ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Power Efficient and Monitoring of Street Light System

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ABSTRACT:

The proposed remote-control system can optimize management and efficiency of street lighting systems. It uses Zig Bee-based wireless devices which enable more efficient streetlamp-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 Zig Bee 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.

1. 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. 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, light-emitting 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 on intelligent lamp posts that send information to a central control system, thus simplifying management and maintenance issues. Researchers have developed a street lamp system using the general-packet radio service (GPRS), power-line carrier, or Global Systems for Mobile Communications (GSM) transmissions.

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

1. 2 .System Design Model :

Fig. 1 shows the conceptual scheme of the proposed system. It consists of a group of observation stations on the street (one station for each lamp post) and a base station typically placed in a building located nearby. It is a modular system, easily extendable. The measuring stations monitor the street conditions and the intensity of sunlight and, based on them, they decide to turn the lamps on or off. The conditions depend on the pattern of the street where the lights are located and on the solar irradiation at a given point of the street, with frequent changes, depending on weather conditions, season, geographical location, and many other factors. For these reasons, we decided to make each lamp completely independent in the management of its own lighting.

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Figure 1: Schematic image of the system

The on-street station also checks if the lamp is properly working and sends the information through the wireless network to the base station for processing data. If any malfunction is detected, the service engineer is informed through a graphical interface and can perform corrective actions.

2. LITERATURE REVIEW:

Literature review is an assignment of previous task done by some authors and collection of information or data from research papers published in journals to progress our task. It is a way through which we can find new ideas, concept. There are lot of literatures published before on the same task; some papers are taken into consideration from which idea of the project is taken.

B. K. Subramanyam1 et al. worked on intelligent wireless street light control and monitoring system, which integrates new technologies, offering ease of maintenance and energy savings. Using solar panel at the lamp post By using LDR it is possible to save some more power and energy, and also we can monitored and controlled the street lights using GUI application, which shows the status of the lights in street or highway lighting systems.

P. Nithya et al. in their work on Design of Wireless Framework for Energy Efficient Street Light Automation suggested an Intelligent management of the lamp posts by sending data to a central station by ZigBee wireless communication. With the suggested system, maintenance can be easily and efficiently planned from the central station, allowing additional savings.

Srikanth M et al. in their work on ZigBee Based Remote Control Automatic Street Light System. This streetlight control system helps in energy savings, detection of faulty lights and maintenance time and increase in life span of system.

Anila Devi Y et al. worked on GSM Based Remote Control System of High Efficiency Intelligent Street Lighting System Using AZigbee Network of Devices and Sensor. New intelligent and smart street light system is designed with wireless technology for maintenance and network of sensors for controlling. In which, they used high efficiency LED lamp which consumes less energy with high life time and which are supplied with renewable energy of solar panels.

3. PROPOSED SYSTEM :

The proposed system is to design new street light control system that is reliable and cost effective by using Zigbee communication system technique, from the coupling interface to the power management, from the type of microprocessor to the Zigbee transceiver, considering their mutual influence, too. Lighting system that uses an RS232 interface done for the base station control unit. In this paper, we present our system, which is able to integrate all thelatest technologies in order to achieve a high efficiency hybrid intelligent street lighting system. Fig. 1 shows schematic of proposed Intelligent Street Lighting system.

ARCHITECTURE OF PROPOSED SYSTEM:

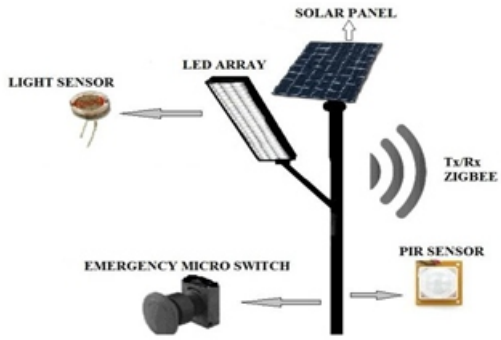

Fig. 1 Schematic image of a model street light station

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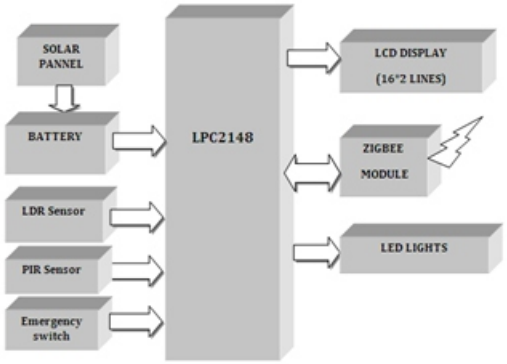
BLOCK DIAGRAM OF PROPOSED SYSTEM:

A.Individual street lamp station:



Base Station Module

HARDWARE DESCRIPTION:

A.Individual street lamp station:

The monitoring station to be located in each and every lamp post, it consists of several modules like PIR sensor, LDR sensor, failure sensor and emergency switch all devices work together and to transfer all the information to a ARM controller which processes all data automatically and get as per the priority in the transmission of information assigned of each sensor. Example: emergency switch takes precedence over any other sensor failure.

1. Light Sensor:

A light sensor can measure the brightness of the sunlight and provide a information. The Intention of this measurement is to make sure a minimum level of illumination of the street, as required by regulations. The sensor must contain high sensitivity in the visible spectrum, given that a photocurrent high enough for low light luminancelevels. For this reason, the phototransistor TEPT5700 (by Vishay Semiconductors) has been selected. Based on the measured luminance, the micro controller drives the lamp in order to maintain a constant level of illumination. This action is visibly not required during daylight time but it is desirable in the early morning and at end of the day, when it is not compulsory to operate the lamp at full power but simply as a “support” the sunlight. This type of mode enables saving electric power supplied to the lamp because the lamp is regulated by the combined action of the sensor and the microcontroller to ensure the minimum illumination required.

2. Emergency Device:

The systems have an emergency button, which can be helpful in the case of an emergency. This device excludes the entire sensor system with the aim to immediately turn on the lamp. The light will stay on for a preset time. After that, the button should be pressed again. These prevent the system from being accidentally active even when the necessity ends. Obviously, this device does not work during the day, when there is no require for artificial light.

Presence Sensor:

The task of the presence sensor is to identify the passage of a vehicle or pedestrian, giving an input to turn on a lamp or a group of lamps. This function depends on the pattern of the street; in case of a street without crossroads, a single sensor is sufficient (or one at each end in case of a two-way street), while for a street requiring more precise control, a solution with multiple presence detectors is necessary. This feature enables switching on the lamps only when necessary, avoiding a waste of energy. The main challenge with such a sensor is its correct placement. The sensor should be placed at an optimal height, not too low (i.e., to avoid any erroneous detection of small animals) nor too high (for example, to avoid failure to detect children).

5. Solar Panel:

Solar panel which is used to convert light energy to voltage which is done by the solar cells, the developed energy was stored in battery, in the power cut time the street light will glow via utilizing this battery energy. Solar panels are made of photovoltaic (PV) cells, which turn sunlight into electricity. It’s also known as solar photovoltaic’s (PV); capture the sun’s energy using photovoltaic cells. The photovoltaic cells do not need direct sunlight to work – they can still produce some electricity on a cloudy day. The cells transfer the sunlight into electricity which can be used to run household appliances and lighting.

ZigBee Network :

ZigBee is a wireless communication technology based on theIEEE802.15.4 standard for communication among multiple devices in a wireless personal-area network (WPAN). ZigBee is designed to be more affordable than other WPANs (such as,

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for example, Bluetooth) in terms of costs and, above all, energy consumption. A ZigBee personal-area network (ZBPAN) consists of at least one coordinator, one (or more) end device(s)and, if required, one (or more) router(s). The network is created when a coordinator selects a channel and starts the communication, henceforth, a router or an end device can join the network. The typical distance of a ZigBee transmission range, depending on the environment conditions and the transmission power, shifts from tens to hundreds of meters, and the transmission power is deliberately kept as low as possible (in the order of a few mill watts) to maintain the lowest energy consumption.

Base Station Module :

The base control station is the hub of the system since it allows the visualization of the entire lighting system. The transmission system consists of a ZigBee device that receives information on the state of the lamps and sends it to a terminal. The processing unit consists of a terminal with a serial Universal Asynchronous Receiver-Transmitter (UART) interface which receives information about the state of the lamps provided by a ZigBee devices. Moreover, data on lamps' operation are associated with the lamp address; consequently, all faults are easily identified. The operator will have a information of the lamp location within the area where the system is installed.The system provides the option to select the AUTO or MANUAL mode .

5. RESULT AND CONCLUTION

RESULT:

This is the implementation result of the street lighting system and the system will helpful to the person when they need light at the night. Here we are using three different types of sensors to detect various parameters. The figure 7(a) represents the monitoring station of the proposed system and it containing PIR sensor, LDR sensor, Hall Effect sensor and so on. Here we are using a LEAD ACID BATTERY that will be charged by a solar panel from sunlight and here we are connecting two 6volts batteries that are in series. These batteries are connected to a power supply. The supply will be distributed to each module like microcontroller. LDR sensor, PIR sensor and so on. LDR is very useful to identify the light working status of system.

The PIR sensor mainly used to identify the passage of vehicles or human using the infrared radiation emitting from the body. The Light sensor module is used to measure the intensity level of the sunlight. These are the input modules and they are work together. Transfer the information to the microcontroller. From microcontroller the information will be passes to the base station through the zigbee modules and control the street lights according to the given instructions.

1.The following figure shows the kit in Manual mode.

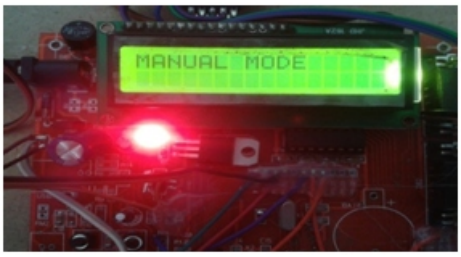

Fig: Manual Mode

2.The following figure shows the kit in Automatic mode which shows day/night,human detection,lights failure.

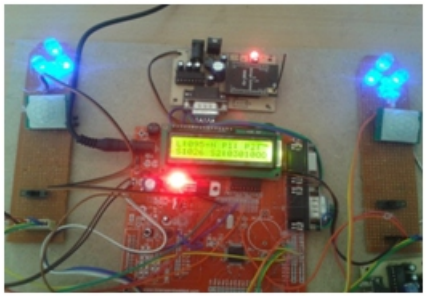

Fig: Automatic Mode

CONCLUSION:

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. The system maintenance can be easily and efficiently planned from the centralstation, allowing additional savings. The proposed system is particularly suitable for street lighting in urban and rural areas where the traffic is low at a given range of time.

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The independent nature of the power-supply network enables implementing the system in remote areas where the classical installations are prohibitively expensive. The system is always flexible, extendable, and fully adaptable to user needs.

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