

With Ethernet Monitoring System Based On Embedded Web Server

¹Ravi kant Kumar
M.Tech. Scholar

Ravikantece.116@gmail.com

Rajasthan Institute of Engineering & Technology, Jaipur

Abstract—In this system, power network parameters are remotely monitored by the existing resource of Ethernet. A practical design of embedded Web server for power network monitoring is introduced, which applies high speed MCU (SX52BD) to conveniently link to Ethernet. Adopting Ethernet interface control mode, the remote network monitoring of power network is realized under Windows.

Keywords-Ethernet; embedded Web server, monitoring system; TCP/IP protocol

I. SYSTEM INTRODUCTION

The Ethernet technical has been widely used in many industry control system. This system is based on SX52BD CPU of American UBICOM Company, Ethernet control CMOS chip (RTL8019AS) of Realtek Company and other periphery circuit. The electrical parameters were carried to control center via the embedded system and Ethernet. we can knock the button to control the relay which is connected to the MCU's output port by Ethernet.

II. SIGNAL ACQUISITION

According to the Fig1, the electrical parameter signal was carried to CPU(SX52BD). The signal's sampling circuit is showed as Fig2. the electrical parameter signal was processed by CPU and transmitted to Ethernet. The electric

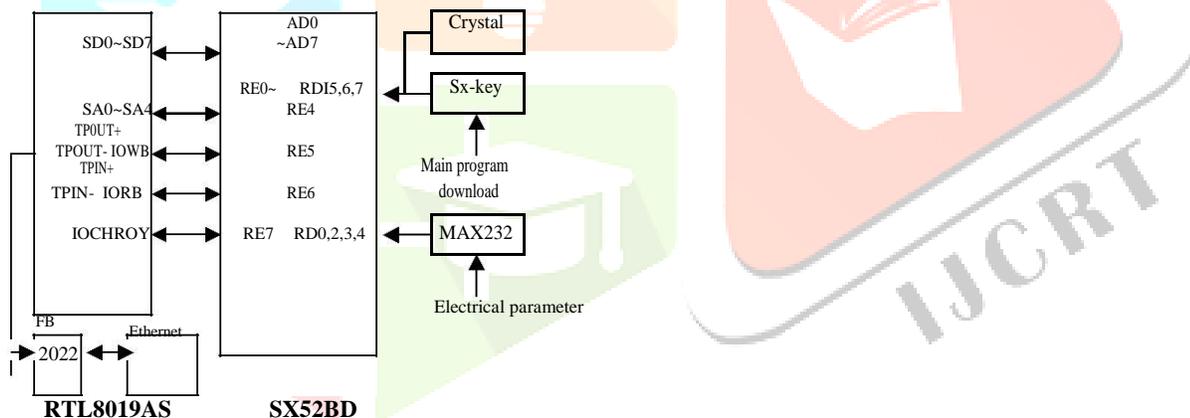


Fig.1 the embedded system structure

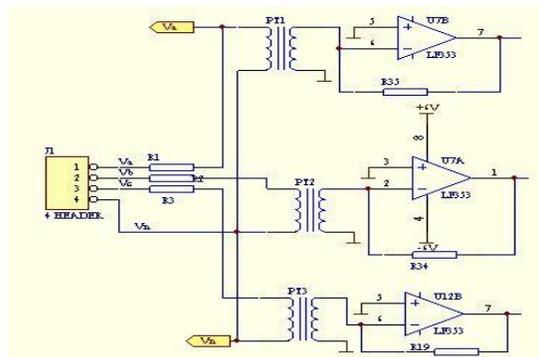


Fig 2 the sampling circuit of voltage and current

power's three voltages(Va,Vb,Vc) and three currents Ia,Ib,Ic are transmitted to signal disposal system via mutual inductance implement. The signal disposal system of electric power includes: preferences module, voltage and current check module, power factor check module, virtual value conversion module, V/F conversion module. Preferences and voltage and current check module: The voltage of voltage and current mutual inductance implement imports to the multinomial selector . The voltage is switched to relevant direct current signal in virtual value. Subsequently the direct current signal is transmitted to V/F conversion circuitry(showed as Fig3) to be converted to digital signals. The main function of V/F module is converting the voltage signal to frequency signal. This module has many characteristics, such as favorable precision, nicer linearity and integral input. The capability of all periphery component isn't high-powered and it can adapt diverse condition , but its conversion speed is higher than the double integral A/D apparatus's. The price of V/Fconversion module is low. The V/F conversion meet has such characteristics:^{[1][2]}simple meet, engross little hardware resource. The frequency signal can be inputted to CPU from any I/O line or regarded as interrupt resource and counter input good anti-jamming. The V/F conversion is principal a integral course. V/F conversion module realizes A/D conversion is really a frequency count course. So it has strong anti-jamming ability.

A. network pages download

The network pages were downloaded by RS 232 port and saved at 24LC256. The normal RS-232 regulation adopts negative logic. The facultative voltage from +3V to +15V is regulated to "0"logic and from - 3V to -15V is "1" logic. But the widely used electric standard in integrate circuit is TTL standard. The "0" logic and "1" logic in TTL standard are regulated respectively as 0.4V and 2.4V. In virtue of the RS-232 and TTL adopt different rules, so it is necessary to switch voltage by MAX232 receive/transmit implement. The electro circuit is showed as Fig3.

B. Ethernet signal filter

The Ethernet signal is filtered to reduce interference by FB2022, which is a Ethernet dispatch and filter. The circuit is showed as Fig4. When the program of web page is loaded to EEPROM, the loading program (E2File.exe) is needed to be run in PC. At the same time, the E2file3ttm1.src must to be run in main CPU of system board. the content of web page was transmitted to system board by loading program. When E2file3ttm1.sr program is been run in the main CPU, the former content will be covered. ^{[3][4]}

C. loading program memorizer

The 24LC256 supports a bi-directional two-wire bus and data transmission protocol. A device that sends data onto the bus is defined as a transmitter, and a device receiving data as a receiver. The bus must be controlled by a master device which generates the serial clock(SCL), controls the bus access, and generates the START and STOP conditions while the 24LC256 works as a slave. Both master and slave can operate as a transmitter or receiver, but the master

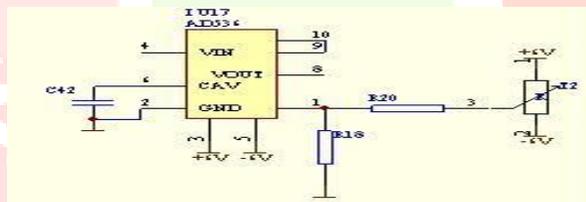


Fig3 the conversion circuit of virtual value

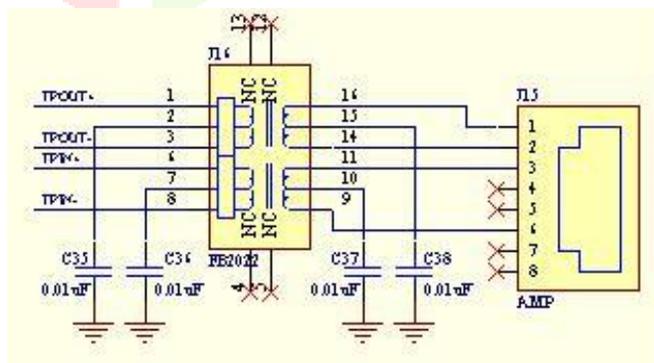


Fig 4 the receiving and transmission circuit of Ethernet

The write control byte, word address, and the first data byte are transmitted to the 24LC256 in the same way as in a byte write. But instead of generating a stop condition, the master transmits up to 63 additional bytes, which are temporarily stored in the on-chip page

buffer and will be written into memory after the master has transmitted a stop condition. After receipt of each word, the six lower address pointer bits are internally incremented by one. If the master should transmit more than 64 bytes prior to generating the stop condition, the address counter will roll over and the previously received data will be overwritten. As with the byte write operation, once the stop condition is received, an internal write cycle will begin. If an attempt is made to write to the array with the WP pin held high, the device will acknowledge the command but no write cycle will occur, no data will be written, and the device will immediately accept a new command subject to TBUF.^{[5][6][7]}

III. THE REALIZATION OF ETHERNET

TCP/IP protocol realization: The protocol's realization is got across of the provided TCP API port in SX52BD protocol inn. It is sustained to establish two TCP links in TCP protocol inn. One is the active link, which is controlled by TCP App1Init();The other is passive link, which is controlled by TCP App2Init(). The TCP is based on the linked protocol, so it is necessary to save the information which is relational to the sending control block. The state of TCP link is realized by TCP software. When detecting a TCP packet that has a SYN symbol, the TCP link will be changed to incept data. The user can also alter manually the state to sending data to set up active link: (1) Using TCP API to set up TCP passive link; (2) Using TCP API to set up TCP passive link; (3) Using TCP API to TXD and RXD. Once establishing TCP link, then there only two leaved state: TXD or RXD. When TCP API is receiving data, the data from IP layer is got rid of TCP head and send to application layer; When transmitting data, the data will be added a head and send to IP layer.

In SX52BD protocol, the mission of IP layer is to pack the messages, which are going to be send. The packed messages coming from physics layer will be separated and send to TCP layer. Because in protocol inn the received data package will not be packed, so it is need to pay attention that the protocol inn will not incept IP package, which is detached.^[8]

A. ICMP IMPLEMENTATION

SX52 ICMP Design and Implementation of the agreement to allow Internet routers in the report of the accident or provide the information in the TCP / IP protocol in the series by adding a special error message used to send the agreement - to control Internet Text of the agreement ICMP (Internet Control Message Protocol). ICMP is part of IP in each of the IP must be used to achieve it. Like all other communications businesses, like, ICMP, is reportedly on an IP data reported in some of the data transmitted. ICMP message is not the ultimate goal or purpose of the application on the machines of users, but the plane on the handling of its Internet Protocol software modules. In other words: Internet control message agreement allows the router to router or other errors or control console sent to the text; ICMP in the two host of Internet protocol software to provide communication between.

ICMP, are each reported to the same three-byte start: an eight integral to the text of the type (TYPE) field used to identify messages, an eight code (CODE) field to provide the type of text Further information, a 16 checksum field. In addition, ICMP message also always have problems, including data on the first and beginning of the 64 data.

ICMP using IP to send a error message. When a router ICMP message to convey, it will create a newspaper and IP data package which ICMP message, that is, ICMP messages were placed in IP data reported in the areas of data, and then this Data were reported as often as forward. That is, the whole package into the data were reported in the frame for delivery.

Each of the ICMP messages have always correspond to an end. Router will be an ICMP packet data will be reported back to a host. Here, only the realization of the ICMP response to the request / response service, mainly used for PING testing the smooth flow of communication links, that is, only to receive treatment for the type of message the ICMP 0x08 frame, sending the ICMP message types 0x00.It does not have its own proprietary variable, the function only ICMP Gen Check Sum () and ICMP Proc Pkt In ().^[9]

B. ICMP IMPLEMENTATION

SX52 UDP Design and Implementation of the agreement is a simple UDP data reported for the transport layer protocol: the process of each output operations are precisely the data to produce a UDP, and assembled into a question sent to the IP data. UDP does not provide reliability, the application of IP transmission of data sent, but does not guarantee that they can reach their destinations. Due to the lack of reliability, we seem to feel that to avoid the use of UDP, and the use of reliable agreements, such as TCP. However, analysts found, UDP in our interconnection design has many advantages: First,UDP efficient transmission protocol, TCP communications do not have to spend before the connection; second, UDP agreement simple, not complex state machine transmission mechanism, Good to avoid SX52 gateway Dead reset due to inconsistent state and can not be normal communications, and the upper agreement also difficult to find the danger. Therefore, it can be used to achieve UDP communications (TCP connection to avoid the costs), while many in need of features (such as dynamic and Retransmission, to avoid congestion, Chacuo, etc.) at the application layer design and implementation. The use of the variables are:

UDP receive data at the source port (udpRxSrcPortMSB, udpRxSrcPortLSB);
 UDP was the purpose of receiving data port (udpRxDestPortMSB, udpRxDestPortLSB);
 UDP receive data on the length of (udpRxDataLenMSB, udpRxDataLenLSB);
 UDP send data at the source port (udpTxSrcPortMSB, udpTxSrcPortLSB);
 UDP send data on the purpose of port (udpTxDestPortMSB, udpTxDestPortLSB);
 UDP send data on the length of (udpTxDataLenMSB,
 udpTxDataLenLSB).

Design-related functions are: UDPAppInit DPGenCheckSum UDPStartPktOut UDPProcPktIn UDPEndPktOut

UDPAppProcPktIn UDPAppProcPktOut (), and so on.^[10]

SX52 TCP protocol Design and Implementation of transmission control protocol TCP (Transmission Control Protocol) is the transmission of important agreements. It provides a completely reliable (no duplication of data or loss), the connection-oriented, full-duplex transmission of streaming services. The design of the complex TCP protocol to do a reasonable simplification: Because faster transmission network, data and a small amount of 10 Mbps Ethernet transmission normally does not happen obstruction, Ethernet, the host will have sufficient capacity to timely processing of data communications, can be fixed overtime and the re - Time for 5 s. RTL8019AS on the two bytes of 1500 to receive the buffer zone, and the CAN network for the control network, small amount of information, you can receive a fixed window for the 1400 bytes. Because we used a general service to meet the TCP application, can be neglected emergency guidelines and options and filled field value. Through the above-mentioned three simplified, in fact greatly simplify the realization of the TCP protocol. TCP overtime because of the time and re-define and control the size of the window has a more complex algorithm and the mechanism to achieve.

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