A Study on CC Processor for NAVTEX System

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요 약

한자는 복잡한 상형문자로서 자모문자와 비교하여 볼 때, 문자의 처리, 프로그램의 작성 및 전송에 있어서 많은 차이점이 있다. 지금까지 NAVTEX프로그램중 한자 전송의 관건적인 기술을 해결하지 못하고 있다.

따라서, 본 논문에서는 NAVTEX프로그램중의 한자처리 방법을 모색을 하고자 하였으며, 이러한 프로그램을 이용하면 NAVTEX단말기에서 바로 한자를 인쇄할 수 있게 될 것으로 기대된다.

1. Research purpose, content and method

1.1 Purpose

China is a developing country of a very large population. She has a 18,000 kilometers long coastline. But the sea fishery, the comprehensive exploitation and survey of marine resources are not very well. The equipment of inshore fishery vessels and shipping in coastal waters are backward in technique. Because many fishermen don't know English, they cannot bring Global Maritime Distress and Safety System (GMDSS)'s faculties into play, so the perils of the sea are often happened.

For increasing the ability of fishermen withstanding natural calamities, decreasing or avoiding the perils of the sea, it is necessary to research on Chinese Character (CC) NAVTEX System.

The purpose of the study is to develop a kind

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of NAVTEX system suitable for Chinese fishery vessels.

1.2 Contents

An important task for developing CC NAVTEX is the study of CC processor. It mainly includes:

1) draft the Decoding Rule of CC processor,
2) make the CC Decoding Data Base,
3) design the circuit of CC processor,
4) program the software of CC processor.

1.3 Method

Because there is not yet a technical specification of the standard for CC NAVTEX in China, the method of study is designing an independent CC processor, which attaches itself to the general NAVTEX. This is a twin-microprocessor system, with main processor in general NAVTEX and CC processor.

In point of fact, for realizing CC NAVTEX, using one microprocessor has not any problem in the technology. In the course of researching, the way of twin-microprocessor is convenient for making the comparing study of different interchange codes in CC NAVTEX, improving the installation and testing the system characteristic. It is also the need for pushing forward the development of CC NAVTEX in China.

In the future, after Chinese Government issues the technical specification about CC NAVTEX, the product will be sure to have one microprocessor only.

2. Chinese character, transmission and key technology in NAVTEX

2.1 Basic characteristic of CC and CC information processing

Chinese language is spoken by the Han Nationality in China, which belongs to the Han-Tibeto family of languages [1]. Chinese language is the mainly and commonly used language within the boundaries of China. It is the one of the commonly used language in the world, too.

2.1.1 Basic characteristic of CC

Characters in the world are mainly divided into two kinds of forms. One is the Pictograph or Hieroglyph, for example, Chinese Character. The other is Alphabetic Writing such as Korean and English Character.

CC, Hanzi, is the symbol system of writing for recording Chinese. The most basic characteristic of CC is that each CC has the information of the form, pronounciation and meaning. They are the three-key elements for composing CC.

2.1.2 Amount of CC

The amount of CC is about 50,000 to 60,000, but about 7000 in commonly used [2].

2.1.3 CC font library

CC font library, which is called generally as CC-Base, is the Matrix Data Set of CC that establishes on the memory medium of computer. It is the basic component when CC information processing system produces CC fonts and graphical symbols.

In the common CC system, CC is formed by means of the dot matrix and the CC font code, which is the code of CC dot matrix font, is a sort of data form of expression. The method is that the square area occupied by a CC is divided into the equidistant checks of M (row)N (line), and this square area is called as MN dot matrix, which M=N is general.

National Standard of the dot matrix has 1616, 2424, 4848, 6464, 9696, and 128128 in China.

2.2 CC transmission

Because CC is a kind of Pictograph, so it

cannot be transmitted directly. At present, there are two kind of different codes for interchanging CC information between CC processing or communication system, which are the Telegraphic Code and CC Code for Information Interchange.

2.2.1 Telegraphic code

In 1879, the first telegraphic line was set up in Tianjin of China [3]. The Chinese Telegraphic Code Book, which was published in 1880, collected 8075 CCs [4]. Every character is expressed by 4-digit Arabic alphabet, which is Telegraphic Code (TC). For example [5],

1129 大; 3189 海

In earlier telecommunication department and maritime communication department, the work of translating CC into TC was finished by the operator; then the TC was transmitted to the destination, finally the TC was translated into CC by the operator again at the other end.

Now, the TC translator has been replaced by computers or microprocessors in many fields.

2.2.2 CC code for information interchange

With the development of computer and network technology, China implemented the standard of CC code for information interchange in 1981, that is GB2312-80, Character Set (Basic Set) of Chinese Character Code for Information Interchange. It is the most basic code standard for information processing system in China. The Basic Set provides 8836 "code positions", 94 rows and 94 columns, which contains 6763 CCs and 682 graphical symbols. Each code position indicates a CC or a graphical symbol, which occupies 2 bytes and the highest bit of every byte is 0. The set of 94*94 forms the Code for Information Interchange, shown in Table 1. The first part of code to be corresponding to each row is called the Area Code (AC), and the last part of code to be corresponding to each column the Site Code (SC), arranged in 01 to 94 orders respectively.

〈Table 1〉 Configuration of code in GB2312-80 basic set

SECOND															
b7	0	0	0	0	0	0	0	0	0		1	1	1		
b6	1	1	1	1	1	1	1	1	1		1	1	1		
b5	0	0	0	0	0	0	0	0	0		1	1	1		
b4	0	0	0	0	0	0	0	1	1		1	1	1		
b3	0	0	0	1	1	1	1	0	0		1	1	1		
b2	0	1	1	0	0	1	1	0	0		0	0	1		
b1	1	0	1	0	1	0	1	0	1		0	1	0		
site→ ↓area	01	02	03	04	05	06	07	08	09	…	92	93	94		

First byte							
b7	b6	b5	b4	b3	b2	b1	
0	1	0	0	0	0	1	01
0	1	0	0	0	1	0	02
0	1	0	0	0	1	1	03
0	1	0	0	1	0	0	04
0	1	0	0	1	0	1	05
0	1	0	0	1	1	0	06
0	1	0	0	1	1	1	07
0	1	0	1	0	0	0	08
0	1	0	1	0	0	1	09
0	1	0	1	0	1	0	10
							:
0	1	0	1	1	1	1	15
0	1	0	0	0	0	0	16
0	1	0	0	0	0	1	17
							:
1	1	1	0	1	1	1	87
1	1	1	1	0	0	0	88
							:
1	1	1	1	1	1	0	94

682 graphical symbols
interval, punctuation, operation, tabulation marks;
numeral, ordinal number;
Chinese phonetic alphabet, phonetic annotation of CC;
Latin alphabet, kana, Greek alphabet, Russian alphabet

Margine area

6763CCs

Margine area

The combination of area and site code formed CC code for information interchange, such as the area code of "大" is 20, site code 83, interchange code 2083; the area code of "海" is 26, site code 03, interchange code 2603.

There is not the simple correspondence relationship between the TC and code for information interchange. The former is a traditional way of communication, which is mainly used by the telecommunication and maritime communication. The latter is a method suitable for the development of computer network, and also as an International Standard, which is mainly used by the computer communication. Now it is not clear which will replace the other.

2.3 The key technology

2.3.1 Chinese NAVTEX service information

In China, except Taiwan and Hong Kong, 5 NAVTEX stations were set up. From South to North, they are Sanya, Guangzhou, Fuzhou, Shanghai and Dalian Stations in proper order. According to the stipulation of Recommendation ITU-R 541, they are broadcasting the NAVTEX Service on the schedule of <Table 2>.

At present only Shanghai station broadcasts the NAVTEX service in English and the Chinese language is in Telegraphic Code. General NAVTEX only prints the TC, then translated into CC by the operator.

2.3.2 The key technology

CC processor is based on general NAVTEX and added in the functions as follows:

1) According to the rule, determine which is TC in ASC code flow;
2) For decoding TC and determining CC, need to set up a Decode Data Base (DD-Base);
3) For printing directly, need to determine the relation ship between CC and CC-Base;
4) Determine which kind of CC-Base.

For realizing CC processor, it is important to set up optimum relationship among TC, DD-Base and CC-Base. How to make the DD-Base is the key technology in CC processor and also the center of this paper.

3. CC NAVTEX message

In China, when the technical code B2 was defined as V, that means the national NAVTEX message to be sent.

When receiving unit gets the international NAVTEX message, the technical code B2 is not V, the information processing unit deals with the input data, and decides whether to feed to the

〈Table 2〉 Chinese NAVTEX service information [7]

	Station Name	Station position	Transmitting Radius	Working Frequency	Sending Time(UTC)	Language
1	Sanya	18.14N, 109.30E	250 miles	518KHz	0200 0600 1000 1400 1800 2200	English
2	Guangzhou	23.08N, 113.29E	250 miles	518KHz	0210 0610 1010 1410 1810 2210	English
3	Fuzhou	26.01N, 119.18E	250 miles	518KHz	0220 0620 1020 1420 1820 2220	English
4	Shanghai	31.08N, 121.32E	250 miles	518KHz	0240 0640 1040 1440 1840 2240	English & Chinese
5	Dalian	38.50N, 121.31E	250 miles	518KHz	0250 0650 1050 1450 1850 2250	English

printer for printing.

When receiving unit gets the international NAVTEX message, the technical code B2 is V, it means that is a national NAVTEX message, so CC processor is excited. ASC II code from the information processing unit is processed in CC processor and is decided whether it is fed to the printer for printing.

3.1 General formatting of CC NAVTEX message

CC NAVTEX message contains two parts, the masthead and the text.

3.1.1 Masthead part

The masthead of CC NAVTEX messages generally consists of the English Alphabet, Arabic Alphabet, symbol and control mark. The masthead format of CC NAVTEX message is followed as:

ZCZC B1B2B3B4
T1T2T3T4T5T6 UTC M1M2M3 Y1Y2Y3Y4
N/W ABC NR12 CK34/56 D1D2 S1S2S3S4

T1T2T3T4T5T6 is the time sending NAVTEX message. *T1T2* indicates the date, *T3T4* the hour and *T5T6* the minute.

UTC is the Universal Time Coordinated.

M1M2M3 expresses the month sending NAVTEX message.

Y1Y2Y3Y4 expresses the year sending NAVTEX message.

N/W means that Navigational Warning.

ABC is the call sign of transmitting station.

NR12 is the numbering of transmitting message. *12* is the Arabic alphabet from 01 to 99.

CK34/56 is the checking figure of text. *34* indicates the actual figure, *56* the valuing figure from 01 to 99, respectively.

D1D2 is the date of making NAVTEX message, from 01 to 31.

S1S2S3S4 is the time of making NAVTEX message, *S1S2* expresses the hour, *S3S4* the minute.

3.1.2 Text

It generally is TC that 4-digit Arabic number is a group. The space between groups is existing, and also includes some symbols and English alphabet, such as 1129, 3189, (321245 N/1215637E).

3.1.3 An example of CC NAVTEX message [8]

ZCZC QV28
201440 UTC JAN 1998
N/W XSG NR76 CK31/26 20 1325
7022 3068 0656 (18) 3597 3187 0626 0143
4999 (311714N/1214810E)
1788 6080 0366 1338 1840 6347 0008 6239
2327 5300
6226 (97/784) 3337 3263 4148 (98/053)
NNNN

The meaning of NAVTEX message is that:

At 14:40, 20th of Jan. 1998, Shanghai Station broadcast No.76 Navigational Warning, which the checks are 31/26 characters and the date & time is 13:25, 20th, as follows:

Again setup No. 18 floating light at Changchikou in which original position is located at Lat. 311714N and Long. 1211410E. Characteristic does not change and cancel No. 97/784 navigation warning issued by Shanghai Harbor Superintendency Administration (No.98/053).

3.2 A decoding rule of CC processor

If the technical code B2 is V, CC processor begins to work, a decoding rule which is as the following

1) Directly the masthead part and don't decode.
2) If each 4-digit Arabic number is a group and the space between groups is existing, it

is decoded into CC and printed.

3) When there are one, two, three or four asterisks "*" in one group, the "*" is printed at the position in correspondence with CC.
4) If NAVTEX returns the watching state from printing automatically, it stops to decode, for example, when the error ratio of the code received is more than the special value (30%).
5) Directly print English alphabet.
6) Directly print Arabic number and other symbol in the brackets.
7) If the code of the end of message, NNNN is received, CC processor stops to get signal of message and decode.

Decoding flow-chart is shown in Fig. 2.

4. Fundamentals of CC processor

4.1 Relation between NAVTEX receiver and CC processor

The block diagram of CC NAVTEX receiver is shown in Fig. 3. As compared with the general NAVTEX receiver, the difference is a CC processor added. Its main function is that input TC which expressed in ASC II code, is decoded into CC, and controls the printer.

4.2 Basic requirement

Considering the practical condition of China, this installation should have

1) the price that can be afforded by fishermen,
2) the stable and reliable function,
3) the simplest operation, and
4) the least maintenance

Because the working condition on fishery vessels is very bad, in order to meet the need of reliability, the equipment is required that is the simpler operation, the lower price, and the better quility. The above is the guiding idea for this design, too.

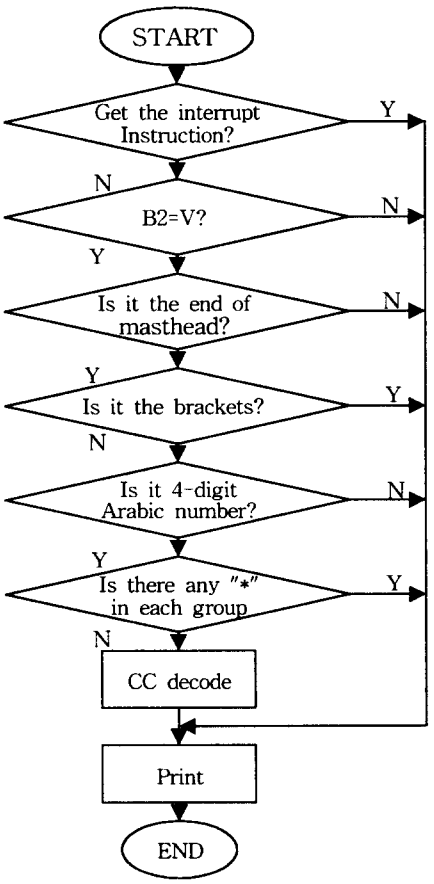

Fig. 2 Decolnkding flow-chart

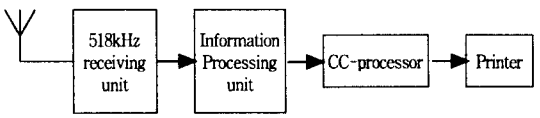

Fig. 3 Block diagram of CC NAVTEX receiver

4.3 Principle block diagram

The principle block diagram of CC processor is shown in Fig. 4. It mainly contains CPU, I/O

(the input/output interface circuit), DD-Base (decoding data base), CC-Base (CC font library) and printer driver.

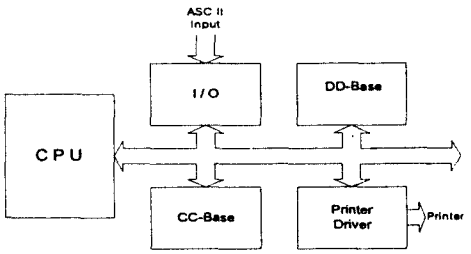

Fig. 4 Principle block diagram of CC processor

The fundamental is described as follows:

Passing through the I/O interface of CC processor, the ASC II code from the information processing unit which is located at the main board of NAVTEX receiver is fed into CPU. According to the decoding rule and the relation of flow-chart, CPU decodes the input ASC II code and sends the relevant instruction.

When need to print the message, CPU calculates the address of DD-Base and sends the instruction for searching address to it. Under every addresses of DD-Base, it stores the information about the address of CC dot matrix of CC-Base.

CPU sends the printing instruction to CC-Base through DD-Base and picks up the information about CC dot matrix into the printing driver.

The address in DD-Base is arranged in TC order, which is transformed into Hexadecimal and the data in DD-Base is the address of CC-Base. DD-Base data configuration is shown in <Table 3>. The mark , which is the address incremental, equals to 4000H. The content in the data column is from the formula (12*12 dot matrix) as

[(AC 1) 94 6] + [(SC1) 6] = (DECIMAL) (HEXADECIMAL)

For example, the AC of a CC is 50, and SC 27, then Decimal is 27792 and Hexadecimal 6C90. As the address in CC-Base, 6C and 90 are stored in DD-Base respectively.

CC-Base is made in a kind of Character Dot Matrix Data Base, which stores 682 marks and 6763 Chinese Characters fonts.

The distribution of dot matrix in the CC-Base is shown in <Table 4>

〈Table 3〉 DD-Base data configuration

TC		Address	Data	
0001		0001 H	6C H	
0002		0002 H	2E H	
:		:	:	CC-Base high-order address
:		:	:	
9998		270E H	00 H	
9999		270F H	··	
··		:	:	
		:	:	
	Address+Δ	4001 H	90 H	
		4002 H	44 H	
		:	:	CC-Base low-order address
		670E H	00 H	
		670F H	··	
		:	··	
		θFFFF h	··	

〈Table 4〉 CC-Base data configuration

Area	Starting Addr. of each CC	Ending Addr. of each CC	Distribution of CC dot matrix		Starting Addr. of each CC	Ending Addr. of each CC	Area
I	0000 H 0006 H 000C H : : BFA6 H	0005 H 000B H 0011 H : : BFAB H	Left & upper part of each CC	Right &upper part of each CC	BFAC H BFB2 H BFB8 H : : 17F52 H	BFB1 H BFB7 H BFBD H : : 17F57 H	II
III	17F58 H : : : 23EFE H	17F5D H : : : 23F03 H	Left & lower part of each CC	Right &lower part of each CC	23F04 H : : : 2FEAA H	23F09 H : : : 2FEAF H	IV

5. Concluding Remarks

According to 1993 Torremolinos Protocol [9], the general trend in modern designed fishing vessels, if they are to be economically profitable, must include improvements in machinery and fishing gear, improvements in safety features as a whole and better working conditions for fishermen. Safety improved life-saving appliances, immersion suits and thermal protective aids, satellite communication systems and other components of the GMDSS.

For safeguarding the safety of life at sea, by the end of last year, the NAVTEX system in 36 countries have been operational, and in 13 countries are being setting up. Now many countries are developing the NAVTEX system of transmitting native languages, which 5 kinds of languages were used to broadcast NAVTEX service in 8 countries [10]. In Asia, Korea and Japan have finished the development of native language's NAVTEX and have produced systems.

According to the stipulation of Recommendation ITU-R-541, after Feb. 1st .1999, China will broadcast NAVTEX service in 490KHz by means of native language. In the nearest future, Chinese Government will issue the decree about equipment of the fishery vessel and shipping vessels in coastal water.

China has thousands of thousands fishery motor vessels and shipping vessels in coastal water. She has the great potential market, so the expected foreground and application of this research result is obvious.

This is the objective condition that develops this research and transfers it into the product.

This research will play a positive role in the development of CC NAVTEX in China.

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