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Intelligent Street Light Control and Monitoring System using Zigbee and Sensors

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ABSTRACT:

The proposed remote-control system can optimize management and efficiency of street lighting systems. It uses ZigBee-based wireless devices which enable more efficient street Lamp-system management, thanks to an advanced interface and control architecture. It uses a sensor combination to control and guarantee the desired system parameters; the information is Transferred point by point using ZigBee transmitters and receivers and is sent to a control terminal used to check the state of the street lamps and to take appropriate measures in case of failure. The remote streetlight monitoring and control system has been applied in urban streetlight. In general, this system monitoring and control scope only reaches the streetlight transformer station. In this work, an experimental system of wireless sensor network was developed to study the feasibility for streetlight monitoring and control system. This system consists of the sensor node, the remote terminal unit and the control center. The sensor node was installed at each lamp pole and used to detect and control lamp. The remote terminal unit serves as relay station between the control center and the sensor nodes. The control center monitors and controls all streetlight real times. The hardware of sensor node and remote terminal unit was design. The software was developed for sensor node, remote terminal unit and the control center. The test results show that the system can be used for the streetlight control. The system application in streetlight can extend control scope to each lamp reduce in streetlight electricity and maintenance cost, and increase availability of streetlight.

INTRODUCTION:

Lighting systems, especially in the public sector, are still designed according to the old standards of reliability and they often do not take advantage of the latest technological developments.

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In many cases, this is related to the plant administrators who have not completed the return of the expenses derived from the construction of existing facilities yet. However, the recent increasing pressure related to the raw material costs and the greater social sensitivity to environmental issues are leading manufacturers to develop new techniques and technologies which allow significant cost savings and a greater respect for the environment. We can find three possible solutions to these problems in the literature. The first one, and perhaps the most intuitive, is the use of new technologies for the sources of light. In this area, lightemitting diode (LED) technology is the best solution because it offers many benefits. Researchers have already considered this possibility, designing an advanced street lighting system based on LEDs. The second possible solution, and perhaps the most revolutionary, is the use of a remote-control system based unintelligent lamp posts that send information to a central control system, thus simplifying management and maintenance issues. Researchers have developed a street lamp system using ZIGBEE network of devices and sensors. Finally, the third possibility would be the use of renewable energy sources locally available, rather than conventional power sources, with a positive effect on the environment. Solar energy is the most important resource in this field. Our work aims at the unification of the three mentioned possibilities, creating an intelligent lamp post managed by a remote- controlled system which uses LED-based light sources and is powered by renewable energy (solar panel and battery). The control is implemented through a network of sensors to collect the relevant information related to the management and maintenance of the system, transferring the information via wireless using the ZigBee protocol. The field of the ZigBee remote sensing and control system is widely present in the literature; we can also find ZigBee systems similar to (the) lighting systems in structure and management. In this paper, we present our system, which is able to integrate the latest technologies,



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in order to describe an advanced and intelligent management and control system of the street lighting.

BLOCK DIAGRAM OF STREET SECTION



In this project we proposed the ZIGBEE based street lighting system. An application will be created for this particular system and by using this application the street light can be operated wirelessly by using ZIGBEE. Whenever the human movements will be occurred beyond the street light then the light will be automatically controlled. After the sunlight has been reduced in the street then the Street light will glow by using a light sensor. By using this project wastage of electricity will be reduced and human effect also reduced. Street light are powered by solar energy. Sensors senses the data, collect the information and sends to microcontroller. Microcontroller controls the signal and runs the software to analyze the system. Initially, motion sensor activates the micro-controller only when vehicle or pedestrian enters into the detection region and activates light sensor. Light sensor gets activated if light illumination is achieved less than fixed threshold to switch the lights ON, else OFF. For example in rainy or winter season automatically control takes action over DIMMING (i.e., low illumination acts as supporting feature for natural light). Now, ZigBee device (at transmission side) is ready to receive information from streetlight and communicate with ZigBee device (at receiver side), then sends to terminal via USB cable. ZigBee device communicates point-to-point to detect the faulty lights in the system.

Block diagram of Monitoring Section:

The monitoring station located in each lamp post consists ofseveralmodules: the presence sensor, the light sensor, the failure sensor, and an emergency switch. These devices work together and transfer all of the information to

a microcontroller which processes the data and automatically sets the appropriate course of action. A priority in the transmission of information is assigned to each sensor, for example, the emergency switch takes precedence over any other device.



PROPOSED METHOD:

In this paper we propose the ZIGBEE based street lighting system. An application will be created for this particular system and by using this application the street light can be operated wirelessly by using ZIGBEE. Whenever the human movements will be occurred beyond the street light then the light will be automatically controlled. After the sunlight has been reduced in the street then the Street light will glow by using a light sensor. By using this project wastage of electricity will be reduced and human effect also reduced.

HARDWARE COMPONENTS: Sensors:

LDR (Light Dependent Resistor):

Light dependent resistors are used to re-charge a light during different changes in the light, or they are made to turn a light on during certain changes in lights. One of the most common uses for light dependent resistors is in traffic lights. The light dependent resistor controls a built in heater inside the traffic light, and causes it to recharge overnight so that the light never dies. Other common places to find light dependent resistors are in: infrared detectors, clocks and security alarms.

Identification:

A light dependent resistor is shaped like a quarter. They are small, and can be nearly any size. Other names for light dependent resistors are: photoconductors, photo resistor, or a CdS cell.

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There are black lines on one side of the light dependent resistor. The overall color of a light dependent resistor is gold. Usually other electrical components are attached to the light dependent resistor by metal tubes soldered to the sides of the light dependent resistor.

Function:

The main purpose of a light dependent resistor is to change the brightness of a light in different weather conditions. This can easily be explained with the use of a watch. Some watches start to glow in the dark so that it is possible to see the time without having to press any buttons. It is the light dependent resistor that allows the watch to know when it has gotten dark, and change the emissions level of the light at that time. Traffic lights use this principle as well but their lights have to be brighter in the day time.

Considerations:

Light dependent resistors have become very useful to the world. Without them lights would have to be on all the time, or they would have to be manually adjusted. A light dependent resistor saves money and time for any creation that needs a change in light. Another feature of the light dependent resistor is that it can be programmed to turn on with changes in movements. This is an extremely useful feature that many security systems employ. Security would be harder without light dependent resistors.

Expert Insight:

It is possible to build a light dependent resistor into an existing light circuit. There are many electrical plans that outline how to install one. Usually the sign for a light dependent resistor on these plans is marked by a rectangle with two arrows pointing down to it. This shows the placement of the light dependent resistor in the circuit so that it will work properly. Usually only an electrician can build new circuits, however.

Benefits:

There are many great benefits to light dependent resistors. They allow less power to be used in many different kinds of lights. They help lights last much longer. They can be trigged by several different kinds of triggers, which is very useful for motion lights and security systems. They are also very useful in watches and cars so that the lights can turn on automatically when it becomes dark. There are a lot of things that light dependent resistors can do.

3.2.2 IR (Infrared):

The cheapest way to remotely control a device within a visible range is via Infra-Red light. Almost all audio and video equipment can be controlled this way nowadays. Due to this wide spread use the required components are quite cheap, thus making it ideal for us hobbyists to use IR control for our own projects.

Infra-Red Light:

Infra-Red actually is normal light with a particular color. We humans can't see this color because its wave length of 950nm is below the visible spectrum. That's one of the reasons why IR is chosen for remote control purposes, we want to use it but we're not interested in seeing it. Another reason is because IR LEDs are quite easy to make, and therefore can be very cheap.



Fig 3.6 Infra-Red light

Although we humans can't see the Infra-Red light emitted from a remote control doesn't mean we can't make it visible. A video camera or digital photo camera can "see" the Infra-Red light as you can see in this picture. If you own a web cam you're in luck, point your remote to it, press any button and you'll see the LED flicker. Unfortunately for us there are many more sources of Infra-Red light. The sun is the brightest source of all, but there are many others, like: light bulbs, candles, central heating system, and even our body radiate Infra-Red light. In fact everything that radiates heat also radiates Infra-Red light. Therefore we have to take some precautions to guarantee that our IR message gets across to the receiver without errors.

3.3 ZIGBEE:

ZigBee is a low-cost, low-power, wirelessmesh networking proprietary standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range.



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The ZigBee Alliance, the standards body that defines Zig-Bee, also publishes application profiles that allow multiple OEM vendors to create interoperable products. The current list of application profiles either published or in the works are:

i.Home Automation ii.ZigBee Smart Energy iii.Commercial Building Automation iv.Telecommunication Applications v.Personal, Home, and Hospital Care vi.Toys

ZigBee Coordinator (ZC):

The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally.

ZigBee Router (ZR):

As well as running an application function a router can act as an intermediate router, passing data from other devices.

ZigBee End Device (ZED):

Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than a ZR or ZC.

RESULTS:

A complete set up made so that whenever human movements or vehicle is detected the street light will automatically glow as seen in figure below



Case1: When the street is having the natural sufficient lights the street light will not glow as shown in figure below



Case 2: When the street is not having natural sufficient light the street light will glow as shown in figure below



CONCLUSION:

This paper describes a new intelligent street lighting system which integrates new technologies available on the market to offer higher efficiency and considerable savings. This can be achieved using the highly efficient LED technology supplied by renewable energy of solar panels, for which the cost of energy is independent from the power supplier prices, combined to an intelligent management of the lamp posts derived by a control system switching on the light only when necessary, increasing the lamps' lifetime. Another advantage obtained by the control system is the intelligent management of the lamp posts by sending data to a central station by ZigBee wireless communication.