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Research Article

Design and Implementation of Smart Home Intranet Based on ZigBee

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Abstract: The study has design and implementation of smart home intranet based on ZigBee. As the continuous development of Internet of Things (IOT), life intelligent gradually. Therefore, designed of home intranet become the inevitable trend of development. Therefore, the study is going to talk about an Intelligent Monitoring System based on ZigBee which was designed by the author. The system uses a low-power-cost CC 2430 processor as central controller, present a home gateway of wireless access scheme base on ZigBee wireless network. The touch screen interface allows the ZigBee technology to achieve wireless monitoring of home device. Such as light, temperature, humidity, fire alarm, curtain, smart socket and so on. At the end of the study it will give out the techniques and implementation of the original system.

Keywords: Home device, home intranet, interface, wireless monitoring, ZigBee

INTRODUCTION

The study presents a home gateway of wireless access scheme base on ZigBee wireless network (Shouwei and Canyang, 2009). The user would control nodes for sensor data and monitoring node equipment real time through the interface.

Relative to the others wireless communication standard, ZigBee protocol stack is very simple and low requirements of the master controller. 8-bit processor with 4 KB ROM and 64 KB RAM, etc., to meet the minimum requirements, thereby reducing the cost of product development. The network structure is shown in Fig. 1.

MATERIALS AND METHODS

The hardware of smart home intranet:

CC2430 module: The Micro-controller module is made up of the CC 2430 and its peripheral circuit, mainly used for wireless access scheme. CC 2430 has a 2.4-GHz IEEE 802.15.4 compliant RF transceiver, with 128 K bytes of Flash and 8 K bytes of SRAM (CC2430, 2013). It is the first choice for the build of intelligent home network. The wireless control structure of the system is shown in Fig. 2:

Handheld devices: The module is made up of the STM32F103RBT6 and its peripheral circuit (STM32F103RBT6 Datasheet, 2013), mainly used for the gateway, which is the core of the system. The operating frequency of this type microprocessor is 72 MHz, with 128 K bytes of Flash and 20 K bytes of SRAM and a wealth of GPIO and a rich communication interface in it.

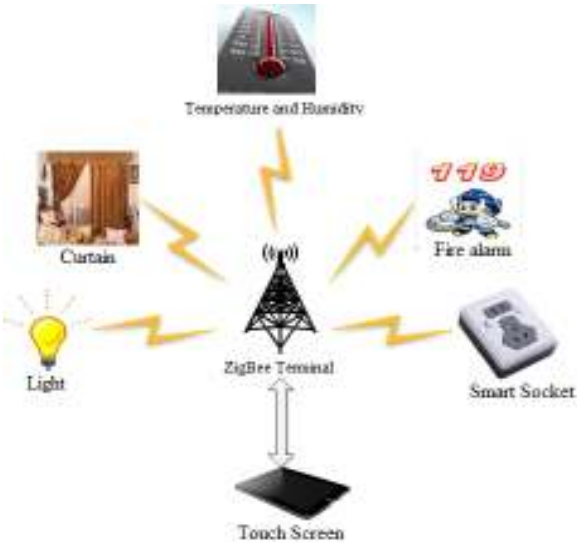

Fig. 1: The network structure

Temperature and humidity sensor: The module uses a calibrated digital signal output of temperature and humidity sensor (DHT21 Datasheet, 2012). The module is small size, low power consumption. Which signal transmission distance up to 20 m, is the best choice for all kinds of applications.

Smoke sensor: MQ-2 sensor module can be used for the family of gas leakage monitoring device suitable for

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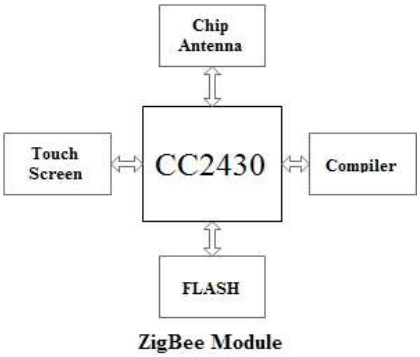

Fig. 2: Wireless control structure of the system

LPG, butane, propane, methane, alcohol, smoke, (MQ-2 Datasheet, 2013). The module has a high stability, long life and other characteristics. The schematic diagram is shown in Fig. 3.

Curtain control module: The curtain control module L298N DC motor contains an internal 4-channel logical drive circuit, which is a two-phase and four-phase motor dedicated drive (L298N Datasheet, 2013). We change chip level through I/O input, to control the motor rotating and stop. The schematic diagram is shown in Fig. 4.

Smart socket: The smart socket with 5 V Relay Module, using Opto-isolated circuit improve safety and using low level interrupt to turn on or off home device of 220 V (Relay Datasheet, 2012). The schematic diagram is shown in Fig. 5.

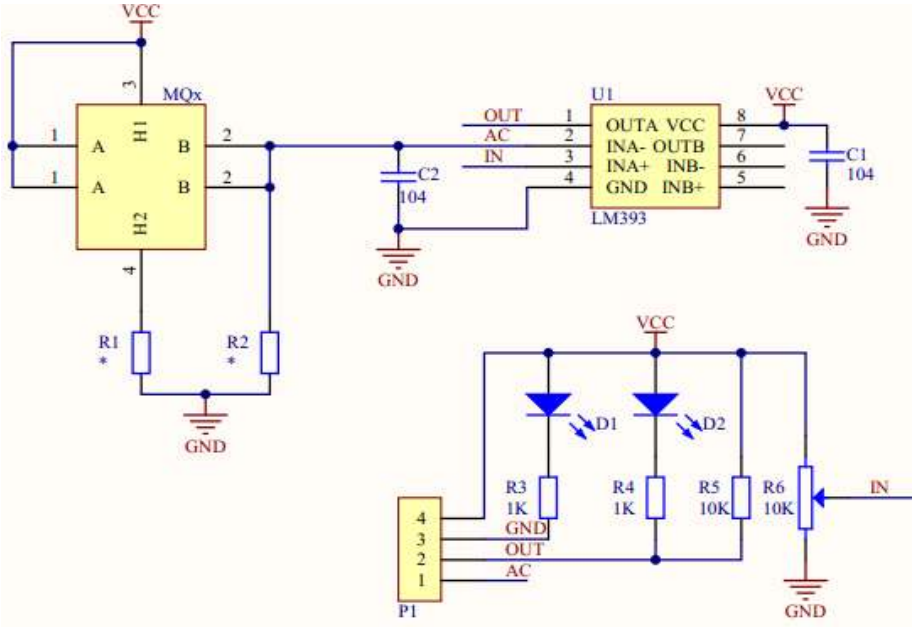

Fig. 3: The schematic diagram of smoke sensor

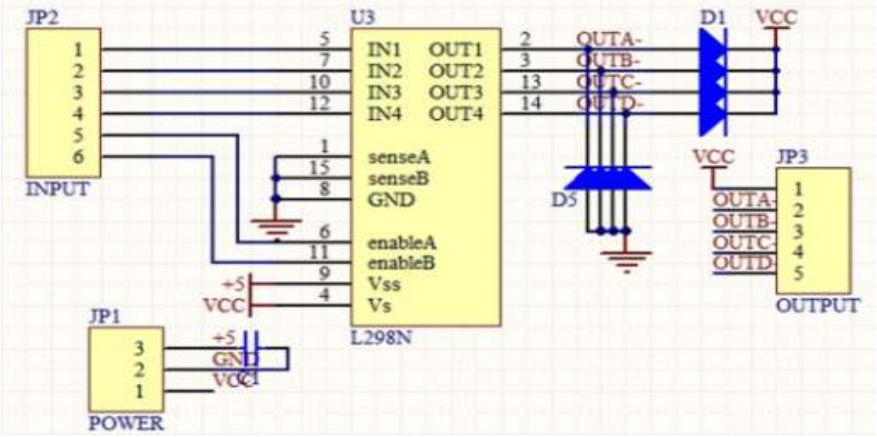

Fig. 4: The schematic diagram of curtain control module

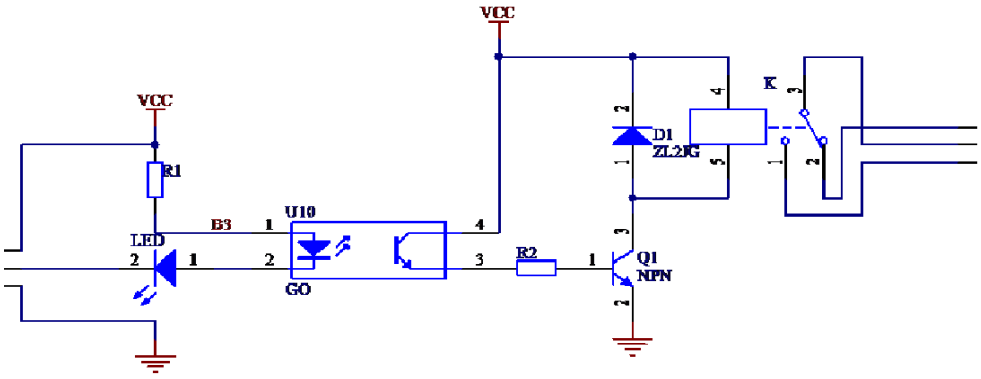

Fig. 5: The schematic diagram of smart socket

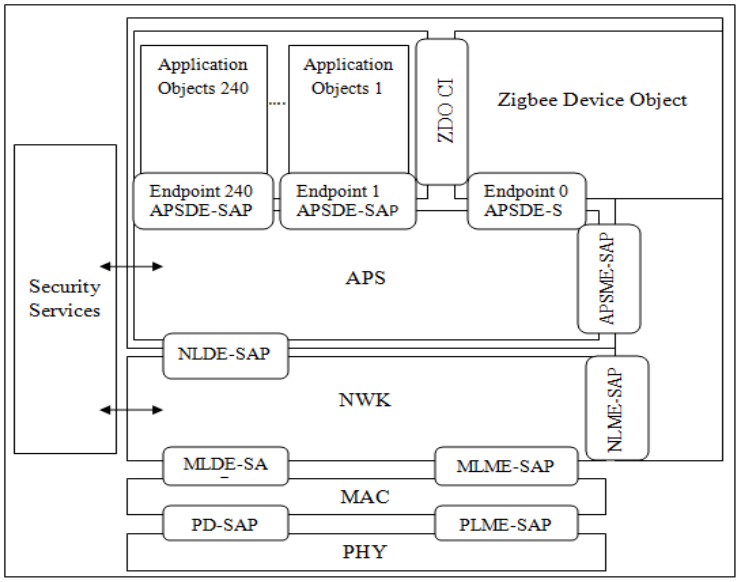

Fig. 6: ZigBee protocol stack structure

THE SOFTWARE OF SMART HOME INTRANET

The wireless network protocols ZigBee: ZigBee protocol uses the IEEE 802.15.4 defines the Physical Layer (PHY) and the media Media Access layer (MAC) (Shouwei and Canyang, 2009). And on this basis to define the architecture of the Network layer (NWK) and Application Layer (APL) (Shouwei and Canyang, 2009). ZigBee protocol stack structure is shown in Fig. 6.

Home node control: Temperature and humidity sensors, mainly through the temperature reporting functions as well as the humidity reporting function, to achieve the home environment temperature and humidity detection, as follows:

```
if (event == MY_REPORT_EXTEMP_EVT) // temperature reporting functions
{
pExTemp [0] = EXTEMP_REPORT;
myApp_ReadExTemperature ();
osal_memcpy (pExTemp+1, ch, 6);
zb_SendDataRequest (0xFFFE, SENSOR_REPORT_CMD_ID, 7, pExTemp, 0, AF_ACK_REQUEST, 0);
}
if (event == MY_REPORT_RH_EVT) // humidity reporting function
{
 pExTemp [0] = RH_REPORT;
 myApp_ReadR_Humidity ();
 osal_memcpy (pExTemp+1, sh, 6);
 zb_SendDataRequest (0xFFFE, SENSOR_REPORT_CMD_ID, 7, pExTemp, 0, AF_ACK_REQUEST, 0);
 }
```

Smoke sensor, primarily through the interrupt function, to achieve real-time monitoring of the smoke of the home environment, as follows:

Fig. 7: Interface display of the touch screen

Fig. 8: Wireless home node 1

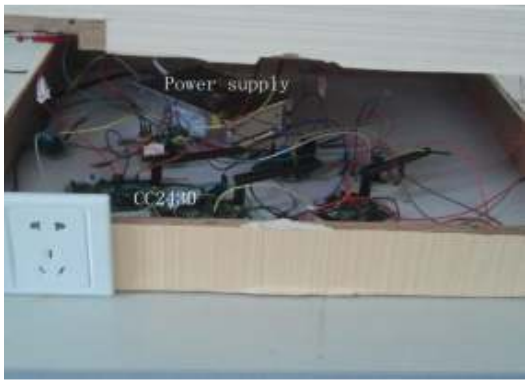

Fig. 9: Wireless home node 2

```
if (keys and HAL_KEY_SW_6) // the interrupt function of the smoke
    {
    osal_start_timerEx (sapi_TaskID, Interrupt0, my Interrupt Report Period); HalLedSet (HAL_LED_1, HAL_LED_MODE_BLINK);
    }
```

Curtain control, mainly through the motor stop function, open function and close function, to open and close the curtains, as follows:

```
if (event == MY_STOP_MOTO_EVT) // motor stop function
{
pData [0] = MOTO_REPORT;
pData [1] = 5;
zb_SendDataRequest (0xFFFE, SENSOR_REPORT_CMD_ID, 7, pData, 0, AF_ACK_REQUEST, 0);
}
```

RESULTS AND DISCUSSION

There are four parts of the test: remote terminal test of the touch screen and test of ZigBee wireless home node. System test are shown in Fig. 7 to 9.

CONCLUSION

This study designs and implements an intelligent monitoring system based on ZigBee. Achieved the ZigBee short-range wireless sensor networks connect with terminal. The thesis also presented the structure of hardware based on the ZigBee protocol, handheld devices, temperature and humidity sensor, smoke sensor, curtain control module, smart socket. This System is low-cost, high-safety, energy-efficient and eco-friendly so that it gives new development direction of intelligent household system.

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