SEMINAR REPORT

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ON

VIRTUAL KEYBOARD

VIRTUAL KEYBOARD

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UNDER THE GUIDANCE OF

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CERTIFICATE

This is to certify that ***AVINASH KUMAR CHAUHAN*** has given the seminar on the topic ***'VIRTUAL KEYBOARD'*** under the guidance of his facility within his time limit and his full effort to make his Seminar good.

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TABLE OF CONTENTS

1. INTRODUCTION

Virtual Keyboard is just another example of today's computer trend of 'smaller and faster'. Computing is now not limited to desktops and laptops, it has found its way into mobile devices like palm tops and even cell phones. But what has not changed for the last 50 or so odd years is the input device, the good old QWERTY keyboard.

The virtual keyboard technology is the latest development. The virtual keyboard technology uses sensor technology and artificial intelligence to let users work on any flat surface as if it were a keyboard. Virtual Keyboards lets you easily create multilingual text content on almost any existing platform and output it directly to PDAs or even web pages. Virtual Keyboard, being a small, handy, well-designed and easy to use application, turns into a perfect solution for cross platform text input.

The main features are: platform-independent multilingual support for keyboard text input, built-in language layouts and settings, copy/paste etc. Operations support just as in a regular text editor, no change in already existing system language settings, easy and user-friendly interface and design, and small file size.

The report first gives an overview of the QWERTY keyboards and the difficulties arising from using them. It then gives a description about the virtual keyboard technology and the various types of virtual keyboards in use. Finally drawbacks and the applications are discussed.

2. ‘QWERTY’ KEYBOARDS

2.1 Introduction

‘QWERTY’ is the most common keyboard layout on English-language computer and typewriter keyboards. It takes its name from the first six characters seen in the far left of the keyboard's top first row of letters.

2.2 Working

The working of a typical QWERTY keyboard is as follows:

1. When a key is pressed, it pushes down on a rubber dome sitting beneath the key. A conductive contact on the underside of the dome touches (and hence connects) a pair of conductive lines on the circuit below.

2. This bridges the gap between them and allows electric current to flow (the open circuit is closed).

3. A scanning signal is emitted by the chip along the pairs of lines to all the keys. When the signal in one pair becomes different, the chip generates a "make code” corresponding to the key connected to that pair of lines.

4. The code generated is sent to the computer either via a keyboard cable (using on-off electrical pulses to represent bits) or over a wireless connection. It may be repeated.

5. A chip inside the computer receives the signal bits and decodes them into the appropriate key press. The computer then decides what to do on the basis of the key pressed (e.g. display a character on the screen, or perform some action).

6. When the key is released, a break code (different than the make code) is sent to indicate the key is no longer pressed. If the break code is missed (e.g. due to a keyboard switch) it is possible for the keyboard controller to believe the key is pressed down when it is not, which is why pressing then releasing the key again will release the key (since another break code is sent).

2.3 Difficulties

It is now recognized that it is important to be correctly seated while using a computer. A comfortable working position will help with concentration, quality of work, and reduce the risk of long-term problems. This is important for all who use computers, and especially so for those with disabilities.

The increased repetitive motions and awkward postures attributed to the use of computer keyboards have resulted in a rise in Cumulative Trauma Disorders (CTDs) that are generally considered to be the most costly and severe disorders occurring in the office. Lawsuits for arm, wrist, and hand injuries have been filed against keyboard manufacturers allege that keyboarding equipment is defectively designed and manufacturers fail to provide adequate warnings about proper use to avoid injury.

As early as1926, Klockenberg described how the keyboard layout required the typist to assume body postures that were unnatural, uncomfortable and fatiguing. For example, standard keyboard design forces operators to place their hands in a flat, palm down position called forearm pronation. The compact, linear key arrangement also causes some typists to place their wrist in a position that is skewed towards the little fingers, called ulnar deviation. These awkward postures result in static muscle loading, increased muscular energy expenditure, reduced muscular waste removal, and eventual discomfort or injury. Researchers also noted that typing on the QWERTY keyboard is poorly distributed between the hands and fingers, causing the weaker ring and little fingers to be overwork.

3. VIRTUAL KEYBOARD

3.1 Introduction

Virtual Keyboard is just another example of today's computer trend of "smaller and faster". Computing is now not limited to desktops and laptops, it has found its way into mobile devices like palm tops and even cell phones. But what has not changed for the last 50 or so odd years is the input device, the good old QWERTY keyboard. Alternatives came in the form of handwriting recognition, speech recognition, abcd input (for SMS in cell phones) etc. But they all lack the accuracy and convenience of a full blown keyboard. Speech input has an added issue of privacy. Even folded keyboards for PDAs are yet to catch on. Thus a new generation of virtual input devices is now being paraded, which could drastically change the way we type.

Virtual Keyboard uses sensor technology and artificial intelligence to let users work on any surface as if it were a keyboard. Virtual Devices have developed a flashlight-size gadget that projects an image of a keyboard on any surface and let's people input data by typing on the image.

The device detects movement when fingers are pressed down. Those movements are measured and the device accurately determines the intended keystrokes and translates them into text. The Virtual Keyboard uses light to project a full-sized computer keyboard onto almost any surface, and disappears when not in use. The translation process also uses artificial intelligence. Once the keystroke has been decoded, it is sent to the portable device either by cable or via wireless.

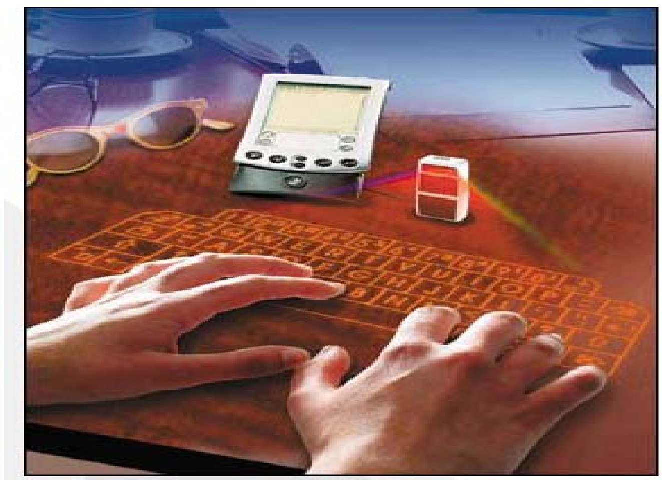

Fig 3.1: Virtual keyboard used in PDA's

The Virtual Keyboard uses light to project a full-sized computer keyboard onto almost any surface, and disappears when not in use. Used with Smart Phones and PDAs, it provides a practical way to do email, word processing and spreadsheet tasks, allowing the user to leave the laptop computer at home. The technology has many applications in various high-tech and industrial Sectors. These include data entry and control panel applications in hazardous and harsh environments and medical markets.

Projection key boards or virtual key boards claim to provide the convenience of compactness with the advantages of a full-blown QWERTY keyboard. An interesting use of such keyboards would be in sterile environments where silence or low noise is essential like operation theatres. The advantage of such a system is that you do not need a surface for typing; you can even type in plain air. The company's Virtual Keyboard is designed for anyone who's become frustrated with trying to put information into a handheld but doesn't want to carry a notebook computer around. There is also the provision for a pause function to avoid translating extraneous hand movements function, so that users can stop to eat, drink etc.

It is also a superior desktop computer keyboard featuring dramatically easier to learn touch-typing and leaving one hand free for mouse or phone. Combination key presses ("chords") of five main and two extra control keys allow users to type at 25-60 words per minute, with possibly greater speeds achieved through the use of abbreviation expansion software. Most users, however, will find memorizing the chords easy and fun, with the included typing tutorial. The scanner can keep up with the fastest typist, scanning the projected area over 50 times a second. The keyboard doesn't demand a lot of force, easing strain on wrists and digits. Virtual keyboards solve the problem of sore thumbs that can be caused by typing on the tiny keyboards of various gadgets like PDAs and cell phones. They are meant to meet the needs of mobile computer users struggling with cumbersome, tiny, or nonexistent keyboards. It might help to prevent RSI injuries.

The Virtual Keyboard uses an extremely durable material which is extremely easy to clean. The Virtual Keyboard is not restricted to the QWERTY touch-typing paradigm; adjustments can be done to the software to fit other touch-typing paradigms as well, such as the DVORAK keyboard. It will work with all types of Bluetooth enabled devices such as PDAs and smart phones, as well as wearable computers. Applications include computer/PDA input, gaming control, TV remote control, and musical applications. Thus virtual keyboards will make typing easier, faster, and almost a pleasure.

3.2 Virtual Keyboard Technology

This system comprises of three modules:

1. The sensor module.
2. IR-light source and
3. The pattern projector.

1. Sensor module:

Fig 3.2: Sensor Module

The Sensor Module serves as the eyes of the Keyboard Perception technology. The Sensor Module operates by locating the user's fingers in 3-D space and tracking the intended keystrokes, or mouse movements. Mouse tracking and keystroke information is processed and can then be output to the host device via a USB or other interface.

Electronic Perception Technology:

Electronic perception technology enables ordinary electronic devices to “see” the world around them so they can perceive and interact with it. Now everyday electronic devices in a variety of markets can perceive users’ actions, gaining functionality and ease of use.

The tiny electronic perception chips and embedded software work by developing a 3D “distance map” to nearby objects in real-time. This information is factored through an on-chip processor running imaging software that translates the image into defined events before sending it off-chip for application-specific processing. It’s an action that is continually repeated, generating over 30 frames of 3D information per second.

Electronic perception technology has a fundamental advantage over classical image processing that struggles to construct three-dimensional representations using complex mathematics and images from multiple cameras or points of view. This single chip “contour mapping” approach results in a high reduction of complexity, making it possible to embed the application independent processing software directly into the chips themselves – so they may be used in the most modestly-priced, and even pocket-sized electronic devices.

2. IR-light source:

Fig 3.3: IR-light source

The Infrared Light Source emits a beam of infrared light. This light beam is designed to overlap the area on which the keyboard pattern projector or printed image resides. This is done so as to illuminate the user's fingers by the infra-red light beam. This helps in recognizing the hand movements and the pressing of keys. The light beam facilitates in scanning the image. Accordingly the information is passed on to the sensor module which decodes the information.

An invisible infra-red beam is projected above the virtual keyboard. Finger makes keystroke on virtual keyboard. This breaks infrared beam and infrared light is reflected back to projector. Reflected infrared beam passes through infrared filter to camera. The camera photographs angle of incoming infrared light. The Sensor chip in the sensor module determines where the infrared beam was broken. Detected co-ordinates determine actions or characters to be generated.

3. The pattern projector:

Fig 3.4: Pattern projector

The Pattern Projector or optional printed image presents the image of the keyboard or mouse zone of the system. This image can be projected on any flat surface. The projected image is that of a standard QWERTY keyboard, with all the keys and control functions as in the keyboard.

The Projector features a wide-angle lens so that a large pattern can be projected from relatively low elevations. A printed image, with replaceable templates allows system flexibility, permitting most any kind of keyboard configuration for greater functionality.

In some types of virtual keyboards, a second infra-red beam is not necessary. Here the projector itself takes the inputs, providing dual functionality. A sensor or camera in the projector picks up the finger movements, and passes the information on to the sensor modules.

3.3 Working of Virtual Keyboard

Fig 3.5: Technology behind Virtual Keyboard

Step 1: Template creation (Projection Module)

A template of the desired interface is projected onto the adjacent interface surface. The template is produced by illuminating a specially designed, highly efficient holographic optical element with a red diode laser.

Note: the template serves only as a reference for the user and is not involved in the detection process. In a fixed environment, the template can just as easily be printed onto the interface surface.

Step 2: Reference plane illumination (Micro-illumination ModuleTM)

An infra-red plane of light is generated just above, and parallel to, the interface surface. This light is invisible to the user and hovers a few millimeters above the surface.

When the user touches a key position on the interface surface light is reflected from this plane in the vicinity of the key and directed towards the sensor module.

Step 3: Map reflection coordinates (Sensor Module)

Reflected light from user interactions with the interface surface is passed through an infra-red filter and imaged on to a CMOS image sensor in the sensor module.

Custom hardware embedded in the sensor chip (the Virtual Interface Processing CoreTM) then makes a real-time determination of the location of the reflected light.

The processing core can track multiple reflection events simultaneously and can thus support both multiple keystrokes and overlapping cursor control inputs.

3.4 Different Types

There are different types of virtual keyboards, manufactured by various companies which provide different levels of functionalities. The different types of virtual keyboards are:

3.4.1 Developer VKB

Fig 3.6: Developer VKB

Its full-size keyboard also can be projected onto any surface and uses laser technology to translate finger movements into letters. Working with Siemens Procurement Logistics Services Rechargeable batteries similar to those in cell phones power the compact unit. The keyboard is full size and the letters are in a standard format. As a Class 1 laser, the output power is below the level at which eye injury can occur.

3.4.2 Canesta

The Canasta Keyboard, which is a laser projected keyboard with which the same laser is also used to scan the projection field and extract 3D data. Hence, the user sees the projected keyboard, and the device "sees" the position of the fingers over the projected keys. They also have a chip set, Electronic Perception Technology, which they supply for 3rd parties to develop products using the projection/scanning technology. Canesta appears to be the most advanced in this class of technology and the only one who is shipping product. They have a number of patents pending on their technology.

Fig 3.7: Canasta Keyboard

3.4.3 Sense board Technologies

The Sense board SB 04 technology is an extreme case of a hybrid approach. The sensing transducer is neither a laser scanner nor a camera. Rather, it is a bracelet like transducer that is worn on the hands which captures hand and finger motion. In fact, as demonstrated, the technology does not incorporate a projection component at all; rather, it relies on the user's ability to touch type, and then infers the virtual row and key being typed by sensing relative hand and finger movement. The system obviously could be augmented to aid non-touch typists, for example, by the inclusion of a graphic representation of the virtual keyboard under the hands/fingers. In this case, the keyboard graphically represented would not be restricted to a conventional QWERTY keyboard, and the graphical representation could be projected or even on a piece of paper. I include it here, as it is a relevant related input transducer that could be used with a projection system. The technology has patents pending, and is currently in preproduction proof of Concept form.

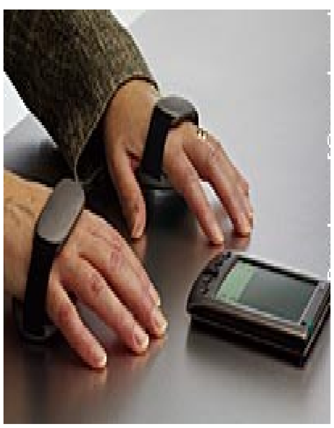


Fig 3.8: Sense board Technologies

Sensors made of a combination of rubber and plastic are attached to the user's palms in such a way that they do not interfere with finger motions. Through the use of Bluetooth technology, the "typed" information is transferred wirelessly to the computer, where a word processing program analyzes and interprets the signals into readable text. The device is currently usable via existing ports on personal digital assistants (PDAs) from Palm and other manufacturers. Sense board officials say it eventually will be compatible with most brands of pocket PCs, mobile phones and laptop computers.

3.4.4 KITTY

KITTY, a finger-mounted keyboard for data entry into PDA's, Pocket PC's and Wearable Computers which has been developed at the University of California in Irvine.

Fig 3.9: Kitty

KITTY, an acronym for Keyboard-Independent Touch-Typing, is a Finger mounted keyboard that uses touch typing as a method of data entry. The device targets the portable computing market and in particular its wearable computing systems which are in need of a silent invisible data entry system based on touch typing .the new device combines the idea of a finger mounted coding device with the advantages of a system that uses touch typing.

3.4.5 InFocus

InFocus is one of the leading companies in providing video and data projectors. Their projectors are conventional, in that they do not use laser technology. This has that advantage of delivering high quality colour images with a mature technology. However, it has the disadvantage of larger size, lower contrast, and higher power requirements, compared to laser projection systems. In 2000, InFocus merged with Proxima, which had been one of its competitors. I include InFocus/Proxima in this survey not only because they make projectors. In their early days, Proxima developed one of the first commercially available projection/vision systems. It was called Cyclops, and they still hold a patent on the technology. Cyclops augmented the projector by adding a video camera that was registered to view the projection area. The video camera had a band pass filter over the lens, which passed only the wavelength of a laser pointer.

The system, therefore, enabled the user to interact with the projected image, using a provided laser pointer as the input device. The camera detected the presence of the laser pointer on the surface, and calculated its coordinates relative to the currently projected image. Furthermore, the laser pointer had two intensity levels which enabled the user to not only point, but to have the equivalent of a mouse button, by the vision system interpreting the two levels as distinguishing button up and down events.

4. ADVANTAGES

1. It can be projected on any surface or you can type in the plain air.

2. It can be useful in places like operation theatres where low noise is essential.

3. The typing does not require a lot of force. So easing the strain on wrists and hands.

4. The Virtual Keyboard is not restricted to the QWERTY touch-typing paradigm; adjustments can be done to the software to fit other touch-typing paradigms as well.

5. No driver software necessary, it can be used as a plug and play device.

6. High battery life. The standard coin-sized lithium battery lasts about eight months before needing to be replaced.

5. DRAWBACKS

1. Virtual keyboard is hard to get used to. Since it involves typing in thin air, it requires a little practice. Only people who are good at typing can use a virtual keyboard efficiently.

2. It is very costly ranging from 150 to 200 dollars.

3. The room in which the projected keyboard is used should not be very bright so that the keyboard is properly visible.

6. APPLICATIONS

1. High-tech and industrial Sectors

2. Used with Smart phones, PDAs, email, word processing and spreadsheet tasks.

3. Operation Theatres.

4. As computer/PDA input.

5. Gaming control.

6. TV remote control.

7. CONCLUSION

Virtual Keyboard uses sensor technology and artificial intelligence to let users work on any surface as if it were a keyboard. Projection key boards or virtual key boards claim to provide the convenience of compactness with the advantages of a full-blown QWERTY keyboard. The company's Virtual Keyboard is designed for anyone who's become frustrated with trying to put information into a handheld but doesn't want to carry a notebook computer around.

Canesta appears to be the most advanced in this class of technology. Different types of virtual keyboards suit different typing styles. Thus virtual keyboards will make typing easier, faster, and almost a pleasure.

8. REFERENCES

1. http://www.newscom.com/cgi-bin/prnh
2. www.canesta.com
3. www.procams.org
4. www.billbuxton.com/3state.html
5. www.smarttech.com
6. www.3m.com/us/office/meeting/product_catalog/wd.jhtml
7. http://www.virtual-laser-keyboard.com/demo.asp