

Smart Street Light

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Abstract: Street light is a source of light that is generally used with roads when it gets dark. Recently, the lighting control system technology has been developed on several roads to control and maintain street lighting. But, there are some drawbacks in the developed system. Due to the lack of adequate communication, there is no system response, so the system is considered old. This document also includes the design of intelligent public lighting systems, which use the ZigBee device to ensure high efficiency and to overcome current difficulties. The system can inspect the fault and inform the control room about it.

Keywords: Detect fault, ZigBee, LED, Networks, WSN, Street light, higher efficiency.

I. INTRODUCTION

Intelligent street lighting for public lighting, which is ready for the movement of pedestrians, cyclists and cars, can be done by installing public lighting cameras or other sensors. This allows them to explore the movement. Until there are no complaints or the incorrect street lights do not occur during a higher inspection, the street lights break down and no major efforts are made to repair it. With the development of the economy and urbanization, the public lighting system has become one of the important concerns of people. Street lights are a source of light that is installed along the streets, which is used to provide certain amounts of brightness when the surrounding area darkens. Street lights are also very beneficial for the public, as well as for the government, for the reduction of accident and crime rates in the areas. This system, the efficient management of lighting and the control of energy saving. But, most of the officers, while supervising the street lights. It also provides services related to some other services such as telemetry, humidity, temperature, noise monitoring and road information systems, smart roads and intelligent transport systems. The general street lights depend on the photoelectric relay to turn on / off the lights and have no communication capabilities. Ignoring the wrong street lights can waste large amounts of electricity and can increase the cost of maintenance. Apart from this, due to the incorrect lights of the street, crime rates and accidents have increased.

II. PROPOSED ZIGBEEBASEDSYSTEM AND WORKING

Street lights based on ZIGBEE are mostly battery powered, therefore, there is no requirement for underground cable laying. The ZIGBEE wireless sensor network application based on street lighting uses the ZIGBEE wireless communication protocol to improve the lighting technology system of the Providing communication capabilities. The microcontroller is the brain of the general system that controls the input and output of the data. When the sensor senses that the street light circulates as dark or bright, it sends a signal to the microcontroller. The microcontroller immediately sends a high or low level to turn the LED lamp on and off. With the help of ZIGBEE, the microcontroller reports all the actions and the status of the street light to the control panel wirelessly.

A. Control Unit

The sensors in the control unit transfer the collected information to a controller, which uses software and is then used to administer the system. The microcontroller measures the current through the Hall sensor that stores the values in the memory, if a fault is not detected. All operations have predestined time for time management. At the stop signal, the lamp goes off.

B. Measuring Stations And Detector

The measuring station is located in each street lamp and contains many modules: the sunlight sensor, the presence sensor, the fault sensor and an emergency switch. The presence sensor or the PIR sensor has the task of detecting the passage of a vehicle or pedestrian that causes the lamps to turn on / off. This feature allows to activate the lamps when it is mandatory and avoids wasting energy.

C. Supervision Module

This sensor improves fault management. A Hall sensor recognizes when the lamp is on. The system detects faults that are compared with the stored information. This information is described by the ZigBee network to the station management unit.

III. TYPES OF ZIGBEE NETWORKS

A. Star Structured

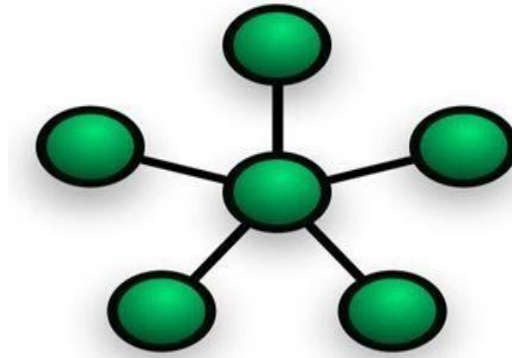


Fig no.1 Star Structure

Star method is the simplest and most limited topology available for ZigBee. All the devices are connected to a single Coordinator node and all the communication is done through this Coordinator. It is interesting to note that this topology is actually defined by the 802.15.4 repressed specification.

B. Mesh Structured

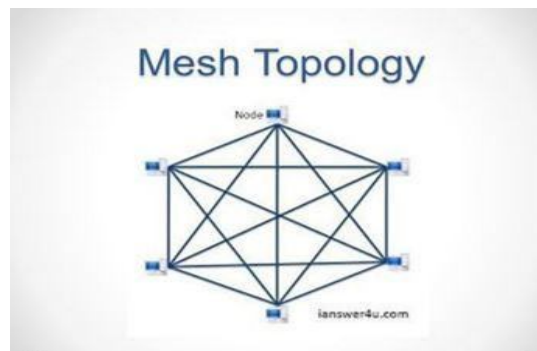


Fig no.2 Mesh Structure

Mesh structure Network Coordinator (FFD), which interacts directly with very few Chase Cum end devices. This network uses "multiple hop" routing to achieve the contrast. This network is more complex, but it is also more tolerant and robust in the face of failures.

C. Cluster Tree Network

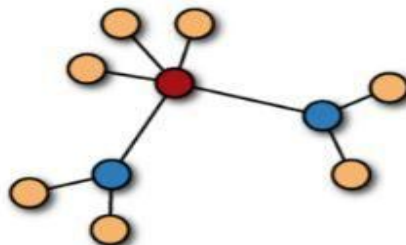


Fig no. 3 Cluster Tree Network

It is similar to the Star network but has more nodes that can interact with each other; as a result more RFD/FFD can be coordinated with other FFDs.

IV. WIRELESS ZIGBEE NETWORK

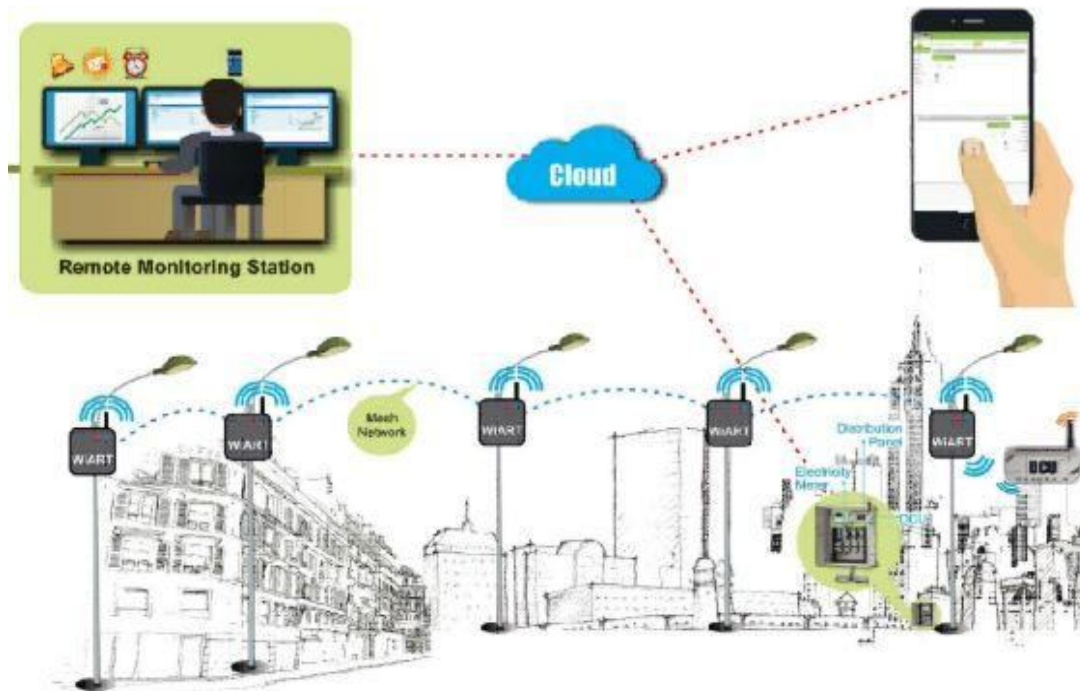


Fig no.2 Zigbee Street Light

ZigBee is wireless communication technology for communication between multiple devices in a Wireless Personal space Network (WPAN). Zigbee is used in devices where a low data rate, secure networking and long battery life are needed. Zigbee devices employ the technique of Direct Sequence Spread Spectrum (DSSS), which ensures the dependable of signal transmission, avoiding interference from other signals and thus increase the maximum operating range of up to 100m. Zigbee network can have up to 65336 devices and each node can join with every other node, which ultimately results in a very big network.

V. ADVANTAGES OF ZIGBEE TECHNOLOGY

- A. Low cost
- B. Available from number of source
- C. Low cost
- D. Supports large number of nodes
- E. Less Power Rating
- F. Low maintenance
- G. Small in size
- H. Open standard protocol with no licensing fees
- I. Standard based security (AES 128)

VI. RESULTS

Street Light Status Corresponding To Adc Value

ADC Value	Lamp State	Environmnt	Status
0-199	ON	Dark	Healthy
200-399	OFF	Dark	Unhealthy
400-599	OFF	Dark/Bright	Error
600-899	ON	Bright	Unhealthy
900-1023	OFF	Bright	Healthy

VII. DISCUSSION

A high analog-to-digital converter (ADC) value is obtained as the environment becomes darker, resulting in an increase in the resistance of the light-dependent resistance (LDR). The value of the analog to digital converter (ADC) can be between 0 and 1023, where 0 is for the brightest environment and 1023 for the darker environment. The values obtained from ADC are directly proportional to the value of the voltage divider of both the potentiometer and the LDR in series with each other. The ADC value is reactive to the change in LDR resistance. The microcontroller used in the system is 10 bits; Therefore to assemble up to 1023 values. The resistance of the LDR is inversely proportional to the brightness of the local environment.

The system of public lighting in this project can be explained by three different cases that include health, unhealthy and defective. In healthy conditions, the street light works normally by turning on and off automatically the night and day light respectively. However, in an unhealthy condition, the street light does not turn on or off automatically and, in return, sends a feedback message to the control room to notify the host. With the use of GUI (graphical user interface) on the host computer, the host can turn on or turn off the street light, which is at a manual and wireless distance as shown in Figure 3 and Figure 4. In a defective condition, it is considered that the street light did not work properly and sends an error message as seen in Fig. 4 to the control room to alert the host about the error. The host is notified and other measures are taken to carry out repair work. Compared to the conventional public lighting system, the public lighting system based on Zigbee provides high reliability and low maintenance with the introduction of the feedback system. The feedback system allows the street light to communicate with the control room informing its status and daily condition. In addition, it involves the use of circuits that include wireless monitoring and control with a maximum of 5 V to turn on the LED lights.

VIII. FUTURE WORK

Further development can be done to increase the efficiency of the system by locating the GSM system (Global System for Mobile Communications) to send automatic text messages to the host at the control station, the Zigbee communication range can be increased using amplifiers from RF (Radio Frequency) The capacity of the network can be increased by making top-class topologies and having an internal database (time, location, date and status) to track the street lighting activity for maintenance and reference purposes. A separate motion sensor can be installed so that it turns on only when there is a sense of movement, while the rest of the time is in the OFF state to reduce the waste of energy.

IX. CONCLUSION

Therefore, using these two concepts of zigbee and WSN. The PIR sensors can make public lighting systems highly efficient and low energy consumption. There is moderate maintenance and a high rate of transmission of information from one device to another in the systems explained.

The Zigbee wireless communication protocol is intended to monitor and control. Zigbee also prepares the street light to communicate with the microcontroller and the control station wirelessly without the need to lay cables. In addition to Zigbee, street lighting is more efficient, saves energy and has less installation costs than the normal public lighting system. In addition, the developed application used integrated programming to control the behavior of the system in general. The developed application has communication capabilities to provide system information that allows robust communication in different environments.

REFERENCES

- [1] Singal T.L. "Wireless Communications," Tata McGraw Hill, New Delhi, 2010, pp.579.
- [2] Sagar Deo, Sachin Prakash, Asha Patil, " Zigbee based intelligent street lighting system ", 2014 second international conference on devices, circuits and systems(ICDCS)
- [3] Fabio Leccese, Zbigniew Leonowicz, "Intelligent wireless street lighting system", co-sponsored by National science center, Poland.
- [4] Xinshun Zhang, Jiyujin, Huimin Meng, Zhisen Wang, "A sensing optimal Proposal Based on intelligent Street lighting system", Proceedings of ICCTA2011.
- [5] Maciej Mendalka, Michal Gadaj, Lukasz Kulas, Krzysztof Nyka, "WSN for intelligent street lighting system", Proceedings of the 2nd International Conference on Information Technology Gdansk, Poland, ICIT 2010 ,on pages 99-100 ,28-30 June 2010.