ANALYSIS OF AUTO DYNAMIC INTENSITY VARIATION FOR ACTIVE DISPLAY INTENSITY CONTROL FOR WIDE BACKGROUND INTENSITY RANGE

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ABSTRACT: The display systems with the human eye features like automatic intensity control (AIC) under varying background luminance conditions add more challenge to design of display systems. The AIC can be achieved by varying the display intensity according to the background intensity level taking into account the comfort level of the user. In this paper, various parameters important for automatic intensity control design have been discussed and a new methodology based on look up table generated using experimental values has been devised by which the display intensity can be adaptively varied maintaining an adequate contrast ratio in real time mode.

NOT PRESENTED

1. INTRODUCTION

The use of automatic change in display intensity with the change of background intensity enhances the comfort level of the viewer by maintaining an appropriate contrast ratio. The main challenge is to make the system response in real time mode and provide good contrast ratio of the scene, image or symbology against wide dynamic range of background light condition.

2. REQUIREMENT OF AIC

The contrast of the image on CRT screen depends on the strength of video signal input while the intensity depends on the DC level of the video signal. By suitably varying the DC level of the video signal, the display intensity can be adaptively varied and a contrast ratio between 1.2 and 2.5 can be maintained under varying background intensity.

3. AIC PARAMETERS

The photo sensor is based on eye response curve of the intensity sensor, i.e. in the wavelength region of 500-600nm. The basic block diagram of AIC implementation is shown in figure 1.

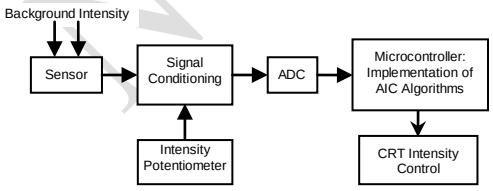


Figure 1: Block Representation of AIC Implementation

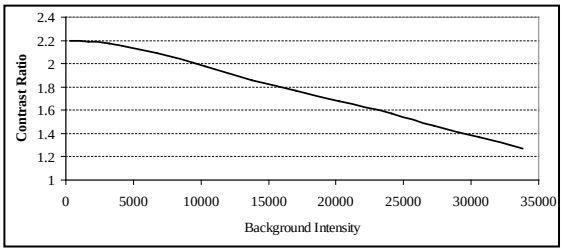
Accordingly, the inputs for implementation of AIC algorithm are: user controlled intensity control and AIC sensor output voltage corresponding to the background intensity. The Contrast Ratio was one of the major factors in the implementation of AIC algorithm which is expressed as:

Contrast Ratio = (Display Intensity + Background Intensity) / Background Intensity

4. AIC ALGORITHM REALIZATION

Various algorithms or methodologies like approximations by power series, exponential series, and approximation methods can be used for generation and implementation of AIC output function but they suffer from shortcomings like large scale of error, low accuracy, complexity, non-real time operation, etc. The AIC algorithm using lookup table has been derived and based on experiments conducted on CRT projection display. Experimental values are based on measurements of background intensity and background + display intensity at various settings of the user controlled intensity potentiometer. These two inputs are conditioned and given as input to ADC which is further processed by the microcontroller. A curve has been plotted and piecewise linearized. A line equation for each linear section has been used given by:

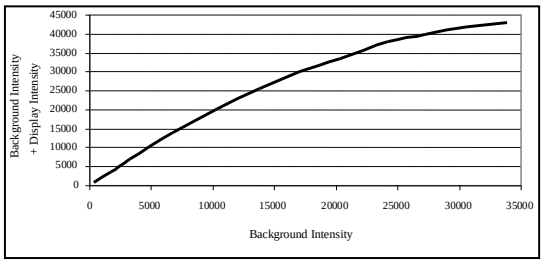
$$Y = (X / \cos\theta) + C$$



Where $\theta = \tan^{-1}(\Delta Y/\Delta X)$ and C is user controlled intensity calibrated for intensity levels from 0cd/m^2 to 6800cd/m^2 converted to 0V to 2.5V corresponding to ADC reference voltage. Three modes i.e. Day time, night time and AIC (where major control of the intensity is done automatically through software)

mode for intensity control have incorporated. The contrast ratio can be further improved by a factor of 0.2 through user controller intensity potentiometer. The following plot shows that the contrast ratio of 1.271 to 2.20 has been achieved, as desired.

The achieved curve plotted between background intensity and background intensity + display intensity is shown in figure below.



5. CONCLUSIONS

The desired contrast ratio range from 1.2 to 2.2 using look table generated through experimental values has been achieved in real time mode for the full dynamic background intensity range.

6. REFERENCES

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