Inventions on Integrating Pointing Devices with Computer Keyboard

Umakant Mishra
Inventions on integrating Pointing Device with Computer Keyboard
-A study based on US patents

Umakant Mishra
Bangalore, India
http://umakantm.blogspot.in

Contents
1. Introduction ..................................................................................................................2
2. Inventions on integrating Pointing Devices with Computer Keyboard ..............2
   2.1 Joystick attachment for computer keyboard (4575591) ...................................2
   2.2 Using both stylus and keyboard for Portable computer (5241303) .................3
   2.3 Keyboard with attachable pointing device (5281958) ........................................4
   2.4 Modular keyboard (5865546) ..............................................................................5
   2.5 System for integrating pointing functions into keyboard (5269004) ...............6
   2.6 Computer keyboard with accessory platform (5880685) ................................7
   2.7 Cushion for keyboard cursor control stick (5889508) .......................................8
   2.8 Configurable keyboard to personal computer video game controller adapter
       (5896125) ........................................................................................................9
   2.9 Keyboard-compatible optical determination of object's position (5909210)
       .........................................................................................................................10
   2.10 Tri-fold personal computer with touchpad and keyboard (5926364) ..........11
   2.11 Combined keyboard and mouse employing conventional typing keys
       (5935655) .........................................................................................................12
   2.12 Multifunction Keyboard (6453027) ..................................................................13
   2.13 Mouse emulation keyboard system (6469694) .............................................14
   2.14 Emulating PS/2 mouse and keyboard functionality for a USB mouse and
       keyboard (6496891) .......................................................................................15
3. Reference: ..................................................................................................................17
1. Introduction

A keyboard is the most essential input device for the computer. Although a keyboard contains navigation keys, in most cases we use a pointing device like mouse to operate the cursor. There are many kinds of pointing devices like mouse, trackball, touchpad, touchstick, joystick and so on each used for different purposes. Although each of these pointing devices have specific advantages, the disadvantages of using all these pointing devices is that they occupy lot of desk space, clutter the table by using several cables and makes the place messy. Many inventors have tried to integrate one or more of these pointing devices with the computer so that the user can save space and get operating comfort as well.

2. Inventions on integrating Pointing Devices with Computer Keyboard

2.1 Joystick attachment for computer keyboard (4575591)

Background problem

Computer games are played with keyboard, mouse, joystick or other input devices. A joystick is a specialized input device for the purpose and often more suitable and preferred for gaming than other devices. Joystick is typically large to be comfortably held and operated by the player. This objective of a joystick does not allow it to be smaller. But practically it occupies lot of desk space. A computer table is hardly left with any space when a monitor, keyboard and joystick are in place.

Solution provided by the invention

Thomas Lugaresi disclosed a method of (Patent 4575591, Issued in March 86) attaching a joystick with a keyboard. The objective is to have a new and novel joystick attachment to the keyboard which can be attached and detached as required.

A joystick attachment for a computer keyboard which includes a bracket on which is supported a housing for a joystick assembly, the bracket being detachably mounted on a computer keyboard. The joystick is placed above the keyboard but
with some gap from the upper surface of the keys for safety. The attachable and detachable feature gives the dual benefit of a keyboard and joystick without loosing extra space.

TRIZ based solution
The same keyboard is changed to a joystick when the user wants to play a game and changed to a keyboard when the wants to input characters (Ideal Final Result).

The invention uses a joystick attachment to the keyboard, which is mounted on top of the keyboard without using additional table space (Principle-7: Nesting).

2.2 Using both stylus and keyboard for Portable computer (5241303)

Background problem
Some portable computers use a stylus as an input device. The stylus input computers are also referred to as pen-based computers or slate computers. As a laptop has limited space it is difficult to accommodate both the keyboard and the stylus into it. An external stylus is not convenient to carry.

Solution provided by the invention
Register et al. disclosed a method (Patent 5241303, assigned to Dell USA, Issued in Aug 93) of using both keyboard and stylus input in a very small compact computer. According to the invention the chassis of the system contains a bay in its underside where a detachable keyboard can be stored. For one-hand stylus input, the keyboard is left in its bay while the display is mounted flat on top of the system chassis. For keyboard input, the keyboard is mounted on the system chassis, and the display is supported at an angle which makes it easily visible to a user typing on the keyboard. This method provides separate ergonomically advantageous positions for keyboard input and for stylus input.

In a first position the keyboard is mounted on the top of the chassis so that a user can place the computer on a desk in front of him, and type on the keyboard with both hands while looking at the display. In a second position the keyboard is safely stored in its bay. The computer provides a small unit which can be carried in one hand with a display/touch-screen exposed. Thus the user can hold it in
one hand and wield the stylus in the other as is desirable for a stylus-operated computer.

**TRIZ based analysis**
The same keyboard should turn into a stylus when required *(Ideal Final Result)*.

One solution is to split the keyboard surface and use half the surface for keyboard and half for the stylus *(Principle-1: Segmentation)*. But this is not a good solution, as it will make the keyboard too small to operate.

This invention makes detachable keyboard and stack the stylus and keyboard one on top of the other *(Principle-7: Nesting)* and alter the position as required to bring the active one to the top *(Principle-15: Dynamize)*.

### 2.3 Keyboard with attachable pointing device (5281958)

**Background problem**
A mouse takes quite a lot of space on the desktop and does not move with the movement of keyboard. When you pull the keyboard to your lap, there is no place for keeping the mouse. A laptop computer is often used in environments where a work surface is not provided. There is a need to move the pointing device according to the movement of the keyboard.

**Solution provided by the invention**
Ashmun et al. invented a keyboard (Patent 5281958, assigned to Microsoft, Issued in Jan 94) to which a pointing device is attachable through a clamp. The pointing device is attachable not only to the keyboard but even to any part of the computer such as the screen. The pointing device is coupled to an attachment or clamping assembly. The variable clamping assembly makes it suitable to fit into any type and size of different keyboards.

![Figure 2](image)

The full weight of the pointing device is supported by the clamps and the holding keyboard. This makes it movable with the keyboard and eliminates the need of extra working surface for the pointing device.
TRIZ based analysis
The pointing device should be placeable at any position of user comfort (desired result).

The invention attaches the pointing device with the keyboard (or elsewhere) by using a clamp (Principle-5: Merging).
This makes the position (or placement) of the pointing device flexible to be mounted anywhere instead of being placed only the table (Principle-15: Dynamize, Principle-17: Another Dimension).
The pointing device can be placed at different sides of the keyboard and even on the monitor by using a clamp (Principle-24: Intermediary, Principle-15: Dynamize).

2.4 Modular keyboard (5865546)

Background problem
The modern keyboards are having more number of special purpose keys. The 83 keys of the early days' keyboards have been increased to 101 keys to include additional control and function keys. But this enhancement of the keyboard has certain drawbacks. (i) There are two sets of navigation keys out of which most users use only either of the sets. (ii) Besides the user has to use one or more external pointing devices each having a separate cable to connect to the rear side of the computer making the table messy. (iii) Moreover each device needs additional desk space.

Solution provided by the invention
Ganthier et al. found the solutions to all the above by disclosing a modular keyboard (US patent 5865546, Assigned to Compaq, Issued in Feb 99). The modular keyboard has several openings in which any of the input modules can be inserted. The user can insert a module and replace a module independently.
The disclosed modular keyboard has two additional slots other than the basic keyboard module. The user can use any two extra devices depending on need, either a numeric pad and a trackball, or a trackball and joystick or any two other devices depending on need. The user can plug in and plug out any device as required. A controller in the keyboard assembly will determine which types of input device modules are coupled with the keyboard assembly. This has the advantage of no extra cables, quick reconfiguration and saving of space.

**TRIZ based analysis**

Ideally the same keyboard should provide functions of a pointing device, navigation keys, joystick and other devices without needing extra cables and desk space for each device required (Ideal Final Result).

The invention uses the same keyboard cable for all other external devices thus avoiding separate connections for each device to the computer (Principle-6: Universality).

The invention proposes to connect upto two attachments such as pointing device, navigation keys or joystick etc. and remove the other attachments that are not used (Principle-2: Taking out).

The invention allows connecting multiple pointing devices of our choice into some sockets on the keyboard (Principle- Nesting).

We can select any two devices of our choice out of various devices including trackball, touchpad, joystick, pointing stick, or stylus etc. to plug into the keyboard (Principle- Dynamize).

**2.5 System for integrating pointing functions into keyboard (5269004)**

**Background problem**

In many cases a pointing device like mouse is useful to move a cursor from one location to other. But there is some disadvantage of moving the hands from one location (from keyboard) to another location (to mouse) which degrades the performance of data entry operations.

One approach to solve this problem is by using the cursor control keys provided on the keyboard. But the cursor keys are usually positioned at the right side of the keyboard and the user has to move his hand from the home position.

**Solution provided by the invention**

Comerford et al. disclosed to implement a pointing function (Patent 5269004, assigned by IBM, issued Dec 1993) on a computer keyboard by sensing a lateral force applied in the place of the tops of the keyboard keys. According to the invention the computer keyboard is implemented with a lateral force detecting device for determining the magnitude and direction of a force which is applied to
the surface of the keys. The sensed force is then used as a control signal to move the cursor pointer.

The invention advises the presence of a processor within the keyboard to distinguish between lateral forces arising from user’s intention to move the cursor and unintentional lateral forces caused during keystrokes by using distinctive force timing signatures.

**TRIZ based analysis**

The invention uses the same keys on the keyboard to move the cursor pointer without moving your hand to operate a mouse (*Principle-6: Universality*).

While the vertical depression of the keys are used for character generation, the lateral force on the keys are used for cursor movement (*Principle-17: Another dimension*).

**2.6 Computer keyboard with accessory platform (5880685)**

**Background problem**

Conventionally the keyboards are doing the job of a keyboard. Cannot we extend the functionality of the keyboard to do multiple functions? Besides we need to reduce the size of the keyboard for notebooks and portable computers.

**Solution provided by the invention**

James Weeks disclosed a new type of keyboard (Patent 5880685, March 99) having only four rows of keys in contrast to five rows of keys in the conventional keyboard (*Principle- Taking out*). All the keys are accessed only by moving the fingers and without moving the hand from a central location. The space bar and enter keys are actuated by pressing horizontally rather than vertically as in standard keyboards (*Principle- Another Dimension*). The keyboard also includes an accessory platform that can accommodate audio speakers, microphone, detachable antenna, notepad and pen and other accessories. The keyboard has labels of lower-case letters.
TRIZ based analysis
The invention makes the keyboard to accommodate audio speakers, microphone, notepad, pen and other accessories (Principle-38: Enrich). Reorganizing the location of function keys and special keys reduces the overall size of the keyboard (Principle-17: Another Dimension).

2.7 Cushion for keyboard cursor control stick (5889508)

Background problem
The notebook computers generally come with a control stick as a cursor pointing device. The control stick is typically mounted between the "G", "H" and "B" keys on a standard "QWERTY"-type keyboard. When the user puts some horizontal pressure on the stick the cursor moves in the corresponding direction. Some models of control sticks are hard which become slippery because of perspiration or natural body oils. When the user applies excessive force to control the cursor, it affects the finger and hand muscles to get physically tired, causes irritation, inflammation and bruising of the finger tissues after prolonged use.

Solution provided by the invention
Slotta disclosed a method (Patent 5889508, March 99) to attach a cushion to the control stick to take care of this issue. The cushion is flexible enough to prevent tissue damages to the user’s fingers due to repetitive motions. The cushion can be used on an existing control stick by fixing it through adhesive.

Later in patent 6621485 the same inventor (Slotta) discloses a method of gel filled cushion.

**TRIZ based analysis**

The control stick should be soft and suitable for human skin *(Desired result).*

The invention uses a cushion on the control stick, which is soft to operate *(Principle-11: Cushioning).*

The later invention uses gel to provide cushioning effect *(Principle-29: Pneumatics and hydraulics).*

### 2.8 Configurable keyboard to personal computer video game controller adapter (5896125)

**Background problem**

Typically joysticks are used to control the video games on the computers. If there are two players to play a game, it needs two such adapters to take input from individual players. Typically only one joystick can be connected to a game port. Games needing multiple game ports create problem.

**Solution provided by the invention**

Niedzwiecki invented an adapter (Patent 5896125, April 99) which has got a socket for the keyboard and sockets for multiple joysticks. The system will contain a user defined association list to map the keys of the game port that of the keyboard. During the time of operation, the input from the game port is sent to the keyboard port based on the association list.
TRIZ based analysis
The computer should support multiple joysticks for multiple players (desired result).

The invention attaches multiple joysticks to the keyboard (Principle-5: Merging). The joystick control signals are converted to keyboard control signals (Principle-36: Conversion) for computer input.

2.9 Keyboard-compatible optical determination of object’s position (5909210)

Background problem
There are several pointing devices including mouse, trackball, touchpad, touchscreen, joystick and so on. Each has its own advantages and disadvantages. A mouse although convenient to hold, requires significant amount of space. The cable of a cabled mouse obstructs the movement of mouse. All pointing devices also need to move the hand from the keyboard to the pointing device which looses the flow of typing.

Solution provided by the invention
Knox et al, invented a method (patent 5909210, assigned to Compaq Computer Corporation, June 99) which communicates positional information to the computer by obstructing a light grid with the user’s finger. The method provides an optical digitizer comprising a light grid. The light source and light sensor detects the obstacle made by user’s finger. This method does not require the user to move its hands out of the keyboard, so enables the user’s time to be more effectively utilized.
TRIZ based analysis
The user need not move hands from the keyboard to operate the pointing device (Ideal Final Result).

The invention integrates a pointing device very much inside the keyboard like a control stick in other inventions (Principle-5: Merging).

The method substitutes a manual control (of mouse or trackball) with an optical control (Principle-28: Mechanics Substitution).

2.10 Tri-fold personal computer with touchpad and keyboard (5926364)

Background
The notebook computers are small, light but expensive. The desktop computers are powerful, cheaper but large. There is a need to combine the elements of both desktop and a notebook computer and get the benefits of both.

Solution provided by the invention
Karidis disclosed a solution (patent 5926364, assigned to IBM, July 99) of a hybrid packaging design for a portable personal computer. The invention comprises a tri-fold mechanical structure with a touch-screen display screen and a detachable keyboard, which is easy to pack with the computer. It has a stylus, a wireless remote control and other devices as well. The user can operate through the touchpad using fingers or a stylus.
TRIZ based analysis
The small notebook computer should contain all the features of a desktop computer (desired result).

Normally a notebook has a folded display unit (Principle-15: Dynamize). This invention proposes to increase the number of folds to threefold (Principle-17: Another dimension).

It uses a detachable keyboard (Principle-15: Dynamize).

2.11 Combined keyboard and mouse employing conventional typing keys (5936555)

Background problem
Conventionally mouse is used as the most popular pointing device. Although a mouse does the expected job of the device, it has some drawbacks. The conventional mouse is a separate device that uses up valuable desk space. Besides as the same hand is used for operating the keyboard and mouse the user has to stop using one while using the other. There is a need to achieve the functionality for a pointing device like mouse without wasting so much of space and without needing to move your hand to use the device.

There are other pointing devices to solve this problem like trackballs, touch-pads, and pointing sticks which are integrated with keyboards. But they are not as efficient as the conventional mouse.

Solution provided by the invention
Zagnoev discovered a keyboard combined with a pointing device (Patent 5936555, Aug 1999). The keyboard is broken into two parts (Principle-Segmentation) having one them movable on the support surface. All the keys of
a standard keyboard are located on the keyboard, equally distributed on both the halves. One of the keyboard parts can be gripped and be moved on support surface as a mobile keyboard part to generate pointing movement commands to cause movement of a pointing member on the computer. A transducer is used to detect relative movement or positioning of the mobile part of the keyboard and a communication means is provided between the two keyboard parts.

**TRIZ based analysis**

The mouse should not use any desk space. Besides the user need not stop operating keyboard while operating the mouse *(desired result)*.

The invention attaches the mouse with the keyboard *(Principle-5: Merging)*. This brings the mouse closer to the keyboard and facilitates undisrupted keyboard operation. The mouse can use the surplus space on the keyboard *(Principle-25: Self Service)*.

**2.12 Multifunction Keyboard (6453027)**

**Background problem**

Conventionally the keyboards are used for typing alphanumeric characters where as there is a great potentiality for the keyboard to do a variety of different functions such as Internet phone function, audio input/output function, computer speaker switching function, recording function, burglar alarm function, telephone function etc. in addition to its original function of entering characters and symbols to the system.

**Solution provided by the invention**

Kang Hwan et al. invented a multifunction keyboard (patent 6453027, Sep 2002) which performed a variety of functions apart from its usual functions of inputting characters. The multifunction keyboard comprises a computer speaker switching unit for adjusting a tone level and performing a computer speaker/ headset mode switching operation, an audio input/output unit having audio input and output terminals for inputting and outputting audio signals, a semiconductor-type recording unit having a recording button for performing a recording operation while it is pushed by the user, and a play button for performing a playback.
operation when it is pushed by the user in a one-touch manner, a telephone unit for conducting a direct conversation with a call-connected party and performing an internet phone function, telephone function, extension exchange function, redial function, mute function, hook function, flash function, headset function, speaker phone function and message recording function, burglar alarm unit having a PIR sensor for sensing a body temperature of a trespasser, a door opening sensor and a fire sensor.

TRIZ based analysis
The computer keyboard should provide all other functionalities that the user might require during computer operation (desired result).

The invention adds telephone, multimedia, remote control and other such functions into the keyboard (Principle-40: Composite).

2.13 Mouse emulation keyboard system (6469694)

Background problem
Conventionally computers use separate keyboards and mouse, which plug into separate ports via separate cables. In some places like shop floors it’s not convenient to have two separate devices.

Solution provided by the invention
Peter Mikan invented a keyboard (patent 6469694, Oct 02) which solves this problem by incorporating a bifurcated keyboard cable such that normal keyboard functions are interfaced to the keyboard port and the normal mouse functions are interfaced to the mouse port. But both the events are generated by the keyboard alone. The objective is to fool the computer to believe that two separate devices are interfaced to it when in fact there is only one device connected to it via two separate ports. As the ports are different for mouse and keyboard, it is possible to emulate the mouse function by hardware as contrast to software emulation. The keyboard microprocessor and a mouse function microprocessor may be combined into a single microprocessor.
As per the invention there are some dual function keys which do the function of a keyboard and on a toggle option the functions of a mouse. When the key is pressed the mouse pointed moves pixel by pixel (slow) and when pressed for a longer period it moves faster and faster.

**TRIZ based analysis**

The devices should use no cables to be connected with the computer *(Ideal Final Result)*.

There are some integrated dual function keyboards, but they simulate the mouse function on the keyboard by using the keyboard port. Some other methods simulate mouse by the software alone without any hardware emulation. *(Principle-26: Copying)*. But a software simulation or an integrated hardware utilize the same keyboard port. The simulated devices are not functionally transparent to the computer because they have interfaced via the same keyboard port.

This invention solves a problem by using a two-in-one cable which bifurcates to connect both keyboard and mouse port *(Principle-5: Merging)*.

**2.14 Emulating PS/2 mouse and keyboard functionality for a USB mouse and keyboard (6496891)**

**Background problem**

Recently USB ports are popularly used for connecting various devices to the computer. The recent operating systems like windows 2000 have the feature to automatically detect the devices connected to an USB port which simplifies installing USB peripheral devices. But the older operating systems like DOS, Windows 3.1, Win 95 etc. does not support USB mouse. But they support PS/2 keyboard and PS/2 mouse.
Solution provided by the invention
Cluff et al. disclosed a method of emulating PS/2 interrupts from USB keyboards (patent 6496891, assigned to Intel Corporation, Dec 02). The method uses an interrupt request (IRQ) register to trigger the interrupts. The invention eliminates the need of a PS/2 controller to run USB keyboards.

TRIZ based analysis
This problem can be solved by using a PS/2 controller as an intermediary (Principle-24: Intermediary). The USB keyboard and USB mouse communicates through the controller for PS/2 keyboard and PS/2 mouse, which causes the USB keyboard/USB mouse to be recognized and treated as if they were PS/2 keyboard and PS/2 mouse (Principle-36: Conversion). But this mechanism requires PS/2 controller and ports to be physically present which requires space in the computer.

This invention makes USB keyboard and USB mouse to emulate interrupts to be appeared and treated as PS/2 devices by older operating systems without needing the presence of a controller for PS/2 keyboard and PS/2 mouse (Principle-26: Copying).
3. Reference:


2. US Patent 5241303, “Using both stylus and keyboard for portable computer”, Register et al., assigned to Dell USA, Aug 93

3. US Patent 5281958, “Pointing device with adjustable clamp attachable to a keyboard”, Ashmun et al., assigned to Microsoft, Jan 94


6. US Patent 5880685, Keyboard with accessory platform, having only 4 rows of keys, Invented by James Weeks, patented March 99


12. US Patent 6453027, Multi-function keyboard having telephone, multimedia, remote control and other function, Kang Hwan et al., Sep 2002

13. US Patent 6469694, Mouse emulation keyboard, Peter Mikan, Oct 02

14. US Patent 6496891, Emulating PS/2 keyboard and mouse functionality from USB keyboard and mouse, Cluff et al., assigned to Intel Corporation, Dec 02