Controlling and Monitoring of Wireless Home Lightening System Using Web Enabled Interface

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***Abstract*—** Now a days Wireless sensor Network (WSN) of spatially distributed autonomous sensor to monitor physical or environmental conditions, such as temperature, sound, pressure etc. and to cooperatively pass their data through the network to a main location. The existing system provides the monitoring and controlling light, pressure, temperature etc but this paper describes the monitoring and controlling of smart home lightening system using web enabled interface. This system is more flexible as this is monitored and controlled by web remotely. In this system personnel computer acts as server which automatically monitor and control the entire system. Remote user can also access the system by their personal mobile phones or tablet or personal computer.
The main advantage of this system is that user can access it remotely through web.

***Index Terms*— —** Wireless sensor network (WSN), AVR based development board, CC2500 Trans receiver modules, Sensors modules (LDR), Controlling devices (Light).

I. INTRODUCTION

Wireless communication technologies have led to great progress in wireless sensor network (WSN) [1]. WSNs are wireless network comprises of numerous spatially distributed sensors with limited data gathering and processing capability to monitor the environment situation. Recent times WSN are gaining popularity in various application domains like, Health care monitoring, Home & commercial monitoring, Industrial and transport monitoring, etc. [2] [3] [4]. Many organizations are developing a proprietary technology to implement a WSN to provide a wide range access to WSN network from remote location. The major problem is it has limitation over long range on other hand The HW platform and SW framework for such application needs to be domain independent to make the system generic and useful in different scenarios.Nowadays the wireless sensor network are being used in many industry and home automation scenario to mainly automate various device in order to monitor and control to optimize energy consumption [5]. This paper concentrates about monitoring and controlling of smart home lightening system using web enabled interface. The system consists of two sensor node which comprises LDR sensor [6] to sense the light intensity, At mega 16, LCD to display light intensity, CC2500 (RF

Module) [7] and LED lights. The system also consists of one computer which acts as a server and mobile phone at user side to remotely access the entire system.

II. RELATED WORK

There are various technologies which have been used for monitoring and controlling of wireless sensor network. But the problem is that every technology is used to show the result on simulation. In paper [8] author describe why simulation is currently the primary practical approach to analyze WSNs quantitatively [9] because experiments or test beds on a physical WSN are expensive, the nature of distribution and large number of sensor nodes make debugging very complicated. In this paper ns-2 is used for simulation since ns-2 platform dependent and is rather difficult to use in a web-based environment. wireless sensors are used for tracking, locating, and monitoring the status of a car manufacturing plant [10]. A wireless tracking system is applied to (i) provide real-time visibility of assets and stock, (ii) improve supply chain management, (iii) monitor the progress of assembly lines, (iv) identify operational and logistic pinch points, (v) improve production planning, and (vi) reduce stock level. A ZigBee network is developed to support the communications among sensor nodes. ZigBee works in the license-free and globally available 2.4 GHz bandwidth, based on IEEE 802.15.4 Private Area Network (PAN) standard [11]. Eclipse platform has been selected as the tool to develop the integrated environment.In paper [12] author focuses on hardware system design issues, software framework and application case studies. The gateway subsystem has been assisted with sufficient storage for local data shielding. The system comprises of three components namely WINGZ [13] (Wireless IP Network Gateway for Zigbee), Ubimote (Wireless ZigBee mote with generic sensor interface) and Ubi-Sense (Generic Sensor board) for application case study. In this paper WINGZ [13], a ZigBee [14] based multi-protocol gateway is the heart of the system which interfaces the wireless sensor network and the IP based network. The paper has discussedvarious hardware design issues and options to design multi-wireless protocol gateway andsoftware framework assisting monitoring and controlling of sensor network end devices/routers etc.

III. PROPOSED SYSTEM

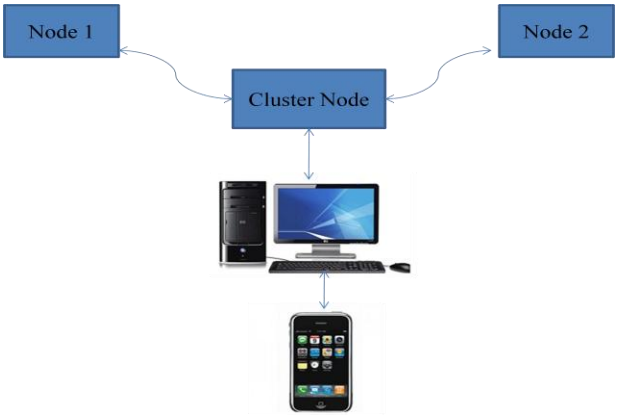

Figure 1: Proposed System

In proposed system, two wireless sensor node and one cluster node are designed. Both sensor node will sense the light intensity and then communicate with the cluster node. The communication between the sensor node and the cluster node is wireless i.e. via RF module [7]. The cluster node will then communicate with the computer which acts as a server via serial interface. At the server, the light intensity of the home will be monitored and controlled automatically. The computer is communicating with the external device via web. The external device may be mobile phone, laptop, PDAs, personal computer etc. A software application will be used to read and write data to and from WSN node over serial communication. This complete scenario will then connected to web interface / application to let the user communicate with the WSN head using internet from anywhere.

A. Wireless Sensor Network

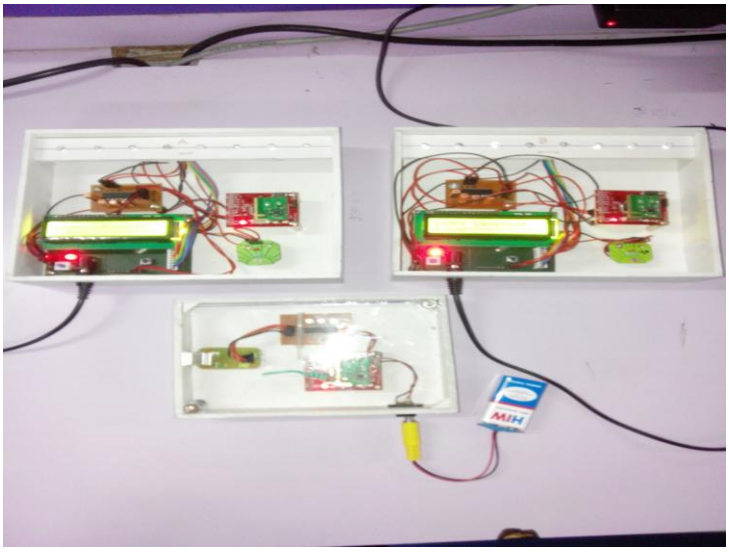

Figure 2: Wireless sensor Network

1. Sensor Node

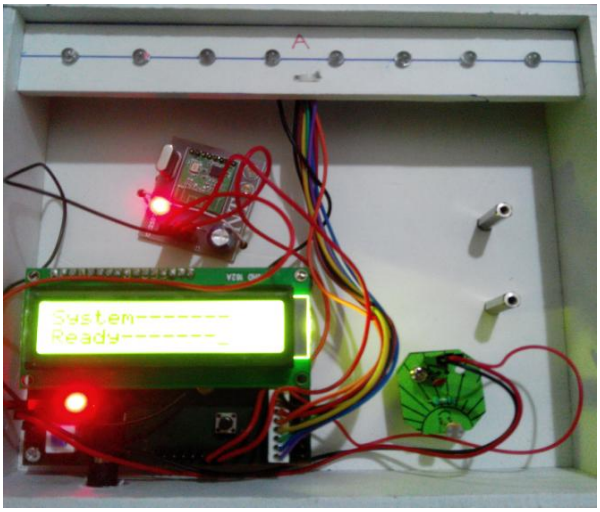

Figure 3: Sensor Node

Every Node will be having following component:

a. Atmega16 Microcontroller:
The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed [15]. Atmega16 Microcontroller having hex code which will control all the control logic, the source code will be written in 'C' using Atmel Studio.

b. CC2500 Wireless Module:
The CC2500 is a low-cost 2.4 GHz transceiver designed for very low-power wireless applications. The RF transceiver is integrated with a highly configurable baseband modem. CC2500 provides extensive hardware support for packet handling, data buffering, burst, transmissions, clear channel assessment, link quality indication, and wake-on-radio [7].
RF Performance-
- High sensitivity (–104 dB at 2.4 kBaud, 1% packet error rate)
- Low current consumption (13.3 mA in RX, 250 kBaud, input well above sensitivity limit)
- Programmable output power up to +1 dB
- Excellent receiver selectivity and blocking performance
- Programmable data rate from 1.2 to 500 kBaud
- Frequency range: 2400 – 2483.5 MHz

c. LDR sensor for light detection:
A photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. LDR sensor will be usedto detect light level & as LDR return analog value, so through ADC at port A in Atmega16 system will read the LDR reading [6]. A photo resistor or light dependent resistor. It is made up of cadmium sulfide (CdS) cell which is a resistor whose resistance decreases with increasing incident light intensity. It can also be referenced as a photoconductor.

d. LED bulb:
LEDs are solid state semi-conductor devices that convert nearly all electrical energy into visible light. Depending upon the LDR light level microcontroller will use PWM mode to control the electric light intensity in order to balance inner and outer light level [16].
LEDs offer substantial benefits beyond energy efficiency:
- Longer rated life than regular bulbs
- Produces equal or better quality of light per energy input
- Offers additional savings through reduced maintenance costs
- Reduction in air conditioning cooling load;
- Easy integration and control in smart buildings

e. Battery Power Supply:
9 volts battery is required.

2. Cluster Node

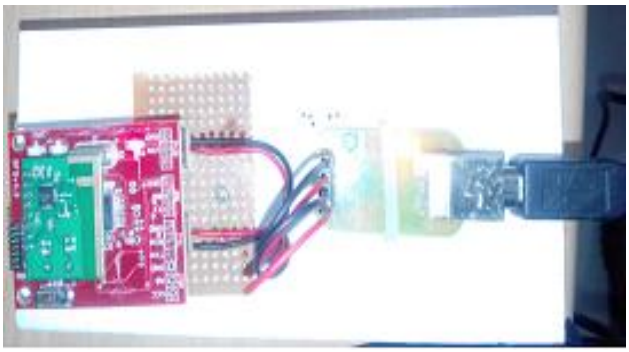

Figure 3: Cluster Node

Cluster Node Details:

a. CC2500 Wireless Module:
Sending LDR reading to system and getting instruction from central unit node will make use of CC2500 wireless module for communication [7].

b. USB to TTL convertor
This USB TTL converter is a port-powered bi-directional USB to TTL/CMOS 5V converter,which can be used to convert any standard full-duplex USB port into a full-duplex TTL port and vice versa [17].

Features

- Adds one TTL port to your USB port.
- Supports 300 to 115,200 baud (auto-sensing and self-adjusting).
- Supports remote wakeup and power management.
- Plug and play (hot-pluggable,data format auto-sensing and self-adjusting).
- Port-powered, no external power required.
- No IRQs requiredany IRQ conflicts.
- Surface Mount Technology manufactured to RoHS and ISO-9001 standards.

c. USB Cable
Universal Serial Bus (USB) is a cables, connectors and communications protocols used in a bus for connection, communication, and power supply between computers and electronic devices.

3. Computer:
The computer in the figure 1 acts as a server. It will communicate with the cluster node through USB to TTL (COM PORT) [17]. The computer will monitor and control the system. It will operate in two modes. One in automatic mode and other in manual mode. Further description is mentioned in section IV.

4. *Mobile Phone:*
The mobile phone in figure 1 acts as remote device which will monitor and control the entire system remotely through web.

IV. Flow Diagram

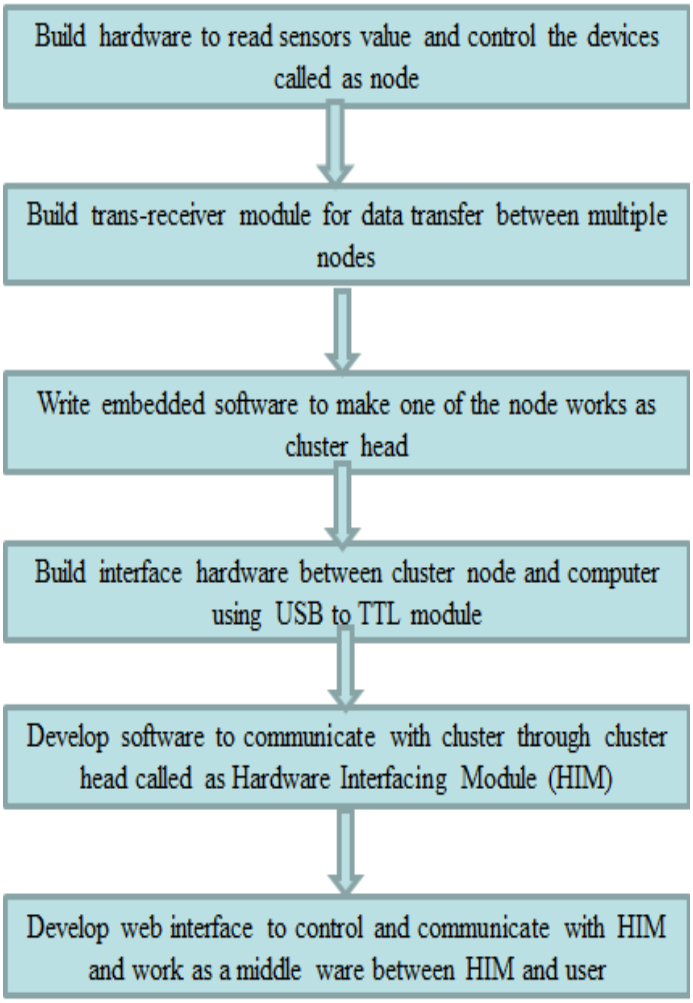

Figure 3: Flow Diagram

Modes of Working:

1. **Automated mode:** Here system will get the light level variations and once the light level reach at the predefined value system will automatically control the light energy. More the light detected by the light sensor minimum voltage supplied to electric light. Here decision will made by controller unit itself.

2. **Manual Mode:** Here system will gets the light level and display it to user on web based application even after the no requirement of bulb system will not perform any action rather user can give feedback action by controlling the light level manually through web application.

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V. RESULT

Figure 5: Snapshot of Form design for the Computer

In the above figure 5, as the user give the port number which is 3 in this case and press on start button, the sensor node start sensing the light intensity. While pressing the Auto Mode the light level is automatically monitored and display on the computer screen. As soon as the user press again on Auto Mode, the system will go under Manual Mode through which user can operate it manually.
The working Node is shown in figure 6.

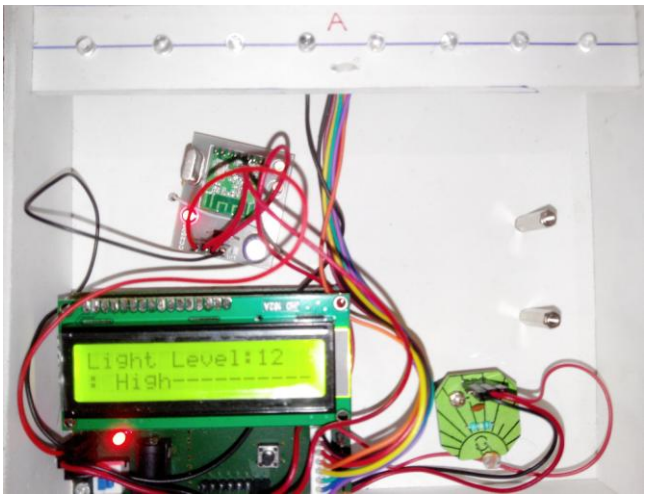

Figure 6: Working Sensor Node A

Figure: 7 Number of option through which light can be controlled

The above figure shows that following are the option through which user can controlled the light. The options are:

a) High Light
b) Normal Light
c) Low Light
d) Close All

High Light means if the light intensity is very high then all the LED will close. Normal Light means if intensity of the light is less than High Light then some LED will glow. Low Light means if the light intensity is less than the Normal Light then all the LED will glow. Close All means if user wants to switch off the all LED then for that there is option of Close All.

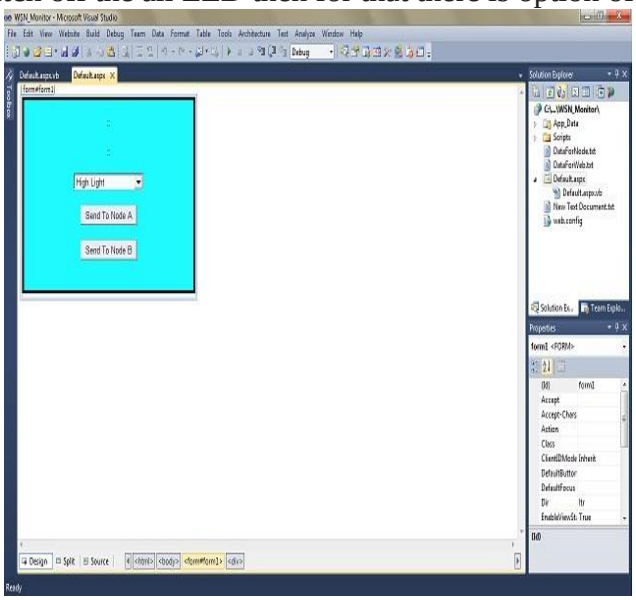

Figure 8: Screenshot of WSN Monitor in Microsoft Visual Studio

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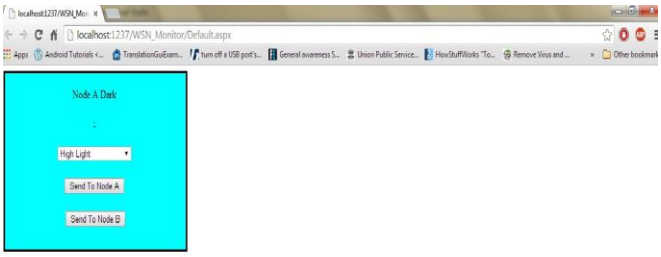

Figure 9: Screenshot of WSN Monitor on Local Host of computer which acts as server

The above figure shows the monitoring and controlling of WSN nodes on the local server.

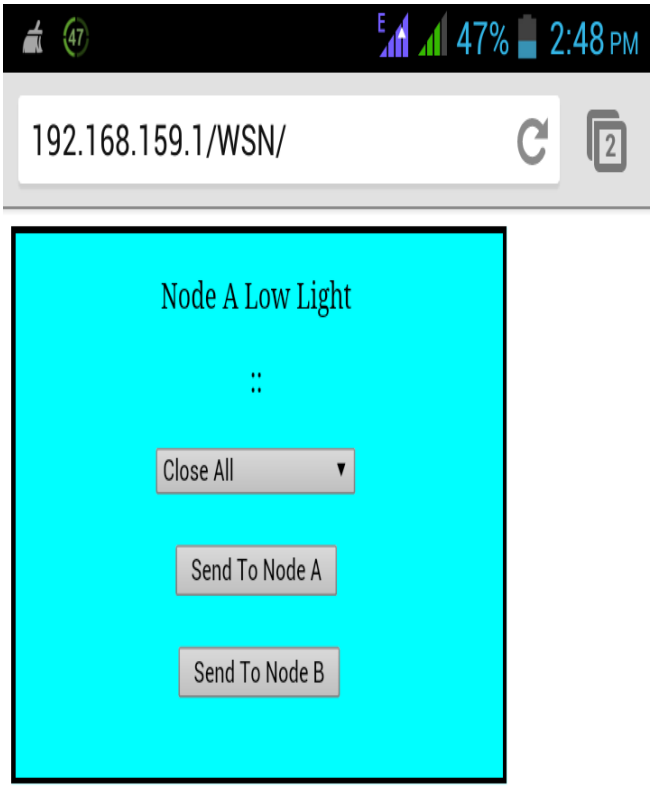

Figure 10: Mobile Application

The above figure shows that the monitoring and controlling of WSN nodes and the entire system can be done through mobile using WEB remotely.The user need to only enter the IP Address of the Local Host server in their respective mobile phones and press the enter key.After pressing the enter key, the entire system can be monitored by the user remotely. The user can also control the entire system by choosing the option at drop-down box. Then the user has to select any of the option and send to the nodes.The result of above figure is shown below.

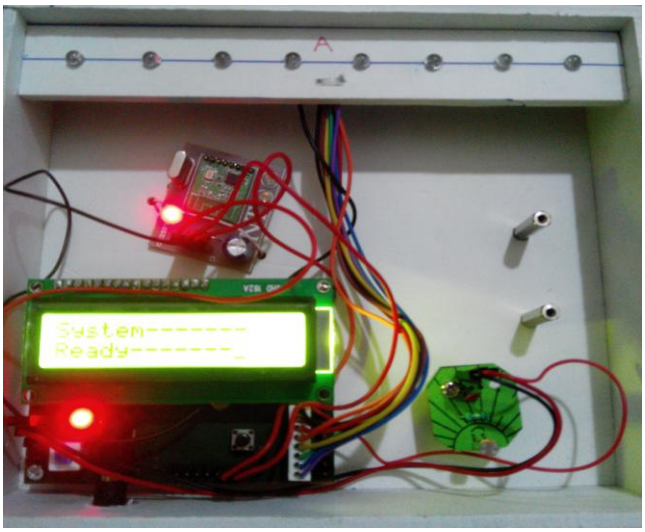

Figure 11: Controlling of the system remotely through mobile by closing all option

By selecting the option of Close All, the entire LED gets closed.

VI. CONCLUSION AND FUTURE WORK

In this paper we have presented the monitoring and controlling of Wireless Sensor Node for Smart home Lightening system using Web Enabled Interface. The proposed system designed in this paper includes the sensor nodes, cluster node, a computer which acts as local server and a web enabled device. All the devices are communicating with each other. The advantage of this system is that monitoring and controlling of entire system are done through web enabled device remotely. As a part of a future work the entire system will be for a large scale.

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