Lighting Control System with Low Rate Network Green Computing System

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Abstract

This paper presents the development of a low rate and low power consumption low rate wireless network. Low rate wireless networks are cheap and comprised of a small fully autonomous processing, communication and remote control devices. The purpose of this study is to develop the system for remote wireless lighting system. They will work with wireless network system (WNS). WNS has been restricted power supply, communication distance and low computing power. But they will work with network in vast area, send and receive raw data from each network node. It has the ability to cooperatively collect data and retransmit in order to process or alert. The step of the experiment is creating main node and sub node in lighting area and transmission of control data between them with less electrical wiring. When wireless node not receiving or transmitting data, the module can be switched into the sleep mode, low power consumption mode. We can reduce the use of electrical wiring, insulated insulation material or other that related to and include energy too.

Key words: Wireless network system, electrical wiring, green computing.

1. Introduction

Components of Wireless Network System (WNS) have end node (EN); and coordinator node or base station. Each node is provided with a radio transceiver, and control device for physical interface, input switch or solid state relay (power electronic switch), to connect with a surrounding environment being used, and basic processor unit. Each node is deployed in house or building. They can perform themselves to ad hoc network, via wireless to communicate with each other, for collecting allocated data, and transfer them pass through base station for other processing. Some applications of Wireless Network System to optimal control of low power consumption systems, forest fire detector system in [1], home or building security system, military wireless sensor networks, or other fields those require wireless event-based sensors. Each node is small, low price, easy to deploy, and no network infrastructure are required. They can drop into dangerous or hazardous areas to monitor events of interested. The one of purpose design WNS is energy awareness.

In this paper presents development of a low rate and low power consumption wireless network node, green computing for lighting control system. What is a low rate, it means low data transfer rate. Low data transfer rate uses lower power consumption than higher rate, low power for green computing, and node will work in the home area for a longer time. There are many techniques to design, an ultra-low power-aware design in [2]. A new modeling assumption for wireless sensor networks, that of node redeployment in [3]. In this paper uses wireless device with IEEE 802.15.4 standard [4][5]. Follow with this standard, there are two physical device types: full function devices and reduced function devices.

2. IEEE 802.15.4 Standard Devices

In IEEE 802.15.4 standard define property of Low Rate Wireless Personal Area Network (LRWPAN) into 2 Layers, Physical Layer and Medium Access Control Sub Layer (Fig.1). It has 2 support simple device types: Full Function Device (FFD) and Reduced Function Device (RFD). Standard FFD device will support fundamental physical and MAC 49 functions but RFD device will support only 38 functions. The devices can communicate to each other (Fig.2).

2.1 Full function device (FFD)

- Function in any topology
- Being the coordinator and PAN coordinator
- And can communicate with any other devices.

2.2 Reduced function device (RFD)

- Function only in star topology
- Cannot perform a network coordinator
- Communicate with its network coordinator
- Peer-to-peer communication.

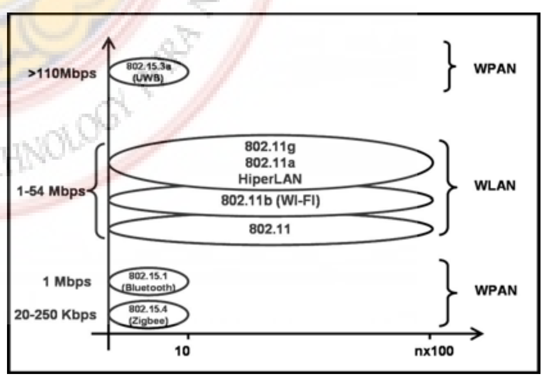

Fig.1 Technology of wireless network [4][5]

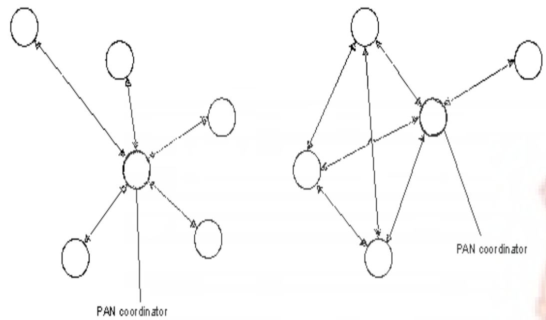

Fig.2 LRWPAN Network topology[6][7]

3. Architecture and system design

Fig.3 XBee Module [8]

Figure 3 is a used module in this experiment. From diagram in Figure 4, XBee 2 modules, one module is connected with microcontroller and the other work as sensor node. It can use standalone with sensor as sensor node.

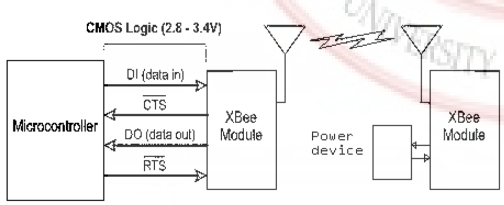

Fig.4 Data flow testing diagram [8]

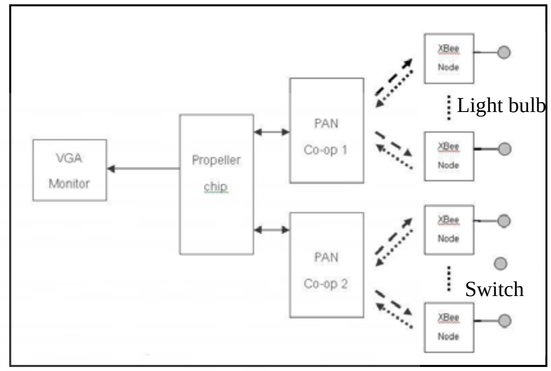

Fig.5 Block Diagram of the Experiment

From figure 5 shows connection diagram between microcontroller (this test use propeller chip) with coordinator node via serial communication. We use signal pins, Dx for data in, Do for data out and use CTS, RTS for hardware flow control signal [9]. Figure 5-7 is experimental devices.

Fig.5 Coordinator node

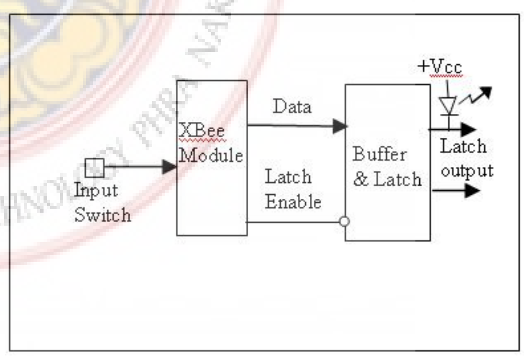

Fig.6 End node (EN) with input or output buffer [11]

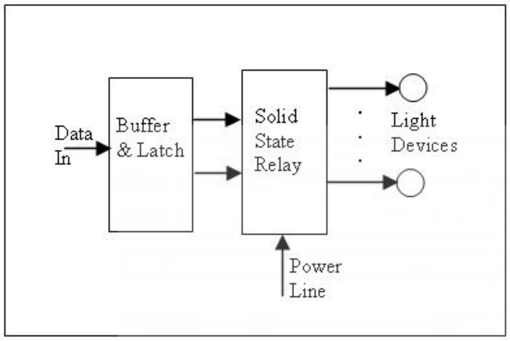

Fig.7 End node is connected with solid state relay [11]

In this application, the main processor is Propeller chip (microcontroller), and use Spin language [10] and Assembly language.

The first step, experiment by testing input and output, switch key and LED output latch, test with wire and wireless.

Next step, experiment by testing solid state relay output, direct control and control with XBee chip, with buffer. Last step experiment by testing with wireless. By using Propeller chip, it can be connected with VGA monitor [10].

4. Experimental results and Discussion

Microcontroller, Propeller chip can communicate with XBee module and coordinator node receives and sends data from/to end node.

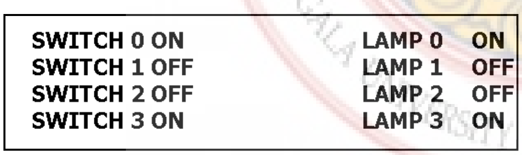

Fig.8 Result Example of result

Table 1 Sent data and received data compared with node distance (%).

	1.0 m	1.5 m	3.0 m	5.0 m	10.0 m
Same floor	100	100	100	100	100
Floor1-floor2	-	-	100	50	10

From Table 1, when end node is in the same floor as coordinator node, it can control lamp and read switch successfully but if it not the same floor, the communication is dropped.

The benefit of this experiment can be adapted to other researches. In the next experiment it should approve mounting point and transceiver's antenna.

5. Conclusion

From the experiment can be information to develop lighting control in same building. The communication distance is decrease when it is not in the line of sight. But, this system is small node, cheap and can control without computer system (example personal computer). It is wireless network system, no wiring, low power consumption node. If the system uses Propeller chip, it can connect with LCD display rather than VGA monitor for energy saving. It, Propeller chip can be used with PS2 keyboard and can implement with mobile phone system for extending.

5. Acknowledgements

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