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Research Article

SMART AND LIVE SURVEILLANCE OF STREET LAMPS

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ABSTRACT

Introduction: More than 350 million lamps that illuminate world consume a large quantity of energy, which may estimate about 19 percent of world's energy consumed. Smart street lightening uses wireless technologies to manage and monitor the particular quantity of energy consumed by these street lamps. The present article discusses the smart and live surveillance of the street lamps.

Aims and objectives: The aim of this proposed smart surveillance of street lamp are reduction of light pollution, maintenance cost reduction, Energy Saving, Wireless communication, Reduced man power etc., The experimental results confirmed that the proposed Smart Street Lamp can improve the energy saving.

Materials and methods: The smartness of street lamps springs from a micro-controller and a few sensors in addition to the wireless module. To show the live surveillance of the street lamps using java script, through fetching the power, voltage values to detect the abnormal condition of the street lamps which includes broken, stolen etc., For power conservation Ambient sensors, IR sensors are used. Smart surveillance of street lamp based on wireless networks (WiFi, 4G) is used to readdress those vintage wired issues.

Results: The Smart Surveillance of Street Lamps in smart cities for the betterment of the people's survival is managed in simplified manner

Conclusion: Intelligent sensing streetlight, Economical network, Versatile management platform, Live data stream management the above all features which is necessary for the smart surveillance is achieved successfully.

INTRODUCTION

Most of those vintage streetlamps are ON all through the night, even when there is no one nearby. Therefore with the aim of saving both electricity and money, growing number of areas around the world are opting for smart technologies to prevent unnecessary wastage of energy by dimming or automatic switching ON/OFF at nights. The smart street-lamping system consists of IR sensors, LDRs, microcontroller and WiFi Modules connected up to each other over wireless media. The resistance of an LDR reduces when light cascade on them and increases in the absence of light. Vehicles passing by a street lamp are detected by Infra Red sensors. In the wireless one, it says that each street lamp must be set with special types of sensors that are linked to a microcontroller to observe its surroundings with regards to its functioning needs like light potency, current capability, voltage load and high temperature which are composed and transferred by the means of radio frequency. Two forms of communication were performed, one for short series communication data substitute between street lights and the second one for long range exchange data from street light and the data center. It is necessary to optimize the current street lamp supervision because of its high energy consumption on a daily basis.

Presently, the street lamps, mainly adopt the manual management or light perception control, which both have certain disadvantages, which are as follows.

More energy consumption: Current street lamps have only two states, OFF and ON. Moreover, they cannot adjust their brightness. Therefore, they consume unnecessary energy. Sometimes, the street lamps can be dimmed to reduce energy consumption.

More Man Power: As the vintage streetlamps method has the manual switching on and off of the lamp it needs the man power unnecessarily. Sometimes he/she may forget to on or off which leads to improper maintenance of lamp.

Excess upholding period: Both manual management and light perception control adopt manual patrol to check broken street lamps. Therefore, the maintenance period is too long, especially for the suburban street lamps, it can be even longer

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than a few months. However, the danger increases just after the street lamps are broken, thus there could be more traffic accidents and more robbery and stealing.

Firm fine speck control: It is obvious that the manual management is not smart enough, and it can be difficult to control in real time. Moreover, to simplify the manual management, one switch is used to control many street lamps simultaneously. In the light perception control, the flexibility is almost limited. Remote and real-time controls are not part of the current management system.

Simply stolen: There is no effective method to prevent stealing of street lamps. There are many streetlamps, so it is particularly impossible to control all of them all the time. To avoid stealing, the effective way is to make street lamps have self-supervise ability.

Increased photo pollution: Photo pollution is the excessive, misdirected or invasive use of artificial outdoor lighting which releases more than 12 million tons of carbon dioxide, the most severe greenhouse gas, into the atmosphere each year.

No live data transmission: For the particular region of street lamps it is difficult to produce the live data transmission about the voltage, power and temperature measure of those lamps.

System Overview

The Smart Street lamp communicates with the server periodically. Each and every street lamp has to send the status of individual lamps to the server. The network media in which the street lights send the information rely on either Bluetooth wifi or any operator network like 3G or 4G.

The sensors like GPS sensor or location sensor for tracking the current position of the smart street lamp. The infrared sensor detects the objects or humans count in particular area where a Smart Street lamp is located. The Ambient or light sensor is used to detect current illumination density in particular area. All these sensors will be sensing the values in a particular SSL. The voltage and current values are also get monitored. Using intelligent sensing street lamps and efficient network, the server gets the information of all street lamps, consisting of lamps states, locations, external environment brightness, and so on. As all the data from each SSL node sends the sensed values to the Server periodically computation will be carried on in edge level based on the values depicted the emergency will be triggered. In case of theft scenario when the GPS sensor is sending varied position values with various changes in all the other sensed data an emergency alarm will be invoked. If the SSL node has got broken then automatically the energy consumption for particular node will be reduced and some unfair values will be generated from light sensor. This upgrades a maintenance complaint to the Server.

To optimize the fore mentioned disadvantages to establish the smart cities, a new generation of street lamps has to improve the lamp performance by introducing the following features.

1. Decrease energy consumption: The brighter the street lamp lights up; the more energy is consumed. However, by using a dynamical light intensity adjustment according to current demands, energy consumption will decrease.
2. Reduced upholding period: The maintenance period is one of the most important parameters in the smart cities. Therefore, the maintenance period must be reduced as much as possible. There must be a mechanism to check broken lamps in real time.
3. Satisfy firm speck control: Fine grain control includes few parts: first, every street lamp needs a unique identification to distinguish each other; second, every street lamp should be controlled independently; third, all street lamps should be controlled all the time; fourth, every street lamp must be able to adjust its brightness according to current demands.
4. Self-directed alarm to avoid stealing: Every street lamp needs to have self-protection ability. When it is stolen, it should autonomously send the alarm that is notification. In this way, the street lamp stealing can be avoided.
5. Motion control: When any object crosses the street lamp it detects the motion of the street lamp and produces the intensity of light according to the strength of the motion passed.
6. Water Resistance: We provide the water resistance box to every street lamp to prevent the damages caused during the rainy season.
7. Reduced photo pollution: Emission of carbon dioxide is controlled by automatic adaptive brightness which is eco friendly to the environment and the human beings.
8. Live data transmission: For a particular region, the street lamps are observed and the live data transmissions of the states are updated simultaneously.

We propose a smart street lamp based on the live surveillance for smarter cities to meet the aforementioned abilities. The proposed system consists of an intelligent sensing street lamp, which can adjust lamp brightness; live stream data transmission; an autonomous notification that reports about abnormal behaviour; an efficient network, which is used for the real-time communication between managers and massive street lamps; and finally, a flexible management platform, which is easy and highly automated.

The main contributions of the Smart Surveillance of Street Lamp in Smart Cities are as follows.

The hybrid network is adopted; the narrow-band Internet of Things (NB-IoT) is used for the real-time communication between the server and massive street lamps, and the Internet is used for the real-time communication between managers and server. A flexible management platform is implemented, and it notifies the managers about the broken street lamps at real time and automatically dispatches the maintenance staff to repair the broken street lamps. The states of all street lamps can be traced and adjusted in real time.

Related Works

The Street lamp maintenance period tends to be more effective for the safety and energy conservation [1], LoRa focuses on the low cost applications. Meanwhile, NB-IoT is directed to high QoS and low latency [2], worldwide system for cell conversation (GSM) [3], Zigbee communication is specially engineered for management and detector networks on IEEE 802.15.4 comm on place for wireless personal space networks (WPANs) [4], Edge computing covers alarge vary oftechnologies like wireless detector networ ks, distrib-uted information storage, increased reality and lot

[5].The main characteristics of the Wi-Fi are high transmission rate and short coverage. The characteristics of different wireless communication technologies [6] in terms of the transmission rate and coverage are presented in Fig. 1.

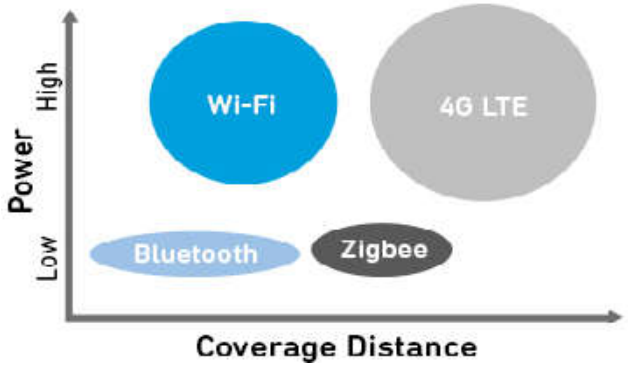

Fig 1 Characteristics of different wireless communication technologies

In order to attach everything and everybody, the 3GPP introduced a brand new radio access network technology referred to as the NB-IoT [7] that operates with a carrier at two hundred kilohertz. The NB-IoT is intended to possess an occasional value, long battery life, and high coverage, and may be wont to connect an outsized range of devices [8]. Moreover, the NB-IoT is characterized by low power consumption, less complicated transceiver, coverage sweetening, and affordable radio chip [9]. The discontinuous reception within the NB-IoT will save power employing a sleep mode supported the periodic waking to send knowledge. Moreover, varied user

Equipments (UEs) may be supported by one NB-IoT, even quite one hundred 000 UEs per NB-IoT channel. Therefore, billions of connections may be supported by the NB-IoT through adding the extra carriers to the network .

Live Surveillance

The live surveillance here is achieved through java script for the particular range of area using wifi module, as the power and the voltage values are directly proportional, any change in the voltage value can directly reflect the power value so as to have the live values fetched from the street lamp will be very useful in upholding the street lamps in particular areas. The proposed system mainly consists of advantages which are as follows

1. The main advantage of using live surveillance technology is as we don't need any camera to have the look at it always as the server fetches the power and voltage values continuously.
2. The Intelligent sensing lamp, the brightness of the road will be adjusted and an emergency trigger can notify concerning abnormal behavior.
3. Efficient network, the network will be used for the real-time communication, the NB-IOT is adopted for the communication between server and large street lamps, and the net technology, like Wi-Fi and 4G, are adopted for communication between server and managers.

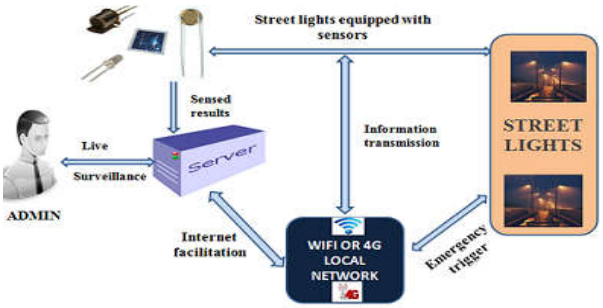

Fig 2 SSL architecture

4 The Versatile management platform, the management platform will optimize resource planning for the straightforward and highly automatic management.

The SSL (Smart Street Lamp) architecture is shown in Fig.2.

Intelligent Lamp Sensing

The street lamp is provided with some sensors, like location detector, infrared detector, and lightweight detector, to make Associate in nursing intelligent sensing streetlight. Consequently, brightness of street lamps is adjusted.The usage of these sensors, the road lamp can speak with the server through the network. In this paper, the street lamp periodically ships reports on its cutting-edge and voltage values. Based on the modern and voltage values on the road lamp, the server can determine the road lamp country. If the current of the road lamp is zero, but the voltage isn't always 0, then the server can finish that the mild bulb can be broken.

With the aid of the location sensors in the street lamp, the server can be informed whether the street lamp is stolen or not. Furthermore, the street lamp can be observed while the road lamp is misplaced. Further, while the server reveals the mild bulbs of road lamps are damaged, the server can send the element place to the service man for repairing, so the serviceman can locate the broken street lamp appropriately, which improves the performance.

The infrared sensor in the road lamp makes the road lamp greater intelligence. Street lamps will distinguish brightness .Namely for street lamps within the unnamed space; the brightness ought to be flip down, and for the road lamps within the thronged space, brightness can be turned up. There-fore, safety within the thronged areas is often warranted, and turning down of remote-controlled street lamps meets energy conservation requirement. The light device within the street makes the road lamp be sentient to the external atmosphere.

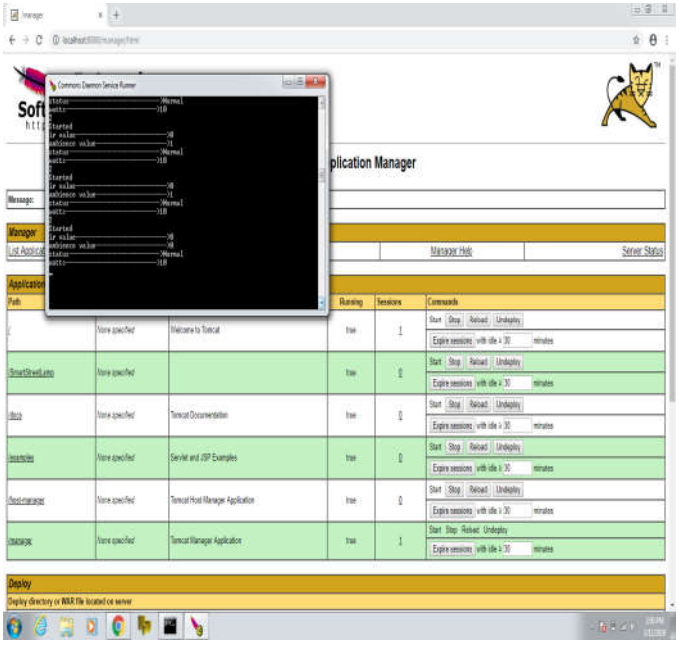

Fig 3 Fetched sensor values

Furthermore, the sensors make the road lamp additional intelligent. Consequently, the lamp will communicate with the server and receive its commands. Namely, the server will send varied commands, like to activate, turn OFF, turn up, turn down, and check states, etc. once street lamps receive these commands they alter their states in keeping with the commands. Using each the intelligent sensing street lamps and economical network, the server gets the data of all street lamps, consisting of lamps states, locations, external surroundings brightness, and so on. Therefore, the management platform could be a key issue of the road lamp management system. Here, we have a tendency to implement a versatile management platform supported the wifi,LTE that simplifies the management system [10]. Moreover, the wifi-based server offers higher period of time response, whereas cloud computing delivers the elastic computing power and storage at a lower value [11].

As already mentioned, all street lamps sporadically send information of their states to the server, and also the server stores received data within the information.

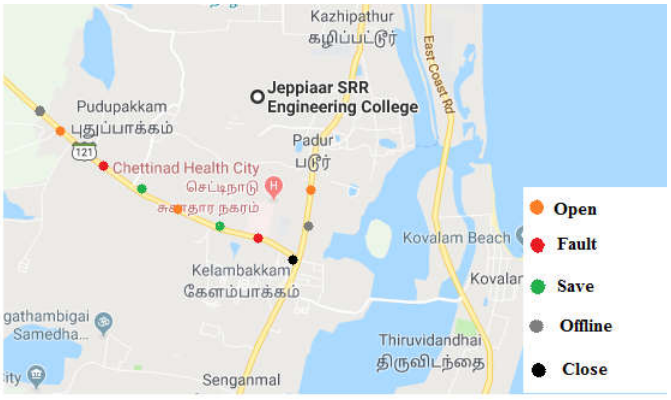

Fig 4 Graphical demonstration of SSL

The Abnormal States are as Follows

1. The road lamp bulb is broken. Once sever checks the road lamp and finds its current is capable zero however its voltage differs from zero, it concludes the road lamp incorporates a broken bulb.
2. The road lamp is offline. Once sever checks the road lamp and finds that no information are received from the lamp, it concludes the road lamp is in offline state.
3. The road lamp is within the power saving mode. Once server checks the road lamp and finds each its current and voltage are less than their traditional values, it concludes the road lamp is within the power saving mode.
4. Fault once sever checks the road lamp and finds that each lamp current and voltage are capable zero, and every one street lamps in this region have the identical state, the server concludes that a fault occurred, which can be an influence failure.
5. The road lamp is closed. Once server checks the road lamp and finds that each lamp current and voltage are capable zero, however not all street lamps in this region have the identical state, the server concludes that the road lamp is closed.

The main operations within the check method are conferred in rule one. The value of rule one is O (n), wherever n is that the variety of street lamps.

Moreover, once the server can check the abnormal states, the server can mechanically send the data to the abnormal lamp state consisting of streetlight ID, lamp location, and abnormal state description to the managers and nearest serviceman [12]. Therefore, the upkeep amounts are often attenuated seriously. The managers will send commands mistreatment the mobile application or web Browser. Therefore, the men will tasks through mobile application or SMS.

Wide Vernacular Algorithm: Shows The Main Operations for The Check Process.

Input

Current o: the current value of open street lamp Voltage_o: the voltage value of open street lamp Current_i: the current value of being checked street lamp.Voltage_i: the voltage value of being checked street lamp.

Output

S: the state of the being checked street lamp
Begin
01: if current _i == current_o && voltage_i == voltage_o
02: S = open;
03: else if current _i == 0 && voltage_i ! = 0; 04: S = bulb is broken;
05: else if current_i ! = 0 && voltage_i == 0 06: S = save;
07: else if receive nothing from street lamp 08: S = offline;
09: else if current_i == 0 && voltage_i == 0
10: if all street lamps in this region have the same states
11:S = fault;
12: else
13:S=close; 14: else
15: return;
16: return; END

DISCUSSION

In order to satisfy the necessities of good cities, this paper provides, Intelligent sensing streetlight (street lamp brightness are often adjusted and autonomous alarm notifies regarding lamp abnormal state).Economical network (real-time communication is achieved, the NB-IOT is adopted for communication between server and big street lamps, and therefore the net communication technology, like Wi-Fi and 4G, is adopted for communication between server and managers); Versatile management platform (management platform will optimize resource scheduling for straightforward and extremely automatic management of streetlight system). Live data stream management provides the enhancement to provide the series of data from the start street lamp to easily notify the abnormal conditions.

CONCLUSION

Thus the Smart Surveillance of Street Lamps in smart cities for the betterment of the people's survival is managed in simplified manner. Flexible management platform management can optimize resource scheduling for easy and highly automated management of street lamp system. Efficient network real-time communication is achieved. Intelligent sensing street lamp street lamp brightness can be adjusted, Live data stream management and autonomous alarm notifies about lamp abnormal state.

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