ENHANCED UK TELETEXT MOVES TOWARDS STILL PICTURES*

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1. Introduction

The UK teletext system has been a full public service for almost four years, and the specification of the system has remained unaltered. It is expected that by the end of 1980 there will be more than 100 000 teletext receivers in use. There is no doubt that the system rests on a firm technical foundation and the deliberate attempt made to stretch technology at the time the specification was formulated means that the system is giving the highest possible information transfer rate consistent with ruggedness and freedom from errors.

In the UK the only significant criticism of teletext has been that the access time is slow. Typically, with two data lines per field, a broadcast magazine will contain a major cycle of about 90 pages repeating about every 20 seconds, and consequently the average waiting time compares unfavourably with that of an interactive viewdata service using the telephone line, such as Prestel.

In Europe the UK teletext system as it stands is not appropriate to the character requirements of many of the languages used. Moreover, there is a desire to be able to mix languages within a single teletext page. A survey of the requirements of the members of the European Broadcasting Union[1] shows that a common-core alphabet of about 200 characters is needed for languages using the Latin alphabet. A requirement to underline text has also been identified.

It is accepted that UK teletext is the beginning of a line of development leading to an enhanced teletext system whose capability is limited only by the display device itself, and capable of producing a sequence of still pictures with a full range of colour, and definition superior to that of the current broadcast television systems. Such a system would, of course, be capable of handling material from systems such as Antiope and Telidon should this prove necessary. An enhanced teletext system should also provide for particular types of auxiliary data such as programme labelling, as well as allowing arbitrary data to be sent as part of a teletext magazine or on totally independent channels within the teletext format.

By reference to a particular proposal, which is annexed, this paper indicates how the UK teletext system can be extended to meet all these requirements, including improved access, while retaining full compatibility with, and the ruggedness of, the existing system. The techniques are described in terms of the 625/50 television system, the adaptation to 525/60 systems has been discussed elsewhere.[2]

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2. Improved access

The UK teletext system already includes ample provision for uniquely addressing individual pages. Within each of eight independent magazines, selected by a single digit, 100 pages can be selected by a further two-digit page number and up to 3200 versions of each page can be selected by a further four-digit subcode (formerly known as 'Time-Code'). So even using the existing keyboards and decoders over 2½ million different pages can be individually accessed. The addition of a 'don't-care' key (see A.2.1.4) allows groups or sequences of pages to be accessed.

Already teletext decoder chip sets are available in the UK which support more than one page store. This means that while a page is being viewed several other pages can be captured and stored ready for instant access. This poses two questions; which other pages should the decoder capture and how does it know when it's caught them?

2.1. Linked Pages

One way of deciding on the choice of pages is to give the viewer the facility to preprogramme a popular selection into the decoder, preferably with non-volatile storage associated with each television channel. Then, when the set is switch on and a channel is selected, the chosen set of pages is captured at the earliest opportunity, ready for viewing. A sequence of pages could be stored so that while any one page is being read, the next one or two are being captured. This approach can be coupled with a quick-select facility so that pre-programmed pages, which normally require a three- or seven-digit number to select them, can be accessed using a single keystroke as in a repertory telephone dialler.

This approach, however, depends on the teletext magazine of a particular television channel

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having a regular structure. From time to time in the UK there is pressure to, for example, always put the Newsflash on page 250 and the initial index on page 100. Such a practice could, however, place an increasingly severe constraint on the editor and sacrifice one of the great strengths of teletext, which is its flexible structure that can be changed instantly to accommodate both the expected and the unexpected. A much more adaptable technique invokes linked pages using the page service row (Annex B) to provide details of up to six pages related to any particular page, and the television service data-line (Annex C) to indicate the initial teletext page of that television channel. This allows the teletext editor to structure the pages into decision trees in such a way that, while any page is being read, up to six related pages are being captured. When a choice is made the new page is immediately available by an abbreviated code of one or two keystrokes. Fig. 1 shows a Ceefax news headlines page with information added to show how linked pages could be indicated. Fig. 2 shows how the operation #4 leads to a new page and a further selection. There is a variety of ways in which the structure could be organised, for example, a long string of pages could include provision for jumps to the next, the previous, the first or the last page of the string.

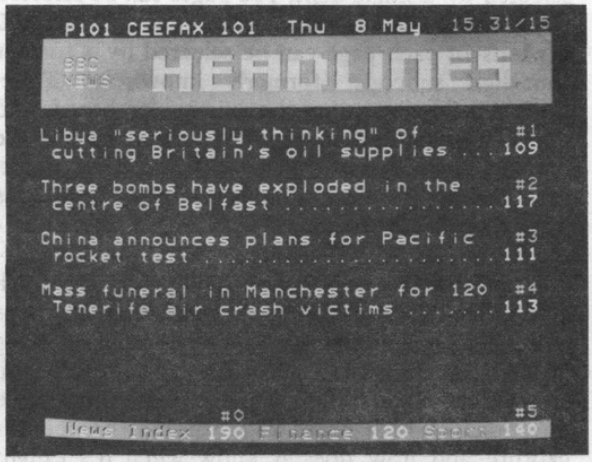

Fig. 1 - A Ceefax page with linking information added

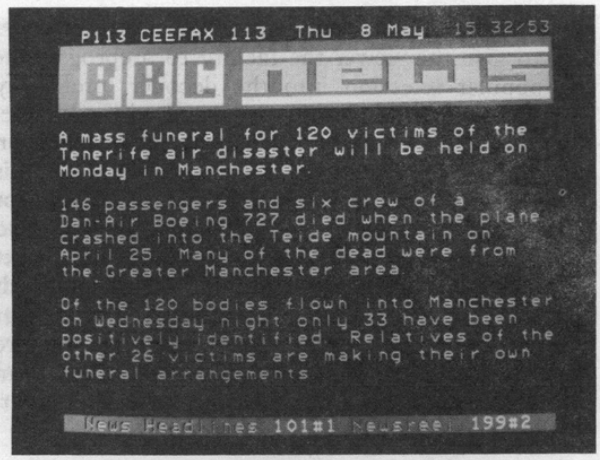

Fig. 2 - A Ceefax page linked to that in Fig. 1

2.2. Page Check Word

Particularly when a multiple page store is used, a definite indication is required to signify that any particular page has been correctly and completely received. This operation should not require human intervention and judgement, as future uses of teletext systems may involve the dumping of several hundred pages at a time into a mass store. In Annex B there is a proposal that an optional service row associated with each page should include a cyclic redundancy check (CRC) word of the entire page content, including presumed characters occupying any rows that were not transmitted. A 16-bit check word would identify 99.998% of all possible error patterns, and an even higher proportion of all likely error patterns. In an automatic page capture routine this test would allow a correct page to be protected in the store and the routine could continue with the next task. When a page is being viewed directly the viewer could be given an indication whether the page had a check word and whether the check was successful, a successful check would indicate a high confidence that the displayed page is correct and complete.

If the page check fails the only possibility for error correction in the basic teletext system depends on the cyclic repetition of pages. A method of using an auxiliary 'flag' bit associated with each byte of the page store to allow such error correction has been described elsewhere[3] together with examples of its use.

3. Character repertoire

Table A3a in the annexed document shows the basic display character set of the UK teletext system, and Table A4a lists the differences between this set and two other national-variant character sets already in use with the UK teletext system elsewhere in Europe.

The UK teletext system is based on the concept of a 'fixed-format' where every address in the

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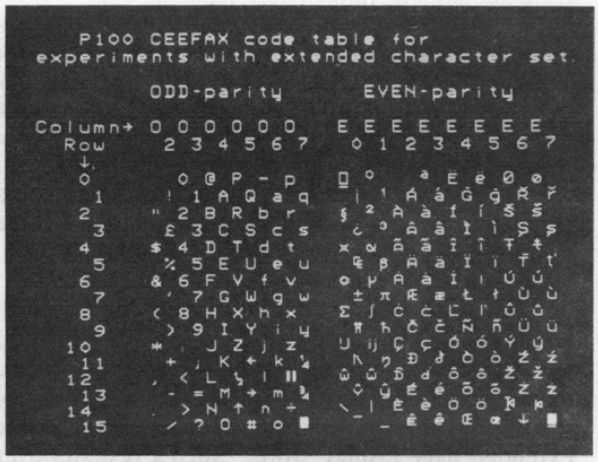

Fig. 3 - An experimental extended character set

page display store corresponds to a given character site within the page, and every stored code is either a display character or a control character. The present system uses seven-bit codes with 96 display characters and 32 control characters. In the annexed proposal it is assumed that eight-bit codes will be used in the page store, still with 32 control characters, but now with 224 display characters. This total is conveniently similar to the requirement for a common-core alphabet for the languages using the Latin alphabet, and allows languages to be mixed within a page. Fig. 3, which corresponds to the display characters listed in Table A3, shows the extended code table currently used in experiments. Two particular characters require comment, code E1/1 is a superscript 1 which can be used, together with superscript 2 and 3, to introduce footnotes or linked pages, and code E0/5 is allocated to the European Currency Unit (ECU) for which a temporary symbol has been devised.

The use of an eight-bit store also allows the size of the mosaic (formerly known as graphic) character repertoire to be more than doubled and an indication of the characters that could be used is given in Table A3b. It has already been recognised that the 48 diagonal mosaic patterns add greatly to the capabilities of the system.

3.1. Existing National Variants

If the existing national variants of the basic character sets, as listed in Table A4a, are to continue in use indefinitely a future decoder operating with an enhanced UK teletext system should be able to recognise which variant is in use and respond accordingly. It is proposed in A.2.3.1 that the three unused control bits in the page header be used for this purpose. There is no need to reduce the overall character repertoire or to provide different character generators because of these variants; all that is required is a permutation of some of the character codes under the control of these header control bits, as indicated in Table A4.

3.2. Implications of Use of Eight-Bit Codes

The use of the full eight bits of every transmitted character byte, which is presumed in the above extended character repertoire, means that many transmitted bytes will not satisfy an odd-parity check. At present all UK Teletext decoders use this check to prevent the writing of character bytes with 1, 3, 5 or 7 errors into storage. This prevents the appearance of wrong characters (other than the spaces which normally appear in place of characters not yet written) on the display when the received data is subject to isolated single bit errors. A decoder responding to eight-bit codes will, in general, display a wrong character whenever the received byte is in error.

It can be argued that the use of the page check word, together with possible use of the 'flag bit' technique, is sufficient to counter errors in teletext; in the vast majority of homes in the UK a properly functioning teletext installation suffers no errors at all on most days. If it is desired to retain the 'parity' type of error detection rows 26 or 27 of a page (see Annex B) can be used* to send, by a direct addressing technique, the locations of the few even-parity sites within a page.

Most UK Teletext decoders use the transitions of the data waveform for recovering the bit-rate clock, so it is prudent to restrict the use of the two bytes which could result in long periods without transitions (see A.1.2). In the code table these bytes have been assigned characters which have restricted use.

3.3. Further Extension of the Character Repertoire

Although a set of 96 characters is enough for many applications, and a common-core alphabet of some 220 characters is likely to meet the everyday needs of most broadcasters using languages written in a Latin alphabet, applications of broadcast teletext are envisaged where an even fuller repertoire is needed. This presents a problem when several million decoders are already in service and con-

* A technique proposed by Mr. W.J. Christis of N.V. Philips', Eindhoven.

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sideration is given to adding more characters to the list, as it is impracticable to modify these decoders.

A more complete Latin alphabet character repertoire, together with a coding scheme, is the subject of an international standard in course of preparation.[4] If UK Teletext is required to handle this fuller repertoire, and its possible further extensions to other alphabets (Arabic, Cyrillic, Greek, Hebrew, etc), as part of a more general text transmission system, this could be done strictly in accordance with the ISO coding scheme and using the independent data channels available in teletext (see C.1). If these characters are to be used within conventional teletext pages it would be essential to have a 'fall-back' presentation on decoders not equipped with the increased and increasing repertoire. This is easily achieved using the concept of over-writing using directly addressed bytes carried by page-associated data channels (Annex B). A normal page is sent in the conventional fixed-format transmission, and this serves as the fall-back presentation on the normal decoder. A decoder capable of responding to the new characters will recognise their codes in the page-associated data channel and substitute them in place of the characters transmitted in the normal way. A detailed proposal for such a scheme, for use with the ISO draft standard for the Latin alphabet, and with Hamming protection for the address information, has been described by Philips' and is known as 'polyglot C'.[2] This technique can be used equally well with a 96-character basic repertoire or with a 220-character basic repertoire, although with the larger basic repertoire there are fewer occasions when the auxiliary rows would be needed in the page transmission.

4. Display modes

The display modes of UK teletext are known as 'serial' modes. Under the control of codes which occupy positions on the displayed page, these modes can be set and changed. The full list of modes and control codes is given in Table A2, and their action is detailed in A.3.1. In this table a new mode has been defined in addition to those given in the current specification;[5] this is the 'underline' mode which shares the same control codes as the separated mosaic mode. Another new feature is the provision for variable character spacing to improve the appearance of text, and a control code has been provided to allow tabulation to be preserved (see A.3).

The provision of 'parallel' modes for teletext is under active discussion. The intention is to allow most, if not all, of the modes to be changed between characters so that, for example, every letter of a word may be in a different colour on a different background colour. Clearly additional storage is required to handle these commands and in the extreme case the page display store for a parallel attribute system would need to be three times the size of a basic teletext page store.

If there is a need to accommodate parallel attributes they too can be provided in an enhanced UK teletext system by using the page-associated data channels to convey directly-addressed control words to modify the appropriate parts of the extended page display store. Such a system forms part of the 'polyglot C' proposal.

5. Data broadcasting

Data not intended for direct display of text on the screen may be coded in either of two ways, chosen according to the application, and in both cases the data transmissions will not interfere with the normal operation of teletext decoders designed to receive only pages of text.

5.1. Pseudo-Pages

When data is conveniently organised as blocks of up to 1K byte it can be treated as a teletext page which cannot be accessed by a normal decoder. As well as the 2½ million addresses available for normal pages there are more than 10 million additional addresses available for these 'pseudo-pages' (see A.2.1.3.1). Such data blocks can be linked together using the method described in 2.1 so that long sequences of data can be sent as packets, each being tested for integrity by means of the page check word. The concept of linked pages allows pseudo-pages to be coupled with normal pages of text which can then be used to introduce and comment upon the contents of the pseudo-pages.

Many uses can be found for such a data broadcasting system closely coupled to the teletext pages, and perhaps the most attractive is its use for sending pictures more intricate than pages of text. A teletext page requires about a kilobyte of memory, a high-quality still television picture requires about a megabyte. Between these extremes there is a large variety of uses, and the challenge is to find an efficient hierarchy of coding which will allow all intermediate cases to be handled effectively. For example, the normal resolution of the teletext mosaic mode (Fig. 4)

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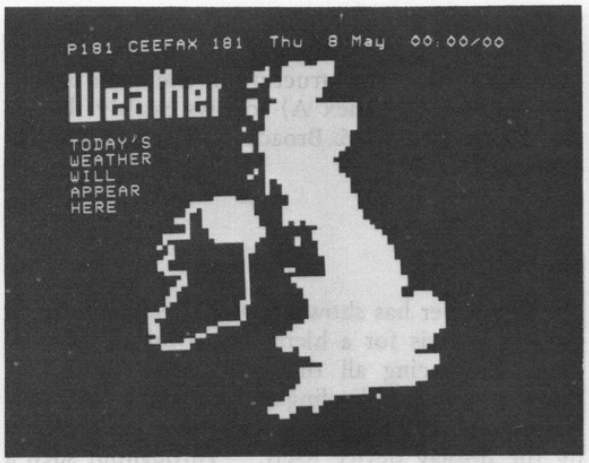

Fig. 4 - Example of mosaic mode resolution

Fig. 5 - Example of picture-element resolution

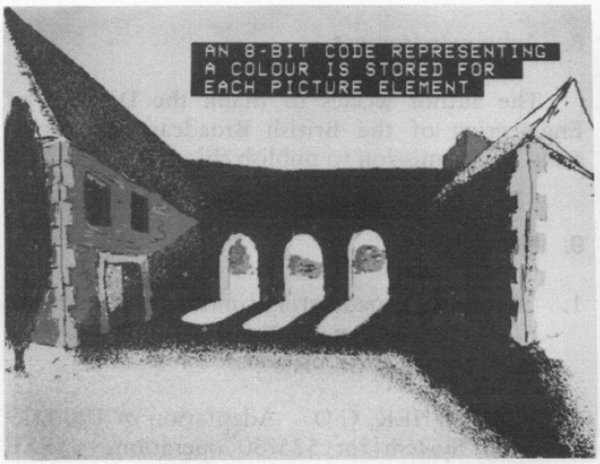

Fig. 6 - Typical 'painting-by-numbers' picture

Fig. 7 - An RGB television picture inset in a teletext page

can be dramatically improved if the shapes can be defined on a picture element basis (Fig. 5). If several bits per picture element are available the code for each picture element can represent one of a range of redefinable colours allowing a 'painting-by-numbers' type of picture to be handled (Fig. 6). With even more bits per picture element full RGB television picture quality can be achieved (Fig. 7) without the jagged edges usually associated with systems involving an approach based on discrete picture elements. Annex D discusses these points in more detail.

5.2. Auxiliary Data Channels

Annex C.1 indicates how UK Teletext can be used to provide 15 data channels independent of each other and independent of the normal teletext service. This resource can be used for any purpose and the data lines can be added or removed without affecting the accompanying teletext signal. The channels can, of course, be subdivided further if required.

5.3. Television Service Data-Line

Annex C.2 indicates how a data-line, repeated perhaps every second, could be reserved for purposes associated with the television channel (such as programme identification), associated with the teletext service (the complete address of an initial introductory page) or unrelated to either television or teletext (a statement of the day, date and time). As with the auxiliary data channels the use of this

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