

A Study on the Retina shaped Optical Path Shift Using the Prism

Yunjung Kwon^{*}, Sang-Yep Nam^{**} and Sungchang, Lee^{***}

^{*} Dept of Inform.&Telecomm. Eng., Hankuk Aviation University, Kyongki-do, 412-791, Korea
Tel : +82-11-755-6322 Fax:+82-31-314-0058 E-mail: Kyj3004@hau.ac.kr

^{**}Dept of Information & Communication, Kyung Moon College, Kyeongki-Do, 459-070, Korea
Tel : +82-31-610-8122 Fax : +82-31-610-8120 E-mail: r13337@unitel.co.kr

^{***} Dept of Inform.&Telecomm. Eng., Hankuk Aviation University, Kyongki-do, 412-791, Korea
Tel : +82-2-300-0127 E-mail: sclee@hau.ac.kr

Abstract: This paper discusses about the mechanism of catching an image through an optical manipulation of each organizations in the eye, more specifically, mechanism of catching an image on a retina through a Camera and a Crystal Lens. In the retina, the macula roles as a fovea contrails and it leads the image which is about 3 mm to be shaped on there. However, even the macula may not properly function, our eyes still can catch the image by shifting the optical path to around of the macula, even if the sensitivity of the image is generally lower than the image on the macula. This paper proposes a method of shifting the shaped image on the retina by refracting the optical path through a prism located on the rear of a screen which consists of a 0.7" TFT LCD. Applying this method that throwing an image around on the macula, central visual disturbance patients among retinitis pimentos patients can expect to recover such a mechanism to catch an image.

Key word : Retina, Prism, Optical path shift, Refraction,

1. INTRODUCTION

As for the narrow meaning of real name, the 9 impression eyesight talks about a case, but it is a blind person of wide meaning, and, as for the box, the visual limit is not the same.

There is a name several kinds of, and it is social blind this, and, as for the degree that cannot live on it, the education blind back whom it cannot be educated of economy blind, average does a blind person of the social degree that I cannot live with a member of society.

Be different, and be 0.1 or below, and as for the limit of a blind person, United States and Canada include or below in 0.05 in England and France according to an each nation, and Japan and North Europe speak the case that is or below in 1m.

Therefore, the comparison is difficult a blind person according to an each nation.

Ideal of a medium, a sight aisle are strange, and intraocular pressure is strange, and refraction this are, and various, the cause of this sight fail studies eyesight supplementary tools for them, too.

A proposal did a way of optical path shift on a retina grain applied central visual disturbance to with central during a Retinitis Pigmentosa (R.P.) patient in the a lot of visual disturbance in this paper.

As for the eye, macula of retina gets image through camera and lens, and, as for the macula surroundings,

density of a cell or a sensitiveness becomes a decrease, but it is state to have visual.

If a central visual disturbance case macula surrounding function uses a prism with a good direction and situation here, and shift gets optical path done, can see an image.

Because is small, as for the size of sweet macula, shift must do a situation in a grain with a prism behind following him whom a mini TFT-LCD screen was composed of with approximately 3mm.

Configuration of a paper was looked into on a refraction principle of a prism in paragraph 2, and the beginning was with the shortsightedness who excluded normalcy if I was made to conclude a phase by retina of a person in paragraph 3, but an explanation did the way how adjust did a focus in order to be in focus.

It was done in order I considered whether the principle that a system principle for shift to do optical path in a grain of retina proposed to in this paper was explained in paragraph 4, and it was proposed to in paragraph 5 was used, and optical path became shift, and to conclude a conclusion in paragraph 6 by the last.

2. REFRACTION OF PRISM

As for the Prism, optical path becomes decide by angle of refraction rate(nd) and the prism which a medium has. If is the same, and the center of light will move it to the medium that delivered light is different in a speed difference with a difference, as for light becoming refraction, be slow a speed.

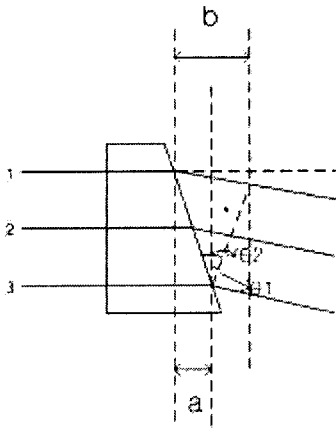


Fig. 1. Refraction of prism.

A speed rate and the refraction rate which, glass has if a speed is determined with 1 during air show with 1.5 with a back in 1.1 or more, and this value is refraction rate, n , and it is done. A line to have made while it is slow a speed of light, and light passes through in the medium which made if the light that this principle can be explained like picture 2, and refraction rate is with 1.5, and an angle performs during air in glass when 10°, prism is reaches prism already does advance with me during out air quickly. That is, a line to have made moment in order the gland who gained just finishes progress in glass, and to pass through is performed by b more quickly than a . Because refraction rate is 1.5 if length of a is watched on 1, a price of b is 1.5. If a prism angle is 10°, and an angle of 10 of prism is therefore taken out if an early Snell's rule is proved because refraction rate of glass is 1.5, it is 5.0.

$$n_1 \sin \theta_1 = n_2 \sin \theta_2 \quad (1)$$

$$\sin \theta_2 = 1.5 \times \sin \theta_1 = 1.5 \times \sin 10^\circ =$$

$$1.5 \times 0.1736 = 0.2604$$

$$\theta_2 = \sin^{-1} 0.2604 = 15.0^\circ$$

If calculate a refraction angle and sees too other way in picture 3, become decide by refraction rate (nd) of wedge angle (θ) and prism of refraction each (θd) Prism like formula (2).

$$nd = (nd-1)\theta \quad (2)$$

It is wedge each (θ) 10° of prism, and it is $\theta d = (1.5-1) 10^\circ = 5^\circ$ because it is refraction rate (nd) 1.5 of glass.

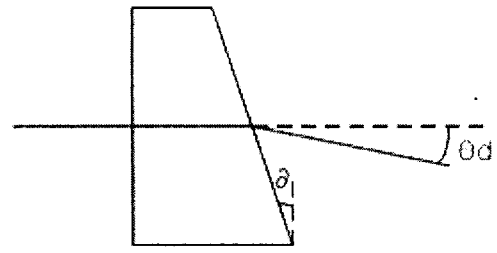


Fig. 2. Angle of refraction .

Therefore, what refraction becomes very much can be known even if θ is small, and an angle of prism is done if refraction rate is high.

3. FOCUS ADJUST

It is necessary because of the farsightedness and the shortsightedness whom please appear and be devoted to correct image in retina, and excluded focus adjust image.

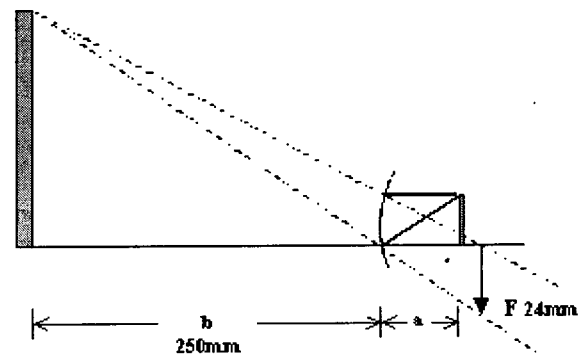


Fig. 3. Focus adjust.

If Focus uses 24^{mm} Lens in the above picture, and a value of this time uses formula if it is a with distance of the object which is going to be seen when visibility distance of a regular person is 250^{mm}.

$$\frac{1}{\alpha} + \frac{1}{b} = \frac{1}{f}$$

$$\frac{1}{\alpha} + \left(-\frac{1}{250}\right) = \frac{1}{24}$$

$$\frac{1}{\alpha} = \frac{1}{24} + \frac{1}{250}$$

$$\alpha = 21.838 \text{mm}$$

If it is farsightedness, it is the state that b value got longer.

If when visibility distance is 500mm, an a value uses formula.

$$\frac{1}{\alpha} + \frac{1}{b} = \frac{1}{f}$$

$$\frac{1}{\alpha} + \left(-\frac{1}{500}\right) = \frac{1}{24}$$

$$\frac{1}{\alpha} = \frac{1}{24} + \frac{1}{500}$$

$$\alpha = 22.9\text{mm}$$

When a visibility distance is 1000^{mm}, an a price is 23.4375^{mm}.

That is, a value can know that I get longer, and b value is short state if short sighted.

When a visibility distance is 150^{mm} a value

If a formula is used

$$\frac{1}{\alpha} + \frac{1}{b} = \frac{1}{f}$$

$$\frac{1}{\alpha} + \left(-\frac{1}{150}\right) = \frac{1}{24}$$

$$\frac{1}{\alpha} = \frac{1}{24} + \frac{1}{150}$$

$$\alpha = 20.69\text{mm}$$

When a visibility distance washes 50^{mm}, a value is 16.216^{mm}.

That is, a value can know that it is short.

Because TFT LCD corresponds to a value when it is visibility distance of 1000^{mm} ~ 150^{mm} because a value is 23.44^{mm} ~ 20.69^{mm}, focus lens is used adjust is done or this is moved, TFT LCD fixes it.

4. SYSTEM CONFIGURATION OF OPTICAL PATH SHIFT

Generally the following image is necessary for at all small 1 inch so that image appears with retina through camera and lens when a person sees an object by an eye, and shift does a situation of image in retina. It is micro display, and the following screens are done in this 1 inch, and it is applied to a virtual display generally.

Focus is matched with Focus lens in order to meet you in shortsightedness or the farsightedness which the image which TFT LCD is used, and micro display is composed like fig.6, and was got through CCD camera is not flashed on TFT LCD, and excluded a r contents, and shift is going to do an image situation of retina ock and regular Focus. And prism is used like proposed.

Image is natural, and, as for looking in fig 4, image appears with macula of an eye with a picture of tire not to have prism.

But used prism after micro display like fig. 5 afterwards is moved a situation of image on refraction while image passes through. A shift situation of image does decide by a wedge angle of refraction rate and prism of prism here. Shift distance calculates a refraction angle to have become by retina in prism, and, in the shift direction, adjust can do a direction f rotate gets a situation of prism done by 360 degrees from 0 degrees.

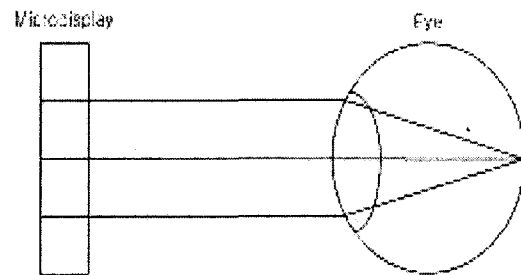


Fig. 4. Shaped image that there is no prism.

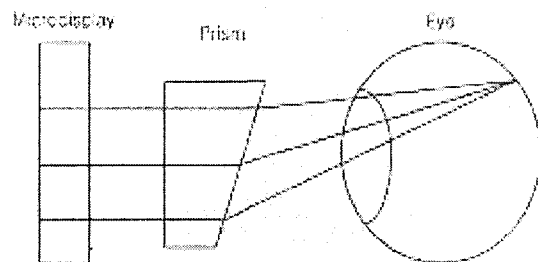


Fig. 5. Optical path shift through prism.

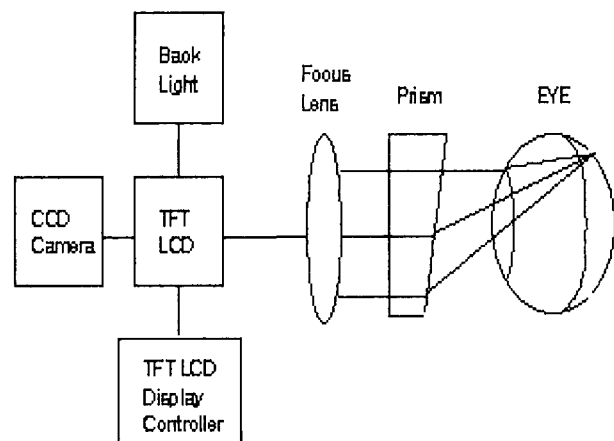


Fig. 6. System block diagram of optical path shift.

5. THE EXPERIMENTATION RESULTS

Basic image made from a oneself was experimented on for a standard in this experimentation, and shift distance fixed it with refraction rate 1.4 and wedge an angle of 10 degrees of prism, and, in 0 degrees, 90 degrees, 180 degrees, an angle was done in a unit in 45 degrees of 270 degrees while moving.

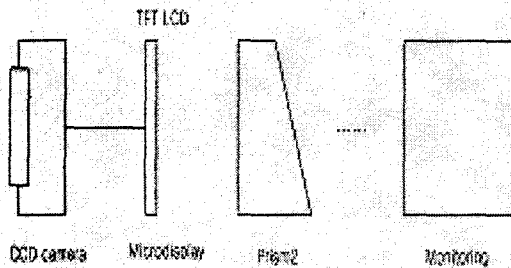
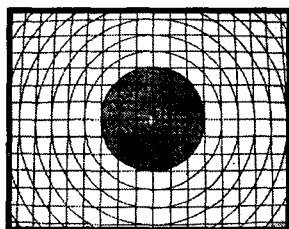


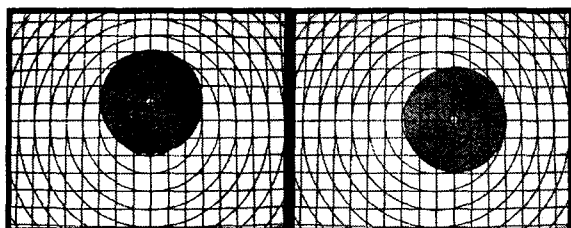
Fig. 7. Schematic diagram of retina shaped optical path shift system

And an eye was substituted for, and feeling to watch on an eye monitored fig 7 with camera together, and it was photographed. Standard image was the 3mm that were size of macula, and, coordinates were 1mm, and a prism situation did shift in approximately 0.5mm in 0 degrees like fig 8 in an upside direction.

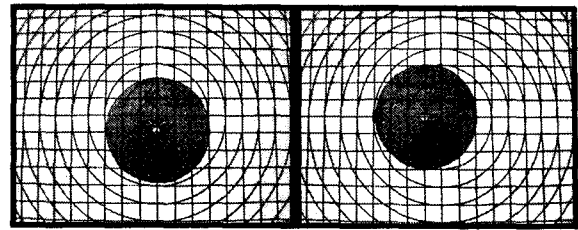
A prism situation did approximately 0.5mm shift in 90 degrees in right side direction, and a prism situation did shift in approximately 0.5mm in 180 degrees in a downside direction, and a prism situation is showing approximately 0.5mm the results that shift did in 270 degrees in left direction.



(1)standard image



(2)Prism 0°[upside shift] (3)Prism 90°[rightside]



(4)Prism 180°[downside shift] (5)Prism 270°[leftside shift]

Fig. 8. Optical path shift done image.

6. CONCLUSIONS

The time when a prism used decision image in order to get shift, and shift did a decision image situation when a problem arose in macula of an eye in this paper was considered. Proposed a way about the distortion correction that an object of a square removed rectangle or that it changed with a trapezoid by the distortion occurrence for an prism aberration reason if image became decision image through a prism. Confirmation was able to do the performance that distortion became correction when the prism which was contrary to camera front end in the rectangle that it was distorted a square object when prism was passed through a standard or state to have been transformed into a trapezoid was passed in proposed performance evaluation directly. And the way how it was proposed to here was experimented on in a prism situation of a 45 ° unit. The prism which broke out was used with a cylindricity for an analysis in the situation which was continuance. In the 360° continuance section, distortion correction is possible, and study must be done in all level in the, future.

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