Hardware Application Queue in ZigBee Control Design for Intelligence Building

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Abstract In this paper, this topic is mainly designed with the smart home as the main axis. The UART End Device terminal and UART Coordinator terminal of Zigbee unlimited random devices are used to simulate the remote control of the LED lights in the building on and off to achieve energy saving and increase convenience of intelligence building.

We use the hypothesis that when people enter the house, infrared rays will sense the person entering the house (ie press the A key), the light inside the house will turn on, and the pressure sensor will recognize when the person goes on the second floor and lie in bed When the person in the house has lie down, the light will be turned off (ie press the B button).

Keywords Wireless sensor network (WSN), ZigBee, Intelligence building

1. Introduction

The ZigBee Alliance slogan, "Wireless Control That Simply Works," is clearly what is needed for end users and implementers, but achieving that result places a heavy burden on the developers and OEMs. Drew Gislason has the ability to take complex topics and present them in a manner that is cogent and easily digestible to OEMs and developers [1]. Today, organizations use IEEE 802.15.4 and ZigBee to effectively deliver solutions for a variety of areas including consumer electronic device control, energy management and efficiency, home and commercial building automation as well as industrial plant management [2].

We can monitor the environment for many applications by using the WSN. The benefits are reducing energy consumption such as to extend the active time of the WSN. The association of ZigBee Alliance company have established many related protocol or standard for ZigBee. Then many standards of reliable, cost-effective, low-power wireless network have been developed. The ZigBee technology is embedded in many ranges of products which across industrial, consumer, commercial applications [3, 4]. The ZigBee defines the network layer specifications for star, tree and peer-to-peer network topologies and provides a framework for application programming in the application layer. The ZigBee is built on the so called IEEE 802.15.4 standard which defines the physical and MAC layers for WSN [5].

In this paper, through this topic design, I learned more about the practical applications and designs of wireless random sensing. In this topic, our group designed a smart home concept house. At the same time, in this thematic design, I learned about the importance of teamwork and the need for good cooperation between each team member to be able to fully present a work. I think this is in the thematic practice, which gives me the greatest gain It is also the most memorable. The results reveal that the control method and experiments are good and satisfied.

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2. Design Method for WSN

The ZigBee specification that you download describes how ZigBee works as a networking protocol. What is not included (at least at the time of this writing) is how applications interact through what are called Application Profiles. To access the Application Profile specifications, you must become a member of the ZigBee Alliance. Application Profiles describe the over-the-air behavior of devices in each of the wireless

control domains. In Telecommunications Applications (TA), for example, companies are creating products that can introduce location-based services such as Fig. 1. These services could advertise specials, services, or sales (at your option) based on the location of your cell phone. The cell phone company already knows where your phone is from a cell tower perspective, but that can be a 15-mile radius or more, far too broad for location-based services.

The main purpose of teaching for students are using application program interface (API) of WSN. This API can be developed to reduce the burden of program design. The Application Queue API is a very important tool to provide a queue-based interface to communicate application file and both the WSN stack and the hardware drivers. The develop environment is called Code::Blocks which can let all these APIs interacts with the IEEE 802.15.4 stack API. Meanwhile, it can interact with many Peripheral Hardware Drivers by Integrated Peripherals API. The Application Queue API handles interrupts between the Medium Access Control (MAC) sub-layer stack and integrated peripherals of wireless microcontroller to save the application time of interrupts [6].

A variety of network topologies have been developed. A star topology is used in this paper. A network must consist of a minimum of two devices. One is called Co-ordinator which is referred to as network commander. Others WSN are called End-Device which can be regarded as client or slave. Each End-Device node has a parent. The Co-ordinator node has one or many client nodes. Each node can communicate only with its parent and its client. Not all nodes may be within range of each others but information can be transferred from one node to another node until the final destination is got. The data transfer methods between network nodes have two types: (1) Transferring data from a Co-ordinator to a node. In this method, request response should be given to the node to request data when it is able to receive. (2) Transferring data from a client node to Co-ordinator node. In this method, confirm response should be sent from a data frame directly. The two data transfer methods are shown in Fig. 2.
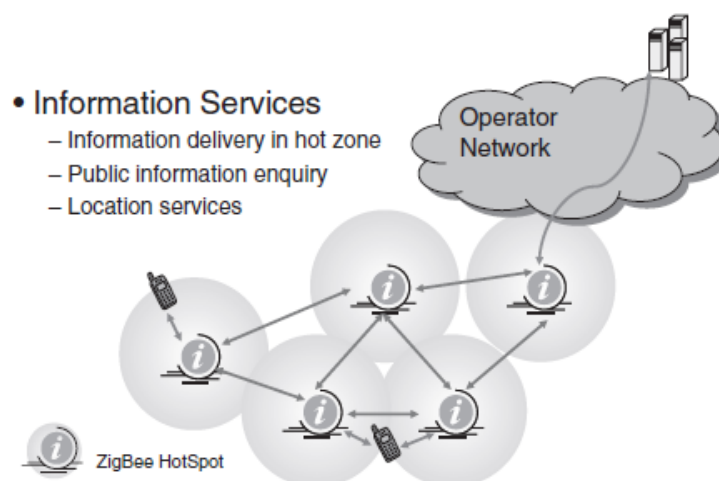

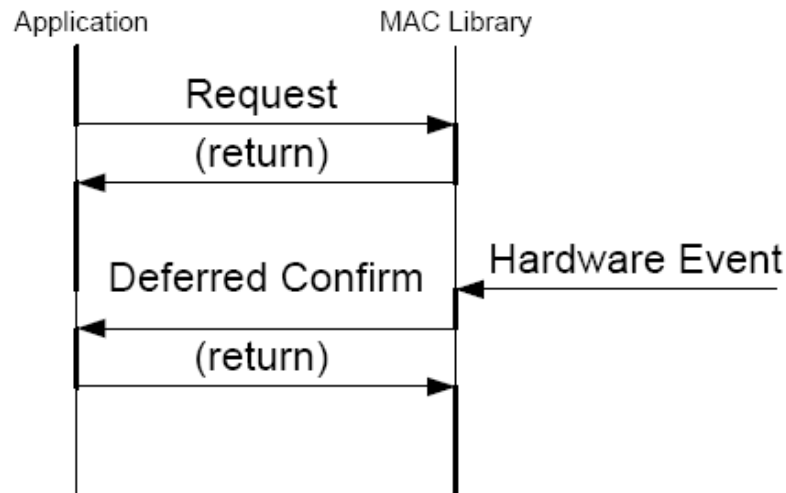*Figure 1: Telecom Application Information Services*

Figure 2: The diagram of WSN data transferring

3. Experiment Results

Use the advantages of Zigbee wireless sensing of low cost, low power, simple circuit, and short-distance transmission to implement smart street lights. Use LED light-emitting diodes and Zigbee unlimited free equipment to write programs to make this topic work normally. I went to the thematic room to make themes and revise the programs on Monday afternoon. This topic is modified based on the programs provided in previous classes for reference. Through the division of labor among students, some students are responsible for the program and the other is responsible for the poster and final model production of the finished product. The final report is then written by each student separately. After completion, the final finished product can be turned on and off by the external Zigbee device for indoor LED and other devices.

The program of WSN is developed on the free software called Code::Blocks. It can provide all the software tools and hardware required to get the first-hand experience with WSN. At first, the program of Co-ordinator is developed then the program of End-Device is developed consequently. Every network must have one and only one PAN Co-ordinator, and one of the tasks in setting up a network is to select and initialize this Co-ordinator. The network setup process is automatically started from stack initialization to data transferred. The entry-level kits contain one base development board (BDB) and one sensor development board (SDB). Each board is equipped with a high-power IEEE 802.15.4 RF module which provides much higher covering range with 2.4GHz RF antenna for easy mechanical design than normal-power RF module. For I/O expansion ports, it has 10 useful pins of GPIO include UART, ADC, DAC and Comparator. The sensor development board features temperature sensors such as Fig.3. After setting the COM Port, you can know that the UART Coordinator will trigger when it receives a hardware event from the End Device (SW1 or SW2 is pressed), and send the result back to the Coordinator to control the startup and shutdown of the external device . The experimental results are shown in Fig. 4.

The API software provides free packages to the peripheral devices single-chip compliant wireless microcontrollers. This is known as the Integrated Peripherals API. It details the calls that may be made through the API. This hardware is controlled using the MAC software stack which is built in the on-chip ROM. The developed program is shown in Fig. 5. In this paper, the WSNs are used to monitoring temperature. The experimental example of verifying the performance of WSN has been presented in this paper. The results reveal that the control method and experiments are good and satisfied.
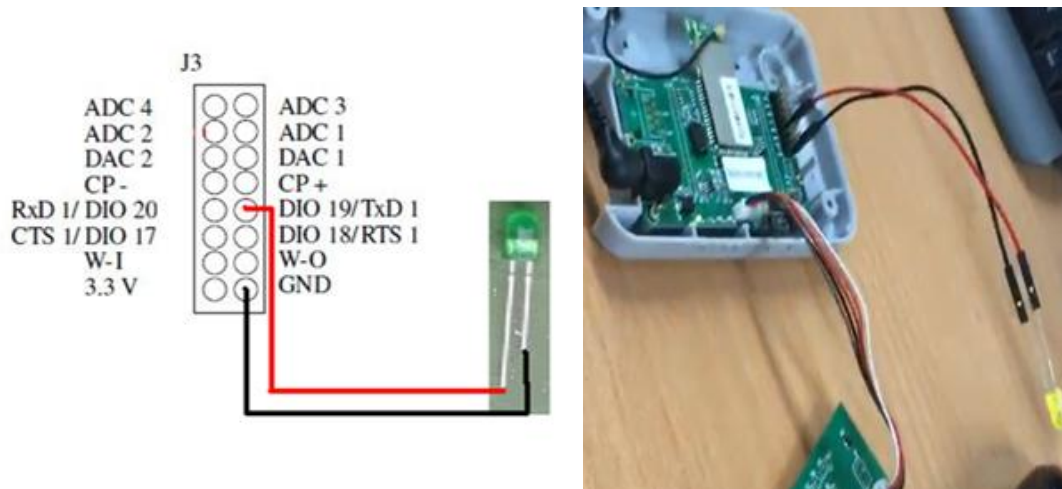
Figure 3: The development boards of WSN

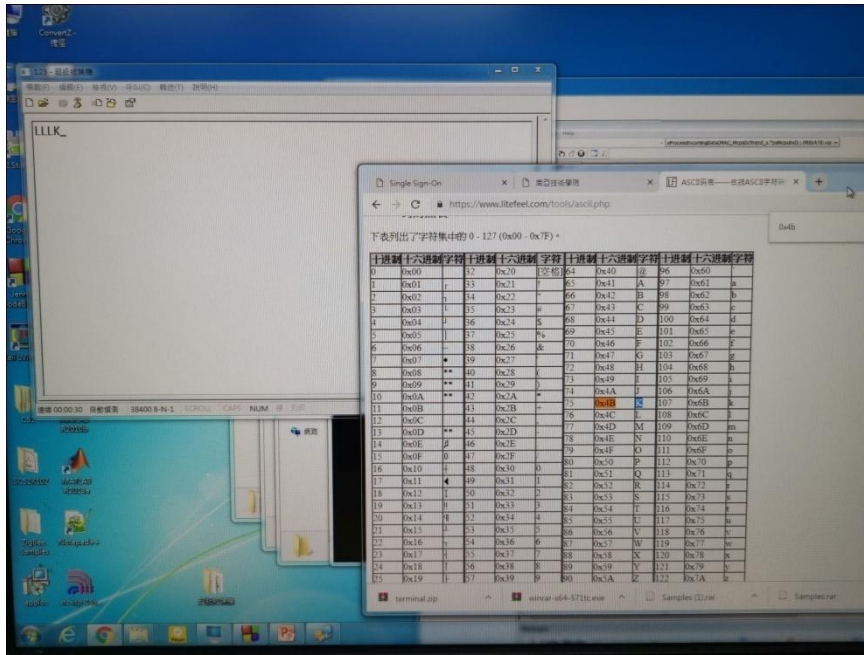*Figure 4: The diagram of experimental results*

Figure 5: The program diagram of intelligence building control

4. Conclusion

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