(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 031 579 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.03.2009 Bulletin 2009/10

(51) Int Cl.:
G09G 5/00 *(2006.01)*

(21) Application number: **08160851.5**

(22) Date of filing: **22.07.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **28.08.2007 TR 200705955**

(71) Applicant: **Vestel Elektronik Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(72) Inventors:
- **Onder, Devrim**
  35430 Izmir (TR)
- **Eralp, Ozgür**
  35430 Izmir (TR)
- **Sezer, Cem**
  35430 Izmir (TR)

(74) Representative: **Cayli, Hülya**
Paragon Consultancy Inc.
Koza Sokak No: 60/6
GOP
06700 Ankara (TR)

(54) **Screen saver via on screen display (OSD) percentage detection**

(57) A method and system for protecting the display devices against the pixel burn-in problem is described. The method can also be applied to all set-top boxes and display devices that need similar protection. The method provides a screen saving method by calculating the OSD percentage value and according to changes in this value and activating the screen protection procedure. These percentage values are used to determine the static OSD during a pre-determined time period. If OSD is perceived as static during the period, pixel burn-in protection methods are activated. The method is independent from user actions.

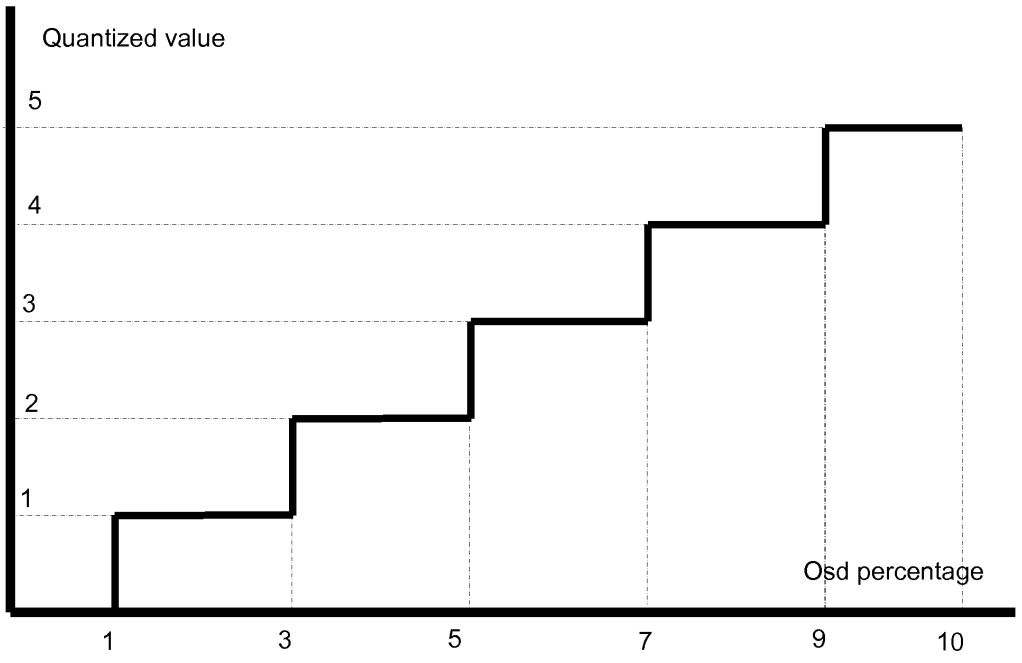


Figure-2

EP 2 031 579 A2

Description

Technical Field

[0001] This invention is related to a protection method for all types of display devices against pixel burn-in problem. The method can also be applied to all kind of devices that are used as video input device.

Prior Art

[0002] In plasma display devices, the image is formed by illumination of tiny coloured fluorescent lights. Each pixel is made up of three fluorescent lights; a red light, a green light and a blue light. The display device is controlled by changing the intensities of the different lights to produce a full range of colours.

[0003] The tiny gas-filled pixels are activated by generating a high amount of power. The ultraviolet photons are radiated, as a result of the gas discharge of high voltage inside the sub pixel. These photons, which are not visible to human eye, are used to excite the phosphor coated at the surface of the pixel. By this way, the phosphor glows and images are formed.

[0004] In a plasma display, when a bright image has been left on one location of the screen for an extended period of time (depending on the panel structure, brightness level and contrast level), the pixels in that region get hot (because of ion bombardment) and a thin surface layer forms over the phosphor. This thin surface layer resists the penetration of the UV photons that excites the phosphors during operation. So the pixels age prematurely and shine less brightly than the others. This problem is called Pixel Burn-in.

[0005] If right half of a plasma screen is fully saturated (i.e. bright white) and the other half is left black for a long time, the right half of the screen will appear to be dimmer. Especially blue pixels dim more quickly than green or red pixels, due to the shorter life span of the blue phosphor gas. Thus, in normal use and after a long period of usage of the display device, the blue pixels will dim more, and the screen will appear to have "yellowed".

It is obvious that the phosphorus will degrade quickly if the panel is operated at high levels of brightness. Also for the static images (such as a stock ticker, a network logo, or letterbox bars) this procedure will speed up.

[0006] One of the precautions against this problem is to use burn-in protection methods. Since pixel burn-in occurs as a result of the static images, the aim is to change the illumination colour of the pixels continually.

[0007] One of these methods as known in the industry is "automatic screen-saver". Screen saver is a method to reduce pixel burn-in caused by static images. It moves the picture around the screen in small amounts at set intervals. Automatic screen-saver normally starts after a predetermined time and prevents burn-in if the display device is left unattended.

[0008] In patent document US 6563495, a method and system for an automatic screen saver is defined. In this method, a peak value of characteristics such as beam current magnitude of a video signal being processed is determined. An average value of the same characteristics of the video signal is calculated. According to the changes in this average value, screen saver method is activated.

[0009] The main disadvantage of automatic screen saver is the interruption while watching TV. In addition, some methods based on user key press tracing, may yield wrong results.

[0010] In addition, methods based on User Interface keys might be much complex and generally require major processing time.

Object of the Invention

[0011] The object of the present invention is to provide a screen saving method against the pixel burn-in problem by calculating the OSD percentage value and according to changes in this value activating the screen protection procedure.

Brief Description of the Drawings

[0012]

Fig. 1: shows alternative two-dimensional sampling structures used.

Fig. 2: shows linear quantization of OSD percentage values to quantized values.

Fig. 3: shows a grid application on the screenshots of an Integrated Digital TV (IDTV).

Detailed Description of the Invention

[0013] The core idea of the method is to use OSD distribution in order to detect the stationary display conditions. The method is independent from user actions.

[0014] The method uses sampled grid pixels on output OSD plane and does not concern about any details of OSD content. The method checks only if there is an update in OSD plane. Therefore, it does not need to process all OSD structure and requires less processing time.

[0015] Sampled grid pixels are composed of grids placed on a two dimensional surface. The number of grids can be changed. Alternative two-dimensional sampling structures are shown as examples in figure-1. These grid pixel structures define the total number of grid pixels, the positions of the grid pixels on the screen, the number of pixels in each grid and grid pixel height parameters. These pixel grid structures are pre-defined by the manufacturer, and they can be adapted according to the settings of the display device.

[0016] By using a suitable sample grid pixel, the OSD distribution is calculated as a percentage value. This calculation is performed by checking each grid on the sample grid pixel structure and determining whether it is an

OSD or not.

[0017] An example of the application is given as screenshots in figure 3. In figure 3(a), an IDTV screenshot is shown. This screenshot is taken when Digital Module is active. In figure 3(b), applied sampled grid is shown. Note that, rounded grid pixels are the pixels that are not an OSD. The remaining pixels represent OSD.
In this specific example:

- total sample points are : 96,
- total OSD sample points : 76,
- OSD percentage value is 76/96 = 79%

[0018] The obtained percentage value is then quantized linearly. The linear quantization of OSD percentage values to quantized values are shown in figure-2.

[0019] The method comprises the steps;

1. Deciding which sampling grid to use.
Total number of grid pixels and grid width and height parameters are adaptable. They can be set to values that fit best to user's Graphical User Interface structure and model. The basic idea is to capture any major OSD changes in the display. Two sample grid structures are shown in Figure 1.

2. Checking each grid pixel on the pixel grid structure for the displayed picture frame one by one and deciding whether the checked pixel is a part of an OSD or not.

3. Increasing the OSD pixels count by one, if the checked pixel is an OSD pixel.

4. Calculating the number of grid pixels which are parts of OSD.

5. Calculating the OSD pixels percentage after checking all grid pixels.

6. Quantizing the OSD percentage value by using linear quantization.
Quantization function is given in Figure 2.

7. Re-calculating the OSD percentage value after each OSD update.
Re-calculation can be performed after a predetermined number of frames of the picture are displayed.

8. Defining the picture to have stationary OSD case, if quantized OSD percentage value stays constant during predetermined time period.

9. Activating the pixel burn-in protection method, in case stationary OSD case is detected.
Pixel burn-in protection methods remains active until new quantized percentage OSD value is introduced (stationary OSD case is over).

[0020] The method is not active when the video is just on display since the OSD grid pixel value for this case will be zero.

[0021] The method can be used in all types of plasma displays and any display that may have pixel burn-in problem.

[0022] In IDTV's which use the method defined by the invention, any change in OSD percentage value is transmitted to TV Controller. TV Controller processes these values and decides whether there is a stationary OSD case or not. If a stationary OSD case is observed in a predetermined time (e.g. 5 minutes), the pixel burn-in protection process is started.

[0023] In a preferred embodiment of the invention included in the system; video input signals are taken and processed by a video processor. On-Screen Display menu or figure or picture on the display is generated by an OSD generator. In order to check each grid pixel defined by a pixel grid structure and decide whether it is a part of an OSD or not, a detector is included. After each grid pixel is checked, the results are processed by a microprocessor, and the number of grid pixels which are parts of OSD is calculated. The microprocessor calculates the OSD grid pixel value by using the number of the grid pixels which are parts of OSD. The micro processor re-calculates the OSD grid pixel value after a predetermined time in order to follow the changes in the OSD grid pixel value. If a constant OSD grid pixel case is detected, a stationary OSD case signal is generated, and the pixel burn in protection method is activated.

[0024] The system comprises means for calculating the OSD grid pixel percentage with respect to the total number of the grid pixels which are parts of OSD and means for quantizing the OSD grid pixel percentage to calculate the OSD grid pixel value. The said means can be the same microprocessor in the system or different means.

[0025] Embodiments of the present invention have been described with particular examples illustrated. However, it will be appreciated that variations and modifications may be made to the examples described within the scope of the present invention.

Claims

1. A method for preventing thermal destruction and burn-in in a display device, the method comprising the steps of:

   • checking each grid pixel defined by a grid structure to decide whether it is a part of an On Screen Display (OSD) or not;
   • calculating the number of the grid pixels which are parts of OSD;
   • calculating an OSD grid pixel value with respect to the number of the grid pixels which are parts of OSD;

• defining the picture to have stationary OSD case if OSD grid pixel value is constant but not 0 during a predetermined time;
• activating the pixel burn-in protection method, in case stationary OSD case is detected.

2. A method according to claim 1 wherein; said grid structure defines the total number of grid pixels, the positions of the grid pixels on the screen, the number of pixels in each grid pixel, grid pixel width and grid pixel height parameters.

3. A method according to claim 1 or 2 wherein; said grid structure is adaptive to the settings of the display device.

4. A method according to any of claims 1 to 3 wherein; said grid structure is pre-defined by the manufacturer of the display device.

5. A method according to claim 1 wherein; the method further comprises checking all of the grid pixels defined by the grid structure for the displayed picture frame.

6. A method according to claim 1 wherein; calculating the OSD grid pixel value further comprises:

• calculating the OSD grid pixel percentage with respect to the number of the grid pixels which are parts of OSD and the total number of grid pixels;
• quantizing the OSD grid pixel percentage to calculate the OSD grid pixel value.

7. A method according to claim 6 wherein; quantizing the OSD grid pixel percentage further comprises quantizing the OSD grid pixel percentage by using linear quantization.

8. A method according to claim 1 wherein; calculating the OSD grid pixel value further comprises calculating the OSD grid pixel value for each frame of the picture.

9. A method according to claim 1 wherein; calculating the OSD grid pixel value further comprises re-calculating the OSD grid pixel value after displaying a predetermined number of frames of the picture.

10. A method according to claim 1 wherein; calculating the OSD grid pixel value further comprises re-calculating the OSD grid pixel value after a predetermined time.

11. A method according to claim 1 wherein; calculating the OSD grid pixel value further comprises re-calculating the OSD grid pixel value for each OSD update.

12. A method according to claim 1 wherein, said pixel burn-in protection methods remains active until stationary OSD case is over.

13. A method according to claim 1 wherein, the method is based on OSD content and is not activated if OSD grid pixel value is 0.

14. A system for preventing thermal destruction and pixel burn-in in a display device, comprising:

• input for receiving or providing video input signals;
• video processor for processing video input signals in order to generate picture on display;
• OSD generator for generating On-Screen Display menu or figure or picture on display;
• detector for checking each grid pixel defined by a grid structure and deciding whether it is a part of an OSD or not;
• microprocessor for calculating the number of the grid pixels which are parts of OSD; calculating the OSD grid pixel value with respect to the number of the grid pixels which are parts of OSD;
• means for generating stationary OSD case signal if OSD grid pixel value is constant but not 0 during a predetermined time;
• means for activating the pixel burn-in protection method, in case stationary OSD case is detected.

15. A system according to claim 14 wherein; said microprocessor further comprises:

• means for calculating the OSD grid pixel percentage with respect to the total number of the grid pixels which are parts of OSD and the total number of grid pixels;
• means for quantizing the OSD grid pixel percentage to calculate the OSD grid pixel value.

16. A system according to claim 14 wherein; said system further comprises means for adapting the grid structure to the settings of the display device.

17. A system according to claim 14 wherein, said grid structure defines the total number of grid pixels, the positions of the grid pixels on the screen, the number of pixels in each grid pixel, grid pixel width and grid pixel height parameters.

18. A system according to claim 14 wherein said grid structure is pre-defined by the manufacturer of the display device.

19. A system according to claim 14 wherein, said detector checks all of the grid pixels on the grid structure for the displayed picture frame.

20. A system according to claim 15 wherein, said means for quantizing the OSD grid pixel percentage to calculate the OSD grid pixel value further quantizes the OSD grid pixel percentage by using linear quantization.

21. A system according to claim 14 wherein; calculating the OSD grid pixel value means calculating the OSD grid pixel value for each frame of the picture.

22. A system according to claim 14 wherein; calculating the OSD grid pixel value further comprises re-calculating the OSD grid pixel value after displaying a predetermined number of frames of the picture.

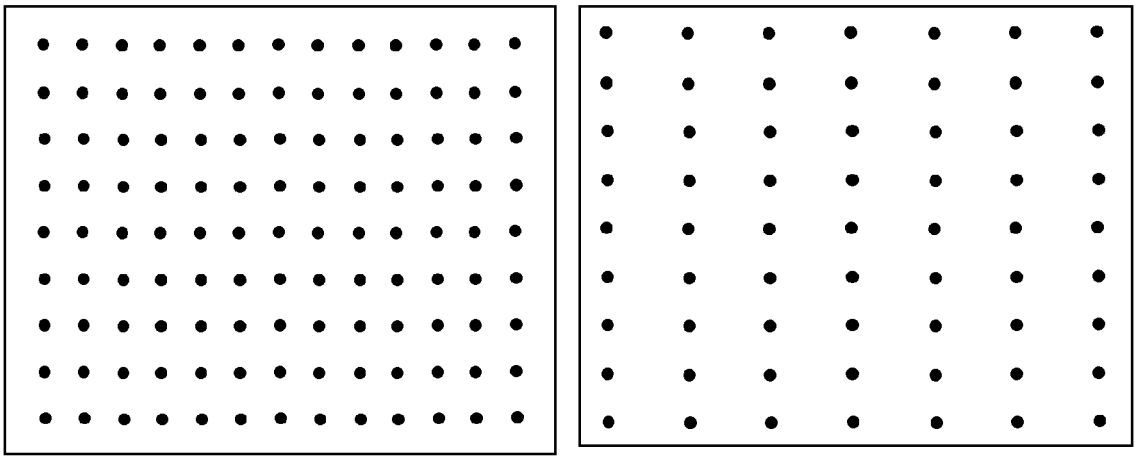
23. A system according to claim 14 wherein, calculating the OSD grid pixel value further comprises re-calculating the OSD grid pixel value after a predetermined time.

24. A system according to claim 14 wherein; calculating the OSD grid pixel value further comprises re-calculating the OSD grid pixel value for each OSD update.

25. A system according to claim 14 wherein, said means for activating keeps the pixel burn-in protection methods active, until there is no stationary OSD case signal.

26. A system according to claim 14 wherein, said pixel burn-in protection is not activated if OSD grid pixel value is 0.

27. A system according to claim 14 wherein, one or more of said means for performing said steps can be nested in each other.



12x8 grid sampling

9x7 grid sampling

Figure -1

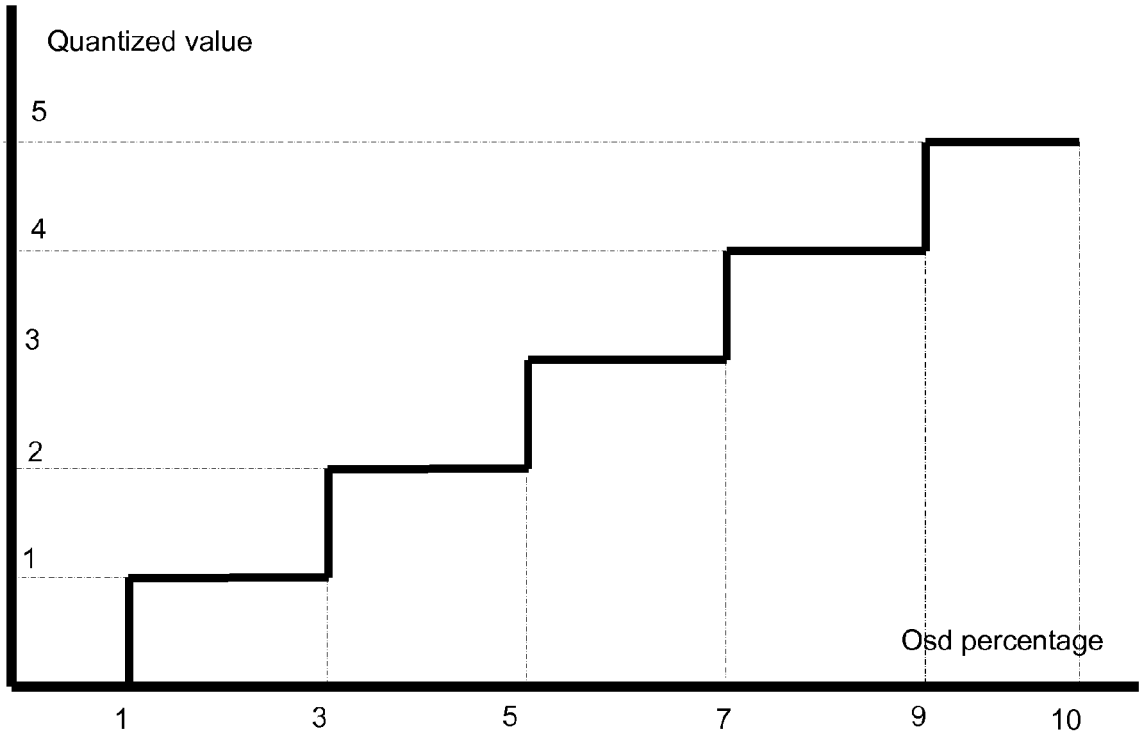
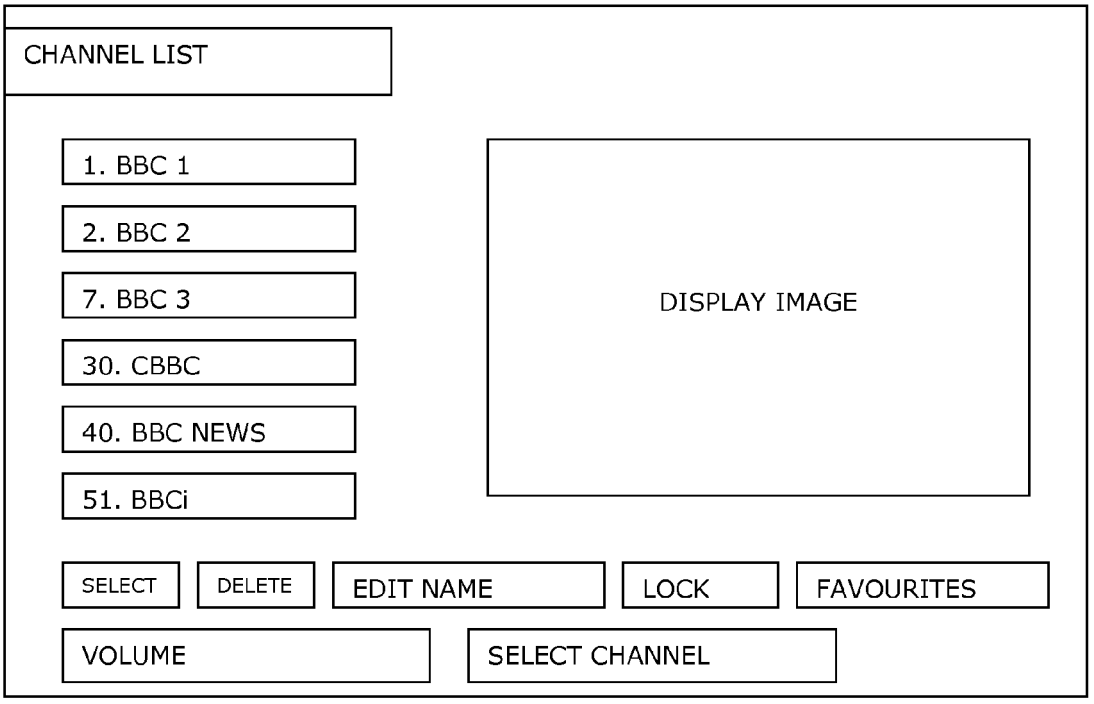
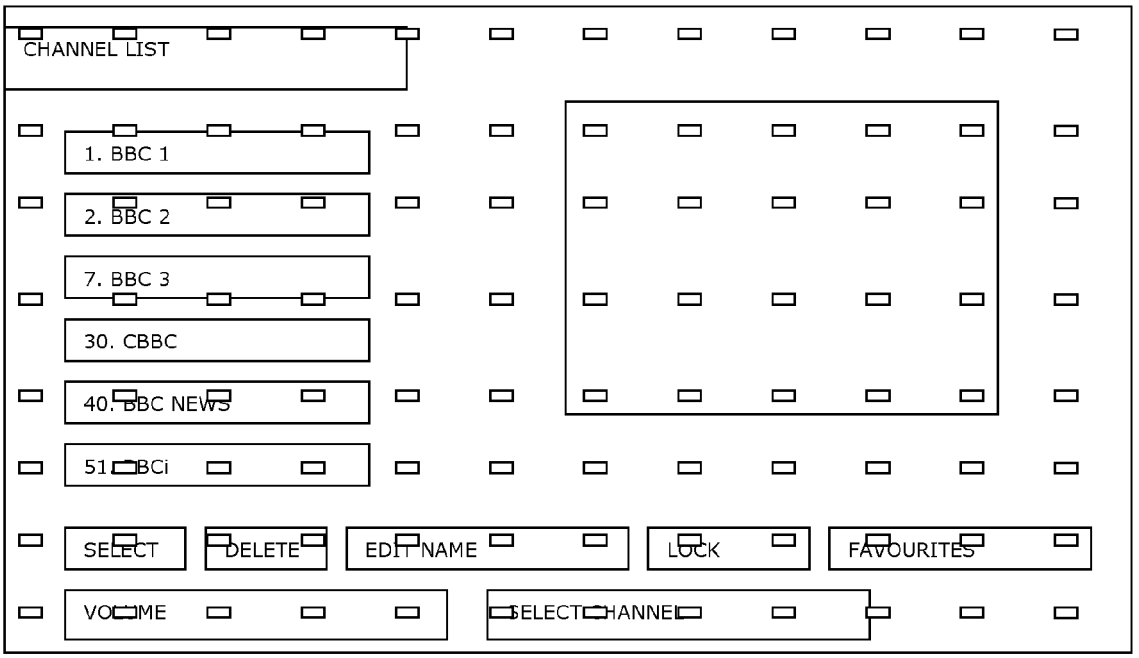


Figure-2



IDTV Screen - (a)



Sampling grid applied IDTV screen- (b)

Figure-3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 6563495 B **[0008]**