

Lighting techniques in machine vision

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Abstract— In machine vision projects due to the extensive image processing techniques and many activities can be done in this area, it has caused that in these projects and operations on samples which have been selected for processing, lighting research and projects would be done in less, while with process of doing a good or excellent lighting depending on type of outgoing projects can reduce the volume of processing of later stages. In this respect subject of lighting techniques and the products which are in this working field so we'll see how far a good exposure processing can improve the efficiency of a machine vision system.

Keywords: machine vision; lighting techniques; ODR ; Illumination; shadows; refractions.

I. INTRODUCTION

It is well understood that the quality and appropriateness of lighting are critical aspects for creating a robust and timely vision inspection. In addition to an understanding of illumination types, techniques, sensor characteristics, and color, a thorough analysis of the inspection environment, including sample presentation and sample-light interactions provide a foundation upon which to design an effective vision lighting solution. Perhaps no other aspect of vision system design and implementation has consistently caused more delays, cost-overruns, and general consternation than lighting. [1]

Nowadays, Machine vision systems are becoming easier to use, but a software algorithm will never be able to detect flawed parts at 100% accuracy without a quality image to inspect. If you are relying on software to compensate for missing or inaccurate data, then your

margin of error increases dramatically and you have an image problem [2]. At advanced illumination (AI), we understand how difficult it can be to choose the correct light source in order to acquire the best image for your application, and that while there are many options to choose from, there is often only one solution for a lighting problem. The objective of these articles, rather than to dwell on theoretical treatments, is to present a "Standard Method for Developing Sample Appropriate Lighting". We will accomplish this goal by detailing relevant aspects, in a practical framework [3].

The remainder of this paper is organized as follows. Section 2 introduces finished works and review of variety of light sources and the importance of substance conditions. Then Section 3 introduces lighting up the microscope to reveal all its attributes. Experimental results in comparison with those of existing methods and conclusions are finally drawn in section 4.

II. THE INTRODUCTION TO ACCOMPLISHED WORKS AND REVIEW A VARIETY OF LIGHT SOURCES AND THE IMPORTANCE OF SUBSTANCE CONDITION

The brief description of lighting methods

1. Calculate the intensity of each of the vertices of polygons.
2. Radiation level according to the material of each three-dimensional object.
3. How the effect of light sources on the surface of three-dimensional objects.

4. How light is reflected from the surface of the object.
5. Used to get a more realistic picture with the study of lighting effects.
6. Blazon to the size and volume of objects.
7. Used to calculate intensity and color of reflected light from each of the polygons vertices.

These models are based on the following factors:

1. Location and direction of light sources
2. Types of light sources.
3. The color and intensity of light sources.
4. Material properties of the object.
5. The place of viewer.

In more complex models calculate the light intensities considering propagation of light energy between surfaces and sources of light. Lighting methods generally fall into two categories: Local Illumination Models AND Global Illumination Models. In local illumination models Two main factors affect:

- A- Light Sources: With the parameters of location, direction, color and weakening rate.
- B- Material properties of the object surface: the surface of three dimensional object considering Different reflection coefficients and transparency level, as for Light emitted from the light source Part of it is reflected. As a result, object would be visible by the viewer.

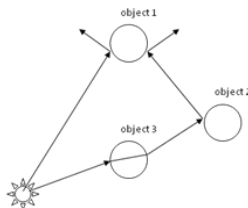


Figure1: A Model of visible objects

Factors used in calculation of illumination of three dimensional objects are: Inter-object Reflections, Refractions, Shadow effects of other objects. Global models are slower but More accurate and better quality. Because they are closer to the reality of optics. Ray tracing and Radiosity are among these methods, namely Obtaining some simple mathematical models for different types of light sources.

Light sources can be divided into the following four categories: 1- Ambient light 2- Point Light Source 3- Directional Light Source 4- Conical light source. More over , Types of lamps consist of :

- Incandescent lamps
- Electrical discharge lamps
- Inflammatory lamps
- Halogen Lamps
- Fluorescent Lamps
- LED lamps
- Carbon arc lamps

During conducted surveys and Working on different projects, It was found that LED lamps Due to their high-

life used more. These lamps currently used for low consumption and affordable jobs like illumination at night. But depending on the application, a good light on a different sample can become harmful light.

The Importance of equipment locating tool

Positioning devices for pieces which are available for all virtual visioning machines, actually are devices with software systems that utilize finding pieces in the scope of vision machine. Usually this stage is the first step in any type of machine applications. However this matter seems so simple but locating the piece in today's industrial environment by vision machines could be so Challenging. Because there are varying conditions which can affect the locating manner of machine that is defined for a particular function. These varying conditions will include: piece rotation, Changes in the quantity of light, far-off light conditions, Natural changes in the appearance of the piece.

III. LIGHTING UP THE MICROSCOPE TO REVEAL ALL ITS ATTRIBUTES

Lighting system: Microscopes have several limitations, but in action illumination of microscope is often the main limitation. Therefore many efforts in preparing and providing good lighting for microscope illumination is done. So the right lighting can make a major role in the resolution of image. Ambient light is not enough to provide a clear picture, So it's necessary to make sure there is light bulbs and artificial light sources provided. Therefore light checking and Methods for their use in microscope can be useful. Lamps are used in microscopes are:

- 1- Halogen Lamp: for photo Micrograph jobs
- 2- Tungsten lamp: for cheap and educational microscopes
- 3- Xenon lamp
- 4- Mercury lamp

Condenser: Condenser duty is to focus light on the sample. Condenser is located below the stage which is the location of sample.

Fluorescent microscope: Certain type of optical microscope which it's light source is ultraviolet radiation.

STM microscope: Innovation in STM is that light waves or other types of radiations are not used, and there is no lens on them.

Ultraviolet microscope: This type of microscope has Higher resolution than conventional light microscope, Since UV light has a shorter wavelength than visible light.

Dark Field microscope: Light source in this type of microscope is visible light and with The refraction of light By the convex and concave mirrors, object would be clear and light on black background.

Components of the light microscope:

- 1- Optical components: optical elements mostly are comprising a light source and its associated

components such as 20 watt bulb, Light correction filter and Condenser

- 2- Color filter (light correction)
- 3- Diaphragm which sets the light volume
- 4- Two Convex lens
- 5- Screws holding the condenser
- 6- Diaphragm adjustment screw

IV. CONCLUSIONS

According to studies and Various devices have been suggested in connection with this article, Products with the following specifications In general usage with Intermediate vision level are recommended:

High exposure in ODR systems of OMRON automation company:

ODR lighting system is the latest version of LED technology which were made during the development of image compression cameras. ODR describes a new dimension in lighting and offers the highest performance in Industrial Lighting.



Figure2: High exposure in ODR systems

Comparison of standard LED and ODR system:

In standard LED system the performance of lighting system is limited. In this model it is possible to increase the light but this enhancement of light can cause some problems such as: deterioration of LED due to increased heat. But in ODR method by using unique lighting technology for an ODR structure on the surface of many chipsets, we encountered to Extreme heat loss and proper Performance. ODR provides a good light which is almost four times better than traditional models of LED technology. The following figure provides a comparison of the two products.

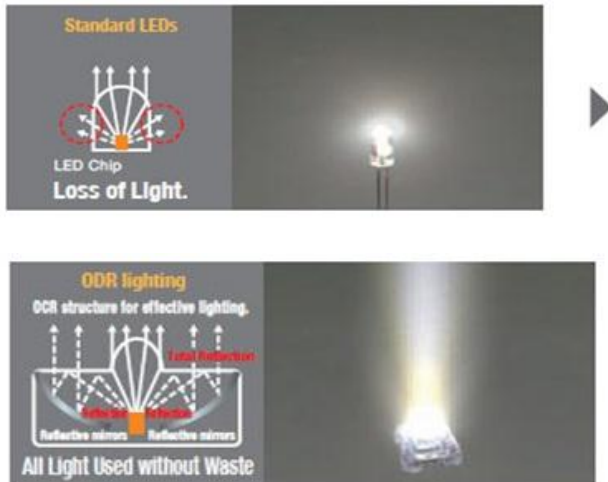


Figure3: Comparison of standard LED and ODR systems

Static displays for high-speed applications:

One of the benefits of ODR is in high speed production line, since light leakage causes the image to be opaque. The ODR system allows production line to have the same speed as its output without and interrupt and Machine vision system also continue its job properly. Test results with the old system and the new system is shown in following Figure.

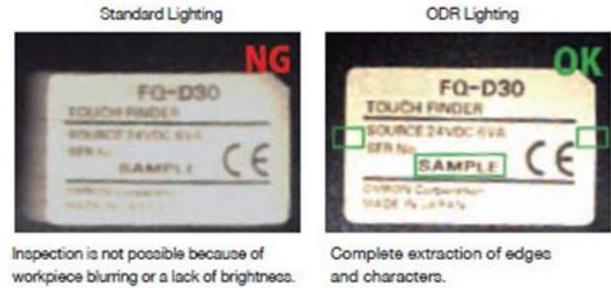


Figure4: Comparison between extraction of standard lighting and ODR lighting

Good lighting on polarized filters:

When the light intensity was not enough in old system, we used polarized filters. As a result, this technique caused in dark images we don't have a clear and sharp picture of our Work piece. With the ODR lighting, brightness of the image's background can be maintained on all polarized filter. This method allows only the light reflected from the glass surface be obtained and makes bright and clear image. The difference between the old system and the new system with polarization filters is shown in the following figure.



Figure5: Comparison between old system and new system

More light on the less size :

In ODR system, we have much more light in a smaller package that it causes the lighting system occupies a smaller space in production line. This can be one of the better options than the old system .

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