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Secretariat, ISO/IEC JTC 1, American National Standards Institute, 25 West 43rd Street, New York, NY 10036; Telephone: 1 212 642 4932; Facsimile: 1 212 840 2298; Email: lrajchel@ansi.org

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Information technology — Technical Report on future keyboards & other associated input devices & related entry methods

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR was prepared by Technical Committee ISO/TC SC 35, , Subcommittee SC 35, *Users Interfaces*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

Introduction

History of the keyboards series of standards, need for TR, current and anticipated problem areas, foreseen work items.

1 Scope

This Technical Report (TR) 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, virtual reality;

- virtual input requirements;

- labelling issues (soft [LCD] and hard, permanent and temporary labels), function symbols and icons;

- technical and manufacturing progress in the use of keyboards and other input devices (USB, wireless transmission…);

- implications of biometric input (fingerprint-, iris-pattern-, face-shape-based…) devices for access and security.

The 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 time of publication of this technical report.

2 References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Technical Report. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 9995:1994 (all parts), Keyboard layouts for text and office systems

ISO/TS 16071:2003 – Ergonomics of human-system interaction -- Guidance on accessibility for human-computer interfaces

ISO/IEC Guide 71:2001 – Guidelines for standards developers to address the needs of older persons and persons with disabilities

3 Terms and definitions

For the purposes of this Technical Report, the following terms and definitions apply/the terms and definitions given in ISO/IEC 9995 part 1 apply.

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

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

- The situation on 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 are interfering with character data entry. Because of the reduced size of the keyboard row A in particular is really confusing, function keys varying locations from model to model and not being 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 if the functions are not universal, a survey of the different functions should be made among the devices available on the market and reserving a relative location to each one in an international standard would be desirable.

- 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 from output representation]); another case in point is the function terminology that is multiple and does not always respect part 7.

5 Comfort of use and productivity considerations

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

- Standardisation of placement and functionality of common functions would appear to be possible as technology is stabilising (example: *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 remain to be fixed (American keyboards typically do not have a Level-3 select function, for example, and Group Select, when available, is done in different fashions due to lack of guidance in the first edition of ISDO/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 other character sets than those engraved on the keyboard in addition to these. This is of particular importance in a more and more global, multilingual environment. Such a scheme would not necessitate a change in the actual "scan-code" technology used today;

- Comfort of use is highly dependent of the actual work done by a specific user; reassigning keys allows to improve user productivity; 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 and this is rarely the case. As an example, the common square keyboard is not ergonomically designed according to the function of normal hands/arms but based on an average that is applied indistinctly to very user.

- Reassignment of actual "scan codes" of the physical keyboard by software would be desirable (so far such reassignment is very difficult at the keyboard-driver level if at all possible), 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 all "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 NP is desirable to standardise the minimum set of keyboard software-driven functions that should be made available by an operating system (and optionally, by an application), standardising 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 [fixed and mobile telephones…] and/or specific applications [banking, healthcare, trade...], virtual keyboards)

Disabled and elderly persons may have many different problems with using a keyboard. These problems may be split up in e.g. 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 tell the difference 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 instead 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

Alphabetic data entry using telephone keypads

Some mobile telephones systems (e.g.GSM) give the possibility to send text with help of the telephone keypads (numeric keyboard). ISO/IEC 9995-8 assign the letters A - Z to the digit keys. Additional characters are generally implemented and accessible through repeated pressing of the keys. The characters are then displayed on the window of the phone. A better and standardized way of doing it would be wanted 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 scancodes, self identifying keys, software-hidden keys...)

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 every 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 PC these coordinates correspond indeed 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 on one hand very flexible from a programming point of view. But on the other hand, 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 1980 years, 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 it 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 would be 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 a character should be identified 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 which depression is never indicated to the computer (keys such as Fn key on portable keyboards), and their location, by some private text identification and also in using the grid system of coordinates of ISO/IEC 9995. As the number of keys affected by those hidden keys may be everything from this hidden key itself to all the other keys of the computer (which depression is then not indicated to the computer), an easy way out of this would be that the keyboard make the computer aware of its generic model identification.

9 Principles of adaptation related especially to linguistic and cultural characteristics

Today ISO/IEC 9995 specifies the possibility to have many groups with three levels in each. Hopefully 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 is many versions it would also be preferable if the keyboard or connected PC had a visual indication which layout is at the moment active. It would also be helpful if there is an easy way to reset the keyboard to a default layout. This is something which is absolutely required by people with visual defects.

Except 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 if the keyboard could 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 state for IME a list of the alternatives for a characters to select from is displayed on-screen, either the alternatives are shown 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 possible that currently 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. There is a requirement so that a given user can 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 an 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 for maximum flexibility between input devices and hardware or software platforms, and will provide a simple method for interfacing input device 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 go to a simple difficulty of adaptation of the user 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 forgot to switch its computer to the right display position, controlled by the portable computer hardware, it is not possible to even have any display through the docking station, and 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 be accessed, as the function to switch on the external display is typically not provided on an external keyboard.

Some proprietary computer systems have their keyboards controlling the sound of external speakers, which preclude replacing the keyboard with another one to support ergonomic functions or extra languages, or even extra functionality normally associated to keyboards for persons with disabilities.

In a general way, 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 actual 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,...

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

13 Control of multimedia actions, mechanical functions (screen reversal, sound and clicker volume...), new additional functions (Internet integration, telephone, tv-tuner, fax...)

In the years since the release of ISO/IEC 9995:1994 the IT industry has developed many new technologies that might be accessed via the keyboard, including multimedia control (sound volume, Audio CD control, etc), screen controls, internet functionality, and many more. These functions have been implemented in proprietatry ways such that keyboard interoperability is not possible with these functions. As a part of good design, any non-standard commands available on keyboards should be available via other methods on the IT device. It would be desirable to survey all of the new functions available on keyboards, and also study adding some of these functions to future versions of ISO/IEC 9995.

14 Test methods for evaluation and optimization

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

15 Function symbols, design and disposition of symbols on keys, consistency between icons and symbols

A problem that has been raised a few years after the publishing of ISO/IEC 9995-7 (Keyboard function symbols) is the discrepancy between current icons implemented by different software makers and some functions whose symbols have been standardised internationally in 1994 (first publication of ISO/IEC 9995-7) or before (some keyboard function symbols were standardised in ISO 7000 before).

There is a need for a technical report that would make a complete survey of issues and document inter-relationship between symbols, icons and even coded characters (ISO/IEC 9995-7 symbols are encoded as workable coded characters in the Universal character set, ISO/IEC 10646, like many other industrial symbols). To be noted that a character-glyph model technical report, ISO/IEC 15285, was already produced by ISO/IEC JTC1 SC2. This could be taken into account too.

16 National keyboard layouts database

AFNOR maintains a registry of keyboard layouts, the access of each one currently being accessible by password to ISO and IEC national bodies. It is mandatory that the registration of keyboards be done by sponsoring national bodies. Interested parties should ask the SC35 secretariat for information about this topic via their national body.

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