

ZIGBEE BASED AUTOMATIC STREET LIGHT SYSTEM

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Abstract: Traditional control and maintenance of street lamps is not enough more to modernization need. The main focus of proposed system is to optimize management and efficiency of street lighting systems and realize a kind of higher autoimmunization, more credible and efficient long-distance monitoring and control system. 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.

Keywords: Control system, Lighting system, Sensors, Wireless networks, ZigBee

I. INTRODUCTION

Lighting systems in the public sector are still designed according to the old standards reliability and they often do not have advantage of the latest technological development, the use of new technologies for the sources of light and also combination of sensors. There are three areas to be concentrated to achieve the high efficiency in the street lighting if the efficiency in each stage can easily achieve the maximum efficiency in overall system development. The first one in this area, is to choose light emitting diode (LED) technology, instead of sodium vapor lamp and compact fluorescent lamp (CFL), because it is the best solution since it offers benefits like power saving and long life. The second solution is the most revolutionary, 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. Finally, the third possibility would be the use of renewable energy sources rather than conventional power sources with a positive effect on the all environment issues. The Solar energy is the most important resource in this field to achieve the maximum efficiency.

Street light control system is a centralized system which control and monitor status of the individual street lamp. Lights are switched to ON/OFF automatically based on PIR and LDR status. Status information stored in the PIC controller and also monitored over all status in control base station via ZigBee communication channel, LED has been the best potential light source for the next-generation lighting as it has many advantages such as high efficiency, long life, high reliability, and low power consumption.

II. 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 a lot of literatures published before on the same task; some papers are taken into consideration from which idea of the project is taken.

1]. B. K. Subramanyam, worked on intelligent wireless street light control and monitoring system , who integrate 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.

2]. 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.

3]. Anile Devi Y et al, worked on GSM Based Remote Control System of High Efficiency Intelligent Street Lighting System Using A ZigBee 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.

III. HARDWARE DISCRPTION

3.1 Solar Panels

Converting solar energy into electrical energy by PV installations is the most recognized way to use solar energy. Since solar photovoltaic cells are semiconductor devices, they have a lot in common with processing and production techniques of other semiconductor devices such as computers and memory chips. As it is well known, the requirements for purity and quality control of semiconductor devices are quite large. With today's production, which reached a large scale, the whole industry production of solar cells has been developed and, due to low production cost, it is mostly located in the Far East.

3.2 Power Supply

The input to the circuit is applied from the regulated power supply. The input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating deck voltage. So in order to get a pure deck voltage, the output voltage from the rectifier is fed to a filter to remove any arc components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

3.3 Streetlight Designing

The idea of designing a new system for the streetlight that do not consume huge amount of electricity and illuminate large areas with the highest intensity of light is concerning each engineer working in this field. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typical cities worldwide.

Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically. Manual control is prone to errors and leads to energy wastages and manually dimming during mid-night is impracticable. Also, dynamically tracking the light level is manually impracticable. The current trend is the introduction of automation and remote management solutions to control street lighting.

3.4 Transformer

Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus the arc input available at the mains supply i.e., 230V is to be brought down to the required voltage level. This is done by a transformer. Thus, a step down transformer is employed to decrease the voltage to a required level. So, here we are using a transformer of rating (12-0-12) V, 750mA.

3.6 Sensors

To detect the movement in the street, the IR sensors have been used in this project, where emitter and receiver are in one unit. Light from the emitter strikes the target and the reflected light is diffused from the surface at all angles. If the receiver receives enough reflected light the output will switch states. When no light is reflected back to the receiver the output returns to its original state. In diffuse scanning the emitter is placed perpendicular to the target. The receiver will be at some angle in order to receive some of the scattered (diffuse) reflection

3.7 Microcontroller

Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical. The Intel 8051 is Harvard architecture, single chip microcontroller (μ C) which was developed by Intel in 1980 for use in embedded systems. It was popular in the 1980s and early 1990s, but today it has largely been superseded by a vast range of enhanced devices with 8052-compatible processor cores that are manufactured by more than 20 independent manufacturers including Atmel, Infineon Technologies and Maxim Integrated Products.

3.8 ZigBee Network

ZigBee is a wireless communication technology based on the IEEE802.15.4 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, for example, Bluetooth) in terms of costs and, above all, energy consumption. A ZigBee personal-area network 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 milliwatts) to maintain the lowest energy consumption. In the proposed system, the network is built to transfer information from the lamp posts to the base station control. Information is transferred point by point, from one lamppost to another where each lamp post has a unique address in the system. Each lamp post can only send the information to the nearest one, until the information reaches the base station. Thus, transmission power is limited to the required low value and the signals sent by the lampposts do not interfere with each other. In case of failure of one lamp, the chosen transmission distance between the lampposts ensures that the signal can reach the next operational lamp post without breaking the chain. The Standard XBee modules have an operation range of tens of meters indoors and hundreds of meters outdoors, while the XBee Pro modules have a wider spread range in the order of hundreds of meters indoors and of about 1.5 km outdoors, because the Pro modules have higher transmission power, but imply higher consumption (about three times the consumption of the Standard version). The receiver has very high sensitivity and a low probability of receiving corrupted packets (less than 1%). The modules should be supplied by 3 V from a dc source; the current consumption is in the order of 50 mA (for XBee) and 150–200mA (for XBee PRO) in uplink and in the order of 50mA in downlink (identical for both versions); moreover, they support a sleep mode where consumption is less than 10 A. The XBee modules are distributed in three versions of antennas: with an on-chip antenna, a wire antenna, and with an integrated connector for an external antenna.

IV. WORKING OF NEW STREET LIGHT CONTROL SYSTEM

The street lighting system is an essential factor in public sectors. So we need to design and implement solar based street lighting system with the help of ZigBee network of devices and the newly proposed street lighting system offer higher efficiency and considerable savings that can be achieved by using high all the day. But the newly proposed system is a good efficient LED technology. Early days, the street lighting systems are controlled manually. So there was much more power consumption if we forgot to switch off the light means that will be glowing power saver and that will be automatically controlled by the base station. This project contains monitoring stations and one base station. The monitoring station located in each lamp post consists of several modules such as PIR sensor, the LDR 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 action. The PIR Sensor will help to detect the presence of human. Whenever the presence of human will be detected the next step is to measure the intensity of light. For that purpose we are using an LDR sensor microcontroller to glow the street light according to the intensity of light.

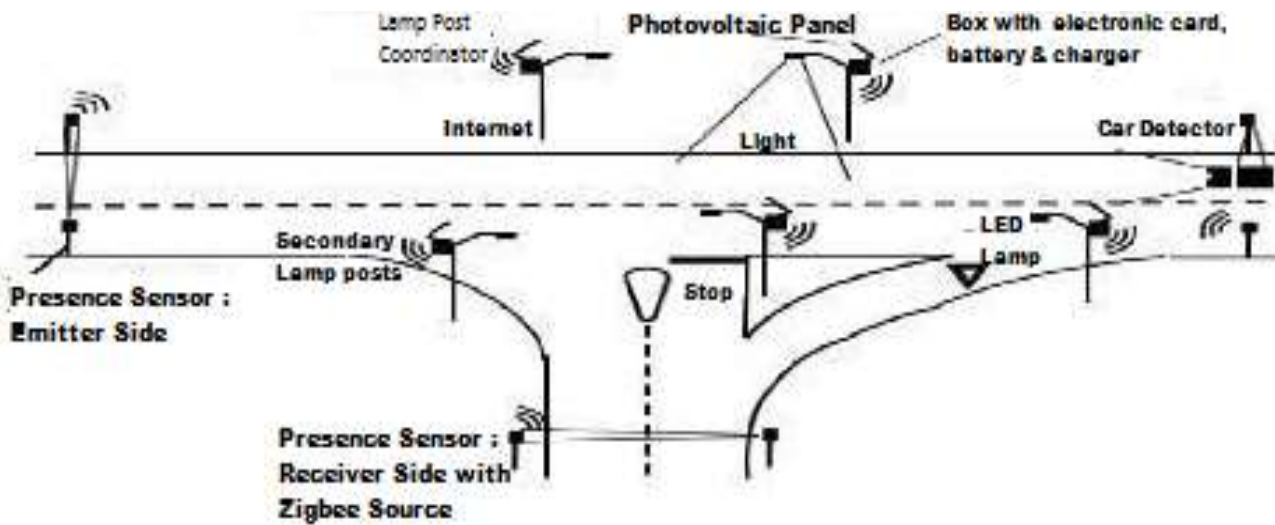


Fig. 1 shows the conceptual scheme of the proposed system.

A light sensor can measure the brightness of the sunlight and provides information. In day time intensity of light will be high because of negative temperature coefficient so no need of lighting system. When the intensity of light becomes low that time necessary of the street lighting. So the information will pass to the base station via ZigBee. For these reasons, we decided to make each lamp completely independent in the management of its own lighting. 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.

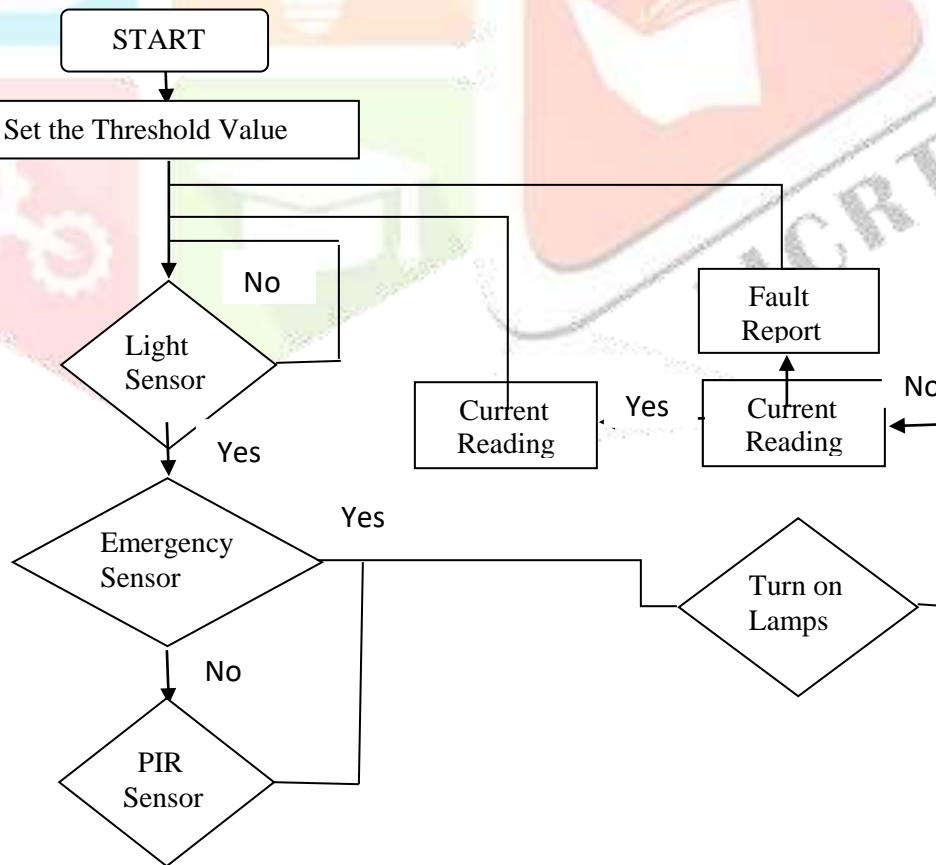


Fig. 2 Control software flowchart

The sensors transfer the collected information to a controller which runs the software to analyze the system. Fig. 5.2 shows the control software flowchart. After the initial setting, the system is controlled by the light sensor which activates the microcontroller only if the sunlight illumination is lower than a fixed threshold. In this case, the system reads the state of the emergency button, and switches on the lamp if this is activated. The same happens in case of vehicle or apedestrian.

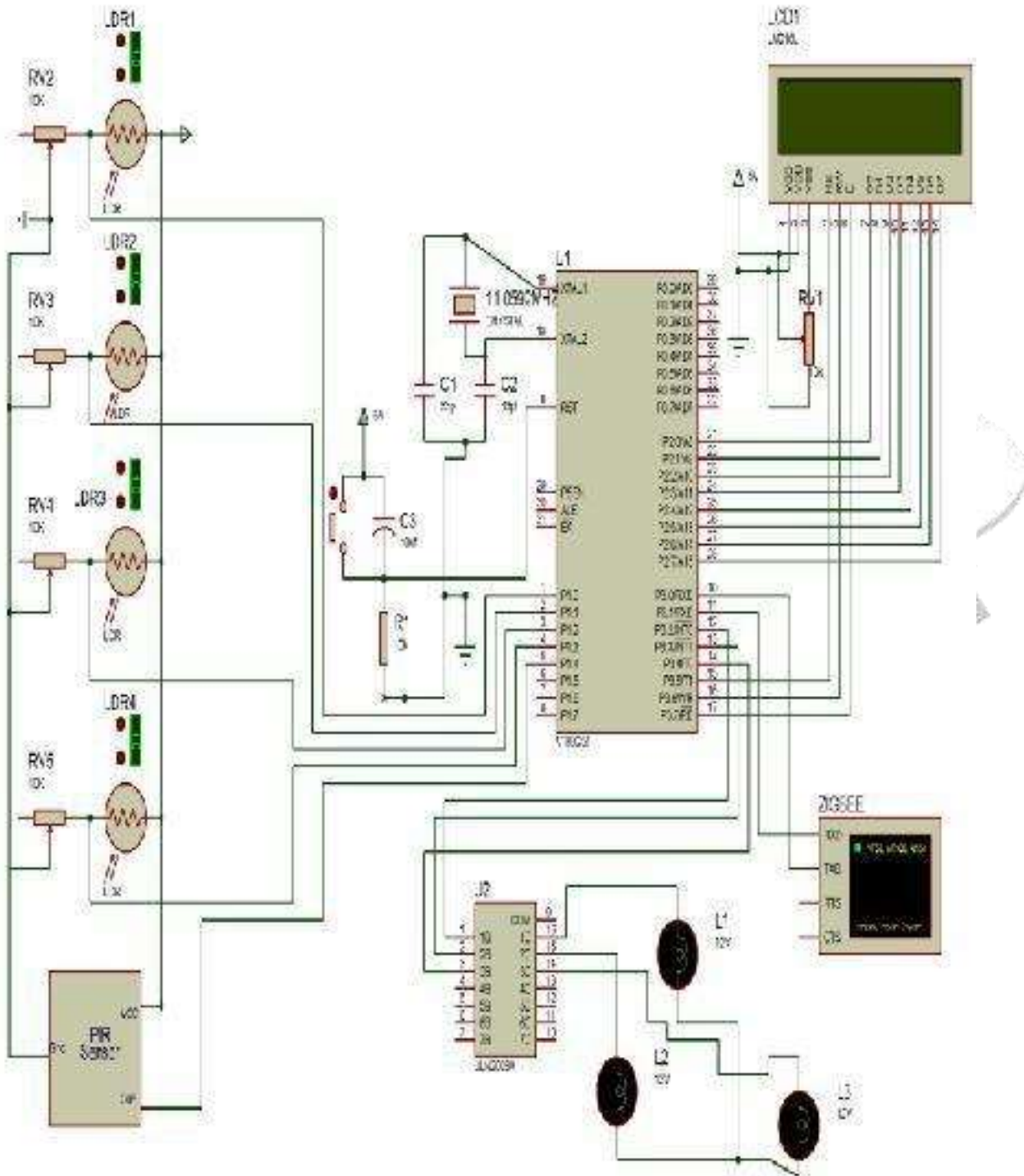


Fig. 3 CIRCUIT DIAGRAM OF PROPOSED SYSTEM

V. RESULT

By using non-conventional solar source we are feeding battery and by using LDR's we are detecting the movement of the vehicle and intensity level of light during a day. By using ZigBee Wireless technology we detected the condition of the light when problem occurs. For the demonstration purpose, a proto type module constructed with lower ratings of devices, & results are found to be satisfactory. In the prototype we can clearly say that a large amount of power can be saved by the use of automatic ON/OFF mechanism of street lighting in addition to renewable source of energy i.e., solar energy.

VI. CONCLUSION

This system can develop new inventive idea for intelligent street lighting with multitasking system. It consists of advance technologies which offer high efficiency & reliability. Energy efficiency is obtained by LED lamp post which high energy efficient & use of renewable energy source hence it is cost effective system. Another merits obtained from this system is Smart management of lamp post by transferring data to base station . From base station system maintenance can be easily and effectively done. This type of Intelligent street lighting system is applicable for both Urban & Rural areas, where the traffic is low. The system is flexible, extendable and adaptive new technologies to user needs. This system can be built-up by simple ZigBee network, reliable component the feature of sensor network processing speed, low cost. This system is ease to installation which gives us a Smart and Intelligent Engineering & Commercial solution with the comparison of different technologies.

Use or consume more and more power getting from sun. This system can be use for multifunction. Save the electricity
Reduce the consumption manmade electric energy.

The technology which we are implementing can be used to find new technology for using natural power.

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