control signals to a motor control panel.

[0044] In some embodiments of the present invention, the load sensor may be various type of detect sensors with controller. However, it can also use the similar sensor available in the market to execute the invention claim of the remote monitoring system accordingly. Data of lift (elevator) and /or escalator or similar equipment status will be collected by installed sensor, and transmit to internet, collected data of individual lift (elevator) will be store in internet database.

[0045] In some embodiments of the present invention, the suspension means may be a rope system or cable or similar system, are the load support, evenly driven, a suspension means (the ropes, cable etc..) and a lifting machine located at a high position. Today, in its simplest form, the lifting machine may be an electric motor, a worm screw reducer and

a drum where during upward travel ropes roll and during downward travel ropes unroll.

[0046] In some embodiments of the present invention, the lifting system further comprises connected devices, such as the operator the flexible cables under the lift car side; traction pulleys connected to the electric motor, drags the ropes by fiction. As it can be easily guessed, this way that the operation is carried out by the lifting machine is greatly reduced.

[0047] In some embodiments of the present invention, the load sensors with controller are installed along lift driving rope or ropes and related equipment and /or similar equipment.

[0048] Fig. 3 illustrates different running modes of a lifting system in one embodiment of the intelligent automatic remote system. The lifting system comprises a plurality of adjustable counterweights 6 for balancing the loading conditions of lift cars 5; a plurality of electric motors 2 for actuating the movement of lift cars. Depending on the movement direction and loading conditions, the lifting system may have running modes such as "HEAVY LOAD UP"; "LIGHT LOAD UP"; "HEAVY LOAD DOWN"; "LIGHT LOAD DOWN". As illustrated in Fig.4, these 4 running modes are configured with roping ratio of 1:1. However, it would be appreciated by ordinary skilled in the art that there may be various kind of roping ratio such as 1:1; 2:1;...:N:1 etc., with N nos. in various kind of lifting systems at different running modes, where N is an integer.

[0049] Referring to Fig. 3, the intelligent automatic remote system further comprises a plurality of regenerative energy storage assemblies 12 for storing the electrical energy regenerated during movement of lift cars and/or counterweights and feeding the stored electrical energy into the lifting system, electricity distribution network, and a main isolator.

[0050] Referring to Fig. 4, the intelligent automatic remote system may further include a plurality of metering devices 11 for interfacing with load sensors; a plurality of electrical power supplies 7, being interlinked with a plurality of motor control panels 3 and the regenerative energy storage assemblies 12.

[0051] As shown in Fig. 5, each of the electrical power supplies 7 comprises a plurality of isolating switches for switching the power supply to motor control panel 3 between the regenerative energy storage assemblies 12 and the electrical supply circuit of the building; and a section of the conduction for hooking on of CT Clamps 14 for interfacing with the metering devices 11.

[0052] Referring back to Fig. 3, the intelligent automatic remote system may further comprise a plurality of optical intelligent systems 13, which may be installed at lift shafts, lift machine rooms and lift equipment or any other locations in or out of the building. The optical intelligent systems 13 may comprise inertial or non-inertial cameras 13, for animating and tracing the elevating trips of the lift cars; and 3D cameras for recording flow of passengers in the lifting system.

[0053] In some other embodiments of the present invention, the optical intelligent systems 13 may be in the form as cameras in adapt with video phone. Opens up a new paradigm, videophone VDP enables a user identification via smart phones and provides a recording capability of still images and video of user, object, building, equipment, things. By providing a wireless network connection via internet to view and talk with a user and or Auditor via a phone from anywhere. They may also provide still image and/or video storing capabilities to upgrade security to the next level. High definition (HD) quality display with more vivid image display may be enabled with LCD displays. It enables a user and or auditor identification via phones and provides a recording capability of still images and video of any object and/or person. The view port configuration and target can be selected. Next step is viewports navigation control and creation of 3D models via specific computer programs, include but not limited to building models in 3DS Max using AutoCAD plans. The following steps may include setting viewport layout Sample Modeling, Material and Maps, Modeling in Detail, Lighting and Camera via Process Zoom functions, perspective and orthographic viewport controls together in computing with metering device 12 and regenerative energy storage assemblies 12.

[0054] In some other embodiments of the present invention, the intelligent automatic remote system further comprises a plurality of door sensors, being installed in the lift cars, for detecting whether doors of the lift cars are opened or closed; and a plurality of hoist brakes, wherein each of the hoist brake is urged to hold a lift car when the door sensor in said lift car detects that the door of said lift car door is opened.

[0055] In some other embodiments of the present invention, the intelligent automatic remote system further comprises a plurality of fire sensors, being installed in a plurality of lift shafts and building facilities for detecting the presence of a flame or fire and transmitting the detected signals to the load control unit; a smoke ventilation system; wherein the load control unit automatically initiates the operation of a smoke ventilation system and moves the lift cars to a safety floor when there is a fire.

[0056] In some other embodiments of the present invention, the smoke ventilation system includes a plurality of ventilation ports being located above the lift shafts, wherein the ventilation ports are powered with solar energy and/or battery and automatically opened when there is a fire.

[0057] In some other embodiments of the present invention, the smoke ventilation system includes a plurality of permanent ports being located above the lift shafts and installed with solar thermal-energy exchange windows; wherein the solar thermal-energy exchange windows are closed to perform energy generation at normal situations and automatically opened to act as ventilation ports when there is a fire.

[0058] In some other embodiments of the present invention, the smoke ventilation system further includes a plurality of buttons, being located at stairs and/or corridors of the building; wherein the load control unit are triggered to initiate the operation of the smoke ventilation system and move lifts to a safety floor when one of the buttons is pressed.

[0059] In some embodiments of the present invention, the intelligent automatic remote system provides almost immediate monitoring and control via the aid of high speed communication channels.

[0060] In some embodiments of the present invention, the control center system 130 is a complete control system inside a box with all the necessary inputs, outputs and control processing logic.

5 **[0061]** In some other embodiments of the present invention, the intelligent automatic remote system may further include sensors or detectors such as electrical, magnetic, mechanical, optical, acoustic, haptical, mechanical, bioactuators, etc., integrated with controllers, making use of various of telecommunication technologies such as 3G Cellular, 4G Cellular, 5G Cellular, NB-IoT, LoRa, Sigfox, for generating data, detecting patterns, increasing forecastability, improving decision making and performing monitoring communication in various fields.

10 **[0062]** In some other embodiments of the present invention, the intelligent automatic remote system may communicate with a total maintenance management system, on the basis of a building information model (BIM) constructed a computer program, to calculate power consumption of each energy consumption of each building facilities and consolidate the date to generate a report for monitoring improved efficiency so as to achieve Total Asset Management System Control.

15 **[0063]** In some other embodiments of the present invention, the intelligent automatic remote system may further measure uneven loading of lift cars, at different running modes in vertical or lateral directions, and generate electrical energy and recycle the stored regenerative energy for effective energy saving. Said system may be applied in various types of transporting or similar facilities so as to realize Energy and Maintenance Cost Control.

20 **[0064]** In some other embodiments of the present invention, the intelligent automatic remote system may further interface with electrical cable carrier communication networks PLC, poLine, use the exiting electrical cable as communication media, avoid investment in wire communication so as to reduce cost of the system and save energy.

[0065] In some other embodiments of the present invention, the intelligent automatic remote system may further detect and monitor abnormal operation of the lifting system or similar facilities, prevent wear and fatigue of ropes, sheaves so as to avoid accidents.

25 **[0066]** In some other embodiments of the present invention, the intelligent automatic remote system may further include force detectors or other types of detectors with similar functions, cooperate with electrical cable carrier communication networks of the lifting system, adopt permanent magnets and copper coils generator to regenerate electrical energy, recycle the regenerative energy for effective energy saving. Said system can be used in various types of transporting or similar facilities, to ensure energy consumption needs of the systems are met and allow the excess energy to be further recycled to be new energy in carbon trading.

30 **[0067]** In some other embodiments of the present invention, the intelligent automatic remote system may further connect with 3D Time of Flight (TOF) or other sensor connection means with similar functions, cope with clearance measurement equipment's for traction elevator doors to design and do functional analysis on various system.

35 **[0068]** In some other embodiments of the present invention, said force sensors may be installed on cables, shafts, chains, rings, or any other suspension means. The detected data are computed with software programs, transmitted via IOT and stored in the cloud server, predict and report tension profile of the cables, so as to allow preemptive diagnosis and adjustment, reduce wearing of the system, such that an even, stable condition and long life cycles of components can be maintained. Operation of the lifts or elevators can be monitored in real-time and the costs for maintenance can be reduced.

40 **[0069]** In some other embodiments of the present invention, the intelligent automatic remote system may be applied in environmental technology fields, coped with other sensors such as electrical, electronic and optical sensing technologies and communication technologies, and used to conduct fatigue and damages analysis of the traction cabling, error analysis with dynamic loading-free balancing index measurement method, analysis for self-weighting selection and traction conditions calculation for over-size cargo lifting system, analysis for resonance in lifting system, monitoring of protective clamps for preventing accidental movement of lift cars, prediction of causes and precautions of vibration of lift cars.

45 **[0070]** In some other embodiments of the present invention, remote network system can be integrated to cellular module connected at different running modes and lifting systems. It held rope force measurements to perform automatic Lift Maintenance and Measure Audit report with the intelligent automatic remote system, according to detail brief at technical field, for general packet radio service (GPRS) wireless communication module, GPRS communication unit which interface with a control unit, Data received is transfer to web server for storage and reporting using cellular wireless communication module, such as GPRS or similar means. The reporting is using a web interface so that user can access the data using a hand-phone or computer internet explorer. Therefore, it can simply and easily correspond to a demand for more frequent Lift Maintenance and measure Audit report. It can also be addressed a Map Database, whereby by cellular wireless communication module GPRS or CTS is accessed by a local system, it displays the map indicating geographic and other necessary information in locating the lift site. It is possibility of linking to the total maintenance management system.

55 **[0071]** The present invention allows real time monitoring during different running modes and continue measurement of rope forces were in full conformity with expected forces. With the present invention, the problem and factors result in

a shorter working life of the ropes, sheaves, both by wear and fatigue can be overcome and the causes of deviations may be prevented:

- i) differences between the diameters of running circles of the traction grooves;
- ii) uneven distribution of load over the ropes;
- iii) deviations of the car weight and the counterweight from the design data.

- i) accuracy of the rope force measuring in the running and stand still condition
- ii) higher tensile forces in the ropes as expected can result in.
- iii) a lower safety factor of rope life than prescribed.
- iv) a high specific pressure between rope and groove than permitted,
- v) a smaller diameter of the running circle for V-grooves, extra rope forces.
- vi) opposite couples of the ropes on the traction sheave,
- vii) higher traction T1/T2 on the traction sheave than the calculated value.

[0072] With the present invention, improvement of rope life and rope sheave can be obtained by:

- i) smaller tolerances of groove and rope dimensions;
- ii) an even distribution of load over ropes on the running lift,
- iii) invented real time check of tensile forces in compare electrical power used,
- iv) accurate estimation of the weights when designing a lift system.

[0073] With the intelligent automatic remote system provided by the present invention, a LMAR can be obtained with the following steps:

- a) Auditors remotely interact with auditees,
- b) Carry out long distance overviews,
- c) Complete checklists with auditee help,
- d) Fill out questionnaires with auditee help,
- e) Review documents with auditee participation.
- f) auditors remotely examine auditee systems to achieve:

- i) Review documents without auditee assistance;
- ii) Analyze information without auditee assistance;
- iii) Observe work without auditee assistance etc.,

[0074] Which audit methods be used will depend on the audit objectives, the audit criteria, and the scope of what audit. It can also depend on the location and duration of the audit and the competence of the audit system. The invented method can optimize the efficiency and effectiveness of the audit process by choosing a variety of both onsite and remote audit methods.

[0075] In some other embodiments of the present invention, an intelligent automatic remote method is provided for optimizing tension profile and power consumption of the lifting system. The intelligent automatic remote comprises steps: collecting, with the load sensors, lift operation data such as cable tension profile, power consumption and loading of the lifting system; detecting, with a plurality of noise sensors, whether the tension of the suspension means is evenly distributed; balancing, with a plurality of adjustable counterweights, the loading conditions of lift cars; adjusting the parallelism of the tracking pulleys; storing, with a regenerative energy storage assembly, electrical energy regenerated during movement of lift cars and/or counterweights; and feeding, with the regenerative energy storage assembly, the stored electrical energy into electric motors, lifting system, electricity distribution network, electric drives; the electric drives actuating the movement of lifts.

[0076] In some other embodiments of the present invention, the intelligent automatic remote method further comprise steps: recording, with a plurality of 3D cameras, flow of passengers in the lifting system; determining size, distribution and movement pattern of population in the premise; determined the required capacity of vertical transportation; dividing floors of the premises into clusters of stops to be served by different lift cars to improve efficiency of the lifting system; and estimating the life cycles of the lifting system for lift maintenance and auditing.

[0077] In some other embodiments of the present invention, the intelligent automatic remote method comprises step of auditing the initial design of lift traffic analysis allow journey times to be kept reasonable values.

[0078] In some embodiments of the present invention, the intelligent automatic remote method further comprises step of metering of lift power consumption together with the building design model and the measuring energy value of the

building power consumption and loading, carry out a scheme for energy saving by steps such as:

- a. Collecting power consumption data for the lift in different loading / time / starting floor / movement;
- b. Verification of optimizing of lift operation;
- c. Consider performing energy modeling;
- d. Develop lift operation optimization plan.

[0079] According to some aspects of the present invention, lift operation / automatic control can be enhanced to achieve effective demand control and operation of lift under optimum condition to

- a. conduct diagnostic monitoring of lift and escalator installation, logging lift power during peak hours and non-peak hours, it is logged for trending analysis.
- a. analyze the collected trend logged data, measuring lift power consumption during a designed specific period, The ratio of lift power consumption during a designed specific period is plotted , it is found that the ratio is relatively high and can be lowered down so as to save energy and/or to store the regenerating power via a serious store battery bank.
- b. speculate and verify the underlying operation problem , such that the lift operation schedule does not match the operation needs whereas not much user using the lift in non-peak hours but most lifts are still on which leads energy waste.
- d. identify improvement and optimization opportunities, reschedule the lift operation hours or consider to shut down or rearrange the transport pattern. Turn off or idle unnecessary equipment.

[0080] An effective working environment can be maintained, run automatically and comprehensively, and be flexible enough to adapt to future changes in the needs of the working environment.

[0081] According to some aspects of the present invention, investigation for building documentation may be carried out to:

- a. conduct initial equipment and system checking;
- b. consider performing energy modeling;
- c. develop a power consumption plan;
- d. conduct diagnostic monitoring;
- e. analyze trend logged data and Develop a List of Energy Gap;
- f. conduct different equipment and system investigation;
- g. held identify potential improvement and optimization opportunities;
- h. held shortlist recommended improvement area and optimization opportunities;
- i. held implementation, implement Selected Opportunities
- J. held performing verification;
- k. held develop a final report;

[0082] For maximizing the effectiveness of power consumption, it is essential to identify as much as possible the building underlying operational problems and the improvement and optimization opportunities during investigation and reliable enough for energy gap identification.

[0083] In some embodiments of the present invention, the intelligent automatic remote method further comprises step of collecting required operational data via on-site measurement to provide sufficient and reliable data for identifying energy gaps, then the service provider to possess adequate on-site trend data.

[0084] In some embodiments of the present invention, the intelligent automatic remote method further comprises step of energy modeling for the building which can accurately breakdown the building energy consumption; and use the baseline model constructed to do parametric analysis to evaluate the accurate energy saving for different improvement and optimization opportunities identified in LMAR . If enough building information can be provided for input to such energy simulation, energy modeling can:

- (a) evaluate accurately the detailed breakdown of energy use for the building; and
- (b) evaluate the amount of energy cost saving to help selecting the identified opportunities.

[0085] The data collection is suggested to be carried out throughout the year so that the operation parameter trends in cooling, heating and intermediate seasons can be examined in full. Underlying operational problems would occur for diagnostic monitoring and functional testing.

[0086] In some embodiments of the present invention, the intelligent automatic remote method further comprises step of conducting initial equipment and system checking simple fixing of LMAR, such as calibration of sensor, as they are

discovered usually increases the effectiveness of the diagnostic monitoring and testing and facilitates the process of understanding the root problems of operational issues.

[0087] In some embodiments of the present invention, the intelligent automatic remote method further comprises step of developing plan, to summarize all the findings in planning stage and plan the subsequent activities in LMAR, for optimizing the existing building, such as building current operating information; building annual energy use and its breakdown;

[0088] In some embodiments of the present invention, the intelligent automatic remote method further comprises steps of conducting diagnostic monitoring, it is the process of collecting data over time, at intervals ranging from a specific period; collecting the trend logged data by the LMAR, provided that it is installed in the lift and connected sensors of building and the trend logged data is adequate and accurate enough for analysis; analyzing trend logged data and develop a list of energy gap. Particularly, the intelligent automatic remote method comprises steps:

a) collect enormous amount of data . Depending on the type of data, the collect interval can be every specific period. Substantially reduce the amount of data to be processed and the work required.

b) collect data throughout the whole year for annual analysis.

c) underlie operational problems are found with the help of equipment and system investigation test results, the potential improvement and optimization opportunities can then be identified.

d) list recommended improvement and optimization opportunities; carry out the cost-benefit analysis on the potential improvement, provides a list of energy gaps and identification improvement and optimization opportunities.

e) implement selected opportunities; propose a staged implementation plan to accommodate budget constraints or to minimize the interruption of system operation and performance.

f) perform verification, After carrying out the measures with the same diagnostic monitoring method as mentioned in the Investigation Phase, such as all kind of input data, equipment and system investigation testing, simple observation or a combination of these methods.

g) develop a final report, it is a comprehensive record of the project which should become a part of the on-site resources.

h) applying energy modeling it is preferred to determine in advance how the building energy consumption is distributed into different CBSIs, such as air-conditioning, lighting, small power, lifts and water pumps and see which categories consume the most energy. Sub-metering installed in the building, if adequate enough and they are properly functioning everyday so that the data is reliable enough, can track constantly the energy use by different CBSIs, which could help determine the breakdown of annual building energy consumption with the following information:

1. Building information (i.e. floor area, shape, floor to floor height, number of storey, orientation, types of usage)
2. HV AC configuration and operation
3. Equipment efficiency (i.e. chiller COP, pump efficiency, fan and motor efficiency; boiler efficiency)
4. Lighting, equipment power density, Miscellaneous load (i.e. lift & escalator, water pump, exterior lighting, domestic hot water)

[0089] In some embodiments of the present invention, lift maintenance data collection are carried out in the lift operating locations. Data could be distributed continuously, and the users would always have the most current data available.

[0090] In some embodiments of the present invention, the intelligent automatic remote method further comprising the steps of monitoring elevator car velocity in response to power control; and adjusting the magnitude of said force to limit said velocity for energy saving.

[0091] In some embodiments of the present invention, the intelligent automatic remote method may further comprise step of examining the power needed to lift the load: if the counterweight load were exactly the same as the load to lift (elevator) (lift car; passengers and connected devices), the operations be carried out by the machine are only those needed to overcome the friction of the first starting and due to the mechanical efficiency of the shaft (pulley, guide shoes, etc.), and a totally different operation when it needs to brake and stop the lift car. According to Fig.4, it was indicated regenerative power used by different running mode of lifts (elevators), regenerative power can be fed to lift system or for be store in a serious battery bank.

[0092] In some embodiments of the present invention, the running mode via condition is generally complied with when the lift(elevator) is occupied by a load which generally represents the 50% of the rated load/ capacity and it is located midway its travel. This condition accomplishes the lift (elevator) balance. This choice of balance come from the fact that statistically the lift car load condition of the lift is rarely equal to 100% (that is the Lift car is loaded to its full load), and therefore if the counterweight balanced this load condition, we would have the most of the time to provide power for unwanted energy consumption .The power needed is affected , besides the load, by the unbalanced load to move ,also by the friction caused inside the travel shaft by mechanical devices making the traction configuration, such as the diverting and overhead sheaves, lift car and counterweight shoes. The sum of these elements defines the shaft efficiency, meas-

uring the quality of our installation. In fact the higher the shaft efficiency is, the lower the energy that is dissipated due to friction. In this way ,it is possible to carry out the desired energy saving .For high performance lift (elevator) installations, it is important to take consideration the power dissipated through the aerodynamic resistance (proportional to the square of the rated speed) produced during the lift car and counterweight movement.

5 **[0093]** In some embodiments of the present invention, the configuration type described above is defined as direct acting (roping ratio is 1: 1) with traction pulley with or without diverting pulley. The presence of the diverting depends on the car overall dimensions and on the lift geometry. As a very approximate rule of thumb for the evaluation of the power in KW required in a roped lift (elevator), with directed acting and full load, it must multiply the number of persons (their weighting in kg) by the rated speed of the lift car (meters /sec).But there are also other configurations, with 2:1 roping or higher, with lifting machine in the machine room, adjacent ,over or below the shaft. There are various layouts for rope system, such overhead, bottom drive, single wrap, Double wrap, with compensation ropes or without etc., One of the most commonly used configurations, because it allows to reduce the masonry works for installation and the service of a lift(elevator), is the Machine Roomless, or lift (elevator) without a machine room. In this configuration , the lifting machine is located inside the shaft, and according to design criteria adopted by the manufacturers, may be located in various positions .

15 **[0094]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of carrying out audit on the quality of lift maintenance works which are currently carried out by the registered lift Contractor's workers. The audit shall involve identifying any shortfall in the lift maintenance works and advising the corresponding best practices for improvement.

20 **[0095]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise step for minimizing rope and or cable wear. As ropes were one the most important components of lifts, which contribute significantly to the maintenance costs. This applies above all if the ropes unnecessarily wear disproportionately quickly. Often the problems are being caused by the construction of the installation which hardly can be changed after assembly fortunately, also in high-performance systems with great hoisting heights, the tension between the ropes during the ride changes constantly. This is mainly caused by pulleys which are positioned not absolutely parallel to each other. The ropes travel different distances, during the ride, which manifests itself in changing cable tensions.

25 **[0096]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise step of measuring rope tension system as weight watcher and monitoring. With the intelligent automatic remote system, rope tension adjustments can be carried out accurately, documented effective and therefore inexpensive. The mobile device and or computer guides the mechanic step by step through the rope adjustments. In the process, each rope of the set is set to an optimal tension calculated by the software and rope tension report and analysis. Distributions of tension in the rope set can be measured during the ride, thus a rope system can be adjusted optimally.

30 **[0097]** In some situation, it might be desirable to know how the total load on each rope is distributed depending on the current position of the lift car when driving over the entire hoisting height and provide a harmonious load distribution in the roping system.

35 **[0098]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of carrying out a pure control measurement or an adjustment of the load distribution in the rope set, producing documentation of measuring data, quality assurance in accordance with independent area authority of such important criteria as wear durability and maintenance costs of an elevator system like the correct or optimal rope setting,

40 **[0099]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of measuring and evaluating cable tension profile during the drive. When rope tensions are not equal the following circumstances can be occurred: i) Noise, ii) Vibration , iii) poor ride quality, iv) Premature rope fatigue and failure, v) Uneven and premature sheave wear and failure, vi) Loss of traction, vii) rope jump off sheaves, entangled in m/c room.

45 **[0100]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of remote monitoring unequal rope tensions, so as to prevent a poor lift (elevator) experience for the riding public, costly/expensive repairs to the lift(elevator) maintenance company and building owners and worst of all, an unsafe elevator. Hence, it can measure the Lift (escalator) load of passenger, so that it also can measure the passenger flow of the area, building . It also can be linked to the total maintenance management system. Remote monitoring within the built environment, mission critical facilities / data centers have particular power requirements that significantly impact how they are designed and operated. In this regards, the building owners and management agencies will gain insight into the critical supply system, from power components to distributions and efficiency; from power requirements to sizing, design, testing and commissioning the portions such as :

- 55
- a) On primary supply and secondary supply;
 - b) Power flow in mission critical supply system;
 - c) Features of major equipment for critical supply;
 - d) Uninterrupted power supply and power storage;
 - e) Backup generator, capacitor bank, power factor correction;

- f) Automatic transfer switch, Static transfer switch;
- g) Isolation transformer; Isolator ;
- h) M/c room and lift (elevator) temperature , Voc report etc.,

5 **[0101]** In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of engaging total energy audit and related test of the building, such as:

- a) Efficiency assessment
- b) Power quality review
- 10 c) Configuration diagram of critical supply (N+1 / 2N) design & analysis
- d) Review of cable sizing to incorporate harmonics content
- e) Earthing system design
- f) Testing and commissioning requirements
- 15 g) Brief of Systems Merging Appraisal Test (SMAT)

[0102] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of calibrating the actual of the system as a whole would also affect the energy performance of the installation. Besides the equipment itself, the actual usage of a vertical transportation system should basically fulfill the vertical transportation needs. The transportation needs of a building depend on the following factors:

- a) Size of population and its distribution in the premises.
- b) Pattern of population movement in the premises.
- c) The quality requirement of the vertical transport service.
- 25 d) Requirements of the local regulations on vertical transport system. \

[0103] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps of achieving energy efficiency of the vertical transport system is to ensure an effective utilization of the system and minimize unnecessary wastage.

[0104] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to minimize the effect of over design of either the number of lifts or size of lift car will result in energy wastage. Especially during the off peak period. And a method as define in one of the claim elements LMA be also held to minimize the effect of a main factor of usage standby of vertical transport system in related to energy wastage.

[0105] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to minimize the effect of over design of contract speed, car cage dead weight and motor ratings will waste unnecessary energy whenever the lift car is in operation.

[0106] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to access accuracy of information about the population in premises via vertical transportation system.

- i) These information include the population distribution and their predicted pattern of flow within the day. It held to solve the difficult problems while obtaining the optimum size for the vertical transportation system.
- 40 ii) Furthermore, the size and pattern of population flow within a building will change throughout the life cycle of the building as new tenant move in and change of business nature.
- iii) The need to estimate population size and distribution in a building is not confirmed to lift and escalator installations. It is also crucial for the design of other services such as the HVAC, provision of toilet facilities or even the planning
- 45 of the escape route.

[0107] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to audit the design of plan the mode of vertical transport (e.g. by mean of stairs' escalator' lift system or a mix of different modes of traffic). This can make the information more realistic for traffic analysis purpose. The most commonly used method of traffic analysis is the "Up Peak" model which is a method to size the vertical transportation system for premises having an "up peak" period (e.g. the hour before the commencement of office hours). As computer aided lift design programmes for sizing of lift installations. These programmes can also take care of more complicated scenarios such as peak inter-floor traffic' down peak traffic flow etc.

[0108] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to audit other building services installations which the design calculations give an "exact" prediction of the system performance. LMAR should also held to audit the design of lift traffic analysis methods give result in a probabilistic sense or is a theoretical figure to close to "exact" prediction and reality.

[0109] In some embodiments of the present invention, the intelligent automatic remote method may further comprise

steps to regularly reviews with the building sector. Hence, expanding the remote Intelligent Measuring, Monitoring, Auditing report unit in connect to Total Maintenance Management Network System to achieve different level of integration to traditional System, Non- integrated, partial integration, full integration etc.,

[0110] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to perform lift maintenance audit for the lifts as included in Clause and prepare an audit report according to the requirements below:-

(i) Assessing conditions for critical components, environment data and parameters, e.g. Ropes, door, leveling, by examination and measurement. Automatic and intelligence Observation site measurement and CCTV photo taking shall be made by random sampling.

(ii) Assessing quality of equipment maintenance by the current condition.

(iii) Assessing adjustment/performance quality.

(iv) Suspension ropes, compensation ropes/chains and their anchorages

(v) Lubrication of lift components

(vi) Brake operations

(vii) General conditions of safety gears and over-speed governors

(viii) Car door and landing door operation

(ix) Levelling

[0111] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to coordinate with various public vertical and horizontal transport modes and enhance the efficiency of transport system to reduce carbon emissions. The use of remote intelligent Network held producing energy via running mode of regeneration of the electric power of the vertical transportation of the building together with real - time of elevator traffic information which helps reduce electricity consumption.

[0112] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to collect, via the optical intelligent systems 13, detailed information of coherence and modal analysis and vibrations. The elevating trip is animated and traced using inertial and non inertial cameras. It also adapts a customer-operable remote control service and information display service inside the lift car utilizing the system's platform. By focusing on image data, a new communication infrastructure for lift remote monitoring and invented services utilizing it.

[0113] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to measure the lift traffic, provide statistics of the lift performance. General traffic profiles with estimated population assumption are frequently used in traffic analysis, In comparison with data collected by load sensors 4, 3D camera may perform more accurate measurement of the people flow of the vertical transportation, the effect during the upgrading can be recognized.

[0114] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to appropriately arrange lift zoning which subdivide the floors of the premises into clusters of stops to be served by different lift cars. It is by making this arrangement passengers that travel to a particular floor have a higher chance of being grouped together such that the efficiency of the traffic as well as the energy usage can be improved. Appropriate zoning arrangement will not only improve the energy performance.

[0115] In some embodiments of the present invention, the intelligent automatic remote method may further comprise steps to generating an emergency signal that is automatically transmitted via telephone line, and /or Wi-Fi, GPRS system, wireless system etc., for the Lift Service Company in monitoring the Lift.

[0116] In some embodiments of the present invention, the intelligent automatic remote system may further be configured with photovoltaic and heat-exchange generator to generate and store electrical energy. For example, the photovoltaic generator may comprise a transparent energy conversion coatings on the surface of glass of lift shafts such that solar energy can be used for electricity generation in lift shafts. With solar-energy collection coating, the lift shafts can become a storage station of electrical energy.

[0117] In some embodiments of the present invention, the above-said transparent energy conversion coatings may be applied on glass or plastic surface such that the originally heat absorptive window glasses or similar materials can be converted to electrical generator devices to generate electricity via solar energy and heat.

[0118] In some embodiments of the present invention, through high pressure and high temperature processing, the transparent energy conversion coatings can be used as a heat absorbing layer in glass lift shafts. Applicable solar-energy heat absorbing coatings may be deposited by means of electrical plating, anodized plating, vacuum deposition technics. Such technologies have been widely adopted in energy storage and recycling, in the applications such as Drones, unmanned flying vehicles or remote database service etc.

[0119] In some embodiments of the present invention, the major materials for making solar-powered unmanned flying vehicles, such as soft magnetic material (e.g. Gd) and polyvinylidene difluoride (PVDF) piezoelectric coating, may be used to collect and store wasted heat energy. At smaller heat gradient, after acquiring mechanical vibration, such wasted

heat energy may be converted to usable electrical energy. Also, the heat transfer efficiency would be higher because of the smaller heat gradient.

5 [0120] In some embodiments of the present invention, a solar-energy integration module is used to store heat energy generated during operation and convert the heat energy into electrical energy. Said module is made of soft magnetic material (e.g. Gd) and hard magnetic material (e.g. Nd). During operation, excess heat enters heat diffuser, the damping-connected soft magnetic material is in contact with a heat storage device, the solar-energy integration module absorbs heat energy generated by the heat source and converted the same to usable electrical energy. Said heat storage device is located close to the top of lift shaft and heat source, i.e. in connection with the smoking ventilation ports. Being driven by the high and low electric potentials, magnetic oscillation occurs and cause phase change in the soft magnet from ferromagnetic state to paramagnetic state, and then from paramagnetic state to ferromagnetic state. Mechanical energy due to such piezoelectric effect is then converted to electrical energy. On the other hand, heat energy generated in the heat source is dissipated through the soft magnetic material after diffusing into the heat diffuser. Then, the soft magnet returns to the ferromagnetic state, the magnetic force is enhanced, under the action of hard magnet, the suspension arm is continuously mechanically deformed, the mechanical energy generated is then converted into electrical energy via piezoelectric effect.

10 [0121] In some embodiments of the present invention, the outdoor temperature, local conditions, requirements to indoor temperature and cost-effectiveness by users are taken into consideration to improve the energy usage efficiency. General frameworks, regulated methods for calculating overall energy efficiency of the building, bottom-line usage standard for energy efficiency, adopt said standard in SCADA system for constructing new buildings or renovating existing buildings.

15 [0122] In some embodiments of the present invention, the Overall Thermal Transfer Value (OTTV) of the building wall surfaces of the same orientation, weather and sun data are taken into consideration as the three major components for thermal gain. Transferring via non-transparent surface and glass surface, the OTTV is the index for overall thermal conductivity of the glass lift shaft (or exterior layer of the building).

20 [0123] In some embodiments of the present invention, different absorption of solar-energy by building walls of different orientations are taken in account. Firstly, respective OTTV of building wall of each orientation is calculated first, and then the weighted average of calculated values are obtained. Finally, the overall OTTV of all building walls are calculated.

25 [0124] In some embodiments of the present invention, similar method is used for calculating the OTTV of building roofs. The calculation of OTTV of building roofs would be simpler as the roofs are usually without large area of glasses (except for some courtyard located in the middle of the building). Although OTTV is mainly used for evaluating overall thermal conductivity of exterior layer of the building. the formula obtained with three parameters: TDeq, DT and SF by large determine the accuracy of energy consumption evaluation of OTTV as well as reflect what types of problems are.

30 [0125] In some embodiments of the present invention, it can be noticed from the records of electricity usage of the glass lift shaft that the huge electricity usage is mainly caused by the use of cooling equipment.

35 [0126] In some embodiments of the present invention, the indexes for evaluating the overall thermal conductivity of glass lift shafts or exterior layer of the building, TD and SF, are evaluated with heat conduction and solar radiation on the non-transparent surface as well as the glass surfaces, potential energy saving in the can be calculated and applied in the fields of data-collecting networks, energy collection, deep learning and environmental technologies.

40 [0127] In some embodiments of the present invention, the thermal gain of glass lift shaft is evaluated from outdoor to indoor, through heat conduction of exterior layer of the building, including OTTV, heat dissipated from air conditioners, heat generated by lifts and control systems.

45 [0128] In some embodiments of the present invention, for further reducing energy consumption and effectively enhancing energy gain, the system further comprise openings at the top of lift shafts are configured with windows (or blinds) and, photovoltaic/heat-exchange generator, to facilitate exhausting of heat energy, ventilation and energy collection. In some existing buildings, large amount of energy is consumed. Under the chimney effect, the air inside the well channel raise after being heated up, diffused out of the building through the openings at the top of lift shafts.

50 [0129] In some embodiments of the present invention, the system further comprises central equipment with smoke detection devices and smoke ventilation controller with emergency power supply. In addition to the high temperature/smoke/fire detectors located in the lift shafts, primary evacuation floors are equipped with optical, fire sensors and high temperature/fire detectors. Where there is a fire, the smoke ventilation system is automatically triggered. Further, the central equipment will automatically transmit electrical signals to the controlling system of lifts to move the lift cars to pre-set primary evacuation floors, which would be the first floor where the main entrance is located.

55 [0130] In some embodiments of the present invention, each components of the system are assigned with IP address for internet access, so as to realize comprehensive building monitoring, control system and facilitate operation of fire system through communication with water pumps, drainage pumps and sewage pumps, fire pumps under the lift shafts.

[0131] In some embodiments of the present invention, one of the problems to be carefully evaluated by the designer of a traction lifts is the uncontrolled movement of the lift car due to the loss or excess of traction of the ropes/ cable in the pulley grooves of the traction sheave. In fact, it is required in the clause 1.4.4 of the Lifts Directive 95/ 16/ EC:-" *Lifts*

driven by friction pulleys must be designed so as to ensure stability of the traction cables on the pulley. "

[0132] Manual monitoring and inspection would be required in some existing lifting systems. The adoption of Virtual Reality (VR), Augmented Reality (AR) and integration of the system for monitoring and reporting provided by the present invention and method could improve and minimize the effect of errors, labour & safety problem associated with manual operation. Whereby co-operation with independent Mechanical Rope Gripper be used as stopping element of untended car movement protection (UCMP). Further, focusing on existing Lift E-platform reporting systems also cannot provide data analysis process, deep learning, 24hour-7day data mining. Whereas by further applying and integrating (BIM) Building information modeling system, a digital representation of physical and functional characteristics of a facility can be achieved. Knowledge, resource and information about a facility forming a reliable basis for making decisions, during its life-cycle from conception to demolition, in Enterprise Resource Planning(ERP), Retro-commissioning (RCx), Energy Audit (EAC). Therefore, cost-effective systematic process is provided to periodically check an existing building's performance and identify operational improvements for save energy and lower costs.

[0133] In some embodiments of the present invention, the system for monitoring and reporting may include load sensors on rope and/or cable, a load control unit integrated with long distance wire/ wireless Data transmission device to enable auditor to conduct effective auditing process, predictive analysis and quantifying of the life of detected equipment. Substantial machine learning is realized with processor communicating between load sensors, load control unit, cellular module and SIM card. Automatic communication to remote storage and center control system with apparatus or similar function apparatus are not necessary to obtain the load data as in prior arts from the elevator controller with load weight sensor on the lift car, so advance and fundamental different with prior art which based on get the data from the elevator controller thereof. In the present invention, cellular module is connected with SIM (Subscriber Identification Module) card which is an integrated circuit portable memory chip intending to securely store the international mobile subscriber identity (IMSI) number and its related key used to identify and authenticate subscribers on mobile telephony devices (such as smart phones and computers). Therefore, the present invention may be applied in various types of lift and escalator / passenger conveyors, mechanical car-parking system and similar function apparatus.

[0134] In some embodiments of the present invention, the system for monitoring and reporting further comprises metering devices, storage battery assemblies with capacitor; optic intelligence system; current transformer and remote storage and relevant software for lift data base management and applying circuit formula model for data collection, acquisition, transmission. The system further comprises a controller connected to lift data base input interface circuit. The optic Intelligence System cameras may capture views of the lifts during operation and viewing targets can be selected via view port configuration and distributed with a smart network. As shown in FIG. 1, communication occurs between lifting system and control center as the designed databases are done by more than on architects. The system for monitoring and reporting may have several functions and interfaces to lift/elevator CBSI system, CCTV/ Intercom Control, Network Control, database, statistical analysis/ processing with SIM cards and their IP addresses SIM card from the mobile communications provider. SIM cards used in the outer stations normally have no fixed IP addresses via which the lifts could be reached. Therefore, well-established automatic communication between wired data transmission such as power line carrier and wireless data transmission cellular may facilitate automatic execution of data auditing via existing Smart phone cellular **SIM** (dual SIM) networking generation 3G,4G, 5 G , etc.

[0135] In some embodiments of the present invention, the system for monitoring and reporting may be applied with information and machine learning technologies to form a Smart Network interfacing with Smart IOT, Smart IOS , Smart IOE , Smart IOV, big data & hadoop to processing data such as information of weather on air, forecast, humidity... etc., be provide by Observatory. With the use of mobile devices, Smart phone Apps, application software may be used to control data flow and where it is remote stored, collective intelligence, map reduction, eventual consistency, predictive analytics. The system for monitoring and reporting may further includes software programs for calculation of mechanical characteristics of wire ropes, maintaining and protecting a central database. It shall be appreciated that there are several formula models for such purposes and various algorithms to handle different features. In one embodiment, an algorithm for an analytical study on fatigue failure of main ropes in lift build modeling of roping ratio 2 : 1 is used to obtain a new simultaneous means of non linear lift loading on the ropes during starting-up and acceleration. Regarding total tension and maximum pressure point where car cage is parked at lowest floor and counterweight is placed at upper level, well-established formula for calculation of Fc is:-

$$F_c = (W_{car} + Q + W_{rope} + W_{cable}) \times (g + a) + Total \quad j \ v / R_0$$

Where,

- W_{car} ----- the weight of Lift car " 5 "
- Q ---- the rated load (rated handle capacity) of Lift car " 5 "
- W_{rope} ---- the weight of rope

- j ----- Rotate inertia of a below sheave cal. of detected rope W_{cable} ----- the weight of travelling cable
- a ----- acceleration
- g ----- gravity
- v ----- rotation start up angle
- 5 R0 ----- radius of traction sheave

[0136] In some embodiments of the present invention, lift car 5, lift counterweight 6, Power Supply cubicle 7, and Load Control Unit 8 are basic elements needed to make a rope system or cable or similar system. The system may further include load support and suspension means which may be rope and/or cable suspension (dead point) with elastomeric spring buffers or compression springs be adjusted. Therefore, a system for remote reporting, auditing may be formed and programmable measuring control is installed to accept the signal from the rope sensors and convert them into useable data for measure important parameters for ropes such as the relatively large axial load in comparison to bending and torsional loads wherein can easily viewed. Further the Wire Ropes Under Bending and Tensile Stresses, force and torque related tensions can be audited and adjusted in real time according to the record and report. With similar force measurement means, the following parameters may be to obtained: a) tensile forces, b) number of bending cycles, c) corrected of bending cycles, d) number of working cycle, e) loading sequence bending length, f) load elements per load sequence. Further, there are five dimensioning limits for rope drives (with reference to Feyrer (2007)) such as : i) Rope working cycle, ii) Donandt force, iii) Rope safety factor, iv) discarding number of wire breaks, v) optimal rope diameter etc.. Also, real time measurement of power at different running modes of lifts operation for dynamic tolerance analysis of the lift of different loading conditions (no-load, lightly-loaded or heavily-loaded) can be achieved via input of Sensor '1'.... 'N' as shown in FIG. 5. Based on the analysis results, preventive / predictive maintenance can be scheduled. In particular, regarding acceleration calculation, one of well-established formulas for detecting load weighting value is:

$$\text{Vector K} = \text{Vector N} (G1+G2) / 2Q$$

Where:

- K --- Lift Balance Coefficient;
- 30 N ---- roping ratio
- G1---- the weight difference between Lift car " 5 ", and Lift counterweight "6" LESS system maximum friction coefficient
- G2---- the weight difference between Lift car " 5 ", and Lift counterweight "6" PLUS system maximum friction coefficient
- Q ----- the rated load (rated handle capacity) of Lift car " 5 ",

[0137] In some embodiments of the present invention, the system for monitoring and reporting may be used to dynamic tolerance analysis modelling of the lift balance formats with no-load and full-load at up/down movements. At different running modes, via various type of detect sensors, such as electrical, magnetic, chemical mechanical, optical, acoustic, haptical, mechanical, bio-actuators, salt, acid etc., and controllers integrated with long distance central control circuit for generating data, detecting patterns, increasing forecastability, improving decision making....etc., regenerative electrical power may be used/ stored and supplied to lifts. The system may further interface to various structures such as Cellular IoT Modules enable Rope and/or cable to communicate voice/sound data over smartphone networks with SIM cards installed in Smart phones that operate on the Global System for Mobile Communications (GSM) network CDMA phones, newer LTE-capable handsets or satellite phones. There are SIM cards with a so-called fixed public IP address which every Internet user can access. The reporting is based on a web interface so that users can access the databased using a mobile device or desktop computers by simply and easily corresponding to a demand for a Lift Maintenance and measure Audit report as shown in FIG. 3.

[0138] In some embodiments of the present invention, the system for monitoring and reporting may further connected with wire and /or wireless communication system via cellular module of different class, dual band of a specific range, interface module, GPIO, (General-purpose input/output) Internet protocol support and printer, plotter and /or similar equipment assist responsible persons for lifts to engage lift maintenance audit, overview running mode, data analytics, (include but not limit to descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics,) wherein similar function and several analysis can apply, for example to calculate for Simple Bending and Reverse Bending, as rope bend, even drive, deflection, break are major factors to quantify the life of rope and /or cable that is rove over a sheave for lift operation. The system for monitoring and reporting may be used to process the number of bending cycles of rope "S", as it is necessary to know the effective rope tensile force as precisely as possible. If no more precise information is available, the effective rope tensile force S for lifting appliance can be evaluated from a) the load Q, b) the number of bearing wire ropes nT, c) the acceleration g due to gravity and d) the global rope force factors f s1--- f s4., friction from the load guidance (such as sliding guidance, rope efficiency, parallel bearing ropes, acceleration,

deceleration, load speed), well-established formula calculating the number of simple bending cycles, the number of reverse bending cycles is:-

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$$S = Q \times g / nT \times f_{s1} \times f_{s2} \times f_{s3} \times f_{s4}$$

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[0139] In some embodiments of the present invention, patterns, details characterized in that Database be interface with imaging system also provides still image and /or video storing capabilities to upgrade security to the next level. HD quality display as more vivid image display enabled via LCD application. It enable a user and or Auditor identification via phones and provides a recording capability of still images and video of any object and/ or person for credible audit the Lift operation , such as loaded and unloaded operation in real time and/or various type of vision and audio sensors such as 3D cameras with controller and integrated long distance wire/wireless data transmission device to form a multi/ independent remote, reporting maintenance, audit and measure system easily check the lift shaft integrated to cellular connected interface circuit connected to the output circuit. It is planned to understand what is happening, why is happening, what is likely to happen, and how can make it happen. The control interface circuit comprises a GPRS module wifi, Bluetooth, able, 3G, 4G(LTE), 5G, Z wave, NFC, IEEE 802,15.4 (Zigbee) "....."

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[0140] Ethernet interface circuit and extend to LoRa. Sigfox , NB - IoT (Narrowband Internet of Things), Internet Protocol (IP) Signaling Systems -Advanced Intelligent Networks (AIN) system etc., The application of AR mobile device demonstration system for machinery, for procedural tasks in diagnostic and maintenance. It is a live direct or indirect view of a physical, real-world environment whose elements are *augmented* (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. The technology is available to users by related tool, which give users valuable, additional information on equipment and processes, guide them in performing operational tasks and allow them to work hand free. wherein economical to get a quick safe and report, mitigate safety risk be exposure in related activities and lift works.

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[0141] In some embodiments of the present invention, it also can be addressed a Map Database, whereby by Cellular or CTS is accessed by a local system, it displays the map indicating geographic and other necessary information in locating the lift site. It is possibility of linking to the total maintenance management system. It relates but not limit to NosQL, languages, web oriented/ JSON, Implicit scheme, supports large amount of data, eventual consistency, open source etc., The apparatus described as above claim 1 to 7 or wherein similar function apparatus transform as light software and software correction, connect with 3D TOF (Time of Flight) or similar function sensor connected with (Fig.1 to 5) input. to expand the scope of flexible structure, pay for subscription adopt a risk based model for fault call record , time, running, break Down, Check car & landing Door clearance and leveling measurement, multifunction measuring interface 3D TOF (Time of Flight), check the rope condition of each rope by accessing the lift operation, guide shoe situation, guide rail situation , traction sheave situation, vibration, The method is communicate from the rope suspension and input details such as Normal load Q, Car mass F, Wire rope type, Nominal strength R, rope diameter d, number of bending N, rope bending length L, Diameter of traction Sheave. D_t , Diameter of deflection Sheave D_r , Speed V for predictive analytics several formula models can apply, one of them such as obtain Simple Bending and Combined Fluctuating Tension and Bending With the constant tensile forces S and the number of simple bending cycles and the number of combined fluctuating tension and simple bending cycles for embedment the Claims as calculation as:

$$\lg N = b_0 + (b_1 + b_3 \times \lg D/d) \times (\lg S / d^2 -- 0.4 \times \lg R_0 / 1770) + b_2 \times \lg D/ d + \lg fd + \lg fC$$

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[0142] For general packet radio service Cellular wireless communication module, Cellular communication unit which interface with a control unit, Data received is transfer to remote storage and reporting using Cellular Network..Invented method establish a data and details Intelligence Remote Storage Smart Network System via wire/ wireless Data transmission with relevant software cellular connected and/or various wiring connected with power supply and/or power line carrier, the Smart Network System realizes the information transmission between the rope with related equipment, such as rope tensioning equalizer , load weighting between the Intelligence Remote Storage, such as irregularities in starting, stopping, etc., record the ratio between balance load, overload, no-load, full-Load, Peak time, and similar data interface with CCTV system, record the lift power metering under loading and unloading conditions, riding quality interface with power metering , monitor and storage the regenerative power used by different running mode of lifts interface with power supply & metering, protect the passenger and lift equipment from overload, over-traction interface with power supply & metering, pre-check the power to insure health operation when leaving each floor or landing interface with power metering , equipment safety compliance , critical parts by remote examination and measurement, maintenance and adjustment quality ,visual inspection interface with remote monitoring system , maximize elevator operation by ignoring

hall calls with a full cab or ignoring car calls with an empty car, scanning , analyzer and logger system interface with BMS ,and Building Model System, with power line communication and/or cellular connected monitor the transmission data and security reduce the cost of communication of various systems. LMAR operates in a private network that only permits particular users, is also well-protected against unauthorised access with various claims, elements and formula model described as above claim 1 to 5 identifies a system that is associated with the change link to the TOTAL Maintenance Management System together with the POWER, ENERGY and Maintenance Cost Control. The system for monitoring and reporting can help to audit periodic maintenance plans, risk based model include age and time of last inspection. The system for monitoring and reporting Network can help to compare the Lift operation audited report with the record of Building management. You can Audit the Lift operation in real time, Cloud & Fog computing via language to expand the scope of Analytics on sensor level, Fog Computing an additional layer decentralized (store & analyze & act), Cloud works as fast accessible, flexible storage system). Further to SSD & in memory DB, Storage in relates to data directly saved on memory, mixed storage architecture (hybrid databases), cheap by IO/sec, Price reduction (Moore etc).

[0143] Next step is viewports navigation control and Creation of 3D Models via specify computer program, include but not limited to building models in 3DS Max using AutoCAD plans, go through the steps to set viewport layout Sample Modeling, Material and Maps, Modeling in Detail, Lighting and Camera via Process Zoom function, perspective and orthographic viewport controls together in computing. Cameras capture views and their target can be selected and view port configuration. Basic information is recorded during quality audit of maintenance work factors such as:

a) File No., b) Building Name, c) address, d) Date of Installation, e) No. of Floors, f) Floor Served , g) Lift Manufacturer, h) Maintenance Company , i) Lift Type, j) Lift Number, k) Location of M/C , l) Rated Load, m) Machine Model, n) Disable Lift, o) Fireman lift p) Door open size, p) Door type etc. q) C.P. Model, s) No. of Ropes, t) Roping (1:1 to N:1) u) Rope Diameter, v) Normal load Q, w) Car mass F, x)Wire rope type, y) Nominal strength z) rope diameter aa) number of bending bb) Speed cc) Diameter of traction Sheave. dd) Diameter of deflection Sheave ee) rope bending length ff) the acceleration gg) other environment factors

[0144] In some embodiments of the present invention, a method provides a productive and cost-effective environment through optimization of its basic elements, open source RDBMS, TCO, by addition sensors , vision and IoT, IoS etc., such as temperature, humidity, air flow, flue gas ,IAQ, Lux, record the rope replacement data regarding decidable maintenance, Water leakage damage ; ATP testing , sound & Heat testing which independent separate with the elevator controller (Lift control panel "3") see Fig 5 . independent means obtain lift data implement for several system ,different model or different brand , what ever the lift is old version and new generation of existing lift and similiar equipment under the international standard of rope and/or cable structure interface to prior art element of BIM (Building Information Model), AR (Augmented Reality), AI (Artificial Intelligence), M2M Network, VPN (virtual private network) here are several structures for implementing , and M2M network can also be developed with the help of a VPN network. Simple data SIM cards are used for this purpose, which keeps the regular costs down.

[0145] In some embodiments of the present invention, a method is provided to achieve energy efficiency improvement by metering of lift power consumption (see Fig.3) together with the building design model (BDM) and the measuring energy value of the building power consumption and loading, carry out a scheme for energy saving by steps.

[0146] In some embodiments of the present invention, a method is provided in maximizing the effectiveness of power consumption , it is essential to identify as much as possible the building underlying operational problems and the improvement and optimization opportunities during investigation and reliable enough for energy gap identification.

[0147] In some embodiments of the present invention, a method is provided to conduct diagnostic monitoring of lift and escalator installation, logging lift power during peak hours and non-peak hours, it is logged for trending analysis.

[0148] In some embodiments of the present invention, a method is provided to analyze the collected trend logged data, measuring lift power consumption during a designed specific period , The ratio of lift power consumption during a designed specific period is plotted, it is found that the ratio is relatively high and can be lowered down so as to save energy and/or to store the regenerating power via a serious store battery bank and/or capacitor.

[0149] In some embodiments of the present invention, a method is provided to maintain an effective working environment, run automatically and comprehensively, and be flexible enough to adapt to future changes in the needs of the working environment.

[0150] In some embodiments of the present invention, a method is provided to compute and investigation with the collected building documentation such as invented elements addressed in but not limit to the items list out in Solution.

[0151] In some embodiments of the present invention, a method is provided in maximizing the effectiveness of power consumption, it is essential to identify as much as possible the building underlying operational problems and the improvement and optimization opportunities during investigation and reliable enough for energy gap identification.

[0152] In some embodiments of the present invention, a method is provided in maximizing the building operation improvement, the data collection is suggested to be carried out throughout the year so that the operation parameter trends in cooling, heating and intermediate seasons can be examined in full. Underlying operational problems would

occur for diagnostic monitoring and functional testing.

[0153] In some embodiments of the present invention, a method is provided in conducting initial equipment and devices checking simple fixing of systems, such as calibration of sensor, as they are discovered usually increases the effectiveness of the diagnostic monitoring and testing and facilitates the process of understanding the root problems of operational issues.

[0154] In some embodiments of the present invention, a method is provided in performing energy modeling for the building, if enough building information can be provided for input to such energy simulation. For the required building information to input.

[0155] In some embodiments of the present invention, a method is provided and related to Energy modeling can: (a) evaluate accurately the detailed breakdown of energy use for the building; and (b) evaluate the amount of energy cost saving to help selecting the identified opportunities.

[0156] In some embodiments of the present invention, a method is provided in developing plan, to summarize all the findings in planning stage and plan the subsequent activities in Network, for optimizing the existing building, such as building current operating information; building annual energy use and its breakdown;

[0157] In some embodiments of the present invention, a method is provided in wear-minimizing uneven setting of the rope tensions of hoisting rope in order to Increase safety measure and limit wear and tear. systems be held an elevator installation with various load distributions in the rope set during the ride, it can be adjusted optimally.

[0158] In some embodiments of the present invention, a method is provided to investigate of incidents such as uncontrolled movement, sudden falling or similar complaints via remote auditing. Regarding running environment, quality, stress, tension, suspension, vibration, frequency, force equalization etc., Calculation the service life of wire ropes or cables for even life (the ropes, cable always have a limited services life. Therefore they can be replaced well before failure) and related elements to all related rope and/or cable data regards to lift equipment's such as groove, sheave, pulley, gear, shaft, resist relatively large axial load in comparison to bending and torsional loads interface to prior art element. the collecting data be carried out by the lift to overcome the friction of the first starting and due to the mechanical efficiency of the shaft (pulley, guide shoes, etc.), force factors $f_{s1} \dots f_{s4}$, friction from the load guidance. (LMAR Network) also credible predict the service life caused by the friction and the performance of the lift operation.

[0159] In some embodiments of the present invention, a method is provided to measure power needed is affected , besides the load, by the unbalanced load to move , characterized regeneration of electrical power and storage and reuse (Energy management entities to monitor, measure, and control their electrical building loads. It can provide metering, sub metering, and monitoring functions that allow facility and building managers to gather data that allows them to make more informed decisions about energy activities across their sites according to (a) Energy management system (ISO 50001), (b) Environmental management system (ISO 14001), (c) Information security management system (ISO/IEC 27001)) while stimulating technological innovation and economic growth with the flexibility required to exchange CO₂ cap-and-trade (C&T) Emissions trading program on the wholesale electricity prices market-based approach to controlling pollution by providing economic incentives, reduction emissions most cheaply , achieving lowest cost to society , notably for mitigating climate change; therefore the proposed benefits mentioned list out and embodiment in Solution achieved by the invented method, apparatus and elements .

[0160] In some embodiments of the present invention, a method is provided to audit the sum of basic elements defines the shaft efficiency, measuring the quality of lift installation. In fact the higher the shaft efficiency is, the lower the energy that is dissipated due to friction. Predict the power dissipated through the aerodynamic resistance (proportional to the square of the rated speed) produced during the lift operation.

[0161] The embodiments disclosed herein may be implemented using general purpose or specialized computing devices, mobile communication devices, computer processors, or electronic circuitries including but not limited to digital signal processors (DSP), application specific integrated circuits (ASIC), field programmable gate arrays (FPGA), and other programmable logic devices configured or programmed according to the teachings of the present disclosure. Computer instructions or software codes running in the general purpose or specialized computing devices, mobile communication devices, computer processors, or programmable logic devices can readily be prepared by practitioners skilled in the software or electronic art based on the teachings of the present disclosure.

[0162] In some embodiments, the present invention includes computer storage media having computer instructions or software codes stored therein which can be used to program computers or microprocessors to perform any of the processes of the present invention. The storage media can include, but are not limited to, floppy disks, optical discs, Blu-ray Disc, DVD, CD-ROMs, and magneto-optical disks, ROMs, RAMs, flash memory devices, or any type of media or devices suitable for storing instructions, codes, and/or data.

[0163] The foregoing description of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations will be apparent to the practitioner skilled in the art.

[0164] The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention for various embodiments and

with various modifications that are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalence.

5 **Claims**

1. A system for monitoring operations of a lifting system comprising one or more lifts and one or more counterweights, comprising:

10 one or more load sensors, each installed on a suspension means or lift equipment, for collecting lift operation data comprising tension profile, power consumption, and loading of the lift, wherein the suspension means comprises one or more ropes, cables and one or more tracking pulleys;
a load control unit for controlling the movement of the lifts;
15 a processor, electrically connected to the load control unit, configured to execute an optimization process to optimize load distribution in the suspension means and the power consumption of the lift;
one or more remote processors configured to receive and store the lift operation data;
a communication module, electrically connected to the processor, for communicating with the remote processors and a control center; and
20 the control center comprising one or more networked user interfaces, for accessing and retrieving data from the remote processors.

2. The system of claim 1, further comprises a plurality of noise sensors for collecting noise data for determination of the load distribution evenness of the cables in the suspension means;
wherein at least one of the load sensors is integrated with a wired or wireless transmitter for transmitting the lift
25 operation data to the load control unit;
wherein at least one of the noise sensors is integrated with a wired or wireless transmitter for transmitting the noise data to the load control unit; and
wherein the load control unit is integrated with a wired or wireless transceivers for receiving lift operation data from the load sensors and transmitting data signals to the remote processors for audit control.

3. The system of claim 1, further comprises:

35 one or more electric drives for actuating movements of the lift;
one or more isolating switches, each installed between a motor control panel and an electrical power supply, for allocating currents to the electric drives according to the power consumption of the lifting system measured by the load sensors; and

40 one or more regenerative energy storage assemblies, each respectively connected to one of the isolating switches, for storing electrical energy regenerated during movements of the lift cars and/or counterweights, and feeding the stored electrical energy into the lifting system or an electricity distribution network.

4. The system of claim 1, further comprises:

45 one or more cameras, for capturing the lift movements and passenger flow for simulating the lift cars' flights;
one or more door sensors, each installed in one of the lift, for detecting whether the lift car's doors are opened or closed; and
one or more hoist brakes and braking means, wherein each of the hoist brake or braking means is urged to hold the lift car when the door sensor in the lift detects that the doors of the lift are opened.

50 5. The system of claim 1, further comprises

55 one or more fire or smoke detectors, each installed in one of one or more lift shafts and building facilities for detecting presence of fire and transmitting a fire detection signal to the load control unit when the presence of fire is detected;
a fire alarm system;
wherein the fire alarm system operation comprises moving the lift cars to a safety floor when the fire detection signal is received.

6. The system of claim 5, wherein the fire alarm system comprises one or more ventilation ports located above at least one of the lift shafts;
wherein at least one of the ventilation ports is installed with a solar thermal-energy exchange window;
wherein the solar thermal-energy exchange window; and
5 wherein the solar thermal-energy exchange window is closed for energy generation under normal condition and caused to open for ventilation when the presence of fire is detected.
7. A system for monitoring and reporting one or more building facilities' life cycle, maintenance, and metrics audit, comprising:
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 one or more sensing modules for collecting operation data of the one or more building facilities;
 one or more processors configured to:

 receive and store the collected operation data;
15 simulating a building information model (BIM) of the building using the collected operation data;
 generate the one or more building facilities' life cycle, maintenance, and metrics audit reports using the collected operation data;
 compute a present carbon dioxide emission of the building; and
 predict a future carbon dioxide emission of the building.
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8. The system of claim 8, wherein the sensing modules comprise one or more load sensors, each installed on a suspension means in at least one of the lift for collecting lift operation data comprising cable tension profile, power consumption, and loading of the lift.
- 25 9. The system of claim 8, wherein the sensing modules comprise one or more electrical transformers, each installed in an electrical power circuit of one of the building facilities for measuring electrical and/or voltage of the building facility's electricity consumption.
- 30 10. The system of claim 8, wherein the sensing modules comprise:

 one or more fire or smoke detectors, each installed in one of one or more lift shafts, for detecting presence of fire and transmitting a fire detection signal to the load control unit when the presence of fire is detected;
 a fire alarm system;
 wherein the fire alarm system operation comprises moving the lift cars to a safety floor when the fire detection
35 signal is received;
 wherein the fire alarm system comprises:

 one or more ventilation ports located above the lift shafts, wherein the ventilation ports are caused to be
 opened when there is the presence of fire is detected.
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11. The system of claim 7, further comprising one or more photovoltaic solar electricity generation units;
wherein the photovoltaic solar electricity generation units comprise one or more building windows and building glass wall coated with transparent photovoltaic material and electrically connected to an electricity storage station.
- 45 12. The system of claim 7, further comprising one or more solar thermal-energy exchange units comprising one or more building windows coated with transparent thermal absorbing material and connected to a thermal-electricity conversion layer;
wherein the thermal-electricity conversion layer is a piezoelectric coating on the coated building window electrically connected to an electricity storage station.
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13. The system of claim 11, further comprising a ventilation system comprising one or more ventilation ports located above at least one of the lift shafts;
wherein at least one of the ventilation ports is installed with one or more of the coated building windows; and
wherein the coated building windows installed at the ventilation ports are caused to open for heat dissipation.
55
14. The system of claim 12, further comprising a ventilation system comprising one or more ventilation ports located above at least one of the lift shafts;
wherein at least one of the ventilation ports is installed with one or more of the coated building windows; and

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wherein the coated building windows installed at the ventilation ports are closed for energy generation from the lift shafts heat under normal condition and are caused to open for heat dissipation.

5 15. The system of claim 11 or 12,

wherein excess electricity generated by the coated building windows is redistributed into an electricity distribution network; and

wherein the excess electricity is tracked for carbon trading.

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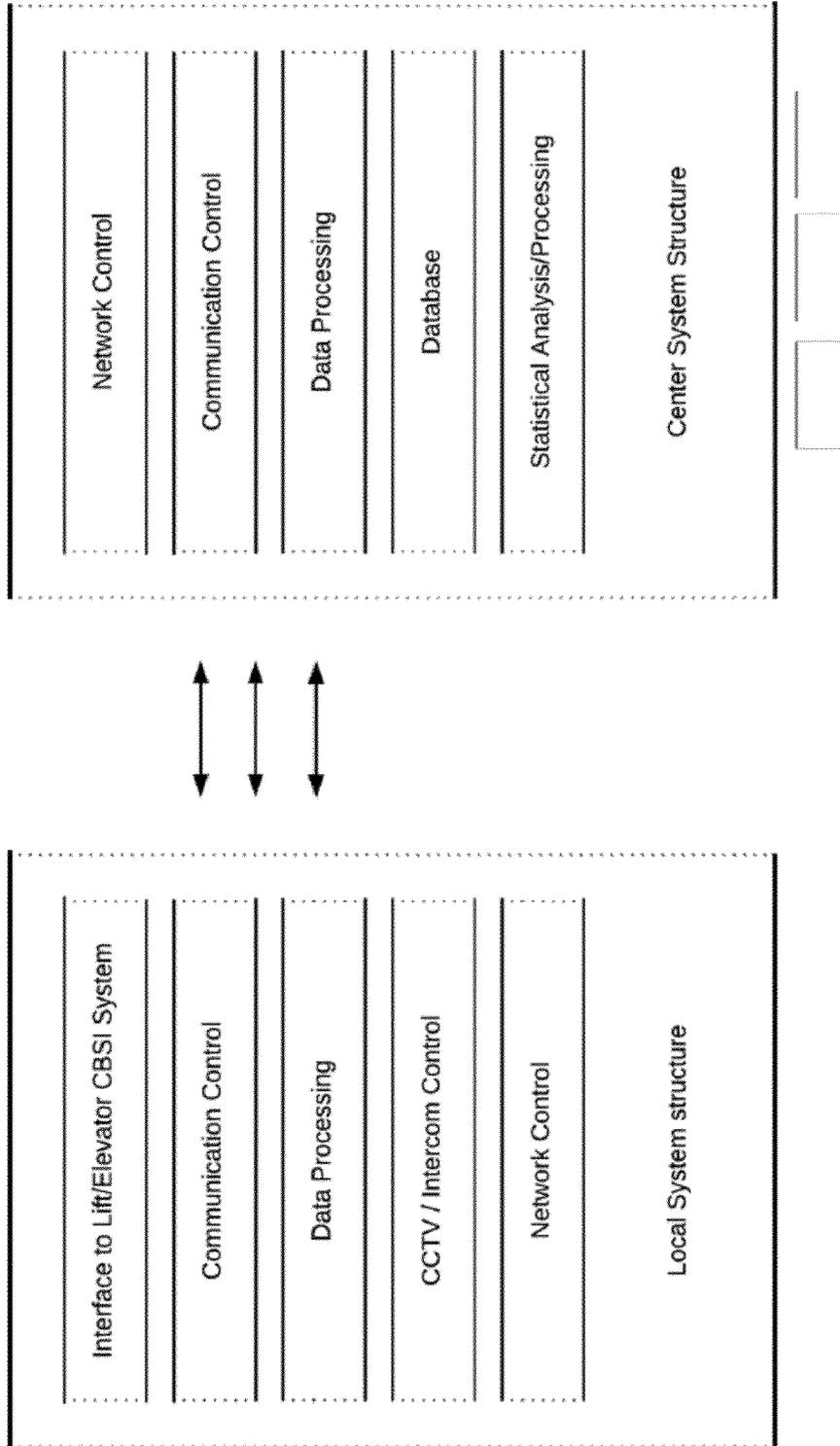


Fig. 1

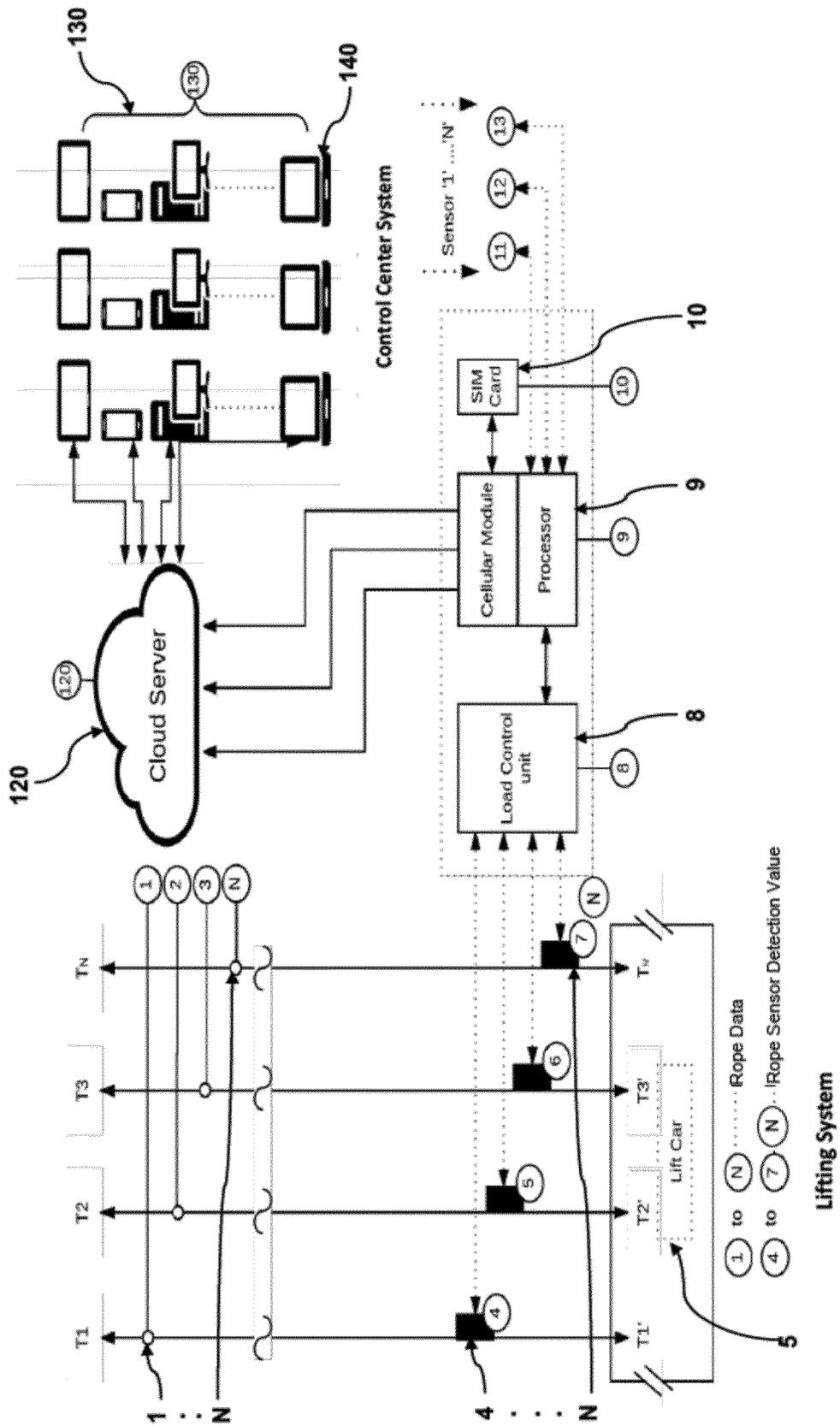


Fig. 2

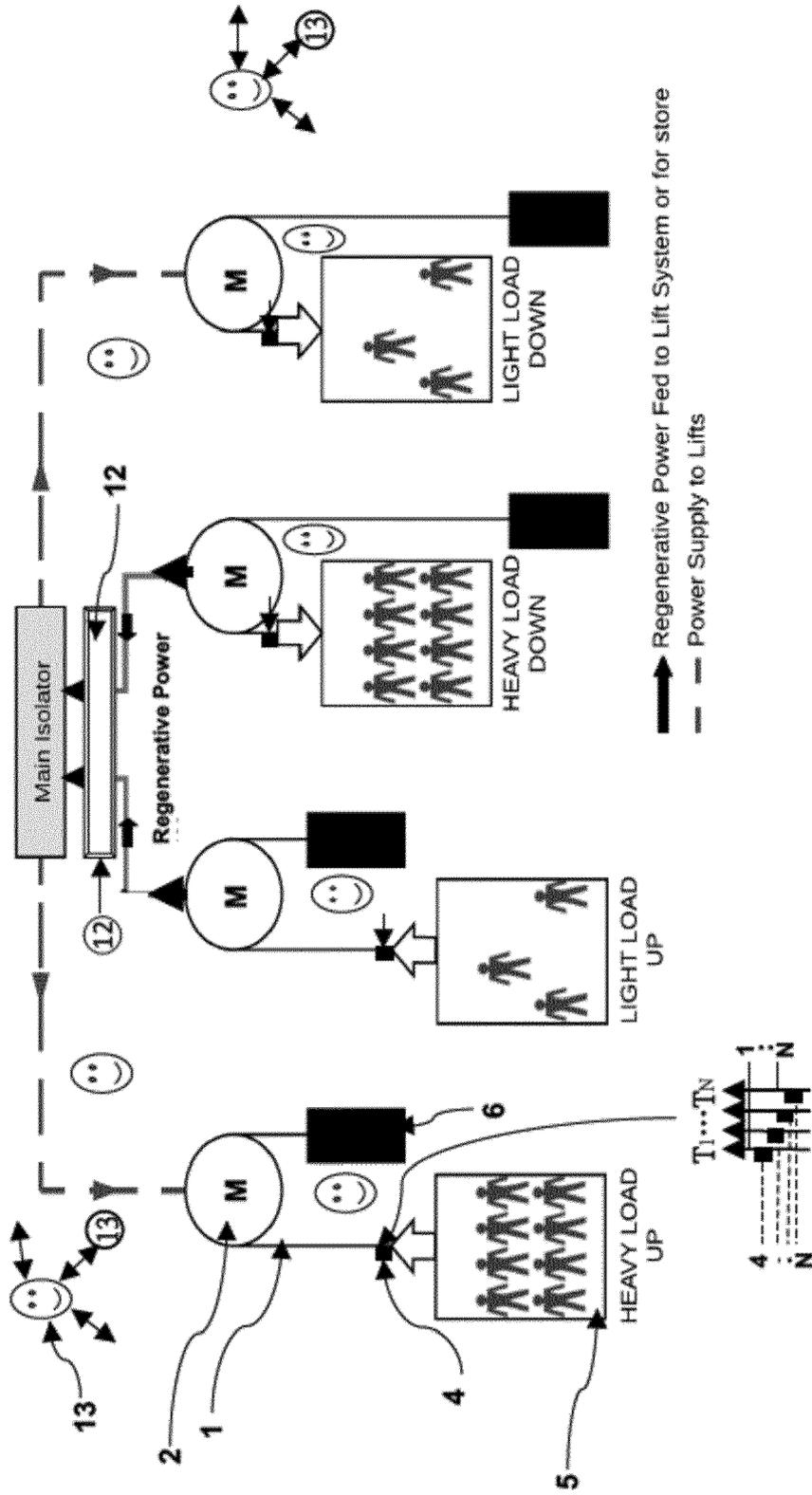


Fig. 3

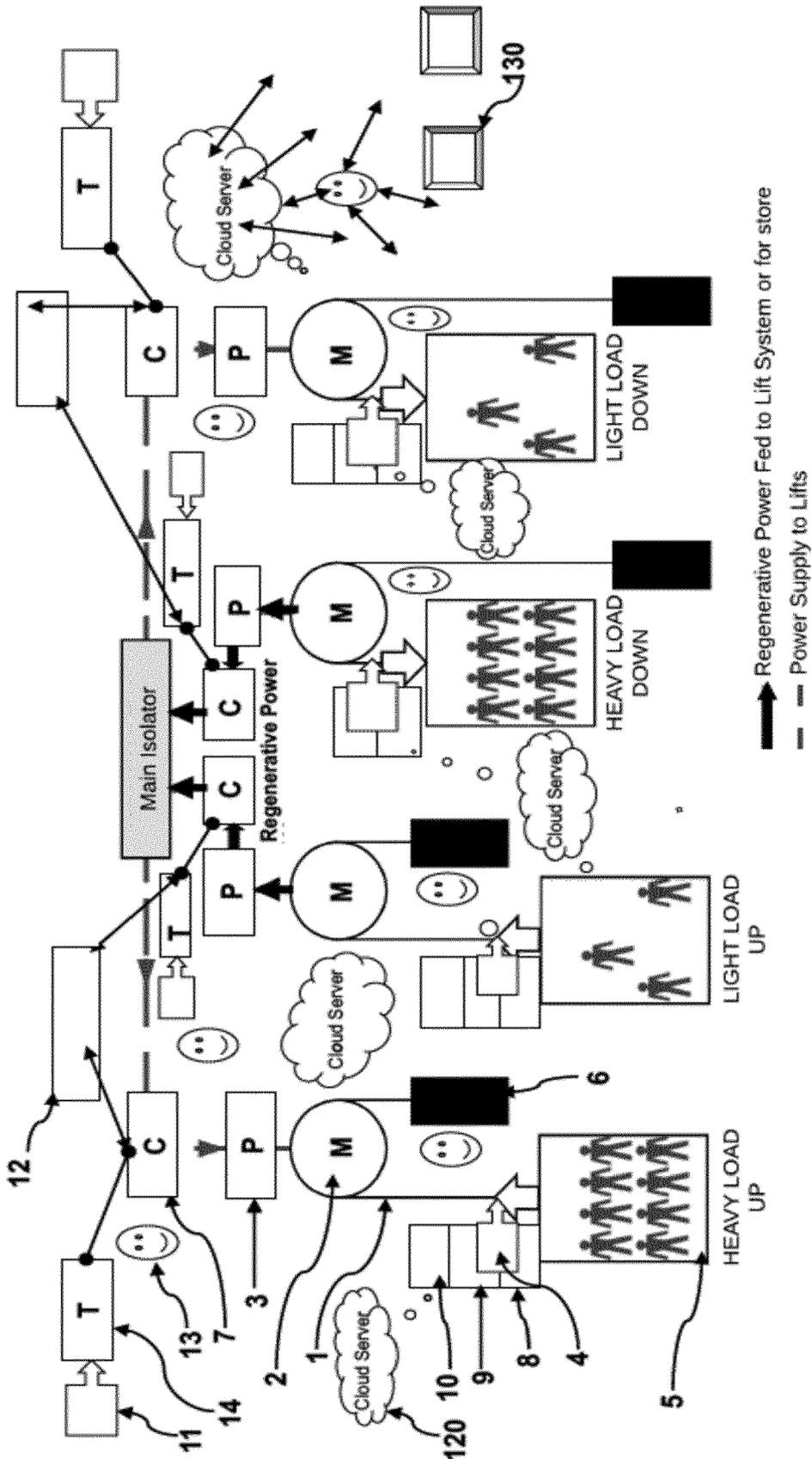


Fig. 4

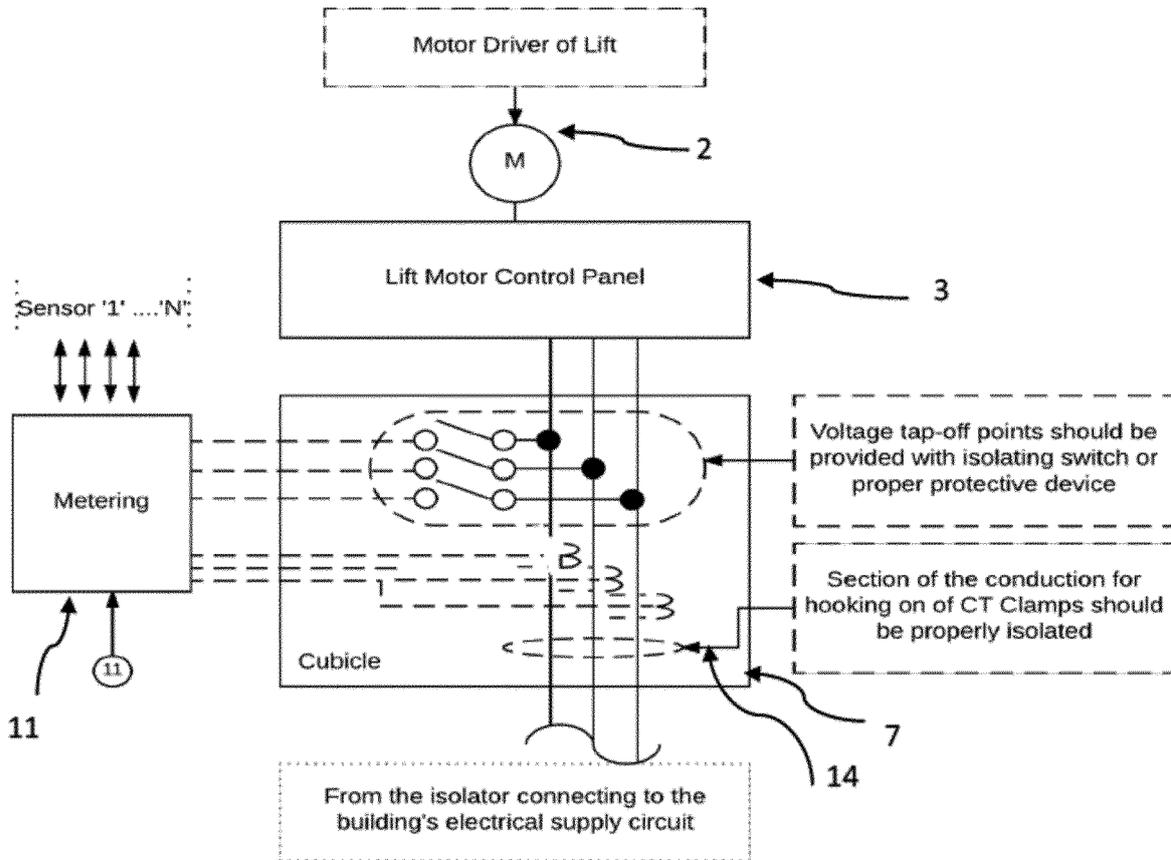


Fig. 5



PARTIAL EUROPEAN SEARCH REPORT

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of subsequent proceedings, as the European search report

EP 17 19 6719

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	MICHAEL MOUSA ET AL: "Utilizing BIM and Carbon Estimating Methods for Meaningful Data Representation", PROCEDIA ENGINEERING, vol. 145, 1 January 2016 (2016-01-01), - 31 December 2016 (2016-12-31), pages 1242-1249, XP055486604, AMSTERDAM, NL ISSN: 1877-7058, DOI: 10.1016/j.proeng.2016.04.160	7,9	INV. B66B5/00
A	* the whole document *	8	
X	US 2013/179207 A1 (PEREZ RODRIGUEZ DORIS S [US] ET AL) 11 July 2013 (2013-07-11)	7,9,11	
A	* the whole document *	8	
X	JP 2014 102590 A (TOSHIBA ELEVATOR CO LTD) 5 June 2014 (2014-06-05) * the whole document *	7-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
INCOMPLETE SEARCH			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.			
Claims searched completely :			
Claims searched incompletely :			
Claims not searched :			
Reason for the limitation of the search: see sheet C			
Place of search		Date of completion of the search	Examiner
The Hague		26 June 2018	Oosterom, Marcel
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		& : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04E07)

**INCOMPLETE SEARCH
SHEET C**Application Number
EP 17 19 6719

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Claim(s) completely searchable:
7-15

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Claim(s) not searched:
1-6

Reason for the limitation of the search:

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1. The present application comprises two independent claims of the same category, namely independent apparatus claim 1 and independent apparatus claim 7, which do not fall under any of the exceptions stated in Rule 43(2) EPC.

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2. In response to the invitation under Rule 62a EPC, the applicant requested to have the second independent claim (and the corresponding dependent claims) searched, i.e. claims 7 to 15.

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 19 6719

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-06-2018

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
15	US 2013179207 A1	11-07-2013	CA 2861552 A1 CN 104185851 A EP 2801060 A2 US 2013179207 A1 WO 2013103463 A2	11-07-2013 03-12-2014 12-11-2014 11-07-2013 11-07-2013
20	JP 2014102590 A	05-06-2014	JP 5619113 B2 JP 2014102590 A	05-11-2014 05-06-2014
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82