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(54) Title: MULTISENSOR INTELLIGENT STREET LIGHT WITH COMPLETE SYSTEM

(57) Abstract: iStreetLight (hereinafter ISLS) street lighting system according to the invention represents a new concept in urban infrastructure building which in addition to lighting has active interaction with the environment by collecting data via sensor array related to atmospheric conditions and traffic conditions. At the same time platform is using solar energy and / or kinetic energy of moving vehicles and transmit radio waves related to utility, navigation and value added services. ISL is a device in the form of standard street lamp with the pole, which is composed of a central microprocessor component iCore (IE), LED bulb (1 K), communication module (1C), sensor array module (IB), module for energy collection iHarvest (1G), battery (1 H) and module for utility and value added services broadcasting to the end users (ID). All components are electrically connected and packaged in one or more water resistant box. Each ISL in network communicates with central system iStreetHost (hereafter ISH) (2D) via wireless network (2B) and the Internet (2C) sending all gathered data and ISL status information. Central ISH system (2D) is performing collection, storage and processing of data received from the ISL network, estimates traffic and microclimate conditions in ISL network area. ISH (2D) estimation results and the data required for the additional service sends back to the interested users via ISL network by using ISL transmission module (ID) and provides them available to the internet users (2C). ISL is collecting energy from the environment by iHarvest module (1G), which is receiving solar panel (1A) output and / or energy output from devices based on electroactive polymers EAP (1L) collecting kinetic energy of moving vehicles. iHarvest module (1G) and is connected to the power distribution network via connection (IF). ISL uses energy from the distribution system only when the energy level in the battery (1H) is below the defined limit of sufficient power for ISL. Figure 1 - Elements iStreetLight lamps Figure 2 - Communication between iStreetLight devices (2A) with iStreetHost (2D) central system and with environment (2E) Figure 3 - Block schematic of iSensor module

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Multisensor intelligent street light with complete system

Technical field

Invention belongs to the field of electrical engineering and information communication technology in general and public lighting systems and network management of public lighting systems.
According to International Patent Classification (IPC) designation is: H01 / CDEF, H01 / A

Background art

The existing street lighting networks performing only passive lighting of public areas with light intensity of 100% all over the entire operating time. There is no interaction with the environment, networks are not adaptive, networks do not provide additional services. The existing lamp networks are not able to transfer data related to the weather* conditions, traffic status and its own status to the central location, there is no possibility to collect energy from the environment, there is no option to program lamp behavior , there is no possibility to change lamp operating mode remotely, existing lamp networks do not have feature for value added services broadcasting.

Existing concepts of street lighting so far are without interaction with the environment and the intelligence embedded in them is minimal or nonexistent. The highest level of intelligence in lamps on the market is information delivery to the central location related to the lamp safety. Systematic collection of energy from the environment in order to optimize consumption and delivery of energy surplus back to the power supply system does not exists. With existing lamps with solar panels solar panel is the only one source of energy. Collection of kinetic energy of vehicles is not existing. Broadcasting service related to value added services wired and/or wireless do not exists. Collection and delivery data related to the environmental and traffic conditions on the field towards central location does not exists. Traffic load measurement does not exists.
There is no advanced central system for street lamps network management able to send data related to value added services to the end users via lamp network available as an Internet resource to.

Disclosure of the invention

iStreetLight (ISLS) street lighting system according to the invention represents a new concept in urban infrastructure building which in addition to lighting control service has an active interaction with the environment by collecting sensor array data related to the atmospheric conditions and traffic conditions. At the same time energy is gathered from the environment using solar energy and/or kinetic energy of moving vehicles and radio transmition is performed related to utility, navigation, and value added services.

ISL lamp is a intelligent device primarily focused to consume optimal energy for lighting, through different modes that can be programmed and changed remotely from a central location ISH. Central location can perform real-time working mode update for individual lamp or group of lamps. Lamps can be grouped at the level of street segments, street segments are grouped into blocks of buildings, blocks of buildings are grouped in the municipality. By optimal working mode selection for lamps based on the traffic density level ISH can achieve significant savings in power consumption.

ISL lamp is monitoring traffic density levelwith very precise estimation based on data gathered from motion detectors installed inside iSensor(3A) module and iEAP (11) module at the control points that are also used to collect the kinetic energy of moving vehicles.

Networked ISL lamp communicates with the central system ISH (2D) via a wireless network (2B) and Internet (2C) delivering all collected data related to atmospheric conditions at the microlocation as well as ISL status information.

ISL collects energy from the environment using iHarvest module (1G), which as inputs has solar panel (1A) for solar energy collection and/or devices based on electroactive polymers EAP (11) for kinetic energy of moving vehicles collection. iHarvest module (1G) is connected to the power distribution network via connection (1F). ISL uses energy from the distribution system only when the energy level in the battery (1H) is below the predefined limit.

Central ISH system (2D) is performing collection, storage and processing of all data received from the ISL network devices. Processed data results and valued added services related data ISH (2D) provides to interested parties through the ISL network via ISL transmission modules (1D) and makes them available to all internet users (2C) to.

Brief description of drawings

Invention is in detail shown on drawing where:
Picture 1 - JStreetLight" inteligent street light (ISL) block schema,
Picture 2 - JStreetLight" inteligent street light (ISL) interconnection with central location (2D),
Picture 3 - iSensor (1B) block schema and connection with sensor bus.

A detailed description of the invention

iStreetLight (hereinafter **ISLS)** street lighting system according to the invention represents a new concept of interactive, intelligent and adaptive network of street lights. **ISLS** is network of street lamps **SL** and information system on central location iStreetHost (hereafter **ISH) (2D).**

ISL is a modular device in the form of standard street lamp with the pole, which is composed of but not limited to central microprocessor based component **iCore** (1E), LED lamp (1K), communication module **iCom**(**1C**), the sensor module **iSensor** (1B), energy collecting module **iHarvest** (1G), batteries (1H), solar panel (1A) module for value added services broadcasting **iTransmit** (1D). Components 1A, 1L, 1K and 1H are independent but wired with the central module **iCore** (1E). Components 1B, 1C, 1D, 1F and 1G are wired with respective lines and packaged in one or more water-resistant casing. **iHarvest** component (1G) in addition to kinetic energy collection from the street surface is providing data related to the weight of vehicles passed over iEAP modules (11).

Each ISL over a wireless network (2B) and the Internet (2C) communicates with the central system ISH (2D), delivering all collected data and information related to status of ISL. Central system (2D) collects, stores and processes all data received from ISL network devices and performs estimations related to traffic and microclimate conditions in ISL networks environment. Informations produced by data processing and data related to value added services iStreetHost (2A) provides back to all interested parties through the ISL network via ISL transmission module (1D) and makes them available to all Internet users to (2B).

Each device is equipped with ISL iHarvest (1G) module and collects energy from the environment. Energy from the sun as solar panel output and kinetic energy of moving vehicles through iEAP (11) device.

Segments of the ISL on roads with high density traffic are two-way system with inverter linked to the power grid and all surplus of energy produced is transfered back to the power grid. ISL can use energy from the power grid or will-send back surplus of produced energy to the power distribution network.

For street lighting in iStreetLight instead of standard neon, sodium and mercury LED bulbs are used. ISL can supports standard light bulbs, although the level of controllability of standard bulbs is significantly lower then controllability of LED bulbs.

iComm communication module is connected to SLH via a wireless network in order to control and monitor network devices ISL. All data obtained by ISL (number and weight of vehicles that have passed over iEAP module, environmental temperature, motion, humidity, level of ambiental light) are sent the SLH information system .

SLH is processing received data in order to establish optimal level of energy consumption for lighting, surveillance and optimal transport infrastructure management as well as for value added services development and support.

SLH is using collected data for creation of maps related to the real-time optimal traffic routing. Mentioned maps are available via Internet to the navigation systems and all interested parties.

Light control (on / off / partially (0-1 00%)) can be realized in three ways:

a) The lamp itself is turning on/off depending on the ambiental light level registered by iSensor module.

b) iSensor module provides data related to movement or vehicle passage over iEAP modules. If there is no traffic or movements close to ISL device , light can be partially shut down during the night time down to the any value between 0% and 100%. Brightness level is controlled by **iCore** module whose work program (firmware) can be remotely updated from SLH system. If iSensor/iEAP detected traffic, lights around the lamp will temporarily turn on according to predefined level defined for hour of the day (00-24).

c) The lamp can be turned off / on / dimmed manually by direct intervention from the central information system (ISLS).

Patent Claims

1. Street lighting system wherein a network of apparatus of claim 1 communicating with the information system on central location (2D) via wireless network and gathering data related to meteorological conditions, motion detection, number and surface impulse of the vehicles during the time that provides iEAP module (11), ISL status, receiving instructions from a central location related to work mode and emit radio waves towards end users who may be humans or machines related to utility and value added services.

2. An apparatus comprising modular device in the form of standard street lamp, composed of a central microprocessor component , which controls all subsystems, LED bulb , communication module , which provides communication with a central location via a wireless network, expandable sensor module , which measures environmental parameters and motion detection, solar panel for collecting solar energy, module for optimum power management , which manages the energy collected from autonomous sources and the energy that comes from power distribution network connection, a module based on electroactive polymers , which collects running vehicles kinetic energy passing over surface and provides data related to vehicles kinetic impulse, batteries for collected energy storage , module for value added services data broadcasting towards end users , which are connected electrically and packaged in one or more water resistant case.

FIG.1

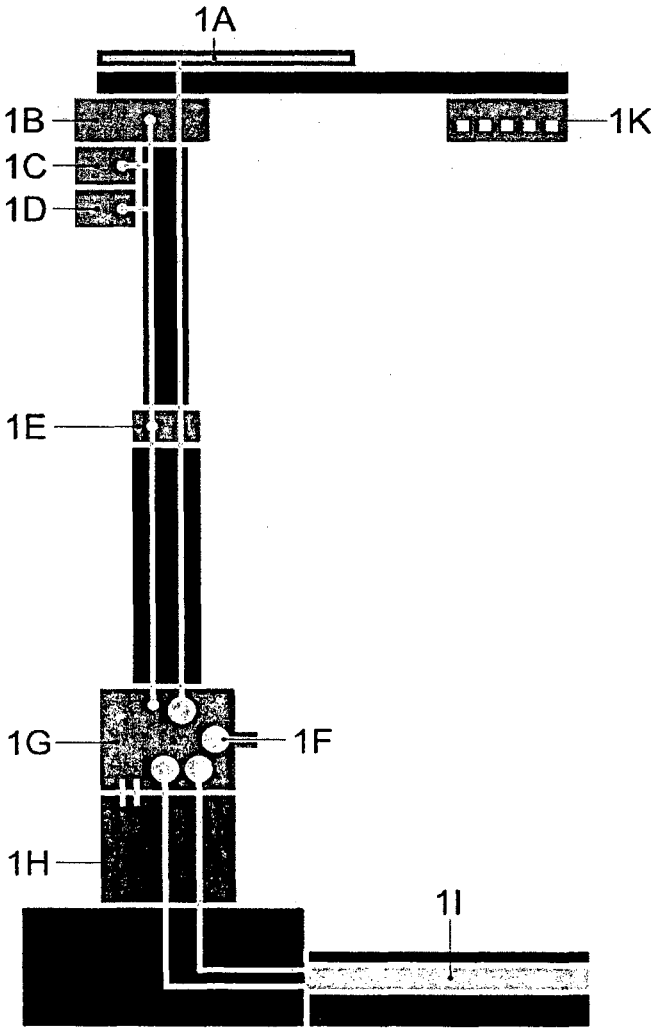


FIG.2

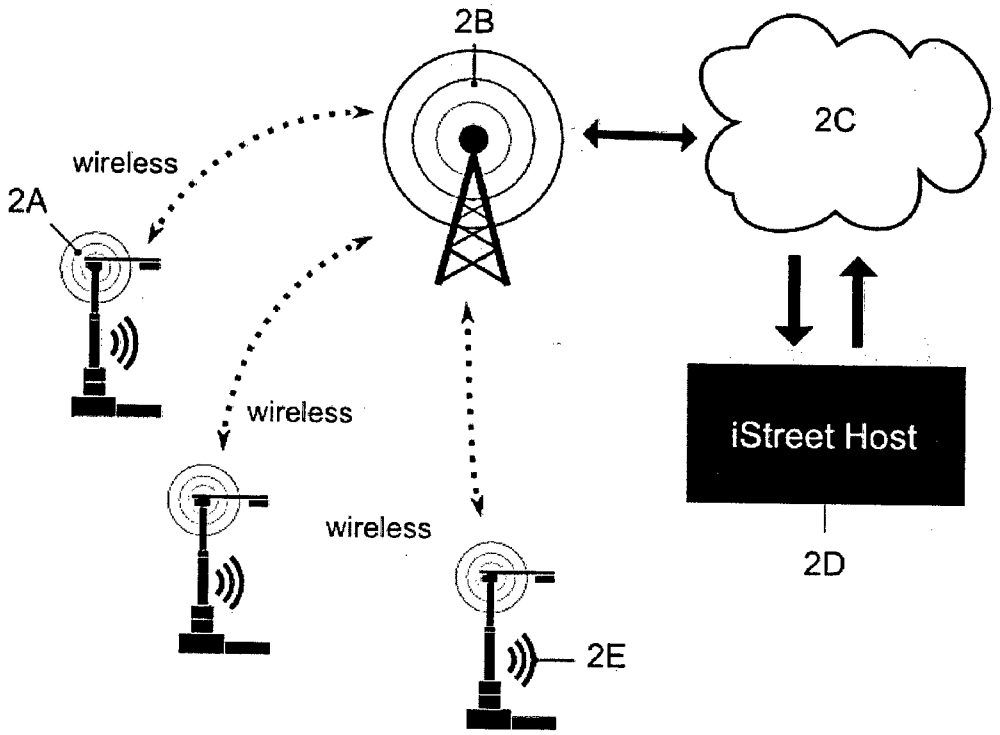
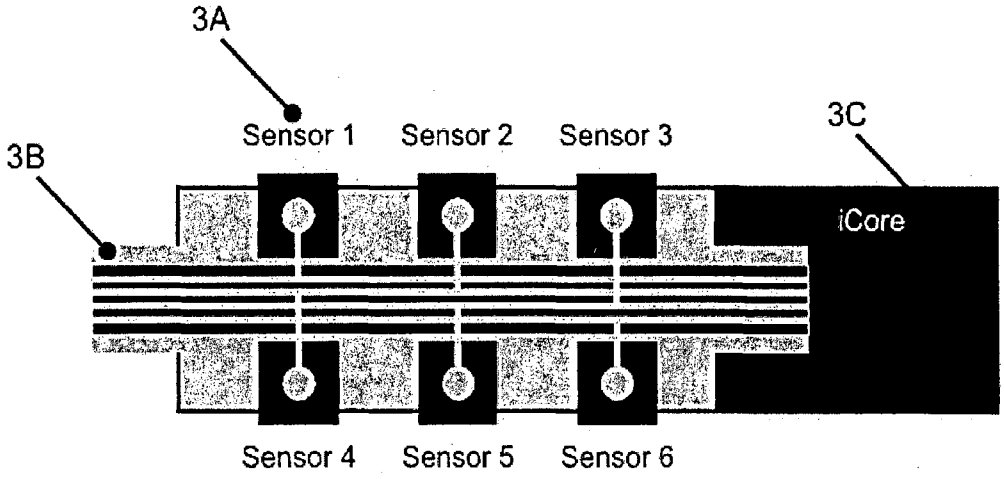


FIG.3


3A
Sensor 1
Sensor 2
Sensor 3
3C
3B
iCore
Sensor 4
Sensor 5
Sensor 6