

Description

The present invention generally relates to Computer Assisted Design (CAD) systems, and more particularly to an inexpensive and easy to use CAD application for personal computers.

Computer Assisted Design (CAD) and Computer Assisted Manufacturing (CAM) systems have been used for some time in the aircraft and automotive industries to design and manufacture aerodynamic and mechanical components. Such systems typically comprise a main frame computer, large bulk memory systems including tape units, rigid disk units and removable disk pack units, high resolution All Points Addressable (APA) Cathode Ray Tube (CRT) displays, a large Random Access Memory (RAM) of sufficient capacity to store the graphics application and address each pixel of the high resolution displays, and Input/Output (I/O) devices such as digitizer pads with cursors and plotters. These systems are very expensive, but their cost could be justified because of the large sums of money invested in the design and manufacture of an aircraft or a new automobile model. The price of CAD systems has come down significantly over the past decade due to economies of computer and memory system manufacture, and because of that, CAD systems are being applied to many new uses among which are architectural design and the layout of photoresist patterns for integrated circuits. Nevertheless, CAD systems are still quite expensive, and their use is generally limited to correspondingly expensive applications. An illustration of such systems is given by the article entitled "Dialogbedienung über Bildschirm und virtuelle Tastaturen bei der Bildkonstruktion", by M. Shahata, published in *Regelungs technische Praxis*, Vol. 19, No. 9, September 1977. This article discloses a CAD system in which preset graphic symbols can be repetitively drawn on a display screen, from one or several tables of graphic symbols. Each table of symbols can be displayed in the form of a virtual keyboard, and a desired symbol can be selected by a light pen and positioned on the screen at any desired place.

At the other end of the spectrum are the so-called personal computers based on the microprocessors which have been developed over the past decade. These typically comprise a mother board containing the microprocessor, a Read Only Memory (ROM) encoded with the Basic Input/output System (BIOS) for controlling the microprocessor, a limited amount of RAM, and a number of adapters for interfacing with various I/O devices. These I/O devices may include a keyboard, a medium or high resolution CRT display, one or more floppy disk drives, and a printer such as one of the more popular dot matrix printers.

Although personal computers are small and compact, they are capable of some fairly sophisticated applications. They are especially well suited to business applications such as accounting, data base management and business analysis.

Recently, a number of business applications have been developed which include graphics support. These applications take the input or calculated numerical data and produce line graphs, bar charts and pie charts which are much easier to interpret than the raw numerical data. Prints of these graphical displays are made by reading out the data in the APA display RAM to a dot matrix printer provided with a graphical capability or to an inexpensive pen plotter. The latter device is also capable of generating transparencies for use in overhead projectors. The acceptance of business applications with graphics support has been immediate and substantial with the result that there is a considerable demand for graphics applications which are not necessarily limited to business graphs. The ability to generate schematic diagrams, flow charts, floor plans and similar graphic displays would be highly desirable in the production of technical manuals, advertising layouts and the like.

It is therefore an object of the invention to provide an inexpensive Computer Assisted Design (CAD) application for personal computers.

It is another object of the invention to provide a CAD system for personal computers which is easy to use and facilitates the generation of schematic diagrams, flow charts and other free form graphics displays.

It is a further object of the invention to provide a user friendly CAD application for personal computers which is operated by an inexpensive joy stick or similar device and supports a dot matrix printer or inexpensive plotter.

The present invention relates to a computer system providing an interactive graphics display comprising:

- a processor
- a keyboard for inputting alphanumeric characters and control data,

- a memory for storing a program for controlling said processor and data which is processed by said processor under the control of said program,
- input and output adapters to which various input and output devices may be connected, and
- interactive all points addressable display means connected to an output adapter for displaying data processed by said processor, characterized in that

- cursor positioning means are provided, which are connected to an input adapter for providing an input to said processor indicating a desired direction of movement of a cursor symbol displayed on said all point addressable display means,

- at least one table of selectable cursor graphic and/or alphanumeric characters is stored in said memory,

- said processor is responsible to said cursor positioning means for controlling said all point addressable display means for displaying graphic and/or alphanumeric data at any addressable point on said display means, and said processor includes:

- means for selecting a cursor character from

said table, the selected character being displayed on said all points addressable display means as the cursor symbol and movable to any point on said display means by said cursor positioning device, and

means for fixing the selected cursor symbol at a desired point on said all point addressable display means thereby facilitating the generation of a graphics display including any arbitrary selection of cursor symbols from said table, said cursor positioning means being capable of moving the currently displayed cursor symbol to another location on said all points addressable display means immediately after an image of said selected cursor symbol has been fixed at a desired point on the display.

In summary, the objects of the invention are accomplished by making the cursor symbol a graphics character or an A/N string which may be moved about the display screen by means of a joystick or similar input device. Once the graphics character or A/N string is positioned at the desired location, the operator presses a command button, and the graphics symbol or A/N string is fixed in position on the display screen by reading the symbol data into the display buffer at that position. The cursor symbol can be moved again to another location on the display and another character fixed in position on the display by pressing the command button. Different cursor symbols can be selected from symbol tables so that a variety of symbols can be used to generate the graphics display. The current cursor symbol is demarked from other graphics characters fixed in the display by continuously exclusive ORing the cursor symbol with the background graphics data. In addition, an erase function is provided to allow the correction of mistakes and modification of standard symbols.

The foregoing and other objects, advantages and aspects of the invention will be better understood from the following detailed description of the invention making reference to the accompanying drawings, in which:

Figure 1 is a system block diagram of a typical personal computer on which the application according to the invention is operated;

Figure 2 is a block diagram of a color/graphics monitor adapter of the type which is required to support the application according to the invention;

Figure 3 is a block diagram of a game control adapter of the type which provides a joystick input to the personal computer shown in Figure 1;

Figure 4 is a flow diagram illustrating the procedure for loading a cursor symbol table;

Figure 5 is a flow diagram illustrating the procedure for displaying a loaded cursor symbol table;

Figure 6 is a flow diagram illustrating the procedure for selecting a new cursor symbol for a loaded symbol table;

Figure 7 is a flow diagram illustrating the procedure for demarking the current cursor symbol from other graphics symbols which may be displayed on the screen;

Figure 8 is a flow diagram illustrating the procedure for generating a circle of any radius at any desired position on the display screen;

Figure 9 is a flow diagram illustrating the procedure for entering and positioning A/N strings in the display;

Figure 10 is a flow diagram illustrating the procedure for erasing previously entered graphics data on the screen; and

Figure 11 illustrates a sample display generated using the application according to the invention.

In order to better understand the invention, a typical personal computer will be first described with reference to Figure 1 of the drawings. The system or mother board 10 includes the micro-processor 12, ROM 14, RAM 16, and an I/O channel 18 which includes a number of I/O expansion slots 20 for the attachment of various options. A power supply 22 provides power to the mother board 10 and the attached options. The mother board 10 in addition includes a crystal oscillator, clock and control circuits 24 and a keyboard attachment 26 to which a keyboard 28 is attached. In addition, the mother board may also include other attachments such as a cassette attachment 30 and a speaker attachment 32 to which are connected a cassette recorder 34 and a speaker 36, respectively. The expansion slots 20 are designed to receive any of the various adapter printed circuit cards shown in the figure. More specifically, a diskette drive adapter 38 may be plugged into one of the slots 20. This adaptor 38 is required to support one or more diskette drives 40 and 42. A color/graphics monitor adapter 44 may also be plugged into one of the slots 20, and this adapter supports either a home color TV or an RGB monitor and a light pen. A parallel printer adapter 46 may be plugged into another one of slots 20 to support, for example, a dot matrix printer 48. Finally, a game control adapter 50 can be plugged into a remaining one of the slots 20 to support one or more joy sticks 52 and 54. Other adapters may be plugged into the slots 20, but only those necessary to support the present invention are illustrated.

The color/graphics adapter 44 has two basic modes of operation; alphanumeric (A/N) and APA. In both modes, A/N characters are defined in a character box and formed from a ROM characters. Figure 2 is a block diagram of the adapter 44 which contains a display buffer 56 and a CRT controller device 58 such as a Motorola 6845 IC. The controller device 58 provides the necessary interface to drive a raster scan CRT. The display buffer 56 can be addressed by both the CPU and the controller device 58 through address latches 60 and 62, respectively. Data is read out of the display buffer to data latches 64 and 66 which provide outputs to a graphics serializer 68 and a character generator comprising ROM 70 and an alpha serializer 72. The outputs of the serializers 68 and 72 are provided to the color encoder 74 which either drives an RGB monitor directly or provides an output to the composite color generator 76 that drives a home color TV. The color encoder 74 also receives the output of the palette/overscan circuits

78 which provides intensity information. The composite color generator 76 receives horizontal and vertical synchro signals from the CRT controller device 58 and timing control signals from the timing generator and control circuits 80. The timing generator and control circuits also generate the timing signals used by the CRT controller device 58 and the display buffer 56 and resolves the CPU and controller contentions for accessing the display buffer.

Figure 3 is a block diagram of the game control adapter 50. The adapter comprises instruction decode circuits 80 which may be composed of 74LS138 IC's. The data bus is buffered by a 74LS244 buffer/driver 82. The digital inputs to this buffer/driver are provided by trigger buttons on the joy sticks. The joystick positions are indicated by a potentiometer for each coordinate which must be converted to digital pulses by resistance to pulse converter 84. This is accomplished by providing a one-shot for each potentiometer so that the potentiometer varies the time constant of its associated one-shot. A select output from decoder 80 causes the one shots to be fired to provide pulse outputs to the buffer/driver 82.

Although the invention is described as using a joy stick to position a cursor symbol on the display screen, it will be understood by those skilled in the art that other input devices can be used including cursor keys on a keyboard. The cursor keys are, however, inherently slow to operate, and so it is preferable to use a joy stick or similar type input device. Besides a joy stick, a "mouse" might just as well be used. These devices have a ball on the bottom of a palm size controller, and the ball is rolled on a flat surface to control the cursor position.

Typically, the ball actuates potentiometers in a manner quite similar to a joy stick. Thus, everywhere a joy stick is mentioned in the description of the invention, those skilled in the art will recognize that a "mouse" or other similar input device could be substituted.

According to the invention, the cursor on the CRT display is replaced by a graphics symbol or an A/N character string and moved by means of a joy stick or similar device. When the graphics symbol or A/M character string are positioned on the display at the desired position, the operator presses a trigger button on the joy stick and the graphics symbol or A/N character string remain fixed at that location by reading the symbol data into the display buffer. A new graphics character or A/N character string can then be selected for the cursor symbol and the process repeated so that a schematic diagram, flow chart or similar graphics display can be built. Previously positioned graphics characters or A/N character strings can be erased totally or partially by means of a box cursor and the operation of the trigger button on the joy stick. This allows not only for the correction of errors but also the generation of modified characters giving more flexibility to the defined character tables. In addition, since the selected cursor symbol will remain the cursor

symbol until changed even after a graphics character or A/N character string has been positioned on the display screen, the cursor symbol is at all times exclusive ORed with display data of all coincident pixels as it is moved about the display screen to provide a clear and visible demarkation of the cursor symbol from other symbols previously placed at various locations on the display screen. Thus, the invention allows a fully interactive positioning of graphics characters and/or A/N character strings at any addressable point on the display screen. Since the screen information is contained in the APA display buffer, the screen can be printed in the usual way to provide a hard copy output thereby facilitating the production of technical illustrations, manuals or the like.

The underlying feature of the invention is the use of a graphics character as the cursor symbol. Therefore, one and preferably more symbol tables are provided. For example, a table could be provided for electrical symbols, another for architectural symbols, and another for industrial process symbols. Each symbol in each table is identified by number so that the code for a symbol includes both the table to which it belongs as well as its number within the table. In order to select a cursor symbol, a symbol table must first be loaded into RAM. This process is illustrated by the flow diagram shown in Figure 4. When the operator requests a new symbol table, s/he is first prompted for the name of the symbol table as indicated by block 86. The name input by the operator is checked to determine if it is a valid name, that is it identifies a table that exists in the current library of tables. This is indicated by the decision block 88. If the name is not a valid name, an error message is displayed to the operator at block 90 and the operator is again prompted for the name of the symbol table desired. When a valid name is input by the operator, the old cursor symbol is exclusive ORed with itself to delete the symbol from the display screen as indicated by block 92. Then in block 94 the new symbol table is loaded into RAM, and in block 96, the first graphics character is exclusive ORed with the current cursor symbol to cause the first graphics character to be displayed as the cursor symbol. In other words, the first graphics character is the default cursor symbol.

The default cursor symbol may not be the symbol desired by the operator, so it may be desirable to display the selected symbol table to permit selection of the desired symbol. This process is illustrated by the flow diagram shown in Figure 5. When the operator requests that the symbol table be displayed, the title of the currently selected symbol table is first displayed as indicated by block 98. The title will always be displayed during this process no matter how the field of the display may change. In other words, any given symbol table may be too large to fit on a single screen and it may be necessary to scroll the display in order for the operator to view all the symbols in the table. While the field of the display may be scrolled, the title placed on the screen by

block 98 will remain. Once the title of the table has been put up, the numbers for the various graphics characters are next put up as indicated by block 100, and then the actual graphics characters are put up adjacent their corresponding number as indicated by block 102. Three function keys identified as F3, F2 and F1 are monitored to detect if they have been pressed by the operator as indicated by the decision blocks 104, 106 and 108. If for example key F3 has been pressed, then the graphics screen is redrawn as indicated by block 110. When this is done, the operator is presented a display of the graphics screen as s/he had generated it to that point in time. If F2 is pressed, then the symbol table is scrolled down a predetermined amount as indicated by block 112, but if F1 is pressed, the symbol table is scrolled up a predetermined amount as indicated by block 114. In other words, the function keys F3, F2 and F1 give the operator control of the display screen after the symbol table is displayed. F3 allows the operator to exit the display, and F2 and F1 allow the operator to scroll the display.

It is not necessary to display the symbol table each time it is desired to change the cursor symbol. The operator may already know the numbers of the symbols s/he wants to use in generating a graphics display, or more likely, the operator will have printed copies of the symbol tables to refer to. In any event, once a symbol table has been loaded according to the process illustrated in Figure 4 and the first symbol of the table is displayed as the default cursor symbol, the operator may wish to change the cursor symbol. This is accomplished with the selection of a new symbol according to the procedure illustrated in the flow diagram of Figure 6. The operator selects a cursor symbol by number within the currently loaded table. The first thing that is done when a cursor symbol selection has been made is to retrieve the table entry as indicated in block 116 and then in block 118 validate the entry. It will be understood that the various cursor symbol tables will not necessarily be the same size and that a symbol number that is valid for one table may be valid for another. Should the operator enter an invalid symbol number, an error message is displayed as indicated by block 120 and the operator is returned to the selection menu. Assuming that a valid symbol number is selected, the old cursor symbol is deleted from the screen by exclusive ORing the symbol with itself as indicated in block 122. Then using the table entry, the offset into the symbol table is determined in block 124.

This provides the access to the desired symbol code for the character generator in block 126, and in block 128, the new cursor symbol is displayed by exclusive ORing the symbol with the background data on the screen.

This latter process is the basis for demarking the current cursor symbol from other graphics symbols already placed in the graphics display. It will be appreciated that since the cursor of the subject invention is not a conventional cursor

mark but rather a graphics symbol that is moved like a cursor to a desired position on the display screen and then fixed by command, there is the possibility that the operator might lose track of where and which of several currently displayed symbols is the cursor. This is accomplished in part by making the cursor symbol a flashing symbol as is conventional, but in addition, the current cursor symbol is exclusive ORed with the background display data to clearly demark the symbol where ever it may be on the screen from other graphics data already in place on the screen. This procedure is illustrated by the flow diagram shown in Figure 7. In block 130, the current X, Y position as commanded by the joy stick control and the cursor symbol data are input and exclusive ORed. Then in blocks 132 and 134, the X and Y positions are temporarily stored as X_{old} and Y_{old} . The current X and Y coordinates are obtained from the joy stick or cursor key input in block 136. Then in blocks 138 and 140 X_{old} , Y_{old} and the cursor symbol data are exclusive ORed and current X, Y and the cursor symbol data are exclusive ORed. This removes the cursor symbol from the display, screen and then redisplay it at its new location. The process is then repeated.

Besides the several symbol tables from which the operator can select a variety of cursor symbols, lines can be drawn between positioned symbols by indicating the coordinates of the end points of the line in the conventional manner. In addition, many graphics displays will make use of circles or arcs. Rather than provide a table of circles, a process for displaying a circle of any desired radius is provided. This process is illustrated in the flow diagram shown in Figure 8. First the operator presses a function key F5 to indicate that s/he desires to draw a circle. This causes a conventional cursor symbol to appear on the screen and represents the center of the circle. The operator can then position this center on the screen using the joy stick. Then by pressing the trigger button on the joy stick, the circle center is fixed as indicated by block 142. Once this is done, the X, Y coordinates of the center are obtained in block 144, and in block 146, a circle of five units is drawn. This is the smallest diameter circle that is displayed. The trigger button is then monitored as indicated by the decision block 146, and if it is pressed, the circle is expanded by one unit in block 148. In this way the operator can increase the size of the circle, and when the desired size has been reached, the operator releases the trigger button.

As previously mentioned, the cursor symbol may be an A/N string as well as a graphics character. The operator enters the A/N mode by making the appropriate menu selection. The process is illustrated by the flow diagram shown in Figure 9. The number of A/N characters entered are counted and so in block 150, the counter is set to 1. The operator is prompted in block 152 to input text from the keyboard, and as each character is keyed, the character equivalent of the operator's entry is put on the screen in block 154.

Assuming that the "ENTER" key has not been pressed in decision block 156, the counter is incremented by one in block 158 and then checked in decision block 160 to determine if the maximum allowed number of characters has been entered. In the case illustrated, the maximum number of characters is sixty, but any number of characters can be arbitrarily set. The process continues until either the operator presses the "ENTER" key or the maximum number of characters has been entered at which time a buffer is loaded with all the A/N characters keyed by the operator as indicated by block 162. This buffer is treated as the cursor symbol data which can be positioned anywhere on the display screen by use of the joy stick. Thus, the A/N string is continually exclusive ORed on the screen as the current cursor until the trigger button is pressed by the operator as indicated by block 164. In other words, when the operator enters the text mode from the menu, s/he first keys in the desired text, presses "ENTER" and then moves the A/N string around the screen as the current cursor symbol. When the text string is in the desired position, the trigger button on the joystick is pressed and the A/N string is fixed in the display data field.

All good designers need an eraser to correct mistakes and modify standard symbols. The erase mode is entered by making the appropriate selection from a menu, and upon entry into this mode, the cursor symbol is changed to a rectangular box of predetermined dimensions. The process is illustrated by the flow diagram shown in Figure 10. After the menu selection, the current X, Y position of the "eraser" rectangle is obtained as indicated in block 166. In decision block 168, the trigger button on the joy stick is monitored to determine if it has been pressed. If it has not been pressed, the position of the "eraser" rectangle is checked again and so on while the operator moves the "eraser" rectangle around the display screen. When the "eraser" rectangle is positioned over that area of the display screen which is desired to be erased, the operator presses the trigger button which causes all the display data within the "eraser" rectangle to be set to "zeros" to blank that area of the display screen as indicated by block 170. It is also possible to move the "eraser" rectangle with the joy stick while pressing the trigger button which will result in all display data within the path of the "eraser" rectangle to be reset to "zeros". The procedure allows graphics data to be removed from the display screen easily and accurately.

Figure 11 is an illustration of a graphics display constructed using the invention. Only a few graphics symbols were used plus circles, lines and A/N strings. Each symbol was selected from a table of symbols and then positioned at a desired location on the display screen using the joy stick and trigger button. At the bottom of the display is a menu from which the operator may make selections of operating modes.

From the foregoing, it will be appreciated that the invention provides an inexpensive CAD

application for personal computers which is easy to use and facilitates the generation of many graphics displays that heretofore could be generated using only much more expensive equipment.

Claims

1. Computer system providing an interactive graphics display comprising

a processor (12),
a keyboard (28) for inputting alphanumeric characters and control data,

a memory (14, 16) for storing a program for controlling said processor and data which is processed by said processor under the control of said program,

input and output adapters to which various input and output devices may be connected, and interactive all points addressable display means connected to an output adapter for displaying data processed by said processor, characterized in that

cursor positioning means (52) are provided, which are connected to an input adapter for providing an input to said processor indicating a desired direction of movement of a cursor symbol displayed on said all point addressable display means,

at least one table of selectable cursor graphic and/or alphanumeric characters is stored in said memory,

said processor (12) is responsible to said cursor positioning means (52) for controlling said all point addressable display means for displaying graphic and/or alphanumeric data at any addressable point on said display means, and said processor includes

means for selecting a cursor character from said table, the selected character being displayed on said all points addressable display means as the cursor symbol and movable to any point said display means by said cursor positioning device; and

means for fixing the selected cursor symbol at a desired point on said all points addressable display means thereby facilitating the generation of a graphics display including any arbitrary selection of cursor symbols from said table, said cursor positioning means (52) being capable of moving the currently display cursor symbol to another location on said all points addressable display means immediately after an image of said selected cursor symbol has been fixed at a desired point on the display.

2. System according to claim 1, further including a display buffer (56) for addressing said all point addressable display means, and wherein said means for fixing include means for reading the current cursor position and data into said display buffer.

3. System according to claim 1 or 2 wherein said means include a joy stick (52) and said means for fixing further include a trigger button associated with said joy stick.

Assuming that the "ENTER" key has not been pressed in decision block 156, the counter is incremented by one in block 158 and then checked in decision block 160 to determine if the maximum allowed number of characters has been entered. In the case illustrated, the maximum number of characters is sixty, but any number of characters can be arbitrarily set. The process continues until either the operator presses the "ENTER" key or the maximum number of characters has been entered at which time a buffer is loaded with all the A/N characters keyed by the operator as indicated by block 162. This buffer is treated as the cursor symbol data which can be positioned anywhere on the display screen by use of the joy stick. Thus, the A/N string is continually exclusive ORed on the screen as the current cursor until the trigger button is pressed by the operator as indicated by block 164. In other words, when the operator enters the text mode from the menu, s/he first keys in the desired text, presses "ENTER" and then moves the A/N string around the screen as the current cursor symbol. When the text string is in the desired position, the trigger button on the joystick is pressed and the A/N string is fixed in the display data field.

All good designers need an eraser to correct mistakes and modify standard symbols. The erase mode is entered by making the appropriate selection from a menu, and upon entry into this mode, the cursor symbol is changed to a rectangular box of predetermined dimensions. The process is illustrated by the flow diagram shown in Figure 10. After the menu selection, the current X, Y position of the "eraser" rectangle is obtained as indicated in block 166. In decision block 168, the trigger button on the joy stick is monitored to determine if it has been pressed. If it has not been pressed, the position of the "eraser" rectangle is checked again and so on while the operator moves the "eraser" rectangle around the display screen. When the "eraser" rectangle is positioned over that area of the display screen which is desired to be erased, the operator presses the trigger button which causes all the display data within the "eraser" rectangle to be set to "zeros" to blank that area of the display screen as indicated by block 170. It is also possible to move the "eraser" rectangle with the joy stick while pressing the trigger button which will result in all display data within the path of the "eraser" rectangle to be reset to "zeros". The procedure allows graphics data to be removed from the display screen easily and accurately.

Figure 11 is an illustration of a graphics display constructed using the invention. Only a few graphics symbols were used plus circles, lines and A/N strings. Each symbol was selected from a table of symbols and then positioned at a desired location on the display screen using the joy stick and trigger button. At the bottom of the display is a menu from which the operator may make selections of operating modes.

From the foregoing, it will be appreciated that the invention provides an inexpensive CAD

application for personal computers which is easy to use and facilitates the generation of many graphics displays that heretofore could be generated using only much more expensive equipment.

Claims

1. Computer system providing an interactive graphics display comprising
 - a processor (12).
 - a keyboard (28) for inputting alphanumeric characters and control data,
 - a memory (14, 16) for storing a program for controlling said processor and data which is processed by said processor under the control of said program,
 - input and output adapters to which various input and output devices may be connected, and
 - interactive all points addressable display means connected to an output adapter for displaying data processed by said processor, characterized in that
 - cursor positioning means (52) are provided which are connected to an input adapter for providing an input to said processor indicating desired direction of movement of a cursor symbol displayed on said all point addressable display means,
 - at least one table of selectable cursor graphic and/or alphanumeric characters is stored in said memory,
 - said processor (12) is responsible to said cursor positioning means (52) for controlling said all point addressable display means for displaying graphic and/or alphanumeric data at an addressable point on said display means, and
 - said processor includes
 - means for selecting a cursor character from said table, the selected character being displayed on said all points addressable display means as the cursor symbol and movable to any point said display means by said cursor positioning device and
 - means for fixing the selected cursor symbol at desired point on said all points addressable display means thereby facilitating the generation of a graphics display including any arbitrary selection of cursor symbols from said table, said cursor positioning means (52) being capable of moving the currently display cursor symbol to another location on said all points addressable display means immediately after an image of said selected cursor symbol has been fixed at desired point on the display.
2. System according to claim 1, further including a display buffer (56) for addressing said all point addressable display means, and wherein said means for fixing include means for reading the current cursor position and data into said display buffer.
3. System according to claim 1 or 2 wherein said means include a joy stick (52) and said means for fixing further include a trigger button associated with said joy stick.



4. System according to any one of the preceding claims, further comprising:

a text buffer for storing an alphanumeric character string input to said computer system from said keyboard (28),

means for displaying said alphanumeric character string stored in said text buffer on said display means as a cursor symbol,

means controlled by said cursor positioning means (52) for moving said cursor symbol to a desired location on said display means by exclusive Oring the alphanumeric character string in said text buffer with the all points addressable data already displayed on said display means at the location of said cursor position data thereby placing text comprising said alphanumeric character string at said desired location on said display means,

means in combination with said cursor positioning device for providing a user input indicating that text is to be fixed on said display means, and

means responsive to said means in combination with said cursor positioning device for writing said alphanumeric character string into said display buffer at the current location of said cursor.

5. System according to claim 4 further comprising:

means for counting the number of characters in an alphanumeric character string input by a user from said keyboard,

means for comparing the number of characters input with a predetermined number,

means on said keyboard for providing an input from the user of an indication of an end of said alphanumeric character string, and

means responsive to said comparing means and to said means on said keyboard for storing an input alphanumeric character string in said text buffer when either the number of characters in said alphanumeric character string is equal to said predetermined number or an input for the user is received by said means on said keyboard.

6. System according to any one of the preceding claims, wherein

said processor includes means for displaying the outline of a geometric figure as said cursor symbol on said all points addressable display, said outline being movable by said cursor positioning means (52); and

means associated with said cursor positioning means (52) are provided for erasing all character data within said outline while said outline is positioned at or moved through a desired location on said all points addressable display.

7. System according to claim 6 wherein said means for erasing the data within said outline includes means for setting all data points in said display buffer corresponding to those data points within said outline when said outline is positioned at or passes through a desired location on said all points addressable display, to zeros.

Patentansprüche

1. Computersystem, welches eine interaktive graphische Anzeigeeinrichtung vorsieht, enthaltend

einen Prozessor (12)

eine Tastatur (28) zum Eingeben von alphanumerischen Zeichen und Steuerdaten,

einen Speicher (14, 16) zum Speichern eines Programms zur Kontrolle des genannten Prozessors und von Daten, welche vom genannten Prozessor unter der Kontrolle des genannten Programms verarbeitet werden,

Eingabe- und Ausgabeadapter, an welche verschiedene Eingabe- und Ausgabegeräte angeschlossen werden können, und

interaktive, adressierbare Mehrpunkt-Anzeigemittel, die an einen Ausgabeadapter angeschlossen sind zur Anzeige der vom genannten Prozessor verarbeiteten Daten, dadurch gekennzeichnet, dass

Kursorpositionierungsmittel (52) vorgesehen sind, welche an einen Eingabeadapter angeschlossen sind, um eine Eingabe an den genannten Prozessor zu liefern, welche eine gewünschte Bewegungsrichtung eines auf den genannten adressierbaren Mehrpunkt-Anzeigemitteln dargestellten Kursorsymbols anzeigt,

zumindest eine Tabelle von auswählbaren Kursor-, Druck- und/oder alphanumerischen Zeichen im genannten Speicher gespeichert ist,

der genannte Prozessor (12) den genannten Kursorpositionierungsmitteln (52) gegenüber verantwortlich ist für die Steuerung der genannten adressierbaren Mehrpunkt-Anzeigemittel zur Anzeige von graphischen und/oder alphanumerischen Daten an irgendeinem adressierbaren Punkt an den genannten Anzeigemitteln, und dass

der genannte Prozessor enthält

Mittel zur Auswahl eines Kursorzeichens aus der genannten Tabelle, wobei das genannte Zeichen an den genannten adressierbaren Mehrpunkt-Anzeigemitteln als das Kursorsymbol angezeigt wird, und durch die genannte Kursorpositionierungsvorrichtung (52) nach jedem beliebigen Punkt auf den genannten Anzeigemitteln bewegtlich ist; und

Fixiermittel des ausgewählten Kursorsymbols an einem gewünschten Punkt auf den genannten adressierbaren Mehrpunkt-Anzeigemitteln und dabei zur Erleichterung der Erzeugung einer graphischen Anzeige, welche irgendeine willkürliche Auswahl von Kursorsymbolen aus der genannten Tabelle beinhaltet, wobei die genannten Kursorpositionierungsmittel (52) in der Lage sind, das gegenwärtig angezeigte Kursorsymbol nach einer anderen Stelle auf den genannten adressierbaren Mehrpunkt-Anzeigemitteln zu bewegen, unmittelbar nachdem ein Bild des genannten ausgewählten Kursorsymbols an einem gewünschten Punkt auf der Anzeigeeinrichtung fixiert worden ist.

2. System nach Anspruch 1, enthaltend ferner einen Anzeigepuffer (56) zur Adressierung der



genannten adressierbaren Mehrpunkt-Anzeigemittel, und worin die genannten Fixiermittel Mittel zum Einlesen der gegenwärtigen Kursorposition und -daten in den genannten Anzeigepuffer enthalten.

3. System nach Anspruch 1 oder 2, worin die genannten Mittel einen Steuerhebel (52) beinhalten und die genannten Fixiermittel einen dem genannten Steuerhebel zugeordneten Auslöseknopf ferner enthalten.

4. System nach einem der vorangehenden Ansprüche, enthaltend ferner:

Einen Textpuffer zur Speicherung einer alphanumerischen Zeichenfolge, welche von der genannten Tastatur (28) in das genannte Computersystem eingegeben wird,

Mittel zur Anzeige der genannten im genannten Textpuffer gespeicherten, alphanumerischen Zeichenfolge auf den genannten Anzeigemitteln als ein Kursorsymbol,

von den genannten Kursorpositionierungsmitteln (52) gesteuerte Mittel zur Bewegung des genannten Kursorsymbols nach einer gewünschten Stelle auf den genannten Anzeigemitteln durch exklusives Mischen der alphanumerischen Zeichenfolge im genannten Textpuffer mit den adressierbaren Mehrpunkt-Daten, welche bereits auf den genannten Anzeigemitteln an der Stelle der genannten Kursorposition dargestellt werden, wobei die Daten den die genannte alphanumerische Zeichenfolge enthaltenden Text an die gewünschte Stelle auf den genannten Anzeigemitteln setzen,

Mittel in Verbindung mit der genannten Kursorpositionierungsvorrichtung zur Lieferung einer Benutzereingabe, welche anzeigt, dass der Text auf den genannten Anzeigemitteln fixiert werden soll, und

Mittel, ansprechend auf die genannten Mittel in Verbindung mit der genannten Kursorpositionierungsvorrichtung zum Einschreiben der genannten alphanumerischen Zeichenfolge in den genannten Anzeigepuffer an der gegenwärtigen Stelle des genannten Kursors.

5. System nach Anspruch 4, enthaltend ferner:

Mittel zum Zählen von Zeichen in einer alphanumerischen Zeichenfolge, welche von einem Benutzer von der genannten Tastatur aus eingegeben werden,

Mittel zum Vergleich der Anzahl von Zeicheneingaben mit einer vorbestimmten Zahl,

Mittel an der genannten Tastatur zur Lieferung von einer Benutzereingabe einer Endanweisung der genannten alphanumerischen Zeichenfolge, und

Mittel, welche auf die genannten Vergleichsmittel und auf die genannten Mittel an der genannten Tastatur ansprechen zur Speicherung einer Eingabe einer alphanumerischen Zeichenfolge im genannten Textpuffer, wenn entweder die Anzahl der Zeichen in der genannten alphanumerischen Zeichenfolge gleich der genannten vorbestimmten Zahl ist oder eine Eingabe für den Benutzer durch die genannten Mittel an der genannten Tastatur empfangen wird.

6. System nach einem der vorangehenden Ansprüche, worin

der genannte Prozessor Mittel enthält zur Anzeige des Umrisses einer geometrischen Figur als das genannte Kursorsymbol auf der genannten adressierbaren Mehrpunkt-Anzeige, wobei der genannte Umriss durch die genannten Kursorpositionierungsmittel (52) beweglich ist; und

den genannten Kursorpositionierungsmitteln (52) zugeordnete Mittel, die vorgesehen sind zum Löschen aller Zeichendaten innerhalb des genannten Umrisses, während der genannte Umriss auf der genannten adressierbaren Mehrpunkt-Anzeige an eine gewünschte Stelle gesetzt oder durch dieselbe hindurchbewegt wird.

7. System nach Anspruch 6, worin die genannten Mittel zum Löschen der Daten innerhalb des genannten Umrisses Mittel enthalten zum Rücksetzen aller Datenpunkte im genannten Anzeigepuffer, welche jenen Datenpunkten innerhalb des genannten Umrisses entsprechen, wenn der genannte Umriss auf der genannten adressierbaren Mehrpunkt-Anzeige an einer gewünschten Stelle gesetzt wird oder durch dieselbe hindurchgeht.

Revendications

1. Un système de calculateur à affichage graphique interactif, comprenant:

un processeur (12),

un clavier (28) pour entrer des caractères alphanumériques et des données de commande,

une mémoire (14, 16) pour emmagasiner un programme pour commander ledit processeur et lesdites données qui sont traitées par ledit processeur sous la commande dudit programme,

des adaptateurs d'entrée et de sortie auxquels divers dispositifs d'entrée et de sortie peuvent être connectés, et

des moyens d'affichage interactifs adressables en tout point, connectés à un adaptateur de sortie pour afficher des données traitées par ledit processeur, caractérisé en ce que:

des moyens de positionnement du curseur (52) sont prévus et sont connectés à un adaptateur d'entrée pour appliquer une entrée audit processeur pour indiquer la direction désirée du mouvement d'un symbole de curseur affiché sur ledit moyen d'affichage adressable en tout point,

au moins une table de sélection de graphiques de curseur et/ou de caractères alphanumériques est emmagasinée dans ladite mémoire,

ledit processeur (12) répond auxdits moyens de positionnement de curseur (52) pour commander lesdits moyens d'affichage adressables en tout point pour afficher des données graphiques et/ou alphanumériques en n'importe quel point adressable sur lesdits moyens d'affichage,

et en ce que ledit processeur comprend:

des moyens pour sélectionner un caractère de curseur de ladite table, le caractère sélectionné étant affiché sur lesdits moyens d'affichage adressables en tout point comme symbole de curseur et mobile en n'importe quel point sur



lesdits moyens d'affichage par ledit dispositif de positionnement de curseur (52), et

des moyens pour fixer le symbole de curseur sélectionné en un point désiré desdits moyens d'affichage adressables en tout point, ce qui facilite ainsi la génération d'un affichage graphique comprenant une sélection arbitraire quelconque des symboles de curseur depuis ladite table, lesdits moyens de positionnement de curseur (52) pouvant déplacer le symbole de curseur affiché à cet instant en un autre point desdits moyens d'affichage adressables en tout point immédiatement après qu'une image dudit symbole de curseur sélectionné ait été fixée en un point désiré sur l'unité d'affichage.

2. Un système selon la revendication 1 comprenant en outre une mémoire intermédiaire d'affichage (56) pour adresser lesdits moyens d'affichage adressables en tout point et dans lequel lesdits moyens de fixation comprennent des moyens pour lire la position présente du curseur et des données dans ladite mémoire intermédiaire d'affichage.

3. Un système selon la revendication 1 ou 2 dans lequel lesdits moyens comprennent un levier de commande (52) et lesdits moyens de fixation comprennent en outre un bouton de déclenchement associé audit levier de commande.

4. Un système selon l'une quelconque des revendications précédentes, comprenant en outre:

une mémoire intermédiaire de texte pour emmagasiner l'entrée d'une série de caractères alphanumériques dans ledit système de calculateur depuis ledit clavier (28),

des moyens pour afficher ladite série de caractères alphanumériques emmagasinés dans ladite mémoire intermédiaire de texte sur lesdits moyens d'affichage comme un symbole de curseur,

des moyens commandés par lesdits moyens de positionnement de curseur (52) pour déplacer ledit symbole de curseur en un point désiré sur lesdits moyens d'affichage par la mise en condition OU exclusif de la série de caractères alphanumériques dans ladite mémoire intermédiaire de texte, les données adressables en tout point étant déjà affichées sur lesdits moyens d'affichage à l'emplacement desdites données de position du curseur, ce qui place ainsi le texte comprenant ladite série de caractères alphanumériques à l'emplacement désiré sur lesdits moyens d'affichage,

des moyens en combinaison avec ledit dispositif de positionnement de curseur pour offrir une entrée pour l'utilisateur indiquant que le texte est à fixer sur lesdits moyens d'affichage, et

des moyens répondant auxdits moyens en combinaison avec ledit dispositif de positionnement de curseur pour écrire ladite série de caractères alphanumériques dans ladite mémoire intermédiaire d'affichage à l'emplacement présent dudit curseur.

5. Un système selon la revendication 4 comprenant en outre:

des moyens pour compter le nombre des caractères dans l'entrée d'une série de caractères alphanumériques effectuée par un utilisateur au travers dudit clavier,

des moyens pour comparer le nombre des caractères de l'entrée à un nombre prédéterminé,

des moyens sur ledit clavier pour permettre une entrée par l'utilisateur pour indiquer la fin de ladite série de caractères alphanumériques, et

des moyens répondant auxdits moyens de comparaison aux auxdits moyens prévus sur ledit clavier pour emmagasiner une série de caractères alphanumériques d'entrée dans ladite mémoire intermédiaire de texte lorsque le nombre des caractères dans ladite série de caractères alphanumériques est égal audit nombre prédéterminé ou qu'une entrée par l'utilisateur est reçue par lesdits moyens depuis ledit clavier.

6. Un système selon l'une quelconque des revendications précédentes dans lequel:

ledit processeur comprend des moyens pour afficher le cadre d'une figure géométrique comme ledit symbole de curseur sur ledit affichage adressable en tout point, ledit cadre étant mobile sous la commande desdits moyens de positionnement de curseur (52) et

des moyens associés auxdits moyens de positionnement de curseur sont prévus pour effacer toutes les données de caractères dans ledit cadre tandis que ledit cadre est positionné à ou déplacé au travers d'un emplacement désiré sur ledit affichage adressable en tout point.

7. Un système selon la revendication 6 dans lequel lesdits moyens pour effacer les données dans ledit cadre comprennent des moyens pour conditionner à zéro tous les points de données dans ladite mémoire intermédiaire d'affichage correspondant aux points de données dans ledit cadre lorsque ledit cadre est positionné à ou passe dans un emplacement désiré sur ledit affichage adressable en tout point.

