MULTI-VIEW DISPLAY

TECHNICAL FIELD This invention related to the field of electronic information display.

BACKGROUND ART

[0001] In-car navigation systems and in-car entertainment systems are available as an accessory in new cars, or are available separately for retrofit, commonly called after market sales. The displays for the systems are placed in or on top of the car dash board. Since the displays are typically of the wide-viewing angle colour liquid crystal type, both the front passenger and the driver may see the display. The display may be supplied with information so that it forms part of the car's navigation system or part of the entertainment system at any one time. If an in-car entertainment system is fitted in view of the driver, the video component such as television and DVD must be disabled whilst the car is in motion, so not to distract the driver who is responsible for the safety of the vehicle. This is federally mandated safety requirement in many countries and is somewhat of a disadvantage as it is desirable for the front passenger, and only the front passenger, to view in-car entertainment. In practice many owners disable this safety feature resulting in potentially fatal distraction for the driver. However, it is also useful for the driver view the in-car navigation system whilst the vehicle is moving. With present systems this would interrupt the passenger's entertainment. A potential solution would be to supply separate displays to the passenger and driver, however this is increases expense and takes up almost double the area restricting design flexibility of the dash board control canter and reducing the space available for peripheral devices and storage space.

[0002] Long aeroplane flights are particularly boring for passengers. Airlines have attempted to alleviate this boredom by including projector systems on the aeroplanes to supply information about the journey and entertainment. However with a single projector system the entertainment is the same for each passenger, and there is no accounting for individual taste or interest. This problem has been alleviated in some aeroplanes with separate displays for each passenger, however a display for each passenger generally increases expense requires individual displays to be quite small, and can add significant weight to the plane increasing costs for airlines.

[0003] It is the object of the present invention specifically to allow a passenger to view full entertainment features such as television and movies on the same display device that a driver can view navigation information without conflict between images and thus to reduce components, reduce complexity, reduce driver distraction, and increase passenger enjoyment. To do this one requires to control the viewing angle of a display. There exist various methods to do this.

[0004] Certain environments such as kiosks or ATM's require privacy. Privacy film or filters are common in the market place which reduce the viewing angle in which the viewer can only see the displayed images within a certain angle—typically directly in front of the display. A simple solution for a privacy screen is to laminate a view control film onto a screen. 3M are well known for producing these products which control the position from where the display can be viewed. The two most common types of privacy film are light control film and blur film. Light control film acts like Venetian blinds. If the observer were to stand at 60' to the front of these blinds the view would be blocked by the sides of the 'louvers'. However when the observer stands directly in front of the 'blinds' the display is viewable. Holographic diffusion film works by dispersing the incident light at particular angles and transmitting it at all other angles. The display appearance changes from translucent to transparent depending on the viewing angle.

[0005] A prismatic film or 'image directing film' can be used to direct the image displayed on a display device. The film rakes the image created by a flat panel display and redirects it to the optimum viewing angle, generally through refraction.

[0006] Parallax barrier methods and lenticular lenses can also be used to direct light.

[0007] Viewing angle can also be controlled by the liquid crystal itself. Viewing angle, which is in the same direction as the maximum contrast, can be controlled by the liquid crystal cell structure itself. The contrast ratio is defined as the ratio of maximum luminance to the minimum luminance. Since the retardation experienced by the ray traversing at the midlayer tilt angle is the lowest in this direction in a normally black panel, the luminance in this direction is lower resulting in a lower contrast ratio. Both the azimuth and tilt of this angle can be controlled by changing the azimuth and tilt angle on the alignment layers respectively. See Liquid Crystal Displays by Ernst Lueder, Wily/SID series in display technology incorporated herein by way of reference.

[0008] At present there exist methods to produce displays where several imaging planes are stacked with set distances between them. These imaging planes may also be stacked as closely as possible. In a preferred embodiment these displays consist of a high-brightened backlight, and multiple image planes including but limited to a background image panel and a front image plane, which are parallel and physically separate and generally are laminated to form a stack. There are generally colour filter stripes, and a matrix on each display which defined the borders of the pixels and a method of eliminated moire interference. The following discussion applies to all image planes that are addressed by passive or active matrices or have filters arranged in any periodic pattern but not limited to those described above.

[0009] The viewing angle of liquid crystal displays can be controlled by the orientation of the liquid crystal molecules with respect to the glass substrates that form the display. Optimum Viewing angle here means the direction a viewers looks in where the display contrast, the ratio between the luminance of the light and dark states of the display, is at a maximum. Orientation here is defined as a three-tuple where each element gives the magnitude of the angle between the x, y and z axes respectively where the x, y and z axes are aligned parallel with the horizontal, vertical and normal directions of the display respectively.

[0010] It has previously been considered undesirable for displays to have a narrow viewing angle because this prohibits multiple users from viewing the same image. However in the case of a car navigation and entertainment system it would be desirable for the driver to be able to see navigation information, and only navigation information and