

## "Meniscus" The Eye Diagnostic Integrated Facility

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### ABSTRACT

*Meniscus, an eye diagnostic product, using semi automatic system. Design to answer eye diagnostic problem, many optician complaint of impractical process of manual diagnostic product, mean while patient also complaint of low accuracy result of automatic system. It indicated that there are some opportunity in blue ocean area. The design result must meet these criteria : practical, accuracy, ergonomic. By doing observations, authors try to create a new product development in new product line, in semi-automatic system. Meniscus is a tool that used FluidFocus Lens replacement lens mechanism. Replacement lens control mechanism is set by the operator remotely by mikrokontroler, integrated in personal computers that have been equipped with computer applications test eye chart software. These replacement methods, which still need using optician effort, are the keyword of "semi" in automatic system means. But, it doesnt mean Meniscus bury the accuracy result, FluidFocus Lens will quarantee the current accuracy result problem.*

*Meniscus is a whole process in a product design. But the different is the methods, the starting point is not from the problem identification, but from the innovative technology finding then try to find idea in product application. Beside the design & technology, ergonomy and aesthetic still the main design consideration of this product. The image design are taken from keywords "simple-futuristic" style. The design process include sketch-rendering-modelling-prototyping. This paper is an improvement of previous paper with same subject. The main concern now is to describe the adjustable frame design, so Menicus can be use for any age user with many kind face characteristics. Authors hope that these early research can be continue and produce a real product.*

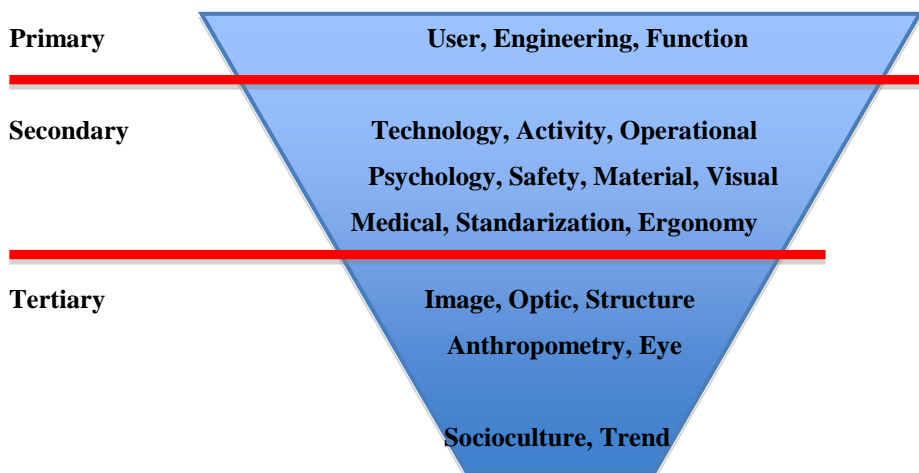
*Keywords: product design, eye diagnosis, semi-automatic, lens, practical, accurate, ergonomy*

## INTRODUCTION

Eye as a primary aspect of human senses yet supported by related product. Lack of eye diagnostic tools is one of the problems frequently encountered. Another trend now is a manual system now being abandoned, the impression of its impractical make people obsessed with everything which are computerized and digital. One of biomedical instruments that still use manual system is a eye diagnosis. This could be an opportunity for designers to create a system that is compatible with computer. Potential market still needs a computerized diagnostic tool eye with high accuracy.

Table 1. Design aspect based on problem identification  
Source: Kumara 2006

	<b>Problem List</b>	<b>Aspect</b>
<b>Background</b>	There's no integrated eye diagnose product	Medical
	Existing product system is unpractice	Psychology
	New product development in range of socioculture with technology based inovation product	Socio culture
<b>Product description</b>	Inaccuracies diagnostic results, so no wonder if our eyes checked at another clinic, the results would be different too	Function
	Replace lens manually need a longer time & energy drained	Ergonomy
	Human error, due to manual system need more human touch operating procedure	Procedure
	There's an eye test chart software, but there's no eye diagnosis glasses to complete the system	Technology Engineering



## DESIGN CONCEPT

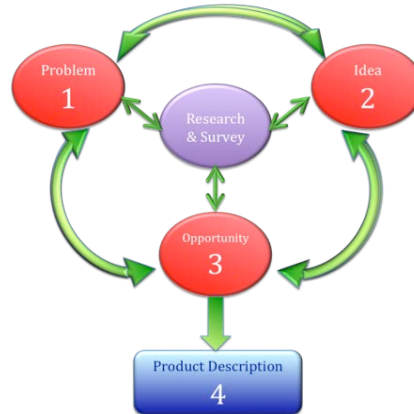


Diagram 1. From design research to product description  
Source: Kumara 2006

## Research & Survey Until Design opportunity

### 1. Research & Survey

FluidFocus lens, is the result of recent research that found by a research team at Philips technology Hanover Germany in March 2004. Features of this lens is can change both size and concave-convex without changing the position and shape of other mechanical components. In future, FluidFocus Lens is very suitable for supporting the camera phones, endoscopes, home security systems and optical storage drives. The principle working of this lens is actually adapting ability of the human eye where there is a conducting aqueous, a kind of liquid that is able to change the focus range of the ability to see without changing shape. Other privileges, FluidFocus Lens has a very small dimension, a diameter of 3 mm and 2.2 mm long.

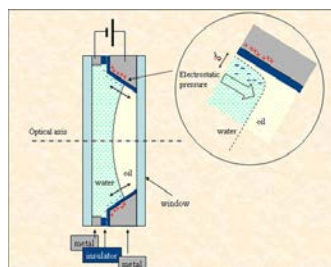


Figure 1. FluidFocus Lens schematic system  
(source: [www.dpreview.com](http://www.dpreview.com))

For the purposes of supporting vision test chart, currently found in the market a computer software to eye diagnose. This software is very complete in addition to containing vision chart snellen, there are also other charts. Such as a test image to read the teletext on TV, UK plated number tests, a tests for car drivers to read the license plates of cars, for this test was used to test a driver's license in the

UK. And there is also clinical images, contain information about the parts and function of the eye that is useful to explain to the patient about his condition. Besides the benefits of this software compared to the manual system, it has been equipped with such other supporting instrument: Integrated IR sensor for remote control, IR remote control handset, RF remote keyboard and optical mouse, Adjustable wall mounting plate and fittings, Test Chart 2000 PRO pre-installed and calibrated red visor.

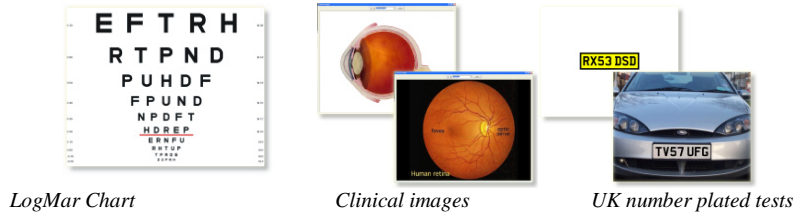


Figure 2. Software test chart feature  
(source <http://www.thomson-software-solutions.com>)

## 2. Idea Gathering

1. Integrating automatic test chart and eye glasses
2. Lens replacement system and test chart are operating by computer
3. Eye glasses design equip with an automatic sensor replacement
4. A compact eye glasses test which can be use for any age

## 3. Design Opportunity

When its compared with the other manual eye diagnostic, there are obviously many advantages. Even if compare with the eye diagnosis in the other classes, diagnostics method that do not require a test chart and glasses, which only requires position sensors shadows fall on the cornea. Eventhough it much more simple tool to use. Still can't beat the integrated test systems. So with this product market opportunities, the needs to complete the test software to chart the existing mandatory demand enthusiasts. Clearly, places such as clinics, hospitals eye will be the main targets of sales. Although individual users such as households, are also still able to enjoy this product.




Product			
	Trial-lens	Poroptor	Auto-ref
System	Manual	Semi Automatic	Automatic
Accuraccy	Good	Excelent	Fair

Diagram 2. Position based on product system & result accuracy.

Source: Kumara 2006

#### 4. Product Description

- a. Product Name : The Eye Diagnostic Integrated Facility, “Meniscus”.
- b. Function :
- Eye diagnosis with an integrated system
  - Diagnose the condition of patients suffering from eye and hipermetropi miopi, which is well known size needs glasses.
- Secondary : To serve as additional supporting instruments for test software charts that already exist, where the function to be achieved by software that is able to diagnose the patient's eyes in order: Recognize the ability of cylindrical, accommodation reflex raises eye on a moving subject such as moving text.
- c. Uniqueness selling point:
- Accurarcy of eye diagnosys result
  - To help eye diagnosys operator for a practical activity.
- d. User : Patient & optician in hospital & clinique, with specification :
- Age : 5 Years old kids until unlimited
  - Sex, Race, Religion: Unlimited
  - Job : Unlimited, patient (primary), optician (secondary)

#### Design Spesification

- A diagnosis glasses with semi-automatic system. Inside glasses there is a lens that can be driven back and forth from the eyes of patients with a computerized system.
- The glasses can adjust the size of someone's face in accordance with the target user which start the children above five years up to seniors. Therefore we need an adjustable handle of spectacles, which can be adjusted in accordance with the long-short size of the patient's face.
- At the other instruments of this system, a eye test chart software, coordinated directly with a PC. Therefore, besides the replacement lenses, eye tests charts are also operated via a PC. So to support the integration between instruments, it takes the LCD projector, remote sensors, red / green Visor.



Figure 4. Integrated system on eye test chart  
Source <http://www.thomson-software-solutions.com>

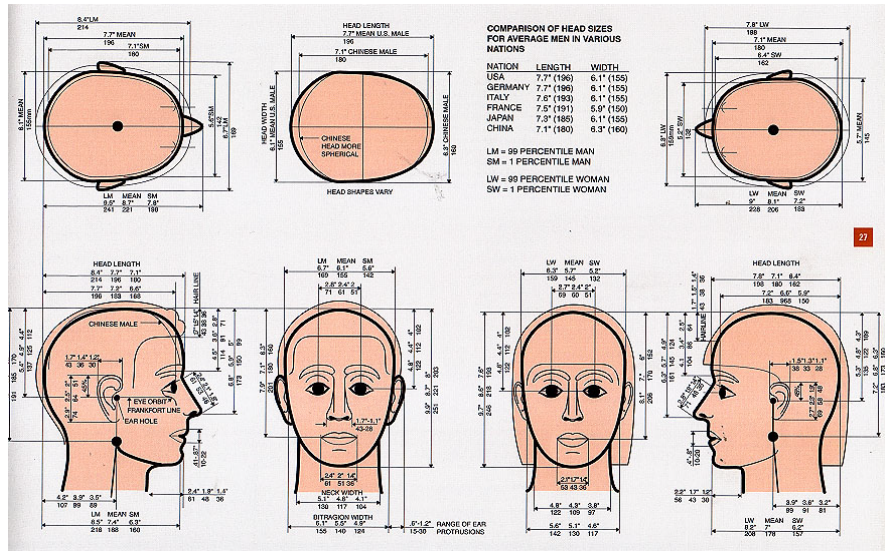


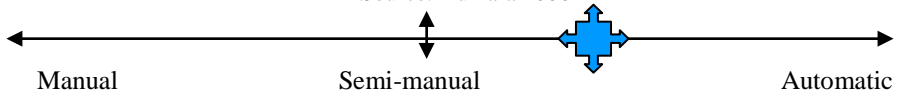
Figure 5. Anthropometri data for human head  
Source [http://www.head\\_measurement\\_for\\_man\\_and\\_woman.com](http://www.head_measurement_for_man_and_woman.com)

### Design Positioning

- Position on similar product lines

Table 2. Product Positioning

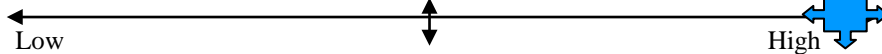
Source: Kumara 2006



- Position on the results accuracy

Table 3. Accuracy result

Source: Kumara 2006



### Design Image

The image chosen was "simple and futuristic." Simple, because the product will be designed to change the impression gained by the patient's about previous product, which is complex and confusing. Futuristic, because this product is equipped with a highly complex technical part. And also, direction of current design trend in biomedic instrument product, appointed to futuristic style with clean look and neutral color





Figure 6. Image board design  
Source: Kumara 2006

## Design Range

This product can not be use stand alone, like on its name its a medium that has an integration to operate. So this product should be utilized with other products. But on this occasion, designers simply try to design an instrument from a variety of eye diagnostic instrument support. That is diagnostic instrument eye glasses. These eye glasses are designed with a system that can be associated with other eye diagnosis instrument like the test chart. The design itself has created its own levels of complexity. Complexity can be viewed on the lens mechanism to accommodate the needs of the patient eye sight conditions. And also from adjustable frame so this product can be used by patients with age. Because of these considerations designer only focussing to eye glasses

## Design problem

In the designing process, there are some problems that become design constraints:

- The success of the lens system
- Thickness of frame that is still accommodate lens legh
- Minimum and maximum size of adjustable frame can be used to accomodate all the patient's age range.
- Efectiveness of biopac system functions to set the long-distance lens system needs.

## PRODUCT DEVELOPMENT

The process of developing an evolutionary manner, starting from the optimization of operating procedures, creation of tables needs and components solutions, product components requirements and process of achieving the design, to manufacture the mock up and prototypes.

### Visual development study.

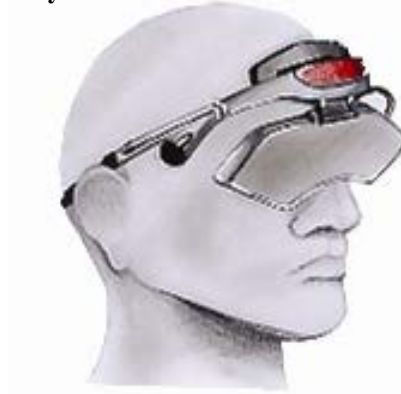


Figure 7. Preliminary Design  
Source: Kumara 2006

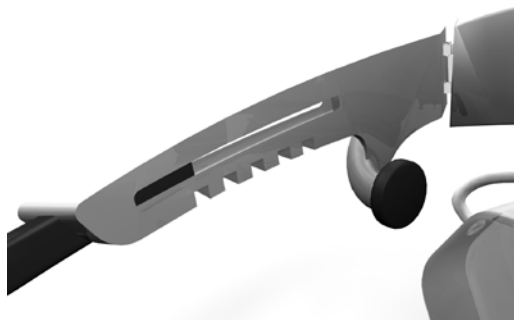


Figure 8. Adjustable frame mechanism  
Source: Kumara 2006

Adjustable frame: Skeletal system used must be pursue in such a way that in the framework of the frame remains sturdy despite its size flexibility. It can be done with a locking system and proper material selection. In this component, human antropmetri aspect becomes dominant, the size of which will be used is a static measure of the human body. Related directly to the product is the size of a human face range data over five years to seniors, not influenced by gender.



## Final Design



Figure 9. 3D modeling using 3D max and prototype on final design  
Source: Kumara 2006

## CONCLUSION

A brand new product with ergonomics uniqueness selling point, which can be adopted by all face & eye characters. Thanks to the adjustable frame design system. Innovative findings in eye diagnosis with a computerized system. Taking advantage of technological sophistication FluidFocus Lens and support by the existence of computer application software eye chart test. Generate a handy product for individual users and optical / eye clinic, is not restricted to age, sex, religion, educational background whatsoever. With the functions of diagnosing a patient suffering from eye conditions like hypermetropia, myopia, recognizing the ability of cylindrical, bring forth accommodation reflex eye on a moving subject such as moving text. It wears like normal eye glasses, and is then integrated with the computer. Image of a futuristic design and simple, contributed to design the optimal position compared to other products, both on the quality of diagnosis and practicality use.



Figure 10. Product operational that can be used on different face characteristics  
Source: Kumara 2006

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