HARDWARE/SOFTWARE FUNCTIONAL CONTROL METHOD OF MICRODISPLAY MODULES FOR PERSONAL VIDEO-PROJECTION SYSTEMS

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The hardware and software functional control method of microdisplay module for personal video-projection system was presented. The main link of the system – Video Pattern Generator (VPG 170) generates video images which are made up of test field images with different parameters and characteristics. The microdisplay test module employed could be an active matrix (SVGA) LCOS or LED technology based on a Schottky structure of nanoporous silicon /aluminium with visually controlled functionality. Specially developed optical system comprising of a polarization cube with antiglare and antiblocking coating of light emitting RGB backlight performs the contro. The control of the generated test signal VPG170 are accomplished with the aid of developed software programme installed on personal computer using windows XP operating system.

Keywords: Video projection system, information display devices, microdisplay, functional controller.

Introduction

Display – a device capable of reflecting changing text, graphic or video information. In modern World displays have become an indispensable major medium of transmitting information.

In the World currently displays are mass produced in millions yearly and they can be classified into different types and forms based on their specific construction technology and applications as shown in figure 1. As evident in the figure, display size forms the major difference. However, their classification are not based only on size but rather pre-set parameters such as observation distance D, resolution capability M and linear size of image element (pixel) A. Optimal distance of observation refers to the distance at which human being can view an image on the display clearly and not discreetly. For high-quality observation, he needs not move his sight or head (comfortable eye motion is considered in the limit 24^0 per vertical and horizontal i.e. 34^0 per diagonal).Optimal distance of observation is associated with human vision and human eye ceases to distinguish individual points of an image located at a distance less than angular minute. If the distance of observation is more than the optimal distance then pixels tend to merge and thus the image becomes blurred. While for distance of observation less than the optimal distance then the discrete structures of the pixels becomes visible. Correspondingly, for normal sharpness of vision, distance of observation D=3500A where A = linear pixel size.

Taken into consideration the dependency in figure 1. The classification of different types of display devices depends on their optimal distance of observation, geometric individual pixel sizes and the resolution cability of the display in megapixel.

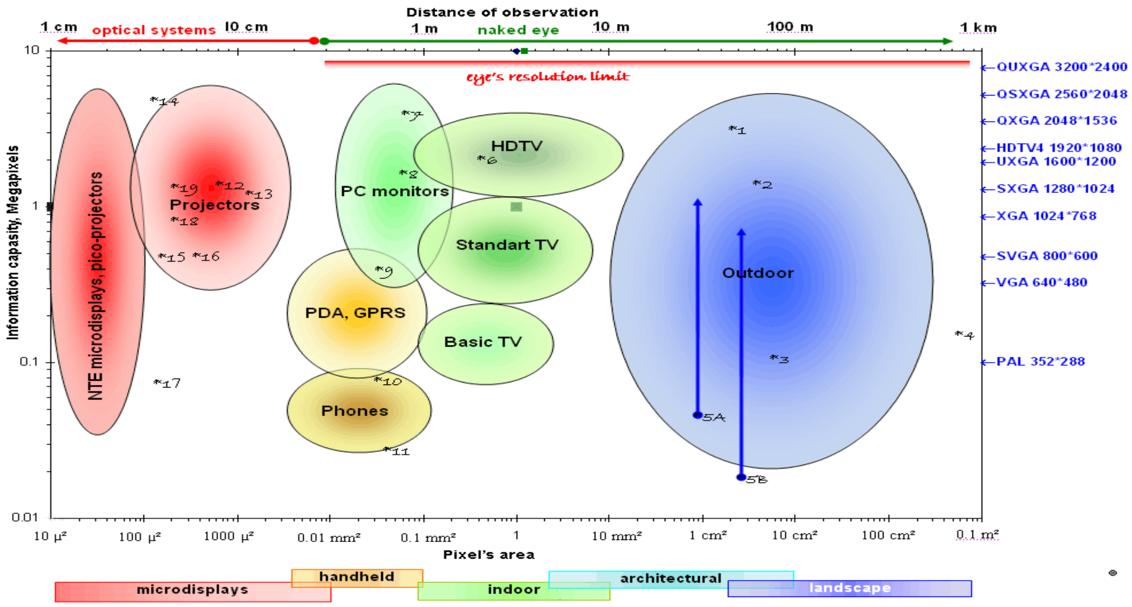

Figure 1 Classification of Displays

Microdisplay are of special interest [1] because of the fact that their distance of observation are usually not more than a few centimeters but operates as a smaller copier of the <<bigger displays>>. They can be used as projection systems (group types) or as personal video projection systems (virtual) images.

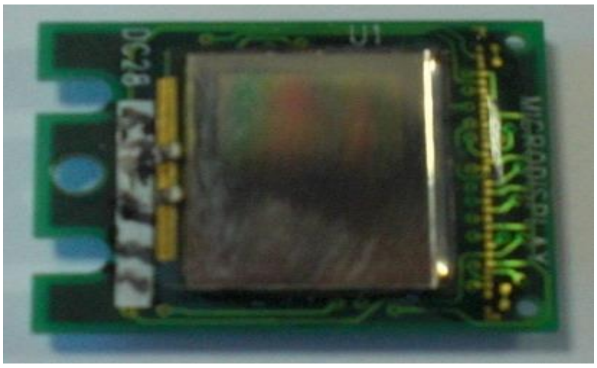

Figure 2. Structure and external view of microdisplay

Presented in table below are the constructive-technological variants and main parameters of microdisplays, in production currently. As evident out of the given data none of the considered variant can satisfy the whole set of requirements.

Main attention is devoted to the investigation of the most common reflective microdisplay LCOS figure 2 and LED [2,3].

Constructive-technological versions of microdisplays

Technology	LCOS	OLED	µLED	DLP	LBS	Por-Si LED
Efficiency	average	low	high	low	low	not high
Brightness radiation	3000 Cd/m^2 (full colour) ~104 Cd/m^2(green)	1500Cd/m^2 (full colour) ~ 10^3(yellow)	~ 10^5 Cd/m^2(full colour) ~ 10^7(green)	~ 1000 Cd/m^2 (full colour)	~ 1000 Cd/m^2 (full colour)	~ 100 Cd/m^2
Contrast	200:1	very high >10000:1	very high >10000:1	high	high	very high >10000:1
Response time	Ms	µs	ns	ms	ms	ns
Working temperature	0---60ºC (needs heater)	-50…70ºC	-100…70ºC	Un-defined	Un-defined	-100…80ºC
Impact resistance	low	average	high	average	Average	high
Lifetime	average	average	long	average	short	long
cost	low	low	low	high	high	low

The hardware/software functional control method of microdisplay modules for personal video-projection system

The structural scheme and external view of the hardware/software functional control method of microdisplay modules for personal video-projection system composed of a row of components connected by various interfaces as shown in figure 3 & 4 respectively.

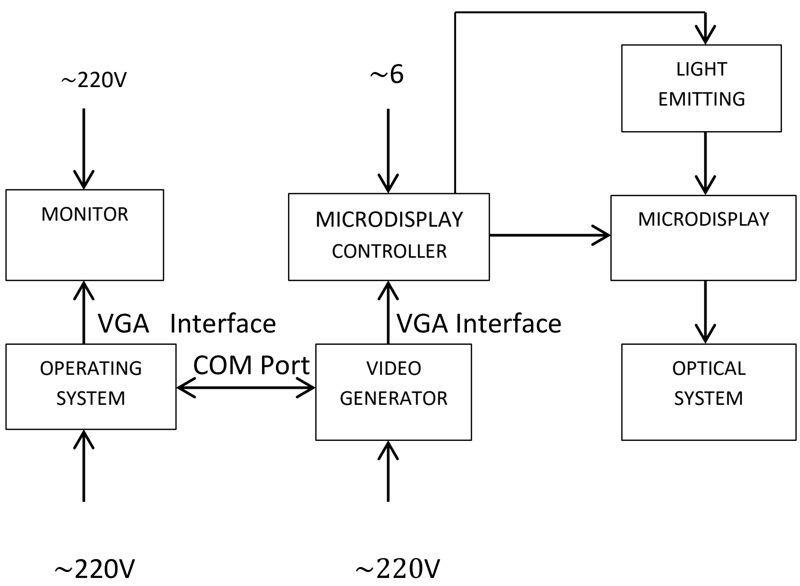

Figure 3. structural scheme of the hardware/software functional control method of video-projection system

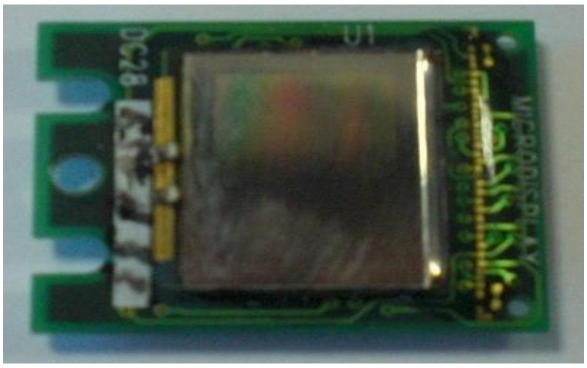

Figure 4. external view of the hardware/software system

The main component of the system known as Video Pattern Generator (VPG 170) generates test field images with different characteristics figure 5. Optical module's external view as shown in figure 6. pre-set for visual functional control for testing microdisplay with lens system, polarizing cube with LED backlight with three components RGB – incident voltage fed with controller in strict synchronic order.

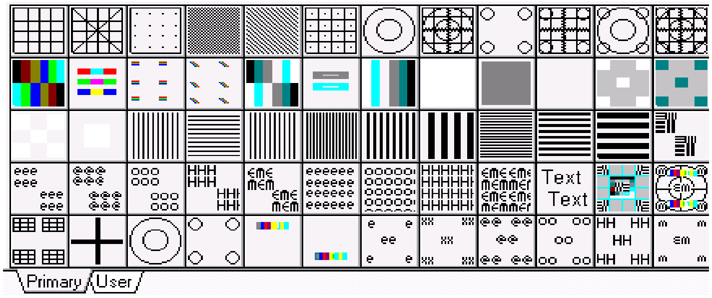

Figure 5.Interractive window for test image selection

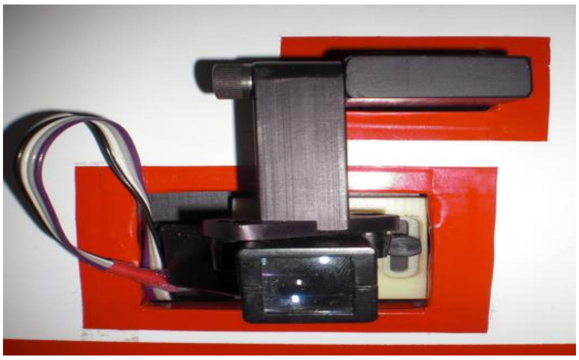

Figure 6 External view of optical module

For the development of the debugging system as microdisplay device we used active matrix microdisplay type DC 28 SVGA resolution.

Testing microdisplay using BGA and DC flex cable 12 are connected to. EK4 which was linked to the generator through a VGA interface figure 7. They were all pres-set to accept digital video signal in the format BT656 and transforms it into its analog RGB signal for the microdisplay respectively. The controller A220/221 composed of three 8 bits ADC analog to digital converter, video amplifier and a 5V charger for transforming YC_bC_r to RGB. The A220 controller supports three sequential conducting interfaces and A221 provides additional support for pulse-width modulation which controls the brightness of backlight.

For contingency, the generated signal of VPG 170 can be controlled with specially developed software program installed on personal computer using Windows XP operating system.

Figure 7. External view of controller EK4

Visual functional control technique

Generally, the generator serves as a universal device for all types of microdisplays, connected through VGA- and BNC – coaxial cable and receiving test images with different characteristics for testing the microdisplay. The generated test signal in turn is controlled with a the aid of software programme with the capability of creating new images and saving given data respectively.

Conclusion

A simple and effective hardware and software functional control microdisplay module developed for personal video-projection system was described.A video pattern generator forms the main component creates testing field images with different parameters and characteristics. The microdisplay module can accommodate either an active matrix SVGA LCOS or LED based technology respectively with visual functional control. Included in the system are special optical systems with polarization cube and RGB light emitting diode backlight control.

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