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Information technology — Future keyboards and other associated input devices and related entry methods

Technologies de l'information — Claviers futurs, autres dispositifs d'entrée associés et méthodes d'entrée liées

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Foreword

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC TR 15440, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 35, *User interfaces*.

Introduction

This Technical Report, supported by the history of information technology keyboards during the last two decades, lists current and anticipated problem areas as seen by users, and tries to pave the way to foreseen work items in JTC1 for solving keyboard-related issues of the user interface.

Information technology — Future keyboards and other associated input devices and related entry methods

1 Scope

This Technical Report covers

- the different input requirements catering for national and international practices and support of cultural and linguistic diversity;
- the recognition of requirements regarding comfort of use (for any user, including children, elderly and disabled people), and improved user productivity related to inputting data;
- enhancements of keyboards and related input devices and methods required for new emerging phenomena such as Internet, multimedia, and virtual reality;
- virtual input requirements;
- labelling issues (soft [LCD] and hard, permanent and temporary labels), function symbols and icons.

This Technical Report does not cover implications of biometric input (e.g. fingerprint-, iris-pattern-, or face-shape-based) devices for access and security.

This Technical Report is aimed at both the users and manufacturers, and intends to present the user requirements regarding keyboards and associated devices and methods at the time of publication of this Technical Report.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 9995 (all parts), *Information technology — Keyboard layouts for text and office systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 9995-1 apply.

4 Benefits and disadvantages of current keyboards and data entry devices on the market

The benefits and disadvantages are as follows.

- Most existing desktop keyboards on the market follow ISO/IEC 9995-1 and ISO/IEC 9995-2. This helps for education and training.

— The situation with regard to portable computers is less clear, as confusion very often exists between function and alphanumeric keys; some dedicated keys like the portable *Fn* key are either not “seen” by software or are used in different fashions between different manufacturers' equipment. Different cursor and editing functions interfere with character data entry. Because of the reduced size of the keyboard, row A in particular is really confusing: the location of the function keys varies from model to model and is not really well thought out (for example, the *Insert* key is sometimes placed immediately next to the *Delete* key, which is extremely error-prone for the user). Blind or visually impaired persons have specific problems, particularly with portable computers: the variation in the placement of the different keys due to the lack of strictly defined international standards for common functions. Because of this, no clues exist to help them finding the location of these functions. Even though the functions are not universal, a survey of the different functions should be conducted among the devices available on the market, and it would be desirable to reserve a location relative to each one in an international standard.

— Most keyboards misinterpret some parts of ISO/IEC 9995. For example, the decimal separator is not used as a function but rather as an alphanumeric key (this creates problems in countries in which the decimal separator is multiple [this function should not depend on output representation]). Another case in point is the function terminology that is multiple and does not always respect ISO/IEC 9995-7.

5 Comfort of use and productivity considerations

Comfort of use and productivity considerations are as follows.

— No major improvement in the comfort of use has been made since 1995 except some innovative, albeit sometimes very specific platform-oriented tools for multimedia and Internet use working with very specific drivers.

— Standardization of placement and functionality of common functions would appear to be possible as technology is stabilizing (e.g. *Print Screen* function could be selectable at the platform level as either an application-dependent function or as a “hard-wired” feature that prints the screen independently of the application running under a given operating system).

— Placement and functionality of functions such as Select Level 3 and Group Select have yet to be fixed (American keyboards, for example, typically do not have a Level-3 select function, and Group Select, when available, is done in different ways owing to lack of guidance in the first edition of ISO/IEC 9995).

— One important drawback of current keyboards is that no software can be made “aware” of the actual geometric layout as it is seen by the user, nor of the actual engraving seen by the user. If standard (*de facto* or *de jure*, even OEM) keyboards were registered and assigned a worldwide-fixed number, then the keyboard could identify itself (i.e. the actual engraving and geometry) to the software on request and then the software could better display actual mapping to character sets additional to those engraved on the keyboard. This is of particular importance in an ever-more global and multilingual environment. Such a scheme would not necessitate a change in the actual “scan-code” technology used today.

— Comfort of use is highly dependent on the actual work done by a specific user. Reassignment of keys allows user productivity to be improved; this is possible only if the software is aware of the actual placement of keys of which it “sees” the “scan codes”. Keyboards should ideally be designed according to human ergonomics but this is rarely the case. As an example, the common square keyboard is not ergonomically designed according to the function of normal hands and arms.

— Reassignment of actual “scan codes” of the physical keyboard by software would be desirable (up to now, such reassignment has been very difficult at the keyboard-driver level, if possible at all); for example, to allow the use of a *7-8-9* layout on a *1-2-3* numeric keypad. Currently hard-wired “scan codes” can be interpreted differently by software, but that advantage becomes at the same time a problem if “keyboard-scan-code-aware” programs do not all use the same interpretation of these “scan codes”. Such a reassignment would greatly improve software compatibility while serving the end-user and innovative application needs.

— An New Project is desirable to standardize the minimum set of keyboard software-driven functions that should be made available by an operating system (and optionally, by an application), standardizing placement of the involved function keys at the same time.

6 Keyboard classification (linear keyboards, segmented keyboards, mono-handed keyboards, keyboards and input devices for disabled persons, specific keyboards for general [e.g. fixed and mobile telephones] and/or specific [banking, healthcare, trade, etc.] applications, virtual keyboards)

Disabled and elderly persons can have many different problems with using a keyboard. These can be divided into, for example, problems with recognizing the wanted key, problems with controlling the movement of the arms and fingers, difficulties with the mouse movements without trembling, possibility to use only one hand. This may result in different types of equipment to solve the problem.

Tactile identifiers are mentioned in ISO/IEC 9241-4 but not exactly specified. ETSI has produced a standard on specifying in detail the conventional “touch-type” marking on alphanumeric keys *F* and *J* and on the numerical keyboard part key *5*. One problem with the numerical keyboard is that the tactile identifier on key *5* does not distinguish between the “*1-2-3*” or “*7-8-9*” layout. It has been mentioned that the keyboard itself instead of the keys could be marked to tell which it is. Austria has proposed to have different marks.

7 Data entry methods for graphic character sets, numerical or non-numerical, use of numeric keypads, pen-based movements, alphabetic data entry using telephone keypads

Some mobile telephone systems (e.g.GSM) give the possibility to send text with the help of the telephone keypads (numeric keyboard). ISO/IEC 9995-8 assigns the letters *A* to *Z* to the digit keys. Additional characters are generally implemented and accessible through repeated pressing of the keys. The characters are then displayed in the window of the phone. A better and standardized way of doing this would be desirable to improve the usability of text input on small keyboards and to replace the variety of proprietary techniques in use in the industry.

8 Logical interface with the central unit, methods of recognition of keys (hardware or software recognized keys, use of scan codes, self-identifying keys, software-hidden keys, etc.)

Nowadays, most if not all keyboards on the market have integrated microprocessors which determine by themselves which keys of the keyboard are being typed and which send indications to a central computer (typically a PC) or a terminal controller whenever a key is depressed and when it is released, possibly with a repetitive indication at a given time interval if the key is kept depressed for a long-enough time). Each one of such indications is called a “scan code” (from the fact that the microprocessor is scanning the keyboard all the time to see if an electrical contact is made on the intersection of a row and column of the keyboard matrix circuitry).

The only thing that is sent to the computer is hence a code which is used to theoretically identify the coordinates of the keys depressed (for PCs these coordinates correspond to the original 1981 PC keyboard, a geometry that is no longer used), and this allows reprogramming the keyboard in the computer according to, for example, the language of the user, or for any other customized purpose. This method of operation is very flexible from a programming point of view; however, due to the numerous geometric reconfigurations of keyboards year after year and the necessity to be backward compatible, the software in the computer can no longer “know” for sure the actual location of a key depressed on the keyboard, which can be an annoyance if the keyboard is to be presented on the screen for help or actual operation purposes.

Furthermore, the software is not aware of what is engraved on the keys. At the end of the 1980s, LCD-display key keyboards were manufactured on a small scale which allowed the computer to show, in a programmable way, what were the characters supported by the keyboard driver in use. These keyboards were significantly expensive to produce (typically six times more than the average keyboard) and their production was stopped. This technology will possibly be replaced by less expensive ways of providing the same functionality, but which will probably be more expensive than standard keyboards.

One idea to make sure that the computer would be made aware of what is engraved on the computer is to assign, in addition to the scan code, an identification of the characters engraved on the keys (theoretically up to 9 characters per key, for up to 3 groups of up to 3 levels each according to ISO/IEC 9995) which could be queried by the computer to the keyboard. This would allow the keyboard to be made aware of the complete physical layout of the actual keyboard (for display or help purposes), including customized one, without affecting the “traditional” mode of keyboard operation, and also inexpensively. The best way to identify a character would be by using the canonical 4-octet encoding assigned to each character in the Universal Character Set (ISO/IEC 10646), which assigns a coding element to each one of the characters used by all known written languages on Earth and much beyond. To complete the solution to the physical placement of the keys on the keyboard, each key should be identified in such a system by its location using the grid system of coordinates of ISO/IEC 9995.

An issue that would remain would be, for help purposes, to make known to the computer all the keys of the keyboard whose depression is never indicated to the computer (keys such as *Fn* key on portable keyboards), and the location of these keys, by some private text identification and also by using the grid system of coordinates of ISO/IEC 9995. As the number of keys affected by those hidden keys can range from just this hidden key itself to all the other keys of the computer (whose depression is then not indicated to the computer), an easy way out of this would be for the keyboard to make the computer aware of its generic model identification.

9 Principles of adaptation related especially to linguistic and cultural characteristics

At present, ISO/IEC 9995 specifies the possibility to have many groups with three levels in each. It is hoped that in the future many keyboards will have the possibility to use this for, e.g., writing in different languages or for different applications. If there were many versions, it would also be preferable for the keyboard or connected PC to have a visual indication of the current active layout. It would also be helpful if there were an easy way to reset the keyboard to a default layout. This is something which is absolutely essential for people with visual defects.

Apart from this possibility to choose between different groups for applications and languages, it would also be possible to, e.g., configure different groups for different diacritics.

Further, it would be desirable for the keyboard to be able to identify for the connected system its different possible groups.

Another similar possibility is a way of toggling between different characters used in e.g. Japan, called IME (Input Method Editor). After setting the keyboard in the IME state, a list of the alternatives to a character is displayed on-screen to select from; the alternatives are shown either one-by-one or all at once. By default, i.e. if key-in continues without any action to choose another alternative, the first alternative should be picked. Getting the next or previous alternative could be done by the tab and back-tab, respectively.

10 Portability and interchangeability of keyboards and related input devices (drivers, physical [plugs] and electrical connectivity)

People who change cultural or linguistic environment or people who use special keyboards do not currently have the ability to plug their own keyboard to a different software or hardware platform. When their keyboard uses a standard layout, it is currently possible that a software driver be provided; but this does not solve the labelling problem of the unadapted keyboard. Furthermore, there will always be a need for special keyboards for people with special needs. A given user must be able to attach his keyboard or entry device to different environments (different computers with different operating systems, ATMs, etc.)

There are many technical approaches to improve the portability and interchangeability of keyboards and related input devices. One approach is through the use of a Universal Remote Console (or a virtual input interface), where a standard is defined for devices to provide a socket to their user interface in a modality-independent method. Any compliant device can connect to this socket via standard networking techniques and create a virtual interface between the input device and the target hardware or software platform. This approach will provide maximum flexibility between input devices and hardware or software platforms, and will provide a simple method for interfacing input devices for persons with special needs to standard computing devices. The use of standardized network connections between the input devices and hardware devices will eliminate the problem of physical plug incompatibilities.

11 Consistency of use between desktop and portable keyboards

A problem that has showed up with the mass-marketing of portable computers and multimedia-function-aware keyboards is the increased inconsistency of operation between the different models of keyboards. This can range from the simple problem of the user adapting to different keyboards not offering the same functionality to situations where productivity can be significantly affected to the point where normal operation can not proceed.

For example, typical portable computer keyboards use a special key position to switch display from the LCD device to an external display, and on many occasions such a portable computer's cover is shut over the keyboard so that the PC can be inserted in a docking station. In many instances, when the user has forgotten to switch his computer to the right display position, controlled by the portable computer hardware, it is not possible even to have any display through the docking station. The computer then has to be de-docked, or the workstation has to be physically reconfigured on the desk space (with the external display removed from its support base over the portable computer), so that the portable keyboard can be accessed, as the function to switch on the external display is typically not provided on an external keyboard.

On some proprietary computer systems, the keyboard controls the sound of external speakers, which precludes replacing the keyboard with another one to support ergonomic functions or extra languages, or even extra functionality normally associated with keyboards for persons with disabilities.

As a general rule, for a good keyboard user interface, special functions which do not belong to a keyboard per se should always be backed up by software-controlled key combinations on standard external keyboards and by software drivers which would give the appropriate orders to the computer whose keyboard is not accessible by the normal functions provided on its regular keyboard.

Generally speaking, a keyboard maker should avoid providing functions on the keyboard that can not be easily and intuitively backed up by any normal keyboard. Generally speaking too, it should go without saying, but unfortunately this has to be said as it is an current problem on the market, any portable computer manufacturer should provide keyboards whose software drivers are compatible with standard external keyboards.

12 Related input devices and especially pointing, dragging and tracing devices and free hand-input devices: mouse, track ball, stick, joystick, pen, tablet, stylus, light pen, eye-movement-driven data entry, etc.

At the time of preparation of this Technical Report, no International Standard relative to these user interfaces existed from a user system interface perspective. Nevertheless, there is still a need for an International Standards project to harmonize the different integration practices of the market with the user interface taken as a whole.