Wireless Smart Street Light Control

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Abstract: *This work is about automation of street lighting system. Nowadays energy crisis in India is a critical issue. Enormous electric energy is consumed by the street lights. At present, street lights are controlled manually and it leads to energy loss. In the present study smart street lighting system manages the street lights automatically turn on in the evening, lighting the road for few hours. It gradually reduces the brightness when no one is detected in that area. When vehicles or pedestrians are detected, the street lights automatically turn on. Design of smart Street lighting system does not only achieve energy-saving but also extend the service life of street light equipment. Conventional street lighting systems in most of the areas are Online at regular intervals of time irrespective of the seasonal variations. The street lights are simply switched on at afternoon and turned off in the morning. The consequence is that a large amount of Power is wasted meaninglessly. As energy consumption is an issue of increasing interest, possible energy savings in public street lighting systems are recently discussed from different viewpoints. So, Smart street light control is developed which is covered in this paper.*

Keywords*: Energy Saving, Smart Steel Light, Arduino, LDR*

1. Introduction

We need to save or conserve energy because most of the energy sources we depend on, like coal and natural gas can't be replaced. Once we use them up, they're gone forever. Saving power is very important, instead of using the power in unnecessary times it should be switched off. In any city "Street Light" is one of the major power consuming factors. Most of the time we see street lights are ON even after sunrise thus wasting lot of energy. Over here we are avoiding the problem by having an automatic system which turns ON & OFF the street lights at given time or when the ambient light falls below a specific intensity. Each controller has an LDR which is used to detect the ambient light. If the ambient light is below a specific value the lights are turned ON.

A light dependent sensor is interfaced to the Arduino Uno microcontroller it is used to track the sun light and when the sensors goes dark the led will be made on and when the sensor founds light the led will be made OFF.

It clearly demonstrates the working of transistor in saturation region and cut-off region. The working of relay is also known Microcontroller and the code is written in c language in MikroC ide, the resulted value can be seen with the help of UART. Automatic Street Light Control System is a simple yet powerful concept, which uses transistor as a switch. By using this system manual works are 100% removed. It automatically switches ON lights when the sunlight goes below the visible region of our eyes. This is done by a sensor called Light Dependent Resistor (LDR) which senses the light actually like our eyes. It automatically switches OFF lights whenever the sunlight comes, visible to our eyes.

2. Process Description

Initially, motion sensor activates the microcontroller 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. Sensors (LDR & PIR) senses the data, collect the information and sends to microcontroller. Microcontroller controls the signal and runs the software to analyse the system. 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. Through GUI technician can identify the faults and can easily maintain the System.
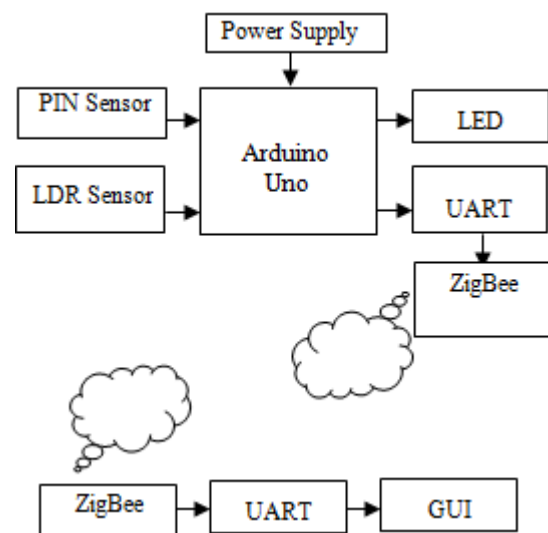

Figure 1: Block diagram of street light control

3. Development

The smart system is developed using Arduino Uno microcontroller kit. Arduino is an open source hardware kit with 8-bit Atmet AVR pre-programmed on-board Microcontroller kit, with boot loader that uploads programs into microcontroller memory. They are different type of Arduino based on their features it is being categorized some of them are Arduino Deicimila, ArduinoUNO, Arduino Leonardo, Arduino Mega, Arduino Nano, Arduino Due,

Arduino LilyPad and many more Development boards. This IDE is supported for every product of Arduino components. In this project we are using two sensors and wireless device modulator accomplish the objective of the projects. Some of the sensors and its descriptions are given below.

PIN Sensor: PIR sensor is a motion sensor, is used to identify the passage of vehicle or pedestrian, giving an input to turn street light or street lights ON/DIM/OFF.

LDR Sensor: A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. The resistance of LDR decreases with increasing incident light intensity.

4. Wireless Communication

Zigbee is a device used to send and receive wireless data. It is consider as one of the Zigbee families. Zigbee or simply zigbee has a feature that is can be easily connected to the air interface UART (RS232)/USB cable.
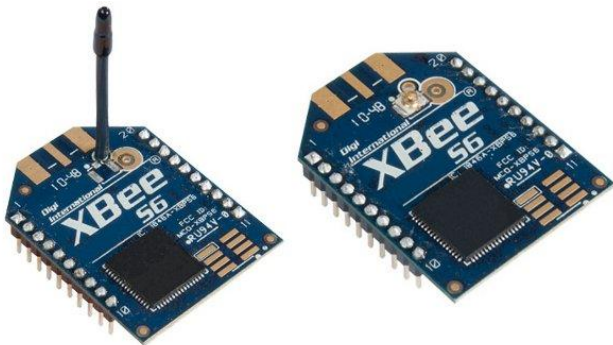

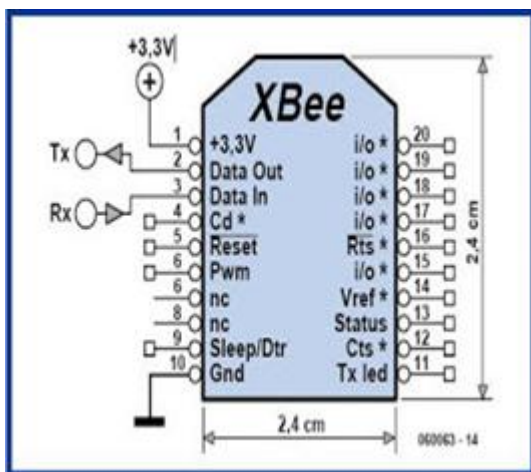**Figure 2:** ZigBee Transmitter and Receiver

Figure 3: ZigBee Pin Diagram

Comparison of Wireless Standards			
Wireless Parameter	Bluetooth	Wi-Fi	ZigBee
Frequency band	2.4 GHz	2.4 GHz	2.4 GHz
Physical/MAC layers	IEEE 802.15.1	IEEE 802.11b	IEEE 802.15.4
Range	9 m	75 to 90 m	Indoors: up to 30 m Outdoors (line of sight): up to 100 m
Current	60 mA (TX	400 mA (TX mode) 20 mA	25-35 mA (TX

consumption	mode)	(Standby mode)	mode) 3 µA (Standby mode)
Raw data rate	1 Mbps	11 Mbps	250 Kbps
Protocol stack size	250 KB	1 MB	32 KB 4 KB (for limited function end devices)
Typical network join time	>3 sec	variable, 1 sec typically	30 ms typically
Interference avoidance method	FHSS (frequency-hopping spread spectrum)	DSSS (direct-sequence spread spectrum)	DSSS (direct-sequence spread spectrum)
Minimum quiet bandwidth required	15 MHz (dynamic)	22 MHz (static)	3 MHz (static)
Maximum number of nodes per network	7	32 per access point	64 K
Number of channels	19	13	16

TX is the standard UART transmit line. Connect to a UART RX pin microcontroller. RX is the standard UART receive line. Connect to a UART TX pin on a microcontroller. CTS is active low and is read by the Module to determine whether the host microcontroller is ready to receive bytes. It should be connected to an output pin of a microcontroller.
High = Module won't send bytes
Low = Module will send bytes

RTS is active low and indicates whether the Module can receive bytes or else its input buffer is temporarily full. It should be connected to an input pin of a microcontroller.
High = Don't send bytes to the Module
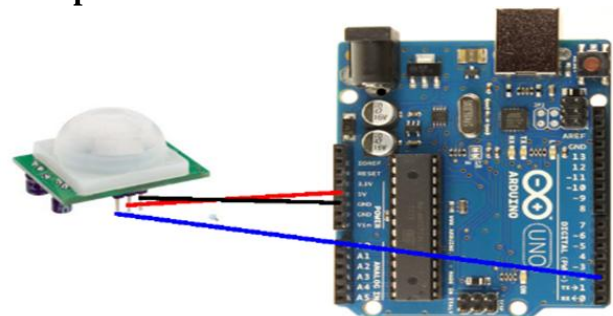Low = Module may receive bytes

5. Experimental Model

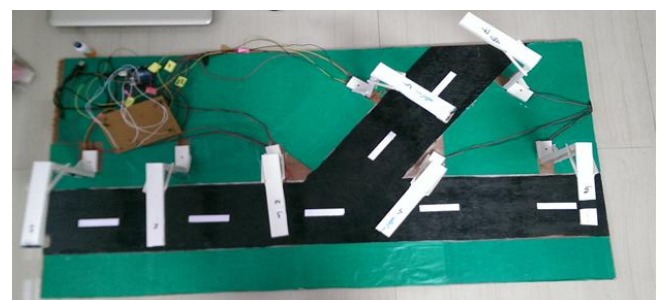**Figure 4:** Pin Sensor interfacing

Figure 5: Working model top view

Figure 6: Working model

6. Conclusion

This paper elaborates the design and construction of automatic street control system circuit. Circuit works properly to turn street lamp ON/OFF. After designing the circuit which controls the light of the street as illustrated in the previous sections. LDR sensor and the photoelectric sensors are the two main conditions in working the circuit.

If the two conditions have been satisfied the circuit will do the desired work according to specific program. Each sensor controls the turning ON or OFF the lighting column. The street lights have been successfully controlled by Arduino microcontroller. With commands from the controller the lights will be ON in the places of the movement when it's dark. Furthermore the drawback of the street light system using timer controller has been overcome, where the system depends on photoelectric sensor. Finally this control circuit can be used in long roadways between the cities.

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