THE DESIGN OF SPEECH-CONTROL POWER POINT PRESENTATION TOOL USING ARM7

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ABSTRACT

This paper was mainly exploring the important tool for many people who were exchanging knowledge especially proceeding power-point presentation as one auxiliary tool. The lecturer's most proper position should be between the audience and screen of power-point and this location is far away the mouse or keyboard and also if he want go for particular slide using mouse or keyboard is long process, so if we have designed one facility with wireless control and could be controlled with speech-recognition function so that users need not rush between the screen and computer and also he can easily go for particular slide. Today some identical products with RF [1] and push function on the power-point pen that needs users to pre-learn the functions and those usage often caused errors especially in the dark environment, so in this paper we combined WSN ZigBee modules [2] with speech-recognition function and ARM7 based LPC2148 microcontroller to design the creative product, so to called “Hi-TEC ZigBee remote-controller of Power-Point presentation”.

Keywords: Wireless Sensor Network (WSN); Speech-recognition, Power-Point; ARM7 based LPC2148 MC

1. INTRODUCTION

Recently there have been many kinds of products of wireless remote-controller for briefing such as portable laser-point pen, RF laser briefing pen, Bluetooth mouse briefing set etc. All of those briefing equipments have to be touched by man to accomplish page-up or page-down function, in addition, with main function of ultra-red rays laser-point it was easy to point out the important section in the presentation with power-point besides its original page-up or down functions and with RF receiver combined with push-button of page-up or page-down the briefer could solve such problem resulting from user’s rushing about between the screen and computer. But there existed some shortages that owing to pushing button to finish specific function the user must be very familiar with the function of every push-button and its position on the briefer, however, the presentation location was happening to be in a dusky occasion it often caused some trouble-using of users or even resulted in big mistook action which would spoil the presentation. More than that, in large conference room the tradition RF wireless transmitting distance was too constrained to get the presentation effects.

So in this paper how to overcome the constraint of short transmitting distance of RF and error action when using briefing equipment in the dusky environment of large conference space [3] became the main resolved part of the research. The resolution was planned to take advantage of combining speech-recognition with ZigBee to control power-point briefing equipment [4]. Since ZigBee has been used in our daily life, therefore, we could easily use related interface of them to link other facilities with the same Zigbee equipment. With the benefits of long transmitting distance, security, and accuracy, the communication outcome was guaranteed so as to replace ultra-red rays and RF wireless transmitting interface, so we used ZigBee wireless communication interface and its modules to design our remote-control power-point presentation briefing equipments [5].

As to the other part of the research was the speech-recognition function which was implemented into the briefing equipments. By combining with ZigBee module, the transmitting distance could reach about 100 meters in non-obstacle space. In such condition it made it possible that if user put on this speech-control wireless remote-control briefing equipment then he could connect with any ZigBee device or computer with build-in ZigBee modules; in addition, user could record instructions beforehand, and train the briefing equipment to learn how to recognize the control instruction given by the user. After training, user could easily give orders such as page-down, page-up, and end up presentation, in other word; user could use speech-function to control wireless remote-control briefing equipment instead of traditional push button way and in this
operation mode, user could easily and precisely proceed Power-Point presentation especially in large and dark conference room [6].

II. PURPOSE OF DESIGN
1) Users could control page-up or page-down of POWER POINT or go for particular slide page with easy speech function.
2) Provide control-command of recording function so that the facility, possessing high-speech-recognition function, could be used by anyone.
3) Owing to adopting ZigBee module with high-power as its wireless interface, the transmitting distance in this system reached to 700 meters.
4) The system could support all kinds of ZigBee transmitting facilities and possessed high compatibility.

III. SYSTEM BLOCK DIAGRAM
The system block diagram of speech control Power point presentation tool was shown in Fig 1; in which the speech recognition module is recognize the predefined speech commands and send them to the Zigbee through the 8051 microcontroller because the output of speech module is parallel and input to the Zigbee is serial so here 8051 will convert the parallel data into serial. In receiver side another Zigbee is there it will receive the speech commands and send them to the ARM7 based microcontroller LPC2148. After that the ARM7 microcontroller will compare the speech commands which are internally programmed like Next, Back, Slide1, Slide2,… if the command matches then it control the PPT according to the speech command.

IV. HARDWARE AND SOFTWARE DESIGN
4.1 Wireless transmitting interface with ZigBee
ZigBee is a communication system according to IEEE 802.15.4 and ZigBee Alliance organizations to construct its software and hardware specifications. As Fig. 2, PHY (Physical Layer), MAC (Medium Access Control Layer), and Data Link (Data Link Layer) was conducted by IEEE [7]. ZigBee Alliance was responsible for configure logic net, security coding for data transmission, and specification for application interfaces and linking constrains of system products.

![Fig.2 Protocol of software & hardware](image)

Transmitter

![Fig.1 System Block Diagram](image)

1) PHY (Physical Layer) mainly conducted items as following:
2) To start and close the radio transmitter and receiver.
3) To detect the transmission power of radio channel signals (ED, Energy Detection).
4) To list the linking quality of received information package (LQI, Link Quality Indication).
5) To judge whether (CSMA-CA, Carrier Sense Multiple Access-Collision Avoidance) channel was cleared or not (CCA, Clear Channel Assessment).
6) To select proper channel and frequency to receive and transmit data.

The frame structure of PHY [7] is consisted of (SHR, Synchronization Header), (PHR, PHY Header), (PSDU, PHY Service Data Unit) which form a PHY Protocol Data Unit as shown in Fig. 3, in which includes:
Synchronization Header: it can be divided into Preamble Sequence Field, which was used as detected data for guaranteeing synchronized receiving terminal chip or symbol and Start of Frame Delimiter Field, which was used to indicate the start of information package and end of Preamble Sequence Field.

PHY Header: It included 7 bits of Frame Length Field and one reserved bit.

<table>
<thead>
<tr>
<th>4 Octets</th>
<th>1 Octet</th>
<th>1 Octet</th>
<th>0-127 Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sync. Header</td>
<td>PHY Header</td>
<td>PHY Payload</td>
<td></td>
</tr>
<tr>
<td>SHR.</td>
<td>PFR.</td>
<td>MPDU</td>
<td></td>
</tr>
</tbody>
</table>

Fig.3 Frame structure of PHY

1) MAC (Medium Access Control Layer) was responsible of following works in addition to connecting with PHY [9]:
2) It was responsible for produce beacon that would synchronize with beacon of coordinator when device itself was configured as Coordinator.
3) To support association and disassociation of individual network.

To use (CSMA-CA, Carrier Sense Multiple Access-Collision Avoidance) mechanism [7] to decide which channel is proper for communication and to control and maintain Guarantee-Time Slots mechanism (GTS, Guaranteed Time Slots)?

The stack structure of IEEE 802.15.4 was shown in Fig.4, in which the application program interact with stack layer through stack API of 802.15.4, and this interaction is used to accomplish the request and acknowledge of (MCPS, MAC Data Services) / (MLME, MAC Management Services) that is the symbols and response of information. Finally, the IEEE 802.15.4 stack layer will interact with the bottom layer hardware through registers.

Fig.4 Software structure of API

Beacon cab divided into Beacon-Enable-Network and Non-Beacon-Enable-Network [7], and the former is used to let coordinator synchronize its attached device and clarify the individual local network of the device. In this study, the Beacon-Enable-Network was adapted in which if the attached devices wanted to transmit data or controlled signals, then those devices must wait for a while randomly and then check whether the channel were idle, if it were, then the data could be transmitted.

As indicated in Fig. 5, every net must have only one PAN-Coordinator, and the first step for constructing net is to initialize coordinator.

Initialise the IEEE 802.15.4 STACK
Create a PAN-Coordinator
Set the Network’s PAN ID
Set the PAN Coordinator’s short address
Select the Radio Frequency Channel
Start the Network
Join Other Devices to Network
Start transferring Data

Fig.5 Procedures of Constructing Wireless Net

The initialization of PAN Coordinator only proceeds in the devices agreed with in advance, a selected PAN ID will be used as symbol of the net after finishing initialization. PAN ID can be changed by users, and PAN ID can also select an in-conflicted ID by detecting the ID of other net. PAN Coordinator can scan lots of channel frequency and can also assign fix channel by command devices using way of priority scan to insure no confliction of PAN ID with other net. If PAN Coordinator accepted the
End Device, then a 16 bits short address would be sent to End Device as a symbol of End Device in the net. Coordinator directly sending data to End Device was shown in Fig. 6 and Fig. 7 was the in-directly data transmission between them.

4.2 Speech Recognition Module

Speech recognition will become the method of choice for controlling appliances, toys, tools and computers. At its most basic level, speech controlled appliances and tools allow the user to perform parallel tasks (i.e. hands and eyes are busy elsewhere) while working with the tool or appliance.

The heart of the circuit is the HM2007 speech recognition IC.

The following are features of Speech Recognition Module:

- User Programmable.
- Maximum 40 word recognition (.96 second)
- Maximum word length 1.92 seconds (20 word)
- Multi-lingual
- Non-volatile memory back up with 3V battery onboard. Will keep the speech recognition data in memory even after power off.
- Easily interfaced to control external circuits & appliances

There are several areas for application of speech recognition technology.

- Speech controlled appliances and toys
- Speech assisted computer games
- Telephone assistance systems
- Speech recognition security
Training Words for Recognition:

Press “1” (display will show “01” and the LED will turn off) on the keypad, then press the TRAIN key (the LED will turn on) to place circuit in training mode, for word one. Say the target word into the onboard microphone (near LED) clearly. The circuit signals acceptance of the voice input by blinking the LED off then on. The word is now identified as the “01” word. If the LED did not flash, start over by pressing “1” and then “TRAIN” key. You may continue training new words in the circuit.

Press “2” then TRN to train the second word and so on. The circuit will accept and recognize up to 20 words (with 1.92 sec each) or up to 40 words (with 0.96 sec each). It is not necessary to train all word spaces. If you only require 10 target words that are all you need to train.

Testing Recognition:

Repeat a trained word into the microphone. The number of the word should be displayed on the digital display. For instance, if the word “directory” was trained as word number 10, saying the word “directory” into the microphone will cause the number 10 to be displayed.

Error Codes:

The chip provides the following error codes.

- 55 = word to long
- 66 = word to short
- 77 = no match

Clearing Memory:

To erase all words in memory press “99” and then “CLR”. The numbers will quickly scroll by on the digital display as the memory is erased.

4.3 Transmitting Circuit with 8051

Fig. 11 Complete Schematic of Transmitter

The Fig.11 is a complete schematic of transmitter, in this the speech recognition module data pins is connected to P1 of 8051, P3.0 and P3.1 are RX and TX pins these two are TTL level and Zigbee is RS232 standard, so in between 8051 and MAX232 is used which is a level convertor. When we say word the speech module will recognize and send the 8 bit data to P1 of 8051 and it convert into serial and send to Zigbee, after that again the Zigbee send to the receiver. The following Fig.12 was transmitter program.

```c
#include <AT89X51.H>
//====================================
void main()
{
  unsigned char ch, pre;
  SCON = 0x50;  //Mode 1 8 bit data,.1 stop bit,.1 start bit
  TMOD = 0x20;  //Timer 1...Mode 2..8 bit Auto Reload
  TL1 = 0xFD;
  TH1 = 0xFD;  //Baud Rate 9600
  TR1 = 1;  //Start Timer
  while(1)
  {
    ch = P1 + 0x30;
    if(pre != ch)
    {
      SBUF = ch;
      while(!TI);
      TI = 0;
      pre = ch;
    }
  }
  //====================================
```

Fig. 12 Program for Transmitter Circuit

4.4 Receiving Circuit with ARM7 Based LPC2148

Fig. 13 Complete Schematic of Receiver

The Fig.13 is a complete schematic of receiver, in this the LPC2148 contains two serial ports, one is UART0 which is connected to PC and also the program will be load by using this port only and another serial port UART1 which is connected to Zigbee. The transmitted data will be received by Zigbee and send to the UART1 and again the UART1 will send the data to the PC through the UART0.
and after receiving, the PPT will control according to the commands which is received by LPC2148. The controlling operation will be done by LPC2148. The following Fig.14 was the receiver program.

```c
#include <LPC21xx.H>

void uart0_init(void);
void uart1_init(void);

void main()
{
    unsigned char ch;
PINS[0]=0x00050005;
    uart0_init();
    uart1_init();
    while(1)
    {
        while(!(U1LSR&0x01));
        ch=U1RBR;
        switch(ch)
        {
            case '1':
                U0THR='B'; //Next Slide
                while((U0LSR&0x20));
                break;
            case '2':
                U0THR='A'; //Previous Slide
                while((U0LSR&0x20));
                break;
            case '3':
                U0THR='1'; //Slide 1
                while((U0LSR&0x20));
                break;
            case '4':
                U0THR='2'; //Slide 2
                while((U0LSR&0x20));
                break;
            case '5':
                U0THR='3'; //Slide 3
                while((U0LSR&0x20));
                break;
            case '6':
                U0THR='4'; //Slide 4
                while((U0LSR&0x20));
                break;
            case '7':
                U0THR='5'; //Slide 5
                while((U0LSR&0x20));
                break;
            ....
            // like this so on up to case 20
            default: break;
        }
    }
}

void uart0_init(void)
{
    U0LR=0x75;
    U0DL=0x50;
    U0DM=0x00;
}

void uart1_init(void)
{
    U1LR=0x75;
    U1DL=0x50;
    U1DM=0x00;
}
```

Fig.14 Program for Receiver Circuit

V. CONCLUSIONS

The lecturer’s most proper position should be between the audience and screen of power-point and this location is far away the mouse or keyboard, so this design can provide one facility to control the page up or page down or go for particular slide of power point tool.

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