GSM Information Collection Design of Logistics Information System Based on Internet of Things

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Abstract. On the analysis of logistics information collecting techniques (including the Unified Information System, The Internet Of Things, Global System for Mobile Communication), the paper puts forward solutions and innovative ways to operate the system based on Unified Information System (UIS) in The Internet Of Things (IOT). GSM information collection, which is based on the UIS, has integrated the technologies of Radio Frequency Identification (RFID), GSM, and Computer Telecommunication Integration (CTI). With the unique characteristics of business processes of UIS and IOT, the systematic design has carried out the technical construction and interactive system design on the brandboard adjustment program of GSM information collection model, the anti-collision technique as well as Network Communication Program of GMS model controlled by AT command. This design has realized the exchange between the logistics information collection and processing and GSM network by the way of adopting the TC35i Single Chip Processor Control System, as a result, it has formed the distributed link for the logistics information system, and identified the feasibility of GSM information collecting system applied in this system.

Introduction

GSM logistics information collection is a creative application of Unified Information System in IOT (Internet of Things) technology, through RFID (Radio Frequency Identification) and collection devices, realize quick logistics information collection system of low cost,being free from communication cable and region restriction, and high confidentiality. IOT RFID technology is one of the widely used new technologies in recent years in logistics information system, which based on RFID passive and non-contact technology features provide convenient quick data collection, exchange and easy solution for maintenance service; RFID tabs have unique identification ID numbers, during logistics information collection process, not only it could ensure effective and complete accuracy of logistics information, but also could provide quantity, performance, status and other information of the logistics, to help system users to identify and track logistics business flow status[1]. GSM global mobile communication system is a mature and widely used mobile system in communication system, which could ensure accuracy, safety and reliability of the data transmission, by combining with Logistics Unified Information System based on IOT, the logistics information collection technology could be easily used on mobile phone, PDA, palmtop, as well as all types of application tools provided by other RFID collectors and internet, to form distributed logistics unified information data chain[2].

System Design and Realization

GSM System Architecture. The Logistics Unified Information System based on IOT adopts GSM information collection solution, which is isomerous integrated information collection platform mainly consisting of RFID, GSM, GPS and Logistics Unified Information System data process system interface, to realize data reading in real time for dynamic logistics information data. The system basic platform is supported by CTI (Computer Telecommunication Integration) and Internet technologies, adopts ISMG, and GSM modem as communication devices, to realize all types of information exchange services of on-site logistics unified information[3]. The GSM collector based

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on FRID mainly consists of RFID identification module, GSM module and CPU, TC35i singlechip is in charge of controlling system to realize logistics information collection, after packaging, the information would be delivered to unified information system database via GSM mobile communication network. Mobile RFID collection devices are working within the range of logistics goods and devices with RFID tabs, collector is activated manually or through short message, GPRS and other methods and RFID tab information is received.

The collection of mobile logistics information is mainly completed by GSM module, the composition of module includes GSM base band processor, Flash memory, ZIF connector, radio module, power supply module etc; programming is done by TC35i singlechip, and base band processor would process the data signal. GSM base band processor uses integrated SIM connector compatible to ISO 7816-3 IC Card standard to connect with ZIP connector, the generated and received short message information is stored temporarily in Flash memory[4].

GSM protocol uses PDU module (Protocol Data Unit), adopts AT command set to implement SMS service. Directly adopts PDU at the AT command data section of unified information system, support different coding format, realize the whole SMS process by only one command[5]. When RFID device receiving mode is on, RFID address and information data would be sent to TC35i according to timing sequence, and then data delivery starts. When RFID collector initiation is at sending mode, the controller lowers the electrical level, initializes local system; when controller lifts electrical level, RFID information receiving mode is on, to receive correct ID address and CRC verification code data packet, TC35i micro-controller starts GSM sending module and sends information via GSM network to Logistics Unified Information System.

RFID Information Identification Process.RFID technology is used in Logistics Unified Information System, RFID tab uses RF signal to send information from RFID unit to GSM receiver, the huge amount of information stored in RFID tab enables the unified information system to be able of intelligent business process. The GSM module working frequency of RFID collector could implement tuning via programming, the chip adopted board band whose frequency range is 860MHz~930MHz to amplify chips, within the frequency range of 750MHz～1000MHz, the linear performance could nearly cover the whole application frequency range. RFID collector, PLC, ISMG or GSM modem, controlling server and other exchangeable connections form data integrated chain of GSM information collection dynamic information, within the range of system covering function and signal, implements information intelligent identification and RFID anti-collision process[6]. The collector reads data through receiving radio signal sent from RFID tabs, when the collector meets RFID tabs, it sends out electromagnetic wave and forms electromagnetic field, the tabs obtain power to activate the micro-chip circuit in the tabs, and the chips convert electromagnetic wave, and then send to collector, the collector converts it into relevant data. RFID collector sends the needed signals to server via GSM, after the signals are power-amplified, and sent out by antenna, to complete the data exchange at the front end of the reader-writer.

RFID anti-collision program design is a key part of the Logistics Unified Information System, when the collecting devices are on standby mode, all the tabs within the coverage of its signals are activated by electromagnetic wave, and form RFID tab read/write collision. Relevant command set is used inside the RFID tabs to design own anti-collision mechanism, when the activated tabs receive command of Select from collector, the tabs send their own UID to the collector, for those tabs sending UID simultaneously, the collector returns FAIL command to the tabs, after tabs of collision modify their own relevant parameters through internal anti-collision algorithm, send UID to collector again, and the collector would judge the collision, until only one tab meets the requirement, and then quits anti-collision program and proceed with further tab process program, meanwhile, the remaining tabs modify their own relevant configuration automatically, to prepare for the next reading; if there’s no tab meeting requirement at that time, the reader-writer would send SUCCESS command, the tabs modify their own parameters, and wait for inspection command from reader-writer.

Realization of Communication Module. To realize information collection function by the Logistics Unified Information System based on IOT, it needs to depend on RFID on information

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reading aspect, but to realize interchange with information system, to extend the unified information system to ubiquitous distributed network; it needs support of CTI technology, and realize smooth information flow by GSM network and communication technology. In the design of communication module, it adopts TC35i based on AT command, and realizes interconnection with collector by information dynamic triggering mode. Part of the program of the system programming is as following:

System performs design on the crystal oscillator, it adopts crystal oscillation method, or it's 1 fractional frequency, when the frequency is bigger than 6.74MHz, it selects external timer source as the system timer, and allows the timer losing detector (reset), the program is as following:

```
void SYStemCLK_Initial(void)
{
    unsigned int i;
    OSCXCN=0x67;
    for(i=0;i<0xFF;i++);  // Switch to external crystal oscillator
    while(!(OSCXCN&0x80)); // External crystal oscillator stability
    OSCICN=0x88; // Choose external clock source
}
```

Forbid ADC, activate tracking when write 1 to ADBUSY, activate switch, no match and right alignment when ADC is 1, configure SAR timer, the gain is 1:

```
void ADC0_Initial(void)
{
    #define SYSCLK  22118400
    ADC0CN=0x40; // Ban ADC
    REF0CN=0x02; // Produce polarization voltage
    AMX0CF=0x00; // All configured to single-ended input
    ADC0CF=(SYSCLK/2500000-1)<<3; // clock
    AD0EN=1; //ADC0 allow
    #undef SYSCLK
}
```

Configuration allows SMBus to send ACK at response cycle, and define SMBus timer frequency, pause and transmission release:

```
void SMBus_Initial(void)
{
    SMB0CN = 0x44; // Allow send ACK
    SMB0CR = 100; // Clock frequency
    EIE1 |= 2; // Interrupt allow
}
```

Unified information system GSM receive/send short message flow design, design waiting character, sending short message content and end note, sending timeout, result etc:

```
UINT8 AtCmgdTack=1;
    #define AT_CMGS_READY 1 // ready
    #define AT_CMGS_WAIT_VV 2 // Waiting for the characters' > '
    #define AT_CMGS_SEND_DAT 3 // Send SMS content and end operator
    #define AT_CMGS_WAIT_RSLT 4 // Results
```

Define AT command failure mark, like sending timeout, error, failure, initialization mistake etc:

```
UINT8 AtErrorSign=0;
    #define ERR_CGMS_TIMEOUT 0x01 // Overtime
    #define ERR_CGMS_UNKNOW 0x02 // Error
    #define ERR_CGMS_NG   0x04 // Failure
    #define ERR_INITAL_MDM 0x08 // Initial error
```

Complete send:AtCommendTack&=ATST_CMGS,Ready to reply to state: AtCmgdTack=AT_CMGS_READY.

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```
#define EndCmgsTack() {AtCommend-Tack&=~ATST_CMGS;AtCmgdTack=AT_CMGS_READY;}
```

Receive short message service number; analyze short message service center number (PHONE):

```
case INIT_CSCA_R: // Receive SMS service number
    +CSCA="+ PHONE "
    if(FineString(g_Uart0Rcv.Data, "OK\r"))
    {
BeginIndex=FindCharacter(&g_Uart0Rcv.Data, '\"'); // Point to start number
StrLength=FindCharacter(&g_Uart0Rcv.Data[BeginIndex], '\"'); // Calculating the length of telephone number
if(BeginIndex&&StrLength)
{
    sAtCmdBuf.Length=StrLength+1;
    Memcopy(sAtCmdBuf.Data, &g_Uart0Rcv.Data[BeginIndex-1], sAtCmdBuf.Length);
```

Design system delay waiting, start or failure and other information, as well as handling of real time message by response system:

```
if(sMdmInitDelay) // Delay waiting for
    return NG;
    switch(ModemInitalTack)
{
    case INIT_DLY30S:// Boot or error and so on 30 s
    sMdmInitDelay=250;
    if(sDelayCnt++>2)
    {sDelayCnt=0;ModemInitalTack=INIT_AT_0;}
    break;
```

Through AT command analyze the phone number and other information, and point to the analyzed phone number and calculated phone number length etc:

```
AtCommendTack|=ATST_CMGD;// analyze phone number
BeginIndex=19;  // point to the second comma or the last point
BeginIn-dex=FindCharacter(&g_Uart0Rcv.Data[BeginIndex], ',')+BeginIndex+1;
    StrLength=FindCharacter(&g_Uart0Rcv.Data[BeginIndex], ',');
    if(StrLength)
{
    g_MsgRcvBuf.PhoneLen=StrLength-2;
    Memcopy(g_MsgRcvBuf.PhoneNo, &g_Uart0Rcv.Data[BeginIndex], g_MsgRcvBuf.PhoneLen);
    g_MsgRcvBuf.PhoneNo[g_MsgSndBuf.PhoneLen]=0; // null-terminated
```

During the receiving flow of the unified information system, the key is to analyze the short message content, in order to handle the specific information:

```
BeginIn-dex=FindCharacter(&g_Uart0Rcv.Data[BeginIndex], 0x0A)+BeginIndex;
StrLength=FindCharacter(&g_Uart0Rcv.Data[BeginIndex], 0x0D);// Message end
if(StrLength)
{
    g_MsgRcvBuf.DataLen=StrLength-1;
    Memcopy(g_MsgRcvBuf.Data, &g_Uart0Rcv.Data[BeginIndex], g_MsgRcvBuf.DataLen);
    g_MsgRcvBuf.Data[g_MsgRcvBuf.DataLen]=0; // null-terminated
    g_MsgRcvBuf.Status=FULL; // Message mark
}
```

Perform system process on the received short message, unread short message, emergency handling and other cases, and re-initialization on the module:

```
  else if(AtCommendTack&ATST_CMGL) // Receiving
{
```


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```
        if(NULL==g_MsgRcvBuf.Status) // if the short messages are not handled, stop reading new
short message
        Com0_Send("AT+CMGL=\"ALL\"\r\n", 15, TRUE);
        g_Uart0Snd.TmeOut=150;
    }
        else
    {
    AtCommendTack|=(ATST_CMGL|ATST_INIT); // emergency handling, re-initialization
    }
```

Conclusion

The GSM information collection design of Logistics Unified Information System based on IOT depends on mature computer network and RFID, CTI intelligent automatic control technology, it integrates the advantages of both FRID and GSM, and combines popular used mobile phone, PAD, RFID collector etc, designs information tracking, positioning and collection system; it adopts GSM wireless communication module, and ensure normal communication with server terminal in the case of no network failure. According to collection devices and RFID tabs of different performances, it allows identification and collection for mobile speed of 15m/s, the identification distance could reach 1-10m, and could identify 200 plus targets simultaneously, it adopts fast anti-collision radio technology, data storage could reach more than 60000 records, and uses real time and packaging transmissions, which is highly stable at identification. The system is a further exploration of IOT technology and mobile communication technology, which integrates the information collection and coordination management, and is highly expandable; it only needs to perform specific system programming to realize GPS global position, short message or phone alarming, GSM two-way monitoring and other functions, is very promising in application value.

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