A CONTROLLER FOR A BRAILLE TERMINAL

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ABSTRACT

A controller for the braille terminal described by Anderson and Rogers permits the braille terminal to communicate with a host computer on a teletype-compatible line without special provisions in the host machine. The controller translates characters and buffers output messages. A complete braille representation of the standard teletype character set is given.

INTRODUCTION

Anderson and Rogers [1] have described a set of modifications which convert a standard model 33 teletype into a device which produces embossed braille characters. Thus, blind computer users can communicate with a computer without the help of a sighted person to read the output. The disadvantage of this terminal alone is that either the applications program or the operating system of the host computer must have special software to map each output character into a sequence of three characters necessary to emboss its braille equivalent. Such software modification can be expensive and has to be done for each applications program or operating system the blind person wants to use.

THE BRAILLE TERMINAL CONTROLLER

Our braille terminal system consists of (1) a teletype converted to a braille terminal in accordance with the directions of Anderson and Rogers, (2) a standard model 33 teletype, and (3) a minicomputer. The minicomputer acts as a controller for the braille terminal and performs the necessary character translation and buffering. Each braille character requires three print cycles on the teletype: two for the character itself and one space. Because the braille teletype operates, in effect, at one third of the standard character transmission rate, buffering is required to enable the braille terminal system to look like a standard full duplex teletype to any host machine.

In normal operation, characters typed on the braille teletype keyboard are transmitted without modification to the host computer. Echoed characters and output are directed to the mini-computer where they are buffered and translated into appropriate characters which are sent to the braille teletype (see Figure 1). Although direct lines could certainly be used instead, our system uses telephone lines and an acoustic coupler to communicate with host computers.

Additional Features

Three additional features have been added to the basic system. First, the mini-computer buffer can be emptied, enabling the user to avoid receiving braille output he knows he does not want. Second, a graph mode is available. In this mode, each received character is transmitted to the braille teletype without translation. This enables the use of graphing programs to display data. Third, an unmodified teletype was added as a "slave." There are many situations in which ordinary typed output is desired. The "slave" teletype is particularly helpful when a sighted person is using the terminal with a blind person. Either person can instruct the other, or both can examine the output.

Braille Character Set

In establishing a braille representation of the printable teletype characters we tried to adhere as closely as possible to standard scientific braille conventions [2]. It was decided, however, for speed, that each graphic character should be embossed as one braille character. Happily, the number of printable teletype characters coincides with the number of possible braille characters, 63. The braille characters chosen for each symbol, with a few inevitable exceptions, relate closely to standard notation. The blind users of our terminal have had little trouble learning these exceptions. Because each graphic symbol is represented as one braille character, ambiguous incidents are reduced. Table I gives the code set used.

Conclusions

The braille terminal system described here has proved to be effective and useful. It gives the blind user complete access to the facilities of any computer to which he connects it. Our terminal is used to communicate regularly with two different host machines. No software modifications have been made to the host systems to accommodate the braille terminal.

The independence that the braille terminal provides blind users more than repays its moderate cost. Braille output produced by the terminal is quite readable and reasonably permanent, and overall reliability of the system appears to be quite good.

Acknowledgements

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References

1. Anderson, G. B. and Rogers, D. W. "An inexpensive braille terminal device, " Comm. ACM, 6 (June 1968) pp. 417-418, 440.

2. Nemeth, Abraham. The Nemeth Code of Braille Mathematics and Scientific Notation, American Printing House for the Blind, Louisville, Kentucky, 1966.

Figure and Table Captions

Figure 1. Braille terminal system block diagram.

Table 1. Braille code set for printable teletype characters.

TABLE I

Octal	Graphic	Braille Cells
040	(blank)	(none)
041	!	1-2-3-4-6
042	"	5
043	#	3-4-5-6
044	$	1-5-6
045	%	2-3-4-6
046	&	1-4-5-6
047	'	3
050	(	1-2-3-5-6
051	)	2-3-4-5-6
052	*	4
053	+	3-4-6
054	,	6
055	-	3-6
056	.	4-6
057	/	3-4
060	0	3-5-6
061	1	2
062	2	2-3
063	3	2-5
064	4	2-5-6
065	5	2-6
066	6	2-3-5
067	7	2-3-5-6
070	8	2-3-6
071	9	3-5
072	:	4-5
073	;	5-6
074	<	1-2-6
075	=	1-2-5-6
076	>	1-4-6
077	?	3-4-5
100	@	1-2-4-6
101	A	1
102	B	1-2
103	C	1-4
104	D	1-4-5
105	E	1-5
106	F	1-2-4
107	G	1-2-4-5
110	H	1-2-5
111	I	2-4
112	J	2-4-5
113	K	1-3
114	L	1-2-3
115	M	1-3-4

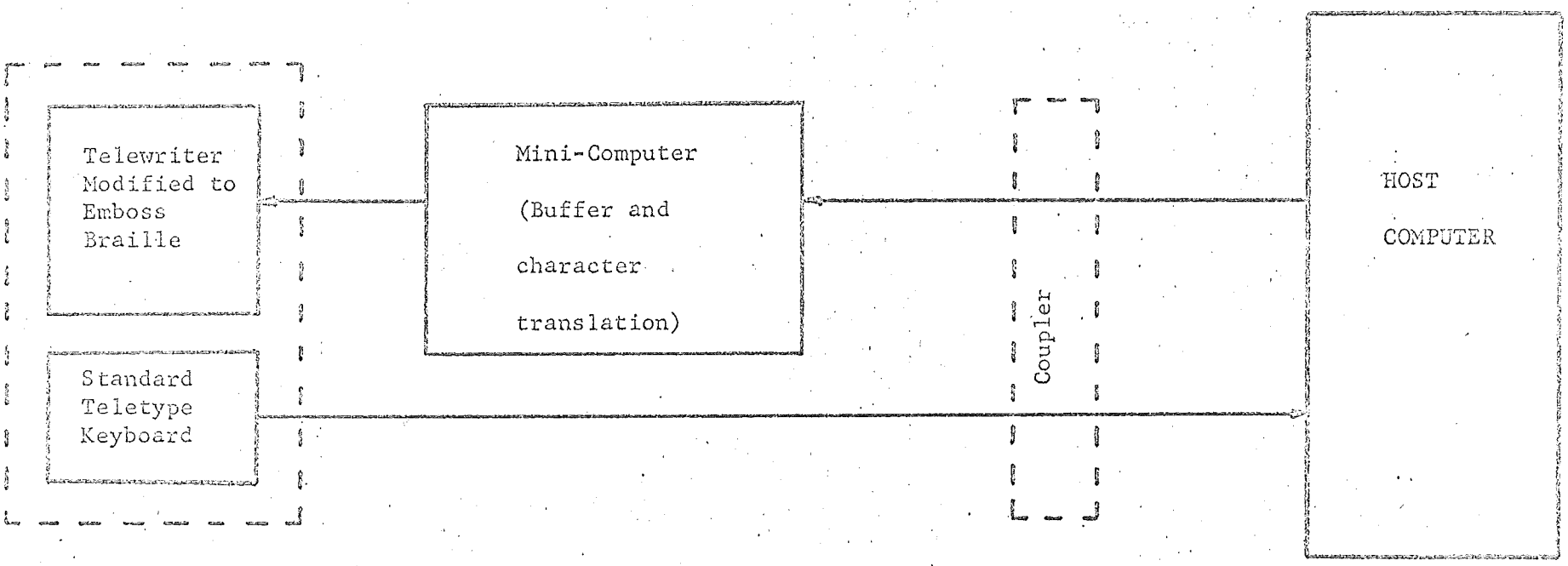
TABLE I (Cont.)

Octal	Graphic	Braille Cells
116	N	1-3-4-5
117	O	1-3-5
120	P	1-2-3-4
121	Q	1-2-3-4-5
122	R	1-2-3-5
123	S	2-3-4
124	T	2-3-4-5
125	U	1-3-6
126	V	1-2-3-6
127	W	2-4-5-6
130	X	1-3-4-6
131	Y	1-3-4-5-6
132	Z	1-3-5-6
133	[	2-4-6
134	\	1-6
135	]	1-2-4-5-6
136	↑	4-5-6
137	←	1-2-3-4-5-6

BRAILLE CELL:

1 4
2 5
3 6

EXAMPLE: " = "


Telewriter Modified to Emboss Braille
Standard Teletype Keyboard
Mini-Computer (Buffer and character translation)
Coupler
HOST COMPUTER