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Implementation of Led Projector

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Abstract: there are two parts of projector according to their desired characteristics. One of them brightness system it composes blue, green and red leds. Each of them has collimator diachronic filter collimated by dichronic filter it combine three wavelength lights together the last part is condenser the micro-lens array and tir prism is used to reduce the size of illumination system and illuminate dmd uniformly.

The one is imaging system. According to the standard of dmd; the effective focal length, angle of view, the imaging quality of lens and the relationship of imaging and object can be defined. By using optical simulation software, code v and zemax, the lens conform to the standards was well designed. Finally the meekness of production was analysed. In this design, the normal light efficiency of three wavelengths led on dmd is 51.13%, and the normal uniformity on dmd is 95.17%. Approximately the screen, the normal light efficiency is 44%, and the normal uniformity is 87.3%.

Keywords:— led, dlp, dmd, collimator, tir.

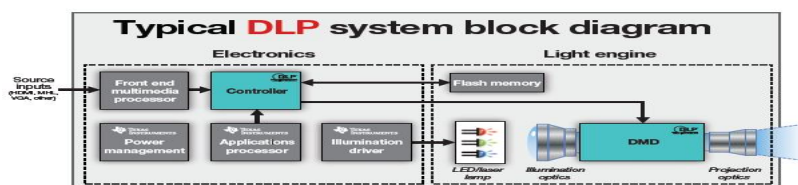
I. INTRODUCTION

The newest type of projector are handheld projector that use LEDs or LASERS to project images. There projection are difficult to see if there is too much surrounding light. LED projector are becoming more famous LED technology is being used in a wide range of products, including business and home theatre projectors, and education projectors, and even emerging markets of pico projectors, and other mini projector system these has its benefits in diversity of fields, with several different uses. Light emitting diode are the inventive generation of light source. LEDs are used to save the power and environmentally friendly. There are two types of properties of LEDs A long life and small size. In projector, the digital light processing and liquid crystal on silicon projectors has been widely used. In DLP projectors there are many advantages in replacing a conventional ultra-high pressure lamp with an LED light source. Most of all an LED light source has highly saturated colour with narrow bandwidth.

A projector is an optical device that projects an image onto a surface, commonly a projection screen. Most projectors create an image by shining a light through a small transparent lens, but latest types of projectors can project the image instantly by using lasers. A virtual retinal display, or retinal projector, is a projector that projects an image directly on the retina instead of using an external projection screen.

However the green, red and blue LED are light sources in a DLP projectors. According to our research homogenized LED illumination using micro-lens arrays for pocket size projector we can use an LED light source in our miniprojector where there are serious colour monotomy issues at the centre and corner of the projection screen.

In early years, the improvements of projectors are not only in the colour and resolution, but also in miniaturization and lightweight, especially when small and powerful light source been published. By using LEDs light source, DMD panel, micro-lens array and TIR prism we can reduce the size and weight with high efficiency and high uniformity. It is an idea to make projection system more popular.



Typical DLP system block diagram

DLP chipsets consist of two primary components: the Digital Micromirror Device (DMD) and the DMD controller chip. Certain chipsets also include a power management chip.

Fig.1

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DLP projector :This object will focus on digital light processing projector technology. Where DLP projector technology came from, how DLP projectors try to provide an image and the advantages and disadvantages DLP projector shall we cover in detail in the article.

What exactly is DLP technology: Digital light processing is a propriety technology grow and belonging to the company texas instrument. To be used in a multimedia projectors. Originally produced by larry Hornbeck in 1987, digital light processing has become currently it is the most regularly implemented projector technologies, and is the main rival to LCD projector technology.

How DLP technology generate an image: Central to how digital light processing projector display an image may be the digital micro-mirror device chip housed interior the projector. The DLP chip contain thousand of mirror, each can be used each pixel. To create a photo, the style source send information for the projector that reason the mirror to be adjusted on both vertical and horizontal axis, therefore varying the quantity of light which can be projected from the lens. The way in which projector generate colour is dependent on the number of digital micro-mirror device chips within projectors. The way in which single chip digital light processing projector along with three chip DLP.

How DLP technology works: During operation, the DMD controller loads each underlying memory sell with a "1" or "0". Next, a micro-mirror clocking pulse is applied, reason each micro-mirror to switch to a plus or minus 12 degree landed state. In a projection system, the 12 degree landed state correspond to an "on" pixel, and the -12 degree landed state corresponds to an "off" pixels.

Optical system : The optical system can be classified into two parts according to design characteristic. One is brightness system; and other is imaging system. projector system was consist of collimator lens, LED light source, diachronic filters, micro lens array, mirrors, condenser, TIR prism, DMD, and projection lens.

A. Lumination System

1) *Led Specifications:* led specification in these design we choose "phlatlight pt54 projection chip" to be our light source. Because of it is shiny enough hand the size is small. by pulsing RGB LED at heighting frequency more than 60 HZ and synchronizing with the corresponding colour the display on the DMD chip. A full colour image is projecting. It has collimated angular intensity distribution for Greenand Blue devices and Lambertian angular intensity distribution for Red devices. Over 1,300 white lumens at 8000KColor temperature from a single RGB chipset under continuous operation.

B. Implimentation of Collimator Lens

Because there is no condenser along Phlatlight RGB LEDs, and the contrast angle is wide. So we design collimator lens for LED to increase light efficiency and control the way of light. And the intensity is conformed . By using this condenser we can collect the lights in divergence angle.

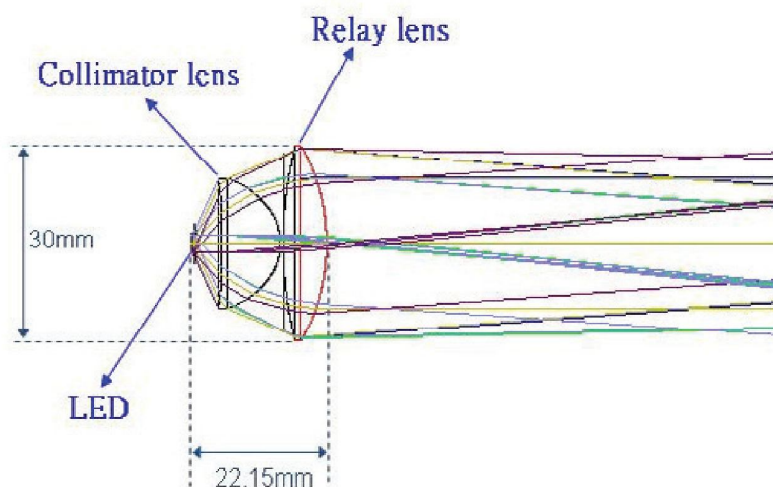


Fig.2

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Item	Parameter	Specification
1.	DMD	0.55" 4:3
2.	DMD Pixel size	13.6 μm
3.	Active area of DMD	11.17 * 8.38 (mm) ²
4.	Wavelength Range	450 ~ 680 nm
5.	Effective Focal Length	14.2 mm
6.	F/#	2.4
7.	Field of view (FOV)	65°
8.	Total track	< 52 mm
9.	Exit pupil position	236 mm

Table 1: Fundamental Specifications

Tolerance	Item	Specification
Centered Tolerance	Test plate fit	2 fringes
	Center thickness	0.01 mm
	Material Index	Index: 0.0005 V: 0.5 %
	Irregularity	1 fringe
Decentered Tolerance	Element Tilt	1 ~ 2 arc min
	Element Wedge	1 ~ 2 arc min
	Element Displacement/Roll	0.01 mm

Table 2: Tolerance Specification

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Lumen Budget	Description	PT54 LED		
		R	G	B
LED Spectrum	Dominant Wavelength	625	525	462
Lumilus R G B LED	PT54 LED Spec	920.0	1725.0	320.0
Duty cycle	Bright Sync	25.0%	50.0%	25.0%
Lens 3 (E480R)	Transmittance	97.0%	97.0%	97.0%
Lens 2 (BK7)_Relay lens	Transmittance	98.5%	98.5%	98.5%
Dichroic mirror	Transmittance & Reflectivity	90.0%	90.0%	90.0%
Fly Eye	Lens Array	95.0%	95.0%	95.0%
Lens 1 (PMMA)	Transmittance	97.0%	97.0%	97.0%
Mirror #1	Reflectivity	98.0%	98.0%	98.0%
RTIR-Prism	Transmittance	90.0%	90.0%	90.0%
DMD Efficiency	DMD Size 0.55", 4:3	68.5%	68.5%	68.5%
Projection Lens	Transmittance	85.0%	85.0%	85.0%
Mechanical tolerance	mechanical tolerance	95.0%	95.0%	95.0%
Simulation Efficiency	From LED to Screen	44.0%	44.4%	43.6%
Total Lumen on Screen	RGB Lumen value	39.1	148.0	13.5
Total Lumen		200.7		

Table 3: The light efficiency of each components in real case.....

II. CONCLUSION

This design uses single R, G, B LED light source with collimator lens and Dichronic filters to replace the mercury lamp (UHP). It curtail reflector, UVIR filter and colour wheel. Using micro lens array supplant rod to increase uniformity and light efficiency. And the TIR prism was used to minimize the total track to 52mm. After consulting the light efficiency, the projection size was implemented in 20 inch. The light efficiency in real case is 16.3% on the screen and the monotony on the screen is 87%.

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