Non-visual Computer Peripherals

J. M. Gill*

Introduction

Non-visual computer peripherals have been developed for:

(i) braille production
(ii) information retrieval systems
(iii) outputs for reading machines
(iv) blind programmers

This survey of devices in production, or under development, is based on replies to a questionnaire circulated in May 1974; the main features of these devices are summarised in Table 1.

A selected bibliography on the use of computers by the visually impaired, but excluding papers on speech synthesis and the employment and training of blind programmers, is at the end of the report.

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University of Warwick
Coventry, CV4 7AL
England
Table 1. Summary of the main features of the devices.

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<th>Device</th>
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1. Developer
American Systems, Inc.
123 Water Street
Watertown, Massachusetts, 02172, U.S.A.

Status
Commercially available as part of the ARTS system.

Description
Compiled speech output delivered over telephone lines. ASI speech and teleprocessing system Nucleus 3000 V/L with central processor and 8192 x 16 bit core memory, ASI 16-line multiplexer with receiver data sets or modems and speech storage disc capable of containing up to 500 seconds of speech definable as more than 2000 English spoken words.

Price
$66,700

Information
Dr. K. R. Ingham, June 1974.

2. Developers
G. B. Anderson and D. W. Rogers
Lawrence Radiation Laboratory
University of California
Livermore, California, U.S.A.

Status
Unknown

Description
New print head for Model 33 teletype. Speed one third that of the normal teletype.

Information

3. Developer
Prof. Ir. R. G. Boiten
Laboratorium voor Werktuigkundige meet-en Regeltechniek Technische Hogeschool Stevinweg 1
Delft, The Netherlands.

Status
Experimental prototype.

Description
Braille printer, powered by electric motor, which prints on Kraft paper tape moving from right to left.

Information

4. Developer
Professor Dr. Werner Boldt,
Pedagogische Hochschule Ruhr
Dept. of Educ. and Rehab. of the Visually Handicapped
46 Dortmund
Kreuzstr. 155
West Germany.
4. Developer: Professor Dr. Werner Boldt (continued)

Status: Commercially available.

Description: Electronically-controlled system for programmed learning of the blind. Audio and braille output freely combined. Braille and multiple choice input according to the character of the program. Braille input electrically evaluated as well as multiple choice input. Branched programs - branching controlled by the input modes. All information (audio, braille, memory, coding) stored on magnetic tape (cassette type). During stop periods use as electronic braille-writer, with program cassette or additional material useful for most school subjects.

Price: circa $2,800

Information: Prof. Dr. W. Boldt, May 1974.

5. Developer: Professor Dr. Werner Boldt
Pedagogische Hochschule Ruhr
Dept. for Educ. and Rehab. of the Visually Handicapped
46 Dortmund
Kreuzstr. 155
West Germany.

Status: Prototype development

Description: "Braillex" enables the blind user to reach prestore information with relatively short access. Information (verbal or braille) is stored and coded on magnetic tape cassettes. Verbal and braille output (for control) is possible. The information wanted is "called" by braille input and discriminated electronically. Examples: information from dictionaries, storing and use of private archives (telephone numbers, scientific notes, etc.), recalling of special parts in literature (pages, chapters, code words).

Information: Prof. Dr. W. Boldt, May 1974.

6. Developers: V. Brown and E. Stuckey
Teletype Corporation
Little Rock, Arkansas, U.S.A.
in collaboration with:
E. Knoch
Arkansas Enterprises for the Blind, Inc.
2811 Fair Park Boulevard
Little Rock, Arkansas 72204, U.S.A.

Status: One prototype built.
6. Developers  
V. Brown and E. Stuckey (continued)

Description  
The device, which produces braille at 100 words per minute, is in parallel with a standard model 32 or 33 printer so there is keyboard input, print output and braille output simultaneously. The unit consists of a modified punch which punches two rows of three dots each or two rows of four dots each, depending on the need, instead of the 8 bit ASCII.

Price  
The original price of duplicating this unit in quantity was estimated to be $1600.00. However, with the modern LSI circuits available, it is felt that this device could be duplicated for under $600.00.

Information  
E. Knoch, June, 1974.

7. Developer  
D. V. Charlesworth
Clarke and Smith Industries, Ltd.
Melbourne House
Wallington, Surrey, England

Status  
Prototype built, general availability mid 1976.

Description  
12, 24, or 72 character 6 point braille display with solenoid operated dots module and computer terminal/information retrieval unit. Fresh lines of information are obtained by pressing button at end of line.

Price  
£300 - £1600 depending on application.

Information  
D. V. Charlesworth, May 1974.

8. Developer  
Dr. M. J. Gee
Scientific Systems Group
Office of Computing Activities
University of Dayton
Dayton, Ohio, 45409, U.S.A.

Status  
Prototype

Description  
A paper embosser which employs an ASR 33 terminal, and produces a configuration of seven dots arranged in an expanded braille cell, with the addition of a seventh position below position six.

Information  
Association for Computing Machinery
Newsletter for Blind Computer Programmers
9. Developer  
Dr. A. P. Grunwald,  
Engineering and Technology Division,  
Argonne National Laboratory,  
9700 South Cass Avenue,  
Argonne, Illinois, 60439, U.S.A.

Status  
Production Prototype.

Description  
Device converts symbols recorded on magnetic tape to raised braille dots on a plastic belt. The belt moves conveyor-like at an adjustable speed; the dots are "erased" by depressing them and new ones raised.

Information  

10 Developer  
Haskins Laboratories Inc.,  
270 Crown Street,  
New Haven, Connecticut 06510, U.S.A.

Status  
Prototype.

Description  
Full text-to-speech processing system is now working in the laboratories. The synthetic speech is not entirely natural although intelligible. Sufficient progress has been made to justify the construction of a pilot reading service centre which would have a combined research and service function.

Price  
$350,000

Information  

11 Developers  
Professor W. B. Heginbothan  
D. W. Gatehouse and D. G. Hassel  
University of Nottingham  
University Park  
Nottingham, NG7 2RD, England.

Status  
Design study.

Description  
A terminal to produce a 36 character wide line of braille print at a speed of 60 characters per second operating on a line printer principle. Also, meant to be adaptable to desk calculating machine. The machine sets up the braille terminals by operating from a bank of 7 electro-magnetic devices.

Price  
Estimated £1000.

Information  
Prof. W. B. Heginbothan, May 1974.
12. Developers
Prof. D de Jong and Ir. A. N. Westland
Technological University Delft
Leegewaterstraat 3
Delft, The Netherlands.

Status
First prototype ready in July 1974

Description
Braille lineprinter operating with papertape as input or on-line with a computer. Working on normal braille paper (180 gsm), printing 5 lines per second, each one consisting of maximum 40 braille cells.

Information

13. Developer
F. Kruger
National Center for Deaf Blind Youths and Adults
New Hyde Park
New York, NY 11040, U.S.A.

Status
Prototype available

Description
A single-cell softcopy braille display which can be connected to a computer via an acoustic coupler.

Information
Electronics, 7th February 1974, page 46.

14. Developer
N. Loeber
IBM Corporation
P. O. Box 66
Los Gatos, California 95030, U.S.A.

Status
Experimental unit

Description
Page braille embosser, based on standard IBM terminal. The unit embosses from the rear, with the data appearing on the front side of the paper. A metal die is used to mate with the selected pins to provide positive control in forming the raised dots.

Information

15. Developer
Professor R. L. Longini
Medical Systems Engineering Laboratory
Carnegie-Mellon University
Pittsburgh, Pennsylvania 15213, U.S.A.

Status
Fourth generation device built.

Description
An alphanumeric audio output where the sounds are voice-like enough so that 100% phonetic output can be learned as a dialect. Forty hours of training (high IQ) permits 150 words per minute of English to be understood.
15. Developer: Professor R. L. Longini (continued)

Price: Circa $300 if built in quantity.


16. Developer: Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, Massachusetts 02139, U.S.A.

Status: Commercially available but supply limited.

Description: The Brailleflex is an automatic braille printer which can operate at speeds up to 16 characters/second.


17. Developer: F. H. Myers
Bell Telephone Laboratories, Inc.
6200 East Broad Street
Columbus, Ohio 43213, U.S.A.

Status: Laboratory prototype

Description: A braille writer was modified for electronic control. Seven solenoids and seven contacts were added.


18. Developer: Perceptual Alternatives Laboratory
358 Life Sciences Building
University of Louisville
Louisville, Kentucky 40208, U.S.A.
in collaboration with Electronic Systems Development Corporation.

Status: Second prototype built.

Description: Braille page embosser that will operate at teletype speeds.

Price: Under $1000.

Information: Annual report of Perceptual Alternatives Laboratory, July 1974.

Department of Computer Science
Michigan State University
East Lansing, Michigan 48824, U.S.A.
19. Developers  Professors M. A. Rahimi and J. B. Eulenberg (continued)

Status  Limited production.

Description  The system uses the speech synthesis hardware/software package implemented on Michigan State University's main computers. The buffered output is normally operated at 300 Baud. The phonetic images of words and sentences are built up by concatenation of 8 bit symbols representing the phones of English in the buffer memory. The 8 bit code consists of 6 bits representing the phone and 2 bits representing one of four levels of intonation.

Price  $4000 - $5000 per unit.

Information  Professor M. A. Rahami, July 1974.

20. Developer  R. Rubenstein
University of California
Irvine, California, 92664, U.S.A.

Status  One-off working model.

Description  A teletype terminal was adapted to produce braille printout.


21. Developer  Dipl.-Ing. K.-P. Schonherr
Arbeitsgemeinschaft fur Rehabilitationstechnik an der Universitat
Stuttgart e.V.
D-7000 Stuttgart 1
Schloß Solitude, Haus 3
Germany.

Status  Prototype.

Description  The device is an electromechanical modular display, the module being a six dot braille cell such that braille lines of any desired length can be made. Writing speed is 30 characters per second.


22. Developer  A. A. Spanjersberg
Dr. Neher Laboratory
St. Paulusstraat 4
Leidschendam, The Netherlands.

Status  Six printers have been built.

Description  The 7 bits of a braille code have to be presented in parallel to the input. The braille characters are embossed on the paper which is transported in the printing mechanism by pin feed. The speed is about 7 braille characters per second.
22. Developer  A. A. Spanjersberg (continued)

Price  D.Fl. 15,000

Information  A. A. Spanjersberg, May 1974.

23. Developer  Dr. W. Tagg
Hatfield Polytechnic
Hatfield, Herts, England.
in conjunction with the Royal National Institute for the
Blind and Business Data Products Ltd.

Status  Prototype built and in daily use.

Description  For Output - IBM Model D braille typewriter plus sighted
typewriter. For input - specially designed keyboard. These
three components are linked electronically to each other and
to a standard Datel data transmission unit.

Information  M. Jenkins, Hatfield Polytechnic, May 1974.

24. Developer  Telesensory Systems, Inc.
1889 Page Mill Road
Palo Alto, California 94304, U.S.A.

Status  Prototype being evaluated

Description  Hewlett-Packard (Santa Clara) have developed an ASCII to Optacon
interface bypassing the Optacon's camera to feed the signals
directly into the circuitry.

Information  Measure (Hewlett-Packard), May 1974.

25. Developer  Ing-Buro Thiel
6105 Ober-Ramstadt
Grafengasse 2, West Germany

Status  Commercially available from stock.

Description  Braille tape input-output attachment to enable blind person
to operate telex-teleprinter machines. Output speed is 12
braille characters per second.

Information  International Catalog of Aids and Appliances for Blind and

26. Developer  T.N.O.
Delft, The Netherlands.
26. Developer  T.N.O. (Continued)

Status     One-off working model.

Description Input is from eight hole punched paper tape which is fed to a modified Perkins brailer and automatic cutting apparatus. A code-translator has a maximum capacity of one braille plate embossing and six braille printing machines. The speed of production is 4 characters per second.


27. Developer  Trask Datasync AB
Stockholmsu, 34
182 74 Stocksdun, Sweden.

Status     Prototype being built.

Description The Zoltan Braille Embosser is a fully automatic system which can provide single copy documents at the rate of 10 seconds per sheet embossed on both sides (interpoint). A second sheet with the same text takes 1 second and all additional copies ½ second each. The quality will be equivalent to that obtained from rotary press using zinc plates. All the functions of the machine are controlled by an electronic digital controller. Text input is made with paper or magnetic tape or alternate as desired. For this reason the acquisition and storage costs of a text library are minimal.

The machine contains two embosser drums which print both sides of a sheet simultaneously. Each drum contains 6720 movable pins. The input text determines the position of each pin, which in turn embosses the paper to provide the corresponding braille text.

Price     circa Skr. 200,000

Information Trask Datasync AB, May 1974.

P. O. Box 127
Wall Street Station
New York, NY 10005, U.S.A.

Status     Commercially available, delivery 90 to 120 days.

Description The BD-3 is a portable unit which produces braille on paper tape, when used in conjunction with a keyboard, digital equipment, a computer, almost anything that uses coded information. Weight - 15 pounds. Speed - up to 15 cps. Operating modes - EIA interface, TTY interface (other interfaces optional). Input code - ASCII, EBCD, BCD, Correspondence, Baudot, any code with eleven bits per character or less.
28. Developer Triforation Systems, Inc. (continued)
Price $1850

29. Developer Triforation Systems, Inc.
P. O. Box 127
Wall Street Station
New York, NY 10005, U.S.A.
Status Under development.
Description The LED-1 is a stand-alone braille device which produces braille device which produces braille from a keyboard, from a computer, from almost any coded information on a page of paper. Speed-up to 15 cps. Operating modes - EIA interface, TTY interface (other interfaces optional). Input code - ASCII, EBCD, BCD, Correspondence Baudot, any code with eleven bits per character or less.

30. Developer Triforation Systems, Inc.
P. O. Box 127
Wall Street Station
New York, NY 10005, U.S.A.
Status Commercially available, delivery 90 to 120 days.
Description The LED-120 is a high speed braille printer which can produce braille from a keyboard, from a computer, from magnetic cassettes or from almost any source of coded information. Speed up to 120 cps. Operating modes - EIA interface, TTY interface (other interfaces optional). Input code - ASCII, EBCD, BCD, Correspondence, Baudot, any code with eleven bits per character or less.
Price $9000

31. Developer Z. Weinberger
National Physical Laboratory of Israel
Hebrew University Campus
Jerusalem, Israel.
Status Unknown
31. Developer Z. Weinberger (continued)

Description A braille tape embosser produces braille cells on half-inch machine paper tape. By suitable interfacing, the brailler can accept input from computers, card readers, Telex tape and Monotype tape.


32. Developer W. A. Zawistowski

Computation Centre
Polish Academy of Sciences
P. O. Box 22-00901 Pkin,
Warsaw, Poland.

Status Prototype.

Description The tape reader-writer unit (type WAZA) reads 8 hole punched paper tape and outputs braille embossed on paper tape. Writing speed is 12 characters per second.

Price Circa $100

Information World Council for the Welfare of the Blind,
Sao Paulo, August 1974.

33. Developer IBM Corporation

Armonk, New York 10504, U.S.A.

Status Commercially available

Description The printing mechanism on an IBM 1403 line printer has been modified to produce braille at about 250 characters per second.

Price Dkr.550,000

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3 ASSOCIATION DE NEDERLANDSCHE BLINDENBIBLIOTHEEK
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