Journal of Theoretical and Applied Information Technology
30th April 2013. Vol. 50 No.3

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

A DEPLOYMENT SYSTEM OF EARTHQUAKE RELIEF SUPPLIES BASED ON ZIGBEE

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ABSTRACT

After earthquake, the communication facilities are severely damaged in the disaster area. In response to the issues, the zigbee is used to connect the post-earthquake field and the command center. Then, a deployment system of earthquake relief supplies based on zigbee, which can send the signal of demands such as drugs, food, excavators, reinforce to the command center, is designed and realized. So the command center can deploy the relief supplies efficiently according to the received demands

Keywords: *Zigbee, Earthquake Relief Supplies, Supplies Deployment*

1. INTRODUCTION

After earthquake, the communication facilities are severely damaged in the disaster area and cannot be recovered in a few days, which leads to incapability to communicate between the scene rescuers and the command center. Then, the efficiency of deployment of relief supplies is very low. Now, the communication between the post-earthquake scene rescuers and the command center is a key bottleneck problem [1].

In response to the issues, the zigbee is used to connect the post-earthquake field and the command center. Then, a deployment system of earthquake relief supplies based on zigbee [2], which can send the signal of demands such as drugs, food, excavators, reinforce to the command center, is designed and realized. So the command center can deploy the relief supplies efficiently according to the received demands.

2. DESIGN OF THE SYSTEM STRUCTURE

The system consists of hand-held terminals and command center [3]. The former sends the signal of materials demands to the command center through the wireless self-organized 2.4GHz Zigbee network. The command center deploys the relief supplies according to the received demands, meanwhile, sends the confirmation signal to the terminal. The system structure is shown in figure 1.

3. DESIGN OF THE COMMAND CENTER

3.1 Design of the Functions

PC has the functions such as the nodes information collection and the display of all the network nodes and the request nodes. Figure 2 shows the functions of the data-processing system.

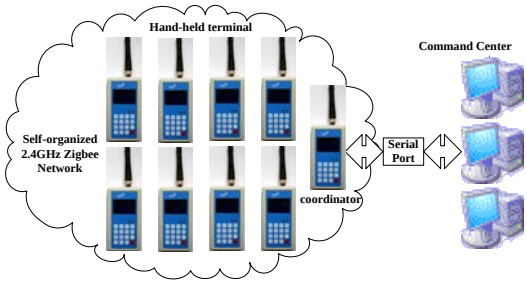

Figure 1 System Structure

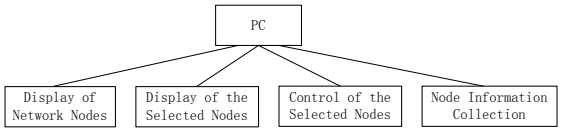

Figure 2 the Functions of Data-processing System

PC receives the demands information and displays all the network nodes and their father nodes. The selected nodes information includes RSSI and LQI. The module of control of the selected nodes is used to send the feedback information to the command center and control four LED and one buzzer [4]. The module of node information collection displays the received demand information and the node serial number.

3.2 Design of the data-processing software

When PC receives the information, middleware service starts and gets ready for the link to the upper

Journal of Theoretical and Applied Information Technology
30th April 2013. Vol. 50 No.3

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

application. All the nodes connect to the coordinator which sends the received information to PC. At the same time, upper application enters the message loop. Through calling MyOnReceive function, the upper application reacts differently according to the different information codes [5]. PC sends feedback information through controlling the LED and the buzzer after receiving the demand information. The flow chart is shown as Figure 3.

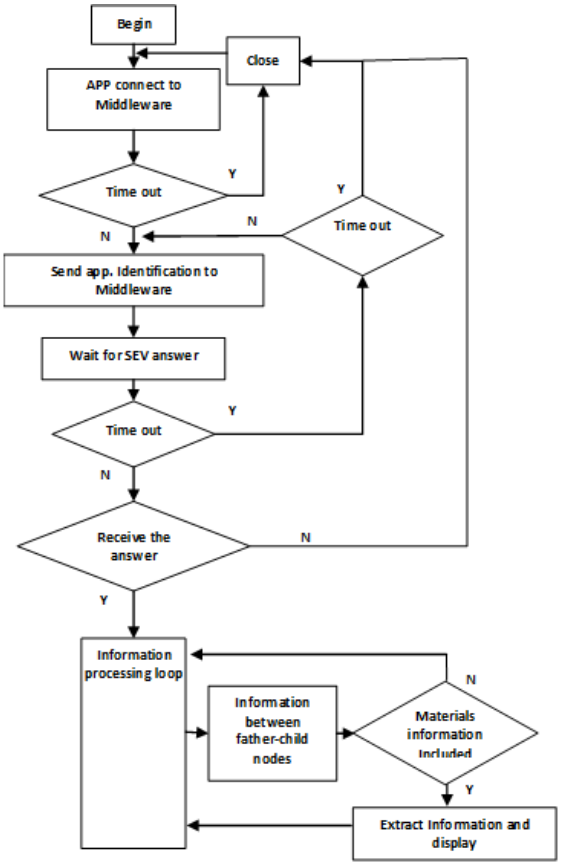

Figure 3 Flow Chart of Data-processing

4. DESIGN OF THE HAND-HELD TERMINAL

The functions of hand-held terminal are demands requesting by button, wireless transmitting, LED show and buzzing prompt. Different button which has the corresponding LED means different materials demand. Figure 4 shows the functions of hand-held terminal.

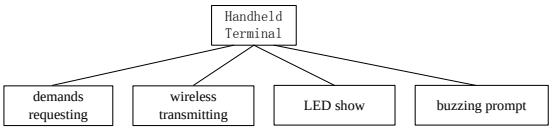

Figure 4 Functions of Hand-held Terminal

4.1 Design of the hand-held terminal Hardware

The structure of the hand-held terminal hardware is shown as figure 5. CC2530 which is a SOC with ultra-low power consumption is used as the microprocessor and the radio frequency module [6]. The SDRAM is used for to store system data temporarily. The JTAG port is used to debug the program.

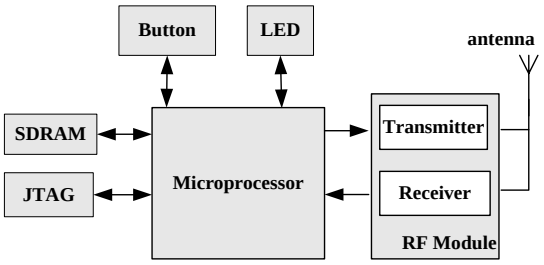

Figure 5 Structure of the Hand-held Terminal Hardware

4.2 Design of the Hand-held Terminal Software

The hierarchy method is applied to the design of the hand-held terminal software. The software hierarchy is shown in figure 6. The layers are device driver layer, intermediate layer and application layer from bottom to top. The intermediate layer provides radio frequency protocol to transmit the data on the self-organized network through the hardware. The functions of application layer are capturing and transmitting the materials request signal and receiving the Corresponding signal.

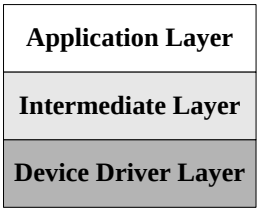

Figure 6 Software Hierarchy

In the application layer, a data structural body is designed in the data packet of parent-child relationship. The structural body is as follow [7-8].

```
typedef struct
{
uint8 Hdr;              //Head
uint8 Len;              //Length
uint16 TransportID;     // Dialog ID
uint8 MSGCode;          //Message Code
uint16 NodeAddr;        //Node Address
```

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

```
uint16 NodePAddr;          //Parent Node Address
char data;
uint8 Checksum;            //Checksum
}PCNodeAddrPacket_t;
```

Nodes transmit messages about the relation between nodes to coordinator periodically to ensure the correct relation between nodes when the relation changes [9]. The flow chart of the hand-held terminal program is shown as figure 7.

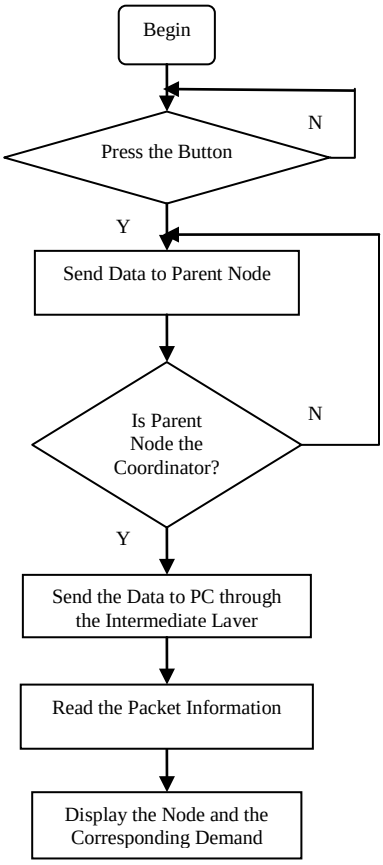

Figure 7 Flow Chart of the Hand-held Terminal Program

5. SYSTEM TESTING RESULT

The system has been tested on a playground. The hand-held terminals are tested through different distance between two nodes. The testing result is shown as figure 8. The result shows that the LQI (Link Quality Indication) is very stable and the RSSI (Received Signal Strength Indicator) does not change sharply with the changing distances. So the performance is able to meet the system requirement.

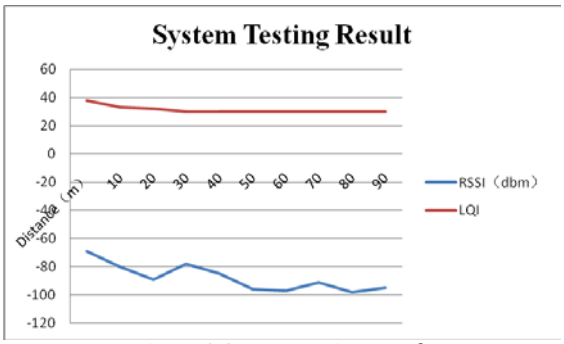

Figure 8 System Testing Result

6. ACKNOWLEDGMENTS

I'd like to express my sincere thanks to Youth Science Fund for Disaster Prevention and Reduction (201101) and Scientific Research Plan Projects for Higher Schools in Hebei Province (Z2012125) that sponsor the paper.

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